COVER SHEET

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSES

BIG CREEK ALP PROJECTS
Docket Nos. P-67, 2175, 2085, and 120

Appendix A
Mitigation and Monitoring Summary
Pages A-1 to A-12
FEIS

APPENDIX A

BIG CREEK ALP PROJECTS MITIGATION AND MONITORING SUMMARY

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Appendix A. Big Creek ALP Projects mitigation and monitoring summary.

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	**Mitigation**	**One-time or Ongoing**	**One-time or Ongoing**	**Mitigation Implementation**	**Mitigation Monitoring**
Increased air emissions from gas-fired generation plant(s) to offset lost generation associated with proposed new flow regimes.	Best available control technology in accordance with the requirements of the geographic area where the replacement power is generated.	**Ongoing:** SCE would purchase replacement energy from the power grid market; although mitigation would be ongoing, the nature of the mitigation may shift if the source of replacement energy shifts.	**Ongoing:** Monitoring of air emissions is typically required at fossil fuel generating facilities.	Owner of replacement energy generation facility	Owner of replacement energy generation facility
Installation of new flow release mechanisms, gaging equipment, and recreational facilities may result in disturbance to special status plants or animals.	Prepare a Biological Evaluation and Biological Assessment or other required document, as appropriate, prior to construction of new project features on National Forest Service land that may affect special-status species and their habitat. Obtain any necessary permits or approvals for potentially affected special-status species and their habitats.	**One-time:** Protective measures would be established prior to construction and implemented during and after construction.	**One-time:** Monitoring requirements, if any, would be established in the approved Biological Evaluation and Assessment.	SCE	SCE

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	**Mitigation**	**One-time or Ongoing**	**One-time or Ongoing**	**Mitigation Implementation**	**Mitigation Monitoring**
Increased bank erosion due to implementation of channel riparian maintenance flows at Mono and Camp 61 creeks and the South Fork San Joaquin River downstream of Florence Lake.	Need for mitigation would be dependent on monitoring results and consultation between SCE, the Forest Service, FWS, Cal Fish & Game, the Water Board, and the Commission and could entail either adjusting the amount of flow released, limiting grazing access to the creek, or stabilizing banks.	**One-time:** If mitigation is determined to be needed, it would likely be a one-time event; however, if subsequent monitoring indicates that additional protective measures are needed, follow-up mitigation would be implemented.	**Ongoing:** Monitoring of sediment accumulation in pools in Mono and Camp 61 creeks would occur within 6 months following any wet water year channel and riparian maintenance flow release. Riparian vegetation monitoring after the first year of license issuance to establish baseline and 5 years following channel and riparian maintenance flow releases made in the first wet water year for Mono Creek and Camp 61 Creek and the second wet water year for the South Fork San Joaquin River, and at 10 year intervals for the remainder of the license term. **One-time:** Jackass Meadow Inundations Study would entail surveying the Jackass Meadow complex to establish microtopography and during first two wet	SCE (if flow adjustment needed); the Forest Service (if adjustments to grazing practices and resulting bank instability needed)	SCE

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	**Mitigation**	**One-time or Ongoing**	**One-time or Ongoing**	**Mitigation Implementation**	**Mitigation Monitoring**
			years to map inundation level at three flow levels to establish basis for retaining or adjusting channel riparian maintenance flows releases from Florence Lake dam to South Fork San Joaquin River.		
Potential sediment releases (primarily at North Slide Creek diversion), asbestos release and disposal (as applicable), air emissions, and noise associated with decommissioning activities related to dismantling of five diversions and abandoning of one diversion (South Slide Creek, which is already breached) in place	SCE would consult with applicable agencies during the first year from license issuance regarding appropriate protective measures; prepare permit applications and supporting documentation and a health and safety plan for any asbestos containing material that may be present at any of the diversion dam sites. Beyond Commission approval	**One-time:** Duration of any mitigation would be set in specific permit and approval conditions.	**One-time:** Duration of any monitoring would be set in specific permit and approval conditions. SCE proposes to prepare a summary report following each diversion decommissioning that includes before and after photographs to document completed activities.	SCE	SCE

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	**Mitigation**	**One-time or Ongoing**	**One-time or Ongoing**	**Mitigation Implementation**	**Mitigation Monitoring**
	of dam decommissionings, the following approvals and permits may also be needed: Wilderness Variance and Special Use Permit from the Forest Service; Streambed Alteration Agreement from Cal Fish & Game; 401 Water Quality Certificate from the Water Board; Nationwide 404 Permit from the Corps; and consultation with FWS.				
Altered flow regimes could, under certain circumstances, cause water temperatures in specific reaches to be inconsistent with Basin Plan objectives for daily mean and maximum water temperatures.	Develop an interim water temperature control program within 1 year of license issuance that identifies feasible measures that SCE could implement to ensure water temperatures are within Basin Plan objectives, when water temperature is a project controllable factor.	**Ongoing:** Implement the approved long-term water temperature control program throughout the term of a new license.	**Ongoing:** Monitoring during at least the first 3 to 5 years that new flow regimes are implemented under the new project licenses, including during at least one dry or critically dry water year type during the summer months (June 1-September 30). Annual Progress Report would be prepared 90 days following the	SCE	SCE

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	**Mitigation**	**One-time or Ongoing**	**One-time or Ongoing**	**Mitigation Implementation**	**Mitigation Monitoring**
	Use the results of water temperature monitoring, supplemented by fish and dissolved oxygen monitoring, to develop a long-term water temperature control program in consultation with the Water Board and other agencies, and implement when approved by the Commission.		completion of each year of temperature monitoring and submitted to the Forest Service, Cal Fish & Game, the Water Board, and FWS. This annual report would serve as the basis for discussions with agencies at an annual meeting, when adjustments to the monitoring plan would be considered.		
Implementation of the proposed flow regimes could have adverse effects on some fish populations in affected stream reaches or in reservoirs where depletion of cool water at deeper strata may occur earlier than under current conditions.	Monitoring fish populations would provide the data needed to enable agencies to assess whether their resource objectives are being met under the new operating regimes specified in any new licenses and whether adjustments need to be considered based on the monitoring results.	**Ongoing:** The nature and duration of any mitigation would be adaptively crafted during consultations by SCE and the resource agencies based on the monitoring results. Any recommended changes to measures that may be included in a license order would need to be approved by the Commission.	**Ongoing:** Fish surveys and associated reporting would begin in the 3rd full year following license issuance during years 8, 18, 28, and 38. Monitoring would occur during August and September in listed reaches along medium and large diversions that were surveyed in 2002.	SCE	SCE

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	**Mitigation**	**One-time or Ongoing**	**One-time or Ongoing**	**Mitigation Implementation**	**Mitigation Monitoring**
Potential short-term increases in turbidity and decreases in the quality of spawning habitat following proposed sediment pass-through and removal activities at Balsam, Bolsillo, Camp 62, Chinquapin, Hooper, Pitman, Ross, Rock, and Ely creeks.	Timing of sediment pass-through activities would occur only during the spring of wet years, corresponding with naturally occurring high flow and sediment transport events. Timing of sediment removal activities, if needed, would be done during low-flow periods, minimizing potential increases in turbidity and decreases in spawning habitat.	**Ongoing:** Sediment pass-through activities would occur during all wet years; sediment removal activities would occur only as-needed.	Monitoring of pool-filling and turbidity is not proposed or recommended, as all indicated streams are high gradient with predominantly bedrock and boulder channels downstream of diversion dams, that would not be susceptible to long-term adverse effects on aquatic habitat.	SCE	Not applicable
Potential short-term increases in turbidity and decreases in the quality of spawning habitat following proposed sediment pass-through at Dams 4, 5, and 6 and if sediment removal is necessary when Dams 5 and 6 impoundments are drained for tunnel inspections every 7	Timing of sediment pass-through activities (between January 1 and March 31) would minimize effects on rainbow trout spawning, especially if conducted earlier in the designated time frame. Once pass-through activities are completed, flushing flows released for 24	Implement sediment pass-through or sediment removal activities within 5 years of approval of the sediment management measures and every 5 years after the initial implementation throughout project operation.	**Ongoing:** Monitoring of pool filling and turbidity would be conducted prior to, and after prescription implementation. Weighted mean value of the level of fine sediments in a representative set of 5 pools would be measured according to procedures defined by Hilton and Lisle (1993). Turbidity would be monitored	SCE	SCE

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	Mitigation	One-time or Ongoing	One-time or Ongoing	Mitigation Implementation	Mitigation Monitoring
years.	hours would likely transport fine-grained sediments from spawning gravel prior to trout spawning. Monitoring results would provide a basis for adjusting mitigation measures in an adaptive manner, as appropriate.		during 2 storm events each year prior to implementation at the same locations to provide a basis for comparing turbidity measurements taken during implementation of sediment management measures. Following submittal of monitoring results, the Forest Service, FWS, Cal Fish & Game, the Water Board, and the Commission would determine if sediment prescription modifications are warranted. Monitoring would be discontinued in subsequent years, upon agency and Commission approval.		

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	**Mitigation**	**One-time or Ongoing**	**One-time or Ongoing**	**Mitigation Implementation**	**Mitigation Monitoring**
Potential short-term increases in turbidity and decreases in the quality of spawning habitat if sediment removal is necessary at Balsam Meadows and Portal forebays	Timing of proposed sediment removal activities (late fall for Portal and Balsam Meadows forebays, during low flow periods) would avoid spawning and incubation periods for rainbow trout. Monitoring results would provide a basis for considering additional mitigation measures, if warranted.	**Ongoing:** As needed.	**Ongoing:** Turbidity would be monitored during 2 storm events each year prior to implementation of planned sediment removal events to provide a basis for comparing turbidity measurements taken during implementation of sediment removal activities.	SCE	SCE

Impact	Mitigation	Mitigation Implementation Duration One-time or Ongoing	Monitoring Duration One-time or Ongoing	Responsibility Mitigation Implementation	 Mitigation Monitoring
Potential effects on special-status bats of increased noise from proposed reconstruction and painting activities.	Protective measures for special-status bats at project facilities would be implemented prior to conducting any non-routine maintenance activities that could result in harm to special-status bat species or their habitat, in structures that are known to support maternal or roosting bat species (including but not limited to, reconstruction and painting).	**Ongoing:** Implementation of appropriate measures based on agency consultation.	None proposed or recommended/	SCE	SCE
Construction-related disturbance of bald eagles and their habitat.	5.4 Bald Eagle Management Plan	**One-time:** File the bald eagle management plan. **Ongoing:** Implement the approved plan throughout project operation.	**Ongoing:** Nesting and wintering surveys every 5 years beginning within 1 year of plan approval by the Commission throughout project operation.	SCE	SCE
Destruction or disturbance of VELB habitat during vegetation and road maintenance and	Protect VELB habitat in accordance with the Valley Elderberry Longhorn Beetle Management Plan;	**Ongoing:** Implement the approved plan throughout project operation	**Ongoing:** Monitoring the mitigation site following planting of shrubs during years 1, 2, 3, 5, 7, 10, and	SCE	SCE

Impact	Mitigation	Mitigation Implementation Duration	Monitoring Duration	Responsibility	
		One-time or Ongoing	One-time or Ongoing	Mitigation Implementation	Mitigation Monitoring
construction of new project facilities in previously unsurveyed areas.	establish a mitigation site where elderberry shrubs would be planted and replace any failed plantings.		15.		
Spread of noxious weeds and invasive plants resulting from new construction and rehabilitation activities.	Control the spread of noxious and invasive species in accordance with the Vegetation and Integrated Pest Management Plan.	**Ongoing:** Implement the approved plan throughout project operation.	**Ongoing:** Surveys for noxious weeds would be conducted in conjunction with special-status plant surveys within the boundaries of the projects every 10 years. Monitoring of noxious weed treatment areas, erosion control and revegetation areas would occur within 1 year of treatment or completion of activity.	SCE	SCE

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	Mitigation	One-time or Ongoing	One-time or Ongoing	Mitigation Implementation	Mitigation Monitoring
Effects of gravel augmentation at the Mammoth Pool dam on dam safety and integrity of project facilities.	Implement the Gravel Pilot Project Feasibility Study following Commission approval.[a]	**One-time:** The pilot study would be implemented on a one-time basis. Depending on the results of the pilot study, gravel augmentation could either be discontinued or continued for the duration of the project license. If the latter, a license amendment, specifying mitigation, if appropriate, would likely be required.	**Ongoing:** Monitoring of gravel transport and distribution would occur during the subsequent two above average or wet water year spill events following the initial gravel placement. Following the monitoring, a report would be filed for agency and Commission review and consideration regarding the viability of gravel augmentation at the Mammoth reach.	SCE	SCE
Potential impacts to prehistoric remains encountered on project lands resulting from construction-related ground disturbing activities.	Negotiate agreement with Native American Advisory Group on reburial of prehistoric human remains encountered on SCE lands in accordance requirements in the California Public Resources Code and other applicable laws.[a]	**One-time:** The agreement would be a one-time event. **Ongoing:** Implement the agreement, as appropriate.	**Ongoing:** Implement throughout project operation, as appropriate.	SCE	SCE

[a] Non-FERC SA provisions.

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Appendix B
Capital and Annual Costs of Measures
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APPENDIX B

CAPITAL AND ANNUAL COSTS OF MEASURES

FOR THE BIG CREEK ALP PROJECTS AND THE PORTAL PROJECT

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In this appendix, we present costs of environmental measures associated with the Big Creek ALP Projects (tables B-1 through B-4. In addition, although the Portal Project (FERC No. 2174) is not part of this proceeding, certain measures included in the Big Creek ALP Projects Settlement Agreement pertain to Camp 61 Creek. Camp 61 Creek provides inflows to the Portal Project, which are diverted from the South Fork San Joaquin River upstream of the Mammoth Pool reservoir. Table B-5 presents costs of environmental measures associated with the Portal Project.

Table B-1. Summary of capital costs, operations and maintenance costs, annualized costs and reduction in annual energy benefits for measures included in the Proposed Action and Proposed Action with Staff Modification alternatives for the Big Creek Nos. 2A, 8 and Eastwood Project. (Source: SCE, 2007a, and staff)

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
1	Implement new MIF releases and channel and riparian maintenance flow releases[a]	$0	$9,140	$2,508,230	$2,517,370	Aquatic	Yes
2	Maintain existing and new gaging stations	$0	$114,220	$0	$114,220	Aquatic	Yes
3	Install minimum flow devices and gaging equipment at Dam No. 5	$2,245,180	$0	$0	$277,080	Aquatic	Yes
4	Install minimum flow devices and gaging equipment at Mono Creek Diversion	$1,347,110	$0	$0	$166,250	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
5	Make modifications needed to release MIFs at Bolsillo Creek Diversion	$89,810	$0	$0	$11,080	Aquatic	Yes
6	Make modifications needed to release MIFs at Camp 62 Creek Diversion	$89,810	$0	$0	$11,080	Aquatic	Yes
7	Decommission Crater Creek Diversion	$409,870	$0	$0	$50,580	Aquatic	Yes
8	Decommission Tombstone Creek Diversion	$667,230	$0	$0	$82,340	Aquatic	Yes
9	Decommission North Slide Creek Diversion	$22,170	$0	$0	$2,740	Aquatic	Yes
10	Decommission South Slide Creek Diversion	$8,870	$0	$0	$1,090	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
11	Implement temperature monitoring programs	$0	$36,880	$0	$36,880	Aquatic	Yes
12	Implement flow monitoring programs	$0	$159,910	$0	$159,910	Aquatic	Yes
13	Implement fish monitoring programs	$0	$13,180	$0	$13,180	Aquatic	Yes
14	Implement riparian monitoring programs	$0	$17,170	$0	$17,170	Terrestrial	Yes
15	Implement Jackass Creek monitoring programs	$0	$20,580	$0	$20,580	Aquatic	Yes
16	Implement the sediment management plan at small diversions	$0	$6,210	$0	$6,210	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
17	Implement the sediment management plan at Dam No. 5 and Mono Creek	$0	$5,230	$0	$5,230	Aquatic	Yes
18	Monitoring of spawning gravel embeddedness after sediment pass-through at Dam 5[b]	$0	$1,940	$0	$1,940	Aquatic	Yes
19	Implement the sediment removal at Dam No. 5, Mono Creek and Balsam Meadows forebays	$0	$31,370	$0	$31,370	Aquatic	Yes
20	Implement the sediment management plan for Mono Creek	$0	$19,400	$0	$19,400	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
21	Implement the LWD measure at the Bear Creek Diversion	$0	$6,850	$0	$6,850	Aquatic	Yes
22	Attend annual consultation meeting for water and aquatic resources	$0	$570	$0	$570	Aquatic	Yes
23	Implement wildlife habitat enhancements	$0	$2,280	$0	$2,280	Terrestrial	Yes
24	Implement the Bald Eagle Management Plan	$0	$2,840	$0	$2,840	Terrestrial	Yes
25	Implement the VELB Management Plan	$0	$14,850	$0	$14,850	Terrestrial	Yes
26	Implement the Vegetation and Integrated Pest Management Plan	$0	$57,110	$0	$57,110	Terrestrial	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
27	Implement proposed license articles for mule deer, special-status species and bats	$1,880	$6,850	$0	$7,080	Terrestrial	Yes
28	Implement environmental programs for environmental training, ESAP, avian protection, noxious weeds, NHSSIP, and environmental compliance	$23,470	$2,860	$0	$5,760	Terrestrial	Yes
29	Attend annual consultation meeting for terrestrial resources	$0	$570	$0	$570	Terrestrial	Yes
30	Perform operation and maintenance of recreational facilities	$0	$71,390	$0	$71,390	Recreation	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
31	Implement rehabilitation of existing recreational facilities	$2,703,330	$0	$0	$333,620	Recreation	Yes
32	Implement new recreational facilities including an accessible fishing platform at Jackass Meadows and a handicapped boat loading platform	$381,700	$0	$0	$381,700	Recreation	Yes
33	Provide maintenance of the accessible fishing platform	$0	$1,600	$0	$1,600	Recreation	Yes
34	Manage reservoir water surface elevations	$0	$2,150	$0	$2,150	Recreation	Yes
35	Fund fish stocking with a 50% cost share	$0	$85,670	$0	$85,670	Recreation	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
36	Disseminate flow information for whitewater boating	$0	$5,710	$0	$5,710	Recreation	Yes
37	Install interpretive signs	$77,300	$0	$0	$9,540	Recreation	Yes
38	Prepare a report on recreational resources	$0	$14,010	$0	$14,010	Recreation	Yes
39	Attend annual consultation meeting for recreational resources	$0	$570	$0	$570	Recreation	Yes
40	Implement the Transportation System Plan	$0	$45,690	$0	$45,690	Land Management	Yes
41	Implement the Fire Plan	$0	$570	$0	$570	Land Management	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
42	Implement the Spill Prevention and Countermeasure Plan	$0	$570	$0	$570	Land Management	Yes
43	Attend annual meeting for land management resources	$0	$570	$0	$570	Land Management	Yes
44	Provide transportation system plan labor and equipment	$0	$400,130	$0	$400,130	Land Management	Yes
45	Implement an HPMP	$228,120	$34,270	$0	$62,420	Cultural	Yes
46	Implement environmental programs for cultural resource awareness	$0	$1,140	$0	$1,140	Cultural	Yes
47	Attend annual consultation meeting for cultural resources	$0	$570	$0	$570	Cultural	Yes

[a] SCE included in its costs for the Big Creek Nos. 2A, 8, and Eastwood Project No. 67 some measures that actually apply to the Portal Project No. 2074. These measures include proposed minimum flow releases and channel and riparian maintenance releases, water and aquatic monitoring, and sediment management. The monitoring and sediment management measures have been removed from the proposed measures for Project No. 67 and have been presented separately below in table B-5. SCE did not provide a breakdown of the costs associated with the minimum flows and channel and riparian maintenance flows for Camp 61 Creek, although we expect them to be small in proportion to the overall costs for minimum flows and channel and riparian maintenance flows provided for Project No. 67 with Camp 61 Creek costs included. Therefore, we have not removed a proportional amount of the Camp 61 Creek costs from Project No. 67 in table B-1, nor have we shown that portion of the costs in table B-5.

[b] This cost of this measure was estimated by staff.

Table B-2. Summary of capital costs, operations and maintenance costs, annualized costs and reduction in annual energy benefits for measures included in the Proposed Action and Proposed Action with Staff Modification alternatives for the Big Creek Nos. 1 and 2 Project. (Source: SCE, 2007a, and staff)

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
1	Implement new MIF releases	$0	$2,880	$5,680,740	$5,683,020	Aquatic	Yes
2	Maintain existing and new gaging stations	$0	$114,220	$0	$114,220	Aquatic	Yes
3	Install minimum flow devices and gaging equipment at Ely Creek Diversion	$314,330	$0	$0	$38,790	Aquatic	Yes
4	Install minimum flow devices and gaging equipment at Balsam Creek Diversion	$314,330	$0	$0	$38,790	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
5	Install minimum flow devices and gaging equipment at Dam No. 4	$2,245,180	$0	$0	$277,080	Aquatic	Yes
6	Decommission Pitman Creek Domestic Diversion	$20,620	$0	$0	$2,540	Aquatic	Yes
7	Decommission Snow Slide Creek Domestic Diversion	$20,620	$0	$0	$2,540	Aquatic	Yes
8	Implement temperature monitoring programs	$0	$10,540	$0	$10,540	Aquatic	Yes
9	Implement flow monitoring programs	$0	$57,110	$0	$57,110	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
10	Implement fish monitoring programs	$0	$9,150	$0	$9,150	Aquatic	Yes
11	Implement the sediment management plan at small diversions	$0	$1,030	$0	$1,030	Aquatic	Yes
12	Implement the sediment management plan at Dam No. 4	$0	$5,230	$0	$5,230	Aquatic	Yes
13	Monitoring of spawning gravel embeddedness after sediment pass-through at Dam 4[a]	$0	$1,940	$0	$1,940	Aquatic	Yes
14	Attend annual consultation meeting for water	$0	$570	$0	$570	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
	and aquatic resources						
15	Implement wildlife habitat enhancements	$0	$2,280	$0	$2,280	Terrestrial	Yes
16	Implement the Bald Eagle Management Plan	$0	$2,690	$0	$2,690	Terrestrial	Yes
17	Implement the Vegetation and Integrated Pest Management Plan	$0	$57,110	$0	$57,110	Terrestrial	Yes
18	Implement proposed license articles for special-status species, bats, and bear-human interactions	$1,880	$6,850	$0	$7,080	Terrestrial	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
19	Implement environmental programs for environmental training, ESAP, avian protection, noxious weeds, NHSSIP, and environmental compliance	$23,470	$2,860	$0	$5,760	Terrestrial	Yes
20	Attend annual consultation meeting for terrestrial resources	$0	$570	$0	$570	Terrestrial	Yes
21	Implement rehabilitation of existing recreational facilities	$9,283,890	$0	$0	$1,145,740	Recreation	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
22	Implement new recreational facilities including a day-use area at Dam No. 3 and an accessible fishing platform	$2,807,920	$0	$0	$346,530	Recreation	Yes
23	Fund fish stocking with a 50% cost share	$0	$57,110	$0	$57,110	Recreation	Yes
24	Install interpretive signs	$124,480	$0	$0	$15,360	Recreation	Yes
25	Prepare a report on recreational resources	$0	$9,180	$0	$9,180	Recreation	Yes
26	Attend annual consultation meeting for recreational resources	$0	$570	$0	$570	Recreation	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
27	Implement the Visual Resources Plan	$8,980	$0		$1,110	Land Use and Aesthetics	Yes
28	Implement the Transportation System Plan	$0	$19,420	$0	$19,420	Land Use and Aesthetics	Yes
29	Implement the Fire Plan	$0	$570	$0	$570	Land Use and Aesthetics	Yes
30	Implement the Spill Prevention and Countermeasure Plans	$0	$570	$0	$570	Land Use and Aesthetics	Yes
31	Attend annual meeting for land management resources	$0	$570	$0	$570	Land Use and Aesthetics	Yes
32	Provide transportation system plan labor	$0	$400,130	$0	$400,130	Land Use and Aesthetics	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
	and equipment						
33	Implement an HPMP	$36,820	$4,190	$0	$8,730	Cultural	Yes
34	Implement environmental programs for cultural resource awareness	$0	$1,140	$0	$1,140	Cultural	Yes
35	Attend annual consultation meeting for cultural resources	$0	$570	$0	$570	Cultural	Yes

[a] This cost of this measure was estimated by staff.

Table B-3. Summary of capital costs, operations and maintenance costs, annualized costs and reduction in annual energy benefits for measures included in the Proposed Action and Proposed Action with Staff Modification alternatives for the Mammoth Pool Project. (Source: SCE, 2007a, and staff)

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
1	Implement new MIF releases	$0	$2,890	$591,330	$594,220	Aquatic	Yes
2	Maintain existing and new gaging stations	$0	$114,220	$0	$114,220	Aquatic	Yes
3	Implement fishwater generator upgrade	$13,413,330	$0	$0	$1,655,360	Project Safety	Yes
4	Install minimum flow devices and gaging equipment at Mammoth Pool Dam	$12,865,850	$0	$0	$1,587,800	Aquatic	Yes
5	Install minimum flow devices and gaging equipment at Ross Creek Diversion	$341,670	$0	$0	$42,170	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
6	Install minimum flow devices and gaging equipment at Rock Creek Diversion	$341,670	$0	$0	$42,170	Aquatic	Yes
7	Implement temperature monitoring programs	$73,090	$15,560	$0	$24,580	Aquatic	Yes
8	Implement temperature (telemetry) monitoring programs	$0	$5,130	$0	$5,130	Aquatic	Yes
9	Implement flow monitoring programs	$0	$28,560	$0	$28,560	Aquatic	Yes
10	Implement fish monitoring programs	$0	$5,270	$0	$5,270	Aquatic	Yes
11	Implement the sediment management plan at small diversions	$0	$2,070	$0	$2,070	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
12	Gravel augmentation feasibility assessment[a]	$0	$6,610	$0	$6,610	Aquatic	Yes
13	Attend annual consultation meeting for water and aquatic resources	$0	$570	$0	$570	Aquatic	Yes
14	Implement wildlife habitat enhancements	$0	$2,280	$0	$2,280	Terrestrial	Yes
15	Implement the Bald Eagle Management Plan	$0	$2,690	$0	$2,690	Terrestrial	Yes
16	Implement the VELB Management Plan	$0	$14,850	$0	$14,850	Terrestrial	Yes
17	Implement the Vegetation and Integrated Pest Management Plan	$0	$57,110	$0	$57,110	Terrestrial	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
18	Implement proposed license articles for mule deer, special-status species and bats	$2,030	$6,850	$0	$7,100	Terrestrial	Yes
19	Implement environmental programs for environmental training, ESAP, avian protection, noxious weeds, NHSSIP, and environmental compliance	$25,390	$2,860	$0	$5,990	Terrestrial	Yes
20	Attend annual consultation meeting for terrestrial resources	$0	$570	$0	$570	Terrestrial	Yes
21	Implement rehabilitation of existing recreational facilities	$496,380	$0	$0	$61,260	Recreation	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
22	Fund fish stocking with a 50 percent cost share	$0	$28,560	$0	$28,560	Recreation	Yes
23	Disseminate flow information for whitewater boating	$0	$5,710	$0	$5,710	Recreation	Yes
24	Provide pre-spill whitewater boating releases	$0	$2,140	$0	$2,140	Recreation	Yes
25	Prepare a report on recreational resources	$0	$3,500	$0	$3,500	Recreation	Yes
26	Provide interpretive signs	$21,240	$0		$2,620	Recreation	Yes
27	Attend annual consultation meeting for recreational resources	$0	$570	$0	$570	Recreation	Yes
28	Implement the Visual Resources Plan	$213,400	$0		$26,340	Land Management	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
29	Implement the Transportation System Plan	$0	$22,850	$0	$22,850	Land Management	Yes
30	Implement the Fire Plan	$0	$570	$0	$570	Land Management	Yes
31	Implement the Spill Prevention and Countermeasure Plans	$0	$570	$0	$570	Land Management	Yes
32	Attend annual meeting for land management resources	$0	$570	$0	$570	Land Management	Yes
33	Provide transportation system plan labor and equipment	$0	$400,130	$0	$400,130	Land Management	Yes
34	Implement an HPMP	$41,640	$4,570	$0	$9,710	Cultural	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
35	Implement environmental programs for cultural resource awareness	$0	$1,140	$0	$1,140	Cultural	Yes
36	Attend annual consultation meeting for cultural resources	$0	$570	$0	$570	Cultural	Yes

Table B-4. Summary of capital costs, operations and maintenance costs, annualized costs and reduction in annual energy benefits for measures included in the Proposed Action and Proposed Action with Staff Modification alternatives for the Big Creek No. 3 Project. (Source: SCE, 2007a, and staff)

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
1	Implement new MIF releases	$0	$3,430	$1,039,670	$1,043,100	Aquatic	Yes
2	Maintain existing and new gaging stations	$0	$114,220	$0	$114,220	Aquatic	Yes
3	Install minimum flow devices and gaging equipment at Dam No. 6	$1,900,170	$0	$0	$234,500	Aquatic	Yes
4	Implement temperature monitoring programs	$52,350	$8,930	$0	$15,390	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
5	Implement temperature (telemetry) monitoring programs	$0	$3,670	$0	$3,670	Aquatic	Yes
6	Implement temperature (Hardhead and DO study) programs	$0	$7,330	$0	$7,330	Aquatic	Yes
7	Implement flow monitoring programs	$0	$28,560	$0	$28,560	Aquatic	Yes
8	Implement fish monitoring programs	$0	$7,740	$0	$7,740	Aquatic	Yes
9	Implement the sediment management plan at Dam No. 6	$0	$2,090	$0	$2,090	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
10	Implement the sediment removal at Dam No. 6	$0	$12,710	$0	$12,170	Aquatic	Yes
11	Monitoring of spawning gravel embeddedness after sediment pass-through at Dam 6[a]	$0	$1,940	$0	$1,940	Aquatic	Yes
12	Attend annual consultation meeting for water and aquatic resources	$0	$570	$0	$570	Aquatic	Yes
13	Implement wildlife habitat enhancements	$0	$2,280	$0	$2,280	Terrestrial	Yes
14	Implement the Bald Eagle Management Plan	$0	$2,690	$0	$2,690	Terrestrial	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
15	Implement the VELB Management Plan	$0	$14,850	$0	$14,850	Terrestrial	Yes
16	Implement the Vegetation and Integrated Pest Management Plan	$0	$22,850	$0	$22,850	Terrestrial	Yes
17	Implement proposed license articles for special-status species and bats	$0	$6,850	$0	$6,850	Terrestrial	Yes
18	Implement environmental programs for environmental training, ESAP, avian protection, noxious weeds, NHSSIP, and environmental compliance	$25,390	$2,850	$0	$5,990	Terrestrial	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
19	Attend annual consultation meeting for terrestrial resources	$0	$570	$0	$570	Terrestrial	Yes
20	Implement rehabilitation of existing recreational facilities	$76,200	$0	$0	$9,400	Recreation	Yes
21	Prepare a report on recreational resources	$0	$700	$0	$700	Recreation	Yes
22	Disseminate flow information for whitewater boating	$0	$5,710	$0	$5,710	Recreation	Yes
23	Attend annual consultation meeting for recreational resources	$0	$570	$0	$570	Recreation	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
24	Implement the Transportation System Plan	$0	$13,710	$0	$13,710	Land Management	Yes
25	Implement the Fire Plan	$0	$570	$0	$570	Land Management	Yes
26	Implement the Spill Prevention and Countermeasure Plans	$0	$570	$0	$570	Land Management	Yes
27	Attend annual meeting for land management resources	$0	$570	$0	$570	Land Management	Yes
28	Provide transportation plan labor and equipment	$0	$400,130	$0	$400,130	Land Management	Yes
29	Implement an HPMP	$38,490	$4,570	$0	$9,320	Cultural	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
30	Implement environmental programs for cultural resource awareness	$0	$1,140	$0	$1,140	Cultural	Yes
31	Attend annual consultation meeting for cultural resources	$0	$570	$0	$570	Cultural	Yes

[a] This cost of this measure was estimated by staff.

Table B-5. Summary of capital costs, operations and maintenance costs, annualized costs and reduction in annual energy benefits for measures included in the Proposed Action and Proposed Action with Staff Modification alternatives for the Portal Project. (Source: SCE, 2007a, and staff)

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
1	Implement new MIF and channel and riparian maintenance flow releases[a, b]	$0	$0	$0	$0	Aquatic	Yes
2	Implement Camp 61 Creek monitoring programs[b]	$0	$9,150	$0	$9,150	Aquatic	Yes
3	Implement the sediment management plan for Camp 61 Creek[b]	$0	$25,060	$0	$25,060	Aquatic	Yes

[a] SCE included in its costs for the Big Creek Nos. 2A, 8, and Eastwood Project No. 67 some measures that actually apply to the Portal Project No. 2074. These measures include proposed minimum flow releases and channel and riparian maintenance releases, water and aquatic monitoring, and sediment management. The monitoring and sediment management measures have been removed from the proposed measures for Project No. 67 and have been presented separately below in table B-5. SCE did not provide a breakdown of the costs associated with the minimum flows and channel and riparian maintenance flows for Camp 61 Creek, although we expect them to be small in proportion to the overall costs for minimum flows and channel and riparian maintenance flows provided for Project No. 67 with Camp 61 Creek costs included. Therefore, we have not removed a proportional amount of the Camp 61 Creek costs from Project No. 67 in table B-1, nor have we shown that portion of the costs in table B-5.

[b] Although we recommend these measures, they would need to be addressed in the license order for the Portal Project.

COVER SHEET

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Appendix C
Summary of Fish Abundance and Condition Factor
by Stream and Location
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APPENDIX C

SUMMARY OF FISH ABUNDANCE AND CONDITION FACTOR BY STREAM AND LOCATION

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Drainage Sub-Basin		**South Fork San Joaquin River Basin**							
	Stream	**South Fork San Joaquin River**							
	Order	5	5	5	5	5	5	5	5
	Reach	Upstream of Florence Lake	Florence Lake to Bear Creek		Bear Creek to Mono Crossing			Mono Crossing to Rattlesnake Creek	Rattlesnake Creek to SJR
	Rosgen Level I Channel Type (Rosgen, 1996)	B	B	C	G	C	B	B	G
Species	**Estimate of**								
Brown Trout	Density (#/km)	206	522	303	306	226	220	350	385
	Density (#/ha)	225	713	312	261	137	123	174	262
	Biomass (kg/ha)	N/A	35.1	11.1	8.6	9.3	8.3	4.7	10.2
	Condition Factor		1.37	1.45	1.38	1.35	1.32	1.24	1.27
Rainbow Trout	Density (#/km)		174	21	32	632	700	984	837
	Density (#/ha)		238	22	27	382	391	490	571
	Biomass (kg/ha)		13.0	2.0	0.4	6.7	23.9	5.8	9.3
	Condition Factor		1.31	1.84	1.44	1.60	1.31	1.38	1.43

Drainage Sub-Basin		South Fork San Joaquin River Basin						
	Stream	**Tombstone Creek**			**South Slide Creek**		**North Slide Creek**	
	Order	1	1	1	1	1	1	1
	Reach	Above Diversion	Below Diversion		Above Diversion	Below Diversion	Above Diversion	Below Diversion
	Rosgen Level I Channel Type (Rosgen, 1996)	Aa+	Aa+	C/E	Aa+	Aa+	Aa+	Aa+
Species	**Estimate of**							
Brown Trout	Density (#/km)	No Fish	416	No Fish	No Fish	No Fish	No Fish	No Fish
	Density (#/ha)		2,960					
	Biomass (kg/ha)		188.4					
	Condition Factor		1.37					

Drainage Sub-Basin		South Fork San Joaquin River Basin					
	Stream	**Hooper Creek**		**Crater Creek**			
	Order	3	3	1	1	1	1
	Reach	Above Diversion	Below Diversion	Above Diversion	Below Diversion	Below Diversion	Diversion Channel
	Rosgen Level I Channel Type (Rosgen, 1996)	Aa+	Aa+	Aa+	Aa+	C	Aa+
Species	**Estimate of**						
Brown Trout	Density (#/km)					No Fish	
	Density (#/ha)						
	Biomass (kg/ha)						
	Condition Factor						
Brook Trout	Density (#/km)			547	276		1,193
	Density (#/ha)			1,495	1,919		3,872
	Biomass (kg/ha)			21.2	29.8		81.4
	Condition Factor			1.46	1.05		1.33
Rainbow x Golden Trout Hybrid	Density (#/km)	663	962				
	Density (#/ha)	2,029	4,229				
	Biomass (kg/ha)	71.3	124.9				
	Condition Factor	1.23	1.31				

Drainage Sub-Basin		South Fork San Joaquin River Basin					
Stream		**Bear Creek**		**Chinquapin Creek**		**Camp 62 Creek**	
Order		4	4	1	1	2	2
Reach		Above Diversion	Below Diversion	Above Diversion	Below Diversion	Above Diversion	Below Diversion
Rosgen Level I Channel Type (Rosgen, 1996)		B	A	Aa+	Aa+	Aa+	Aa+
Species	**Estimate of**						
Brown Trout	Density (#/km)	470	1,406				
	Density (#/ha)	514	3,211				
	Biomass (kg/ha)	18.6	131.3				
	Condition Factor	1.20	1.23				
Brook Trout	Density (#/km)			665	2,034	945	1,162
	Density (#/ha)			5,452	13,094	5,928	6,780
	Biomass (kg/ha)			122.3	215.8	152.3	124.4
	Condition Factor			1.35	1.01	1.21	1.21

Drainage Sub-Basin		South Fork San Joaquin River Basin							
Stream		Bolsillo Creek			Adit No. 2[a]		East Fork Camp 61[a]	West Fork Camp 61[a]	Camp 61 Creek[a]
Order		1	1	1	1	1	1	1	1
Reach		Above Diversion	Below Diversion	Below Diversion	Upper Site	Lower Site	Above Portal Forebay	Above Portal Forebay	Below Portal Forebay[2]
Rosgen Level I Channel Type (Rosgen, 1996)		B	Aa+	B	Aa+	Aa+	Aa+	Aa+	B
Species	**Estimate of**								
Brown Trout	Density (#/km)				No Fish	601	49		940
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor					1.07	1.00		1.07
Rainbow Trout	Density (#/km)						81	65	
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor						0.90	1.00	
Brook Trout	Density (#/km)	2,187	143	1,509			1,299	2,040	
	Density (#/ha)	20,503	1,087	12,378					
	Biomass (kg/ha)	431.9	22.6	216.5					
	Condition Factor	1.11	1.22	1.24			0.97	1.02	

Drainage Sub-Basin		South Fork San Joaquin River Basin							
Stream		Bolsillo Creek			Adit No. 2[a]		East Fork Camp 61[a]	West Fork Camp 61[a]	Camp 61 Creek[a]
Order		1	1	1	1	1	1	1	1
Reach		Above Diversion	Below Diversion	Below Diversion	Upper Site	Lower Site	Above Portal Forebay	Above Portal Forebay	Below Portal Forebay[2]
Rosgen Level I Channel Type (Rosgen, 1996)		B	Aa+	B	Aa+	Aa+	Aa+	Aa+	B
Species	**Estimate of**								
Rainbow x Golden Trout Hybrid	Density (#/km)						16		
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor						1.11		

Drainage Sub-Basin		**South Fork San Joaquin River Basin**						
	Stream	**Cold Creek**[c]	**Mono Creek**			**Boggy Meadow Creek**[c]	**Warm Creek**[c]	
	Order	4	4	4	4	2	2	2
	Reach		Above Lake Edison	Below Lake Edison	Below Diversion		Upper	Lower
	Rosgen Level I Channel Type (Rosgen, 1996)	B	C	B	B	C/G	G	G
Species	**Estimate of**							
Brown Trout	Density (#/km)	632	2,462	1,259	64	848		
	Density (#/ha)				113			
	Biomass (kg/ha)				3.3			
	Condition Factor	1.01	1.07	1.17	1.10	1.08		
Rainbow Trout	Density (#/km)	74	393	259	11	141		
	Density (#/ha)				19			
	Biomass (kg/ha)				0.9			
	Condition Factor	1.05	1.09	1.20	0.91	1.02		
Brook Trout	Density (#/km)	11	243			576		
	Density (#/ha)							
	Biomass (kg/ha)							
	Condition Factor	N/A	1.07			1.05		
Rainbow x Golden Trout Hybrid	Density (#/km)	11					440	374
	Density (#/ha)							
	Biomass (kg/ha)							
	Condition Factor	N/A					1.06	1.08

Drainage Sub-Basin		**South Fork San Joaquin River Basin**					
	Stream	**Mammoth Reach**		**Rock Creek**		**Stevenson Reach**	
	Order	6	6	3	3	6	6
	Reach	Upper Site	Lower Site	Above Diversion	Below Diversion	Upper Site	Lower Site
	Rosgen Level I Channel Type (Rosgen, 1996)	B	B	Aa+	Aa+	G	G
Species	**Estimate of**						
Brown Trout	Density (#/km)	125	52	930	481	7	7
	Density (#/ha)	83	46	2,407	1,155	5	6
	Biomass (kg/ha)	2.0	4.7	91.5	42.4	0.1	0.0
	Condition Factor	1.09	1.18	1.31	1.30	1.22	1.16
Rainbow Trout	Density (#/km)	91	384	241	432	100	
	Density (#/ha)	61	340	623	1,037	76	
	Biomass (kg/ha)	2.1	12.5	29.5	29.0	0.3	
	Condition Factor	1.69	2.25	1.19	1.46	1.36	
Sacramento Sucker	Density (#/km)	498	1,197			514	15
	Density (#/ha)	331	1,061			389	12
	Biomass (kg/ha)	29.3	35.7			3.6	2.2
	Condition Factor						
Hardhead	Density (#/km)						295
	Density (#/ha)						233
	Biomass (kg/ha)						2.2
	Condition Factor						0.97
Sacramento Pikeminnow	Density (#/km)						597
	Density (#/ha)						471
	Biomass (kg/ha)						4.6
	Condition Factor						
Prickly Sculpin	Density (#/km)					43	
	Density (#/ha)					32	
	Biomass (kg/ha)					0.2	

Drainage Sub-Basin		South Fork San Joaquin River Basin					
Stream		Mammoth Reach		Rock Creek		Stevenson Reach	
Order		6	6	3	3	6	6
Reach		Upper Site	Lower Site	Above Diversion	Below Diversion	Upper Site	Lower Site
Rosgen Level I Channel Type (Rosgen, 1996)		B	B	Aa+	Aa+	G	G
Species	Estimate of						
	Condition Factor						

Drainage Sub-Basin		Big Creek Basin						
	Stream	Big Creek						
	Order	4	4	4	4	5	5	5
	Reach	Dam 1 to Powerhouse 1				Dam 4 to Powerhouse 2	Dam 5 to Powerhouse 8	
	Rosgen Level I Channel Type (Rosgen, 1996)	B	G	A	Aa+	A	A	Aa+
Species	**Estimate of**							
Brown Trout	Density (#/km)	320	648	1,214	497	363	602	160
	Density (#/ha)	462	1,852	3,572	1,579	811	946	331
	Biomass (kg/ha)	16.0	50.9	N/A	117.6	N/A	N/A	N/A
	Condition Factor	0.92	1.17		1.42			
Rainbow Trout	Density (#/km)					363	930	769
	Density (#/ha)					811	1,463	1,594
	Biomass (kg/ha)					N/A	N/A	N/A
	Condition Factor							
Prickly Sculpin	Density (#/km)		14					
	Density (#/ha)		4.051					
	Biomass (kg/ha)							

Drainage Sub-Basin		Big Creek Basin						
	Stream	**Pitman Creek**			**Balsam Creek**		**Ely Creek**	
	Order	3	4	4	3	3	1	2
	Reach	Above Diversion	Below Diversion		Above Diversion	Below Diversion	Above Diversion	Below Diversion
	Rosgen Level I Channel Type (Rosgen, 1996)	B	B	Aa+	Aa+	Aa+	Aa+	Aa+
Species	**Estimate of**							
Brown Trout	Density (#/km)	338	22					
	Density (#/ha)	780	50					
	Biomass (kg/ha)	45.4	3.2					
	Condition Factor	1.12	1.23					
Rainbow Trout	Density (#/km)	1,066	613	1,647	1,335	12	190	266
	Density (#/ha)	2,458	1,426	5,496	8,101	33	1,605	1,635
	Biomass (kg/ha)	57.3	38.2	77.5	171.6	2.3	133.9	76.7
	Condition Factor	1.20	1.71	1.45	1.56	2.07	1.25	1.38
BrookTrout	Density (#/km)	82	22					
	Density (#/ha)	189	50					
	Biomass (kg/ha)	1.5	1.0					
	Condition Factor	1.00	1.06					
Rainbow x Golden Trout Hybrid	Density (#/km)							102
	Density (#/ha)							629
	Biomass (kg/ha)							31.4
	Condition Factor							1.40

Drainage Sub-Basin		**Big Creek**			
	Stream	**Adit No. 8**	**Rancheria Creek**[1]		
	Order	1	3	3	3
	Reach	Below Diversion	Above Energy Dissipater	Below Energy Dissipater	Below Energy Dissipater
	Rosgen Level I Channel Type (Rosgen, 1996)	Aa+	B	B	A
Species	**Estimate of**				
Brown Trout	Density (#/km)	No Fish	132	110	22
	Density (#/ha)				
	Biomass (kg/ha)				
	Condition Factor		1.71	1.40	1.11
Rainbow Trout	Density (#/km)		963	679	580
	Density (#/ha)				
	Biomass (kg/ha)				
	Condition Factor		1.39	1.39	1.18
Brook Trout	Density (#/km)		569	154	33
	Density (#/ha)				
	Biomass (kg/ha)				
	Condition Factor		1.40	1.12	1.06
Sacramento Sucker	Density (#/km)		307	88	33
	Density (#/ha)				
	Biomass (kg/ha)				
	Condition Factor				

Drainage Sub-Basin		**Stevenson and North Fork Stevenson Reach**						
	Stream	**North Fork Stevenson Creek**				**Stevenson Creek**		
	Order	2	2	2	2	3	3	3
	Reach	Upstream of Tunnel 7 Outlet	Downstream of Tunnel 7 Outlet			Downstream of Shaver Lake Dam		
	Rosgen Level I Channel Type (Rosgen, 1996)	Aa+	Aa+	G	C	B	Aa+	A
Species	**Estimate of**							
Brown Trout	Density (#/km)	No Fish		305	430			
	Density (#/ha)			703	2,170			
	Biomass (kg/ha)			43.7	33.2			
	Condition Factor			1.23	1.39			
Rainbow Trout	Density (#/km)			210	314	751	966	128
	Density (#/ha)			485	1,588	2,829	3,161	309
	Biomass (kg/ha)			13.5	29.8	52.3	74.9	N/A
	Condition Factor			1.27	1.27	1.04	1.34	
Rainbow x Golden Trout Hybrid	Density (#/km)		583	11				
	Density (#/ha)		487	24				
	Biomass (kg/ha)		9.0	1.3				
	Condition Factor		0.98	1.35				
Sacramento Sucker	Density (#/km)			11	42			
	Density (#/ha)			24	212			
	Biomass (kg/ha)			13.5	65.9			
	Condition Factor							

[a] Data collected in 2002 for Portal Hydroelectric Power Project Relicensing.
[b] In 2001, brook trout were also captured with a density estimate of 1,299 fish/km.
[c] Data collected in 2000 for Vermilion Valley Hydroelectric Project Relicensing.

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FINAL ENVIRONMENTAL IMPACT STATEMENT FOR
HYDROPOWER LICENSES

BIG CREEK ALP PROJECTS
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Appendix D
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FEIS

APPENDIX D

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSES FOR THE BIG CREEK NOS. 2A, 8, AND EASTWOOD PROJECT (FERC PROJECT NO. 67), BIG CREEK NOS. 1 AND 2 PROJECT (FERC PROJECT NO. 2175), MAMMOTH POOL PROJECT (FERC PROJECT NO. 2085), AND BIG CREEK NO. 3 PROJECT (FERC PROJECT NO. 120)

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The U.S. Environmental Protection Agency's (EPA) notice of availability of the draft environmental impact statement (EIS) was issued on September 19, 2008, and comments on the draft EIS were due on November 3, 2008. In addition, Federal Energy Regulatory Commission (Commission) staff conducted a public meeting in Fresno, California, on October 15, 2008.

Five of the six persons attending the public meeting spoke. All made statements that supported the Settlement Agreement. A representative of the U.S. Department of Agriculture, Forest Service (Forest Service) encouraged Commission staff to use a collaborative approach in finalizing the Historic Properties Management Plan (HPMP) for the Big Creek projects.

In this appendix, we[58] summarize the written and oral comments received; provide responses to those comments; and indicate, where appropriate, how we modified the text in the final EIS. We grouped the comment summaries and responses by topic for convenience. We did not summarize statements that are simply in support of the Settlement Agreement or staff alternative measures without providing any new information. We also did not summarize comments that point out minor edits to the draft EIS; however, we have made these edits in the final EIS. The following entities filed comments on the draft EIS.

Commenting Entity	Filing Date
U.S. Department of the Interior	October 20, 2008
U.S. Department of Agriculture, Forest Service	October 30, 2008
Southern California Edison	October 30, 2008
California State Water Resources Control Board	November 3, 2008
U.S. Environmental Protection Agency	November 4, 2008

PROCEDURAL AND GENERAL

Comment 1: The Forest Service asks if our listing of kV on page xvii (Acronyms and Abbreviations) should be Kv.

Response: Our abbreviation for kilovolt is consistent with common practice in the industry.

Comment 2: The Forest Service, commenting on page 1-12 of the draft EIS asks: "Why is there going to be 'no response to Mammoth comments?' Public comments should be addressed."

[58] In this section "we" means the Commission staff.

Response: The statement in question pertains to our documentation of the responses to the Commission's Ready for Environmental Analysis Notice pertaining to the Mammoth Pool Project. The statement reads as follows: "SCE did not respond to the recommendations, terms, and conditions filed for the Mammoth Pool Project." The Commission affords applicants the opportunity to respond to recommendations, terms, and conditions within 45 days of the end of the comment period. Applicants are not obligated to file any responses. We addressed agency and public comments received in response to the Ready for Environmental Analysis notice in section 3 of the draft EIS.

Comment 3: The California State Water Resources Control Board (Water Board) requests clarification regarding whether those environmental protection and enhancement measures not identified in the Settlement Agreement but recommended by Commission staff for the Portal (FERC Project No. 2174) and Vermilion Valley (FERC Project No. 2086) projects would be recommended for inclusion in any new licenses issued by the Commission.

Response: Environmental measures not identified in the Settlement Agreement, but recommended by Commission staff in the National Environmental Policy Act (NEPA) documents for the Portal Project (filed on April 27, 2006) and Vermilion Project (filed on May 4, 2004) remain the same. Only those flow-related measures proposed in the Settlement Agreement that supersede measures analyzed in the Portal Environmental Assessment (EA) have been modified. We identified those superseded recommendations on pages 5-9 and 5-10 (minimum instream flows) and page 5-13 (channel and riparian maintenance flows) of the draft EIS.

Comment 4: The Water Board recommends that we include as appendices to the final EIS the following: (1) the final EA for the Portal Project; (2) the final EA for the Vermilion Valley Project; and (3) the full Big Creek alternative licensing process (ALP) Settlement Agreement.

Response: The three referenced documents are currently available to the Water Board and the general public via the Commission's eLibrary system (Portal Project: P-2174-12, accession number 20060427-3060, filed April 27, 2006; Vermilion Valley Project: P-2086-035, accession number 20040504-3076, filed May 4, 2004; and Big Creek ALP Settlement Agreement: P-2085-014, 2175-014, 67-173, 120-020, accession number 20070223-4013, filed February 21, 2007). Including them as appendices to the final EIS would increase the size of the document by nearly 1,000 pages. Given that all three documents are currently accessible in electronic format, we find little additional value in including them as appendices to the final EIS.

Comment 5: The Water Board comments that many of the impacts listed in the first column of appendix A of the draft EIS would not be considered impacts under the California Environmental Quality Act (CEQA) because they are impacts that have already occurred or currently occur. The Water Board suggests that when evaluating the potential for environmental impacts for the purpose of CEQA, Commission staff should identify impacts associated with proposed environmental measures, rather than identifying ongoing impacts of the project.

Response: We modified appendix A, *Big Creek Projects Mitigation and Monitoring Summary,* in the final EIS to respond to the Water Board's suggestion. This appendix is intended to serve as an aid to the Water Board in its CEQA analysis relating to its consideration of Water Quality Certification of the Big Creek projects.

Comment 6: EPA comments that the draft EIS has no analysis of the environmental impacts on each resource area that would result from implementation of the no-action alternative. It states that the final EIS should provide additional information on the no-action alternative to describe the environmental impacts of continuing to operate the project under the terms and conditions of the current license.

Response: The broad environmental effects of operating the projects under the no-action alternative are described in section 2.1.2, *Existing Project Operations*, of the EIS. Specific environmental effects of the no-action alternative are contained in the affected environment portion of each resource section. For example, current water level manipulation of project reservoirs is described on pages 3-3 through 3-21 of the draft EIS. Project-related flow diversions are described on pages 3-22 through 3-30 and project-related effects on water temperature are shown in table 3-8 (pages 3-36 and 3-37) of the draft EIS. Project-related effects on aquatic habitat are described on pages 3-48 (Crater Creek), 3-49 and 3-50 (Camp 61 Creek), 3-57 (Lower Big Creek), 3-60 (Florence Lake), 3-61 (Shaver Lake), 3-62 and 3-63 (Huntington Lake), 3-63 and 3-64 (Balsam Meadows forebay), and 3-64 and 3-65 (Mammoth Pool). In some instances, we describe the effects of the no-action alternative to set up our environmental analysis. For example, on pages 3-71, 3-120, and 3-126, we indicate that the lack of high quality spawning gravel and large woody debris in some bypassed reaches may be attributed to trapped materials in project reservoirs, and on page 3-108 we indicate that current project operations decrease the duration, magnitude, and frequency of high spring flows at Bear, Bolsillo, Camp 62, and Chinquapin creeks. Similarly, we describe the visual effects of the no-action alternative on page 3-243 of the draft EIS to set up our analysis of the need for a visual resources plan.

Comment 7: The Water Board states that CEQA requires the disclosure of all potential environmental impacts for a given project, a determination of the level of significance of each impact, and a statement regarding whether mitigation measures have been incorporated into the project to offset or reduce the impact. To meet this requirement, the Water Board comments that it would be helpful if we included a table in each resource section that identifies all of the potential significant impacts relative to baseline conditions and any associated mitigation. EPA also recommends that we include a table in each of the resource sections that summarizes: (1) the impacts of the hydroelectric project operation on that resource (the no-action alternative); (2) the environmental measures that are proposed under each alternative; and (3) the impacts of the project after implementing the environmental measures under each alternative.

Response: With regard to EPA's comment, we do not include staff-recommended environmental measures in section 3 of the EIS, *Environmental Analysis*, because our recommendations are also based on our developmental analysis (costs) of implementing various environmental measures as described in section 4 of the EIS. However, with respect to the Water Board's comment, our revisions to the CEQA summary table in the final EIS should address the comment of the Water Board, to some degree. The typical organization of our environmental effects section in each resource area is to define the issue that environmental measures are intended to address if not obvious, list the measures proposed by the applicant and recommended by any other entities that would address the issue (with the exception of Commission staff, as explained above), and our analysis of the effects of the various proposed and recommended measures on the environment. In some instances, we present proposed or recommended measures in tabular form to assist the reader, but since any table in the format that EPA proposes would not include the staff recommendations, the suggested table would not be an accurate representation.

Comment 8: EPA recommends that the final EIS provide additional detail describing how activities would be performed for all proposed dismantling or construction actions, including in-water work activities associated with small diversion decommissioning, sediment removal, and recreational improvements including construction of boat ramps and docks. EPA also recommends that the final EIS include measures that would be taken to avoid and minimize both short- and long-term adverse impacts to water quality, aquatic resources, and other resources and should propose mitigation to compensate for unavoidable impacts. EPA states these measures and mitigation should be included in the Record of Decision.

Response: Commission approval of specific measures that would be included in a new license for a project does not dismiss the need for additional permits and approvals that may be associated with each measure. SCE recognizes this fact in many of the plans that it includes in its proposed project.

For example, although the proposed removal of five small back country diversion dams that are 5 feet or less in height would be accomplished primarily by equipment that can be carried to the site (hand tools and explosives), SCE expects to spend the first year from license issuance consulting with agencies and obtaining appropriate permits for this work, which may include a water quality certificate from the Water Board. We added text to the final EIS to reiterate the proposed agency consultation regarding what, if any, additional measures should be taken to protect water quality and aquatic resources. Only one of these dams (North Slide Creek) is known to have any substantive sediment behind it, which when the dam is breached would have the potential to temporarily increase turbidity. However, all dam removals would occur during late summer or early fall, when flows would be low and potential for adverse effects on aquatic habitat from sedimentation would be minimal and short-term, which we point out on pages 3-117 and 3-118 of the draft EIS. We consider the removal of these five diversion dams to represent a net benefit to aquatic habitat by removing migratory barriers and restoring geomorphological processes, which would more than compensate for any short-term effects during the removal process. SCE would submit its permit applications and supporting material to the Commission when it submits them to other permitting agencies. The Commission would analyze the potential environmental effects of the proposed future specific decommissioning measures in the permit applications.

Monitoring is proposed at most diversions where sediment removal may occur, as indicated in table 3-14 of the draft EIS. Sediment removal would occur during low flow periods when potential water quality degradation from sedimentation would be minimized. Monitoring results would be submitted to regulatory agencies, including the Water Board, and the need for adjustments to sediment management activities evaluated in an adaptive manner. We added text in the final EIS that underscores the adaptive approach that SCE proposes to take regarding sediment management.

SCE also proposes numerous recreational facility enhancements. Many of these represent rehabilitation of existing facilities, some of which are managed by SCE, others by the Forest Service. Rehabilitation of existing recreational facilities, as needed, is part of the expected maintenance of existing facilities and use of best management practices would minimize the potential for adverse effects to water quality and aquatic habitat. We note that proposed rehabilitation or construction of new boat ramps and docks occur at reservoirs that are seasonally drawn down outside the peak recreational season. Thus rehabilitation or new construction of ramps and docks can readily be accomplished without any in-water work. SCE proposes to consult annually with the Forest Service to coordinate plans for recreational facility construction that would occur during the following year. This would include identifying permitting needs and sensitive natural resources that would need to be protected. We added text to the final EIS that reiterates SCE's (and our recommended) approach to working with the Forest Service to minimize adverse effects to natural resources. We also added text to the discussion of recommended measures pertaining to the Recreation Management Plan in section 5.2 of the final EIS to specify that SCE provide best management practices to minimize effects on natural resources in its specific plans for the proposed four new recreational facilities. These plans would be prepared prior to the scheduled implementation of new facility construction.

Comment 9: The Water Board states that clarification and possibly additional analysis would be needed in the final EIS if that document is to serve as the environmental review document under CEQA. Specifically, the final EIS should address whether the potential exists for impacts in the following areas: (1) noise; (2) traffic; (3) hazardous materials; (4) utilities/service systems; (5) air quality; and (6) agricultural resources.

Response: In response to the Water Board's comment, we added sections to the final EIS that discuss noise and air quality. The effects of relicensing on road use and management is addressed in the context of SCE's proposed Transportation System Management Plan, which we discuss on pages 3-240 and 3-241 of the draft EIS. Relicensing the Big Creek ALP Projects should not have a bearing on traffic over the long-term, because recommended recreational measures would do little to increase the capacity of existing recreational facilities. Measures to protect the public and the environment from the accidental release of hazardous materials are required by state and federal regulations, and must be in place regardless of the status of this relicensing proceeding, as we discuss on page 5-31 of the draft EIS. However, the Forest Service specifies that SCE develop a Spill Prevention and Countermeasure Plan as a section 4(e) condition. This would ensure that protection from hazardous materials is appropriately addressed. The effects of relicensing of the Big Creek ALP Projects on the economic aspects of those four utility projects is addressed in section 4, *Developmental Analysis*. Relicensing the Big Creek ALP Projects would have no effect on agricultural resources. As noted in section 2.1.2, *Existing Project Operations*, the Big Creek System projects must be operated in compliance with the Mammoth Pool Operating Agreement between SCE and the U.S. Bureau of Reclamation. This agreement ensures that sufficient water is available from releases at Friant dam for downstream irrigators independent of this relicensing proceeding. Therefore, relicensing the Big Creek ALP Projects would have no effect on agricultural resources.

Comment 10: EPA comments that the final EIS should include a discussion of existing air quality and conformity with the state and federal air regulations. It should describe and estimate air emissions from potential construction and other activities, as well as propose mitigation measures to minimize those emissions. EPA states that the final EIS should include an analysis of impacts expected from implementation of a fire management and response plan.

Response: As noted in the previous response, we added a section to the final EIS that addresses air quality. Implementation of a fire management and response plan by SCE would focus on measures to prevent, control, report, and investigate fires in the vicinity of the projects. SCE would not be in a position to implement controlled burns within the Sierra National Forest, which is managed by the Forest Service. Therefore, implementation of a fire management and response plan by SCE would have no effect on air quality.

NEED FOR POWER

Comment 11: The Water Board comments that it would be helpful if the final EIS included a discussion of how SCE plans to make up for lost generation that would accompany implementation of the proposed measures. This would address potential indirect impacts that may result from the proposed action.

Response: We cannot predict how SCE would make up for lost generation that would accompany implementation of proposed, flow-related measures. SCE states that it must purchase its unmet capacity and energy requirements from the existing market because it does not have any deactivated or retired generation plants that could be restarted to replace lost capacity and energy and has no plans to construct new generation facilities (SCE, 2007a). Depending on the source of the replacement power that SCE would purchase, indirect environmental effects would vary. The power produced by the Big Creek ALP Projects cannot be replaced by an alternative source at a lower cost (SCE, 2007a). Consequently, there would be an increase in energy costs to SCE customers.

PROJECT DESCRIPTION

Comment 12: SCE comments that the Big Creek No. 4 Project is one of the seven projects that make up the Big Creek System and should be included in table 2-1, Big Creek System hydroelectric projects.

Response: We excluded the Big Creek No. 4 Project from this table in an effort to focus the reader's attention on the four projects that are the subject of this EIS and the two additional projects that influence operations at these four projects. All Big Creek System flow chains converge at the upstream end of Redinger reservoir (the Big Creek No. 4 impoundment), and the Big Creek No. 4 Project has already received its license from the Commission. The relationship of the Big Creek No. 4 Project to upstream projects is shown in figures 2-1, 3-1, and 3-6. In response to this comment, we changed the caption of table 2-1 to "Big Creek System hydroelectric projects that are relevant to this proceeding."

Comment 13: SCE recommends modifying the dependable operating capacity values shown in figure 2-1 as follows: (1) Big Creek powerhouse 2A should be 98.5 megawatts (MW); (2) Big Creek powerhouse 1 should be 82.9 MW; (3) Mammoth Pool powerhouse should be 187 MW; and (4) Big Creek powerhouse 3 should be 181.9 MW. In addition, Florence Lake usable storage is 64,406 acre-feet.

Response: We have adjusted figure 2-1 to more accurately reflect the description of various project features.

Comment 14: The Forest Service notes that the schematic shown in figure 2-1 (page 2-3 of the draft EIS) does not indicate that Balsam Creek releases from the forebay are recaptured downstream within the Big Creek System.

Response: The purpose of figure 2-1 is to show the geographical relationship of existing project facilities associated with the Big Creek System, not the flow through the system. The complex nature of flows through the Big Creek System, including the fate of water released to Balsam Creek from the Balsam Meadows forebay, is shown in figures 3-1 (page 3-5 of the draft EIS) and 3-6 (page 3-46 of the draft EIS).

Comment 15: SCE suggests changing the column heading for table 2-2 from "Usable Storage at Maximum Pool (acre-feet)" to "Usable Capacity at Maximum Pool (acre-feet)" because this better defines the volume of water that can be impounded at each facility.

Response: We have modified the referenced column heading to read "Usable Storage Capacity at Maximum Pool (acre-feet)" to be consistent with terminology in the Commission's regulations.

Comment 16: SCE comments that our summary of sediment management prescriptions on page 2-27 infers that sediment management would only occur at Dam 4, 5, and 6. Article 1.10 of the Settlement Agreement calls for sediment management at other small, moderate, and large diversions. Alternative language is offered that reflects the actual proposed measure.

Response: We modified the description of this measure in the final EIS to reflect SCE's suggested clarification.

CUMULATIVELY AFFECTED RESOURCES

Comment 17: The Water Board states that it would be helpful for its CEQA review if we revised the discussion of cumulative impacts to distinguish between ongoing project impacts and impacts associated with the implementation of the proposed environmental measures at the projects.

Response: We modified the cumulative effects discussion of sections 3.3.1.3, *Aquatic Resources*, 3.3.2.3, *Terrestrial Resources*, and 3.3.4.3, *Recreational Resources*, in the final EIS to distinguish between ongoing project effects and effects associated with implementation of proposed environmental measures as requested by the Water Board.

Comment 18: The Water Board requests that we clarify in section 5 of the final EIS whether the potential cumulative environmental effects for the Big Creek ALP Projects are less than significant pursuant to NEPA.

Response: We included a statement that the proposed relicensing of the Big Creek ALP Projects would result in less than significant cumulative environmental effects in the three subsections referenced in the previous response.

Comment 19: The Water Board notes that the Settlement Agreement includes environmental measures for the Portal and Vermilion Valley projects. Consequently, it requests that we clarify whether we consider the cumulative effects of the preferred alternatives for the Portal and Vermilion Valley projects to be less than significant pursuant to NEPA when compared to and included with the potential cumulative effects of the Big Creek ALP Projects.

Response: The Portal and Vermilion Valley projects are integrally related to the Big Creek ALP Projects, and we considered this relationship in our cumulative effects analysis. Therefore, the response to the previous comment would apply to the Portal and Vermilion Valley projects.

Comment 20: EPA states that the draft EIS does not sufficiently evaluate the potential cumulative effects from the projects on resources in the surrounding area other than hydropower operations, nor does it sufficiently describe impacts to resources from other projects or activities within the geographic and temporal scope of the project. EPA recommends that we use the California Department of Transportation Indirect and Cumulative Impacts Analysis in our assessment of cumulative effects. In addition, EPA states that the final EIS should provide a substantive discussion of the cumulative effects of the proposed action, propose mitigation for all cumulative impacts, and clearly state the lead agency's mitigation responsibilities and the mitigation responsibilities of other agencies.

Response: We included a discussion of cumulative effects on applicable resources in sections 3.3.1.3, *Aquatic Resources*, 3.3.2.3, *Terrestrial Resources*, and 3.3.4.3, *Recreational Resources* of the draft EIS. As indicated in our responses to comments 21 and 22, we consider the cumulative effect of relicensing the Big Creek ALP Projects to be less than significant. Therefore, we conclude that no mitigation for cumulative effects is necessary.

Comment 21: EPA recommends including a discussion about the potential effects of climate change relative to the proposed action in the cumulative effects analysis of the final EIS. EPA requests that the discussion summarize the applicable climate change studies, including the findings and recommendations for addressing potential effects on environmental resources and water supplies.

Response: From our review of the reports, EPA references, and other related reports on potential climate change, we conclude that future climate change effects on water resources and water temperatures in the area of the Big Creek System are unknown, although some models may attempt to predict change at the river basin level.

The final EIS examines the effects of operating the projects under a variety of historic flow regimes, including high and low flow years, which shows the flexibility of the Big Creek System to respond to hydrologic change. Brekke et al. (2009) state that adaptive management is an approach that makes decisions sequentially over time and allows adjustments to be made as more information is known. They suggest that this approach may be useful in dealing with the additional uncertainty introduced by potential climate change. Our recommendations in this final EIS incorporate adaptive management principles. The Commission's standard reopener article would be included in any license as the vehicle for making changes to the license if unforeseen and unanticipated adverse environmental effects occur in the future.

AQUATIC RESOURCES

Comment 22: The Forest Service finds the description of lake elevations to be confusing. On page 3-3 of the draft EIS, we describe Florence Lake as the highest elevation storage reservoir in the Big Creek ALP Projects. On page 2-18, we state that Lake Thomas A. Edison is the highest elevation reservoir in the Big Creek System.

Response: We added a footnote on page 3-3 of the final EIS to state that Lake Thomas A. Edison is part of the Vermilion Valley Project, part of the Big Creek System, but not part of the Big Creek ALP Projects that are the subject of this EIS.

Comment 23: The U.S. Department of the Interior (Interior) comments that there are discrepancies between the information presented in table 3-3 and information on the U.S. Geological Survey (USGS) website. Specifically, USGS reports the period of record for station 11230215 is October 1975 to September 2007, not October 1982 to September 2002, and the maximum monthly flows for June, July, and September are different from the data reported by USGS.

Response: We added a footnote to table 3-3 to indicate that the period of record specified in the table should not be interpreted as the total period of record available for these sites. When available, the period of record used for table 3-3 was the 20-year period from water year 1983 to water year 2002, corresponding to the period of record used in the relicensing studies. Several of the gages, such as 11230215, have longer total periods of record, but others, like gage 11237000, have shorter periods of record. We also added footnotes to tables 3-3, 3-4, and 3-7 to clearly indicate that these tables provide the daily minimum and maximum daily flows for each month and not the minimum and maximum monthly flow values.

Comment 24: Interior comments that there are discrepancies between the information presented in table 3-7 and information on the USGS website. Specifically, USGS reports the period of record for station 11237700 is October 1986 to September 2007, not October 1982 to September 2002, and the maximum monthly flow presented for July at station 11230539 is actually the highest daily mean for the period of record. In addition, at station 11230600, table 3-7 presents flow data for December, January, and February, but USGS reports no data collection during these months.

Response: We revised the final EIS to indicate that the period of record used for station 11237700 in table 3-7 was October 1986 to September 2002. We added a footnote to tables 3-3, 3-4, and 3-7 to clearly indicate that these tables provide the minimum and maximum daily flows for each month and not the minimum and maximum monthly flow values. Official year-round data was not available from some of the very small diversions located at high elevations during some winter months when the diversions were not in use. During some winter months, data for gaging stations on Camp 62 Creek (11230600), Bolsillo Creek (11230670), and Chinquapin Creek below the diversion dam (11230560) were based on synthesized data from the SCE license application. A footnote to this effect was added to table 3-7.

Comment 25: SCE comments that the four analytes listed on page 3-35 of the draft EIS, (including benzene, toluene, ethylbenzene, and total xylene) were not detected at concentrations that exceeded Basin Plan standards, and our text should be modified accordingly.

Response: Our text on page 3-35 of the draft EIS was taken directly from page 4-4, lines 3 to 6, of the cited reference (SCE, 2003h. CAWG-4-Chemical water quality), which incorrectly states that values of these analytes occasionally did not meet Basin Plan standards. We reviewed tables CAWG-4-9, 10, 11, and 12 and agree that the four analytes were not detected at concentrations that exceeded Basin Plan objectives. We modified the text to state that these analytes "were occasionally detected, but the measured values did not exceed Basin Plan objectives."

Comment 26: On page 3-47 of the draft EIS, we indicate that natural barriers on Hooper Creek limit brown and brook trout spawning migrations during low flow conditions in the fall. SCE states that brown and brook trout are not found in Hooper Creek, and suggests we modify our text to indicate that the natural barriers would limit brown trout spawning migrations from the South Fork San Joaquin River during low flow conditions in the fall.

Response: We added a footnote that indicates that brook trout and brown trout are not currently known to occur in Hooper Creek, but do occur in nearby streams.

Comment 27: The description of the affected environment of Mono Creek on page 3-51 of the draft EIS, includes the statement: "Streambank erosion in Mono Meadow due to livestock results in large amounts of fine sediment deposition and degraded fish habitat, limiting fish and macroinvertebrate production throughout the bypassed reach." SCE requests that we delete this sentence because no conclusions were made regarding the effects of livestock on instream sediment deposition or the quality of fish habitat in the Amended Preliminary Draft EA or relicensing study reports.

Response: Page 5.2.4-49 of the Amended Preliminary Draft EA states that the low-gradient reach flowing through Mono Meadow is grazed by cattle, and that the abundance and widespread distribution of fine sediments present when habitats were characterized and fish were sampled likely reduced the habitat value of Mono Creek for trout and macroinvertebrates. We modified this text to read: "At the time that SCE conducted its habitat and fisheries surveys in Mono Creek, habitat conditions were adversely affected by the abundance and distribution of fine sediments. SCE reported that fine sediments have been less abundant in pools since high flows occurred in 2005 and 2006."

Comment 28: SCE, commenting on our introductory statement pertaining to minimum instream flows (MIF) on page 3-65 of the draft EIS, notes that flow releases would be the flows specified in the Settlement Agreement or natural inflow, whichever is less.

Response: We added clarifying text to the final EIS in response to SCE's comment.

Comment 29: SCE suggests that we delete footnote 32 on page 3-76 of the draft EIS, which indicates that weighted usable area (WUA) analyses were not completed for the existing brown trout spawning habitat and refers us to CAWG-3, figure-23 for this data.

Response: We have adjusted the text in the final EIS to include a discussion of brown trout spawning WUA for existing and proposed flows in the Stevenson reach.

Comment 30: Page 3-77 of the draft EIS includes the statement: "A WUA analysis was not completed for Sacramento pikeminnow habitat." SCE refers us to CAWG-3, figure 3-25 for WUA analysis data for the Stevenson reach and suggests we delete the indicated sentence.

Response: We have modified the text in the final EIS to include a discussion of WUA results for Sacramento pikeminnow in the Stevenson reach.

Comment 31: On page 3-77 of the draft EIS, we indicate that daily mean and maximum water temperatures in the Mammoth reach were above 20^{o}C and excessive thermal warming was occurring during the summer and early fall months of 2000 and 2001. SCE comments that temperatures above 20^{o}C were not recorded in 2000 and we should delete this reference to 2000.

Response: We have modified the text in the final EIS in response to SCE's comment.

Comment 32: On page 3-80 of the draft EIS we state that Balsam Creek does not have an MIF. SCE states that Upper Balsam Creek currently does have an MIF.

Response: We corrected the text in the final EIS to read as follows: "The current MIF in Upper Balsam Creek downstream of the forebay is 0.5 cfs from October through May and 1 cfs from June through September. Lower Balsam Creek does not have an MIF."

Comment 33: Page 3-83 of the draft EIS, in the description of Upper Big Creek, includes the statement: "The existing MIF (0 to 2 cfs) is much lower than the historic 30-day unregulated minimum flow (639 cfs)." On page 3-84 of the draft EIS, we state that the proposed MIF of 2 to 5 cfs would be substantially lower than the historic 30-day unregulated minimum flow of 639 cfs. The Forest Service and SCE comment that the unregulated 30-day minimum determined by the Indicators of Hydrologic Alteration analysis was 1.6 cfs. SCE states that the regulated value is 2.3 cfs. The 30-day maximum unregulated flow was 639 cfs. SCE suggests we modify the sentence on 3-83 to read as follows: "The existing MIF (0 to 2 cfs) and 30-day regulated minimum flow at the mouth of Big Creek is 2.3 cfs, greater than the historic 30-day unregulated minimum flow at the mouth of Big Creek (1.6 cfs)."

Response: We have changed the values for the 30-day minimum unregulated flows for dry and wet water years according to the values provided in CAWG-6 Appendix L, table 13b (0.4 cfs in dry years and 3.5 cfs in wet years).

Comment 34: Page 3-84 of the draft EIS includes the statement: "IHA (indicators of hydraulic alteration) or WUA analyses were not done for the Ely Creek bypassed reach." SCE suggests that we modify this sentence as follows: "Although IHA and WUA analyses were not done for the Ely Creek bypassed reach, a wetted perimeter analysis was completed."

Response: We have added information from the wetted perimeter analysis to our evaluation of the effects of proposed MIFs on habitat in the Ely Creek bypassed reach.

Comment 35: On page 3-85 of the draft EIS, we list a specific resource objective of the Forest Service and Interior for the North Fork Stevenson Creek bypassed reach as: "Contribute to spring runoff in the South Fork San Joaquin River bypassed reach to provide environmental cues for aquatic and riparian ecosystems." SCE recommends that we remove this bullet because North Fork Stevenson Creek drains into Shaver Lake, not the South Fork San Joaquin River.

Response: The indicated resource objective was identified by Interior, but not by the Forest Service. We agree that this resource objective is not appropriate for North Fork Stevenson Creek and have removed it from the final EIS.

Comment 36: Page 3-86 of the draft EIS includes the statement: "Pitman Creek does not have a current MIF, and IHA and WUA analyses were not done for Pitman Creek." SCE suggests that we change this sentence to: "Pitman Creek has a current MIF of 0.3 cfs throughout the year. Although WUA analyses were not done for Pitman Creek, IHA and wetted perimeter analyses were completed."

Response: We have modified the text in the final EIS to reflect the existing MIF requirement of 0.3 cfs, and we have added information from the wetted perimeter analysis to our evaluation of the effects of proposed MIFs on habitat in the Pitman Creek bypassed reach.

Comment 37: On page 3-87 of the draft EIS, footnote 33, we state: "WUA analyses were not done for the existing conditions in Bear Creek." SCE suggests that we revise this footnote to read: "WUA analysis was completed for flows representing the existing and proposed conditions in Bear Creek."

Response: We have modified the final EIS to include presentation of brown trout WUA under both existing and proposed MIFs in Bear Creek.

Comment 38: Page 3-89 of the draft EIS includes the statement: "The 28-mile long South Fork San Joaquin River bypassed reach is the longest bypassed reach in the project area and receives inflow from 11 tributaries downstream of Florence dam, all of which have flows reduced by hydroelectric diversions." SCE suggests that we clarify this statement by indicating that this bypassed reach also receives flows from undiverted tributaries.

Response: We have clarified this statement in the final EIS.

Comment 39: On page 3-91 of the draft EIS, in our discussion of MIFs for the South Fork San Joaquin River we state: "WUA analyses of adult brown trout habitat and brown trout spawning habitat based on the proposed MIF were not done because existing adult WUA is greater than 90 percent." SCE recommends that we modify this sentence to read: "WUA analyses of adult brown trout habitat and brown trout spawning habitat show that at both the existing and proposed MIFs, WUAs are greater than 90 percent of maximum."

Response: We have modified the text in the final EIS to include WUA values for brown trout adult and spawning habitat.

Comment 40: In our discussion of channel and riparian maintenance flows at Bear, Bolsillo, Camp 62, and Chinquapin creeks on page 3-107 of the draft EIS, we list a project effect as "altered flood plain connectivity" and that "(t)hese alterations also affect the extent and condition of riparian vegetation." SCE comments that no floodplains were identified along these four streams downstream from the diversions in its study reports and no riparian issues were identified on these channels in the amended preliminary draft EA, and these two statements should be deleted.

Response: We have modified the text in the final EIS to reflect that channel and riparian maintenance flows in these reaches would primarily benefit stream geomorphology and sediment transport rather than riparian resources.

Comment 41: On page 3-110 of the draft EIS in our analysis of channel and riparian maintenance flows in Mono Creek we state: "The banks damaged by livestock in Mono Meadow, however, may be susceptible to increased bank erosion under flows of this magnitude. Monitoring would allow a determination of the extent of bank erosion and the potential need to modify channel and riparian maintenance flows or implement bank stabilization measures." SCE recommends that we delete this text because livestock grazing is unrelated to the project, and actions related to monitoring or mitigating for grazing should not be its responsibility.

Response: We recognize that bank erosion caused from livestock grazing is not a project-related direct effect. However, implementation of channel and riparian maintenance flows at Mono Creek would be a project-related action that could result in exacerbation of adverse effects of bank instability caused by grazing. Our statement is meant to support the purpose of the pool monitoring that SCE proposes to implement. If monitoring shows an increase in sediment following implementation of channel and riparian maintenance flows, a possible outcome would be to adjust the magnitude of the flow releases. This would be SCE's responsibility. Another outcome could be to restrict access of livestock to Mono Creek or implement bank stabilization measures, which would not necessarily be SCE's responsibility. We added a statement to this effect in the final EIS.

Comment 42: On page xxii of the draft EIS, we state: "…water temperature would be monitored at selected bypassed reaches and reservoirs to ensure that Basin Plan objectives are met…" SCE suggests that we modify this statement to read: "…water temperature would be monitored at selected bypassed reaches and reservoirs to ensure that water temperature objectives are met to the extent that they are Project controllable effects."

Response: We have adjusted the text in the final EIS in response to SCE's comment.

Comment 43: On pages 5-5 (third bullet under recommended measures at Big Creek Nos. 2A, 8, and Eastwood Project), 5-7 (third bullet under recommended measures at the Mammoth Pool Project), and 5-16 (in our discussion of water temperature monitoring), SCE recommends that we delete references to "telemetry" because not all stations proposed for water temperature monitoring would be monitored via telemetry.

Response: We have adjusted the text in the final EIS in response to SCE's comment.

Comment 44: The Forest Service comments that in our discussion of proposed fish monitoring on pages 3-124 and 3-125 of the draft EIS, no mention is made of the requirement to conduct a minimal amount of night snorkeling in the Mammoth reach of the San Joaquin River.

Response: We added a reference to the night snorkeling element of the proposed fish monitoring plan in the final EIS.

Comment 45: The Forest Service indicates that no mention is made of the number of times that trout livers in Mammoth Pool or tissue from hardhead in Redinger reservoir exceeded the recommended guidelines for mercury or silver in the water quality section or in our discussion of fish tissue sampling that would be conducted in project reservoirs on page 3-126 of the draft EIS.

Response: We added information on the results of fish fillet and tissue sampling to the affected environment, and added text explaining the potential benefits of conducting additional fish tissue sampling for silver as part of the fish monitoring plan.

Comment 46: In table 3-14, we indicate that the need for flushing flows from Portal and Balsam Meadows dam is to be determined. SCE notes that the Settlement Agreement states for both the Portal and Balsam Meadows forebays: "If the licensee determines that 'flushing' flows are required as part of the sediment management, such flows will only be released within the time frames and peak magnitudes specified in the Portal CRM (channel and riparian maintenance) flow unless otherwise agreed to by the USDA-FS (Forest Service) and other interested governmental agencies." SCE points out that since the Portal channel and riparian maintenance flow only specified flows for Camp 61 Creek, not Balsam Creek a flushing flow would only be a possibility at Portal dam. SCE asks us to replace the "TBD" for flushing flows at Balsam Meadows dam with "no." SCE also asks us to adjust the text on page 3-131 where we imply that flushing flows could be implemented at both Balsam and Camp 61 creeks.

Response: We have modified table 3-14 to clarify SCE's intent that flushing flows not be implemented in Balsam Creek and modified the text on page 3-131 accordingly.

Comment 47: The Forest Service agrees with our recommendation to monitor gravel embeddedness downstream of Dam 4, 5, and 6, but adds that the monitoring method should be consistent with other sediment monitoring protocols specified for other reaches, such as V* or riffle sediment monitoring.

Response: We have modified the text to indicate that the specific methodology to be used would be determined in consultation with the agencies. We note that the sediment management prescriptions in the Settlement Agreement include the use of the V* metric to quantify pool-filling downstream of Dam 4, 5, and 6, and that this metric is not appropriate for measuring embeddedness.

TERRESTRIAL RESOURCES

Comment 48: The Forest Service states that the spelling of Klamath weed on page 3-137 of the draft EIS and elsewhere should be corrected to klamathweed, the common name provided by the California Department of Food and Agriculture.

Response: We have corrected the spelling of this species to be "Klamathweed" throughout the EIS, as indicated on the California Department of Food and Agriculture's website (http://www.cdfa.ca.gov/phpps/IPC/weedinfo/winfo_table-commname.htm).

Comment 49: On page 3-152 of the draft EIS, we list where western pond turtles are known to occur at the Mammoth Pool Project. The Forest Service points out that the western pond turtle is also known to occur along Ross Creek.

Response: We have added this information to the final EIS.

Comment 50: On page 3-157 of the draft EIS, in our analysis of riparian monitoring, we state that adaptive management would be implemented based on pool and riparian monitoring results to ensure the channel and riparian management goals are met in Bear, Bolsillo, Camp 62, Chinquapin, Mono, Camp 61, and the South Fork San Joaquin River bypassed reaches. SCE indicates that riparian and sediment monitoring would not be conducted on Bear, Bolsillo, Camp 62, and Chinquapin creeks and asks us to adjust the text in the final EIS accordingly.

Response: We adjusted the text of the final EIS as suggested by SCE.

Comment 51: The Forest Service, commenting on page 3-158, notes that the bald eagle is a Forest Service Sensitive Species.

Response: In our analysis on page 3-158 of the draft EIS, we discuss project effects on special status species, including Forest Service Sensitive Species, that are not federally listed under the Endangered Species Act. This includes the bald eagle. We do not differentiate, in this section, the various special status categories; however, we have revised table 3-16 to reflect the bald eagle's updated status as a Forest Service Sensitive Species that has been delisted under the Endangered Species Act.

Comment 52: The Forest Service states that a table that summarizes the effects determinations for Forest Service sensitive terrestrial and aquatic wildlife and sensitive plants should be included in the effects section of the final EIS. This would ensure the reader understands that Forest Service Manual direct for Sensitive Species has been followed.

Response: Although we list special-status plant and wildlife species that could occur in the vicinity of the Big Creek ALP Projects, and include analysis of those species that we conclude could be affected by the relicensing of the projects, we have not analyzed all plant and wildlife species that could occur in the vicinity of the project. The analysis of all species in the project area is included in SCE, 2007c (Biological Assessment/Biological Evaluation for Southern California Edison's Big Creek

Hydroelectric Projects). This assessment was developed by SCE in consultation with the Forest Service and other stakeholders.

Comment 53: On page 3-156 of the draft EIS, prior to our discussion of riparian monitoring, we state the following: "Additionally, preparing a biological evaluation or assessment, as appropriate, prior to constructing any new project facilities would maintain or enhance the protection of special-status plants and wildlife within the Big Creek ALP Projects during the course of any new licenses." The Forest Service states that both a biological evaluation and assessment would need to be completed, so the "or" should be replaced with "and."

Response: We made the change suggested by the Forest Service in the final EIS. Although in some cases SCE would prepare both a biological evaluation and a biological assessment, this is not always the case. However, the potential that only one of the two documents might be needed is covered by our statement "as appropriate" in the referenced statement.

Comment 54: On page 3-162, we state: "Deer mortality was also caused by the Daulton Creek diversion (steep-sided and hazardous during high-flows), trash buildup at points where deer were trying to swim the reservoir, and harassment from recreational activities on the reservoir." The Forest Service asks if we meant to say the Daulton Creek bridge, since they are unaware of a Daulton Creek diversion.

Response: The referenced document, the TERR-14 Mule Deer Study Report (SCE, 2003i) states that deer mortality was found to be caused by the Daulton Creek diversion. The Daulton Creek diversion was created during the construction of Mammoth Pool when the lower portion of Daulton Creek was diverted. This created a section of creek bed that was steep-sided and hazardous for deer to cross during high water flows. As discussed in the EIS, the Daulton Creek bridge was constructed to aid deer migration.

Comment 55: In our summary of effects of the proposed action and alternatives on page 5-1, we state that "Under SCE's and the staff alternatives: (1) wildlife habitat would be enhanced; …" The Forest asks how wildlife habitat would be enhanced, and suggests that we change this to "wildlife habitat would be maintained;…"

Response: Our analysis indicates that relicensing the projects under the staff alternative would enhance wildlife habitat over current conditions in several ways, including: the release of channel and riparian maintenance flows and additional actions that could result from implementation of riparian monitoring which would enhance riparian habitat; implementation of the vegetation and integrated pest management plan which would limit the spread of noxious weeds thereby enhancing native wildlife habitat; and implementation of mule deer protection measures which would enhance mule deer migration conditions.

THREATENED AND ENDANGERED SPECES

Comment 56: The Forest Service comments that on page 3-169 of the draft EIS, second paragraph, we state "new road will be put in where VELB (valley elderberry longhorn beetle) surveys have not been conducted." They say this sentence should be changed to say "surveys for VELB will be conducted prior to new roads."

Response: The EIS states that, "SCE proposes to include several new roads as project roads that have not yet been surveyed for VELBs." The EIS then continues with, "SCE proposes to survey the roads that are at or below 3,000 feet in elevation to determine the location of potential VELB." Both of these statements are accurate.

RECREATIONAL RESOURCES

Comment 57: SCE comments that in our listing of major rehabilitation measures proposed for the Big Creek Nos. 2A, 8, and Eastwood Project on pages 3-199 and 3-200 of the draft EIS, all but the first two are owned and operated by SCE. As such, SCE conducts rehabilitation and maintenance of signage on an ongoing basis during the term of the license as part of routine maintenance and repair activities, as described in the Recreation Management Plan included as Appendix O of the Settlement Agreement. SCE asks that we add a footnote to this effect to bullets 3 through 8.

Response: The footnote that SCE requests was included in table 3-23 of the draft EIS (page 3-197). It would be redundant to include it again on pages 3-199 and 3-200.

Comment 58: In the first bullet describing proposed rehabilitation measures at the Big Creek Nos. 1 and 2 Project on page 3-201 of the draft EIS, we state that SCE plans to install 3 single standing vault toilets at the Huntington Lake East Boat Ramp. In the third bullet, we state that SCE proposes to rehabilitate 36 picnic sites at the Bear Cove day-use picnic area. SCE states that they only plan on installing two single standing vault toilets at the boat ramp and rehabilitating 30 picnic sites at the day-use area.

Response: In SCE's November 27, 2007, AIR response, in Attachment AIR-2-B, page AIR-2-B-1, SCE states that it would install three single standing toilets at the Huntington Lake East Boat Ramp. We therefore have not changed the first bullet. We have modified the third bullet as requested by SCE.

LAND USE

Comment 59: On pages 3-240 and 3-241, we reference tables included in the Settlement Agreement that specify roads considered project roads, and therefore included within the jurisdiction of new licenses, and non-project roads, which would be regulated by the Forest Service. We note that SCE made a number of corrections to the analogous tables that were included in the Forest Service 4(e) conditions for the Big Creek Nos. 2A, 8, and Eastwood Project, Big Creek Nos. 1 and 2 Project, and Big Creek No. 3 Project. The Forest Service comments that it will provide copies of the tables that should have been included in its 4(e) conditions as agreed to in the Settlement Agreement with its revised final section 4(e) conditions. The Forest Service indicates that our discussion of the Transportation System Management Plan should reflect these tables, and project roads indicated should be subject to 4(e) conditioning.

Response: We added a footnote to the final EIS that indicates that the Forest Service intends to submit revised tables of project roads with its revised final 4(e) conditions to match the tables included in the Settlement Agreement.

DEVELOPMENTAL ANALYSIS

Comment 60: SCE provided updated costs for implementing new environmental measures described under the staff alternative, as well as for measures specified in the non-FERC Settlement Agreements. The estimated cost of implementing certain measures has escalated substantially since the license applications were filed.

Response: We have incorporated the updated values into our developmental analysis and appendix B of the final EIS, as appropriate. The updated values do not change any of the conclusions reached in the draft EIS.

Comment 61: SCE suggests that we replace the reduced power benefits of the proposed and recommended Mammoth Pool Project shown in table 4-12 (13,382 MW) with 11,285 MW.

Response: As SCE pointed out, the reduced power benefit value for the Mammoth Pool Project used in the draft EIS was for the proposed project without channel riparian maintenance flows. We corrected the value in the final EIS to 11,285 MWh to reflect the proposed project with channel riparian maintenance flows.

CONSISTENCY WITH COMPREHENSIVE PLANS

Comment 62: The Forest Service notes that in section 5.5, *Consistency with Comprehensive Plans*, the 2004 Sierra Nevada Forest Plan Amendment, Final Supplemental Environmental Impact Statement, Record of Decision needs to be referenced.

Response: We added this plan to the listing of comprehensive plans.

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FERC/FEIS-0226F

ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSES

Big Creek Nos. 2A, 8, and Eastwood—FERC Project No. 67

Big Creek Nos. 1 and 2—FERC Project No. 2175

Mammoth Pool—FERC Project No. 2085

Big Creek No. 3—FERC Project No. 120

California

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Environmental and Engineering Review
888 First Street, NE
Washington, DC 20426

March 2009

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FEDERAL ENERGY REGULATORY COMMISSION

WASHINGTON, DC 20426

OFFICE OF ENERGY PROJECTS

To the Agency or Individual Addressed:

Reference: Final Environmental Impact Statement

Attached is the final environmental impact statement (EIS) for the Big Creek Projects (Big Creek Nos. 2A, 8, and Eastwood, Project No. 67; Big Creek Nos. 1 and 2, Project No. 2175; Mammoth Pool, Project No. 2085; and Big Creek No. 3, Project No. 120), located in Fresno and Madera counties, California.

This final EIS document documents the views of governmental agencies, non-governmental organizations, affected Indian tribes, the public, the license applicant, and Commission staff. It contains staff evaluations on the applicant's proposal and the alternatives for relicensing the Big Creek Projects.

Before the Commission makes a licensing decision, it will take into account all concerns relevant to the public interest. The final EIS will be part of the record from which the Commission will make its decision. The final EIS was sent to the U.S. Environmental Protection Agency and made available to the public on or about March 13, 2008.

Copies of the final EIS are available for review in the Commission's Public Reference Branch, Room 2A, located at 888 First Street, N.E., Washington DC 20426. The final EIS also may be viewed on the Internet at www.ferc.gov/ferris.htm. Please call (202) 502-8222 for assistance.

Attachment: Final Environmental Impact Statement

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COVER SHEET

a. Title: Relicensing the Big Creek Projects in California, Federal Energy Regulatory Commission (FERC or Commission) Project Nos. 67, 120, 2085, and 2175.

b. Subject: Final Environmental Impact Statement

c. Lead Agency: Federal Energy Regulatory Commission

d. Abstract:

The Big Creek Project Nos. 2A, 8, and Eastwood (FERC No. 67) is located in Fresno County, California. The project affects 2,388.80 acres of federal lands administered by the Sierra National Forest.

The Big Creek Nos. 1 and 2 Hydroelectric Project (FERC No. 2175) is located in Fresno County, California, within the Sierra National Forest. The project affects 2,017.78 acres of federal land administered by the Sierra National Forest.

The Mammoth Pool Hydroelectric Project (FERC No. 2085) is located in Fresno and Madera counties, California and affects 2,029.68 acres of federal land administered by the Sierra National Forest.

The Big Creek No. 3 Hydroelectric Project (FERC No. 120) is located in Fresno and Madera counties, California. The project occupies 508.14 acres of federal land administered by the Sierra National Forest.

SCE proposes to relicense the Projects in accordance with a comprehensive Settlement Agreement that was developed under the Commission's alternative licensing procedures. The Settlement Agreement contains 23 proposed license articles containing various protection, mitigation, and enhancement measures.

The staff's recommendation is to relicense the Projects as proposed, with certain modifications, and additional measures recommended by the agencies.

e. Contact:

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f. Transmittal: This final environmental impact statement prepared by the Commission's staff on the hydroelectric license applications filed by Southern California Edison for the existing Big Creek Projects (FERC Nos. 67, 120, 2085, and 2175) is being made available to the public on or about March 13, 2009, as required by the National Environmental Policy Act of 1969[1]

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[1] National Environmental Policy Act of 1969, amended (Pub. L. 91-190. 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, §4(b), September 13, 1982).

FOREWORD

The Federal Energy Regulatory Commission (Commission), pursuant to the Federal Power Act (FPA)[2] and the U.S. Department of Energy Organization Act[3] is authorized to issue licenses for up to 50 years for the construction and operation of non-federal hydroelectric development subject to its jurisdiction, on the necessary conditions:

That the project…shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in section 4(e)…[4]

The Commission may require such other conditions not inconsistent with the FPA as may be found necessary to provide for the various public interests to be served by the project.[5] Compliance with such conditions during the licensing period is required. The Commission's Rules of Practice and Procedure allow any person objecting to a licensee's compliance or noncompliance with such conditions to file a complaint noting the basis for such objection for the Commission's consideration.[6]

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[2] 16 U.S.C. §791(a)-825r, as amended by the Electric Consumers Protection Act of 1986, Public Law 99-495 (1986), the Energy Policy Act of 1992, Public Law 102-486 (1992), and the Energy Policy Act of 2005, Pub. Law 109-58 (2005).

[3] Public Law 95-91, 91 Stat. 556 (1977).

[4] 16 U.S.C. §803(a).

[5] 16 U.S.C. §803(g).

[6] 18 C.F.R. §385.206 (1987).

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ACRONYMS AND ABBREVIATIONS

ALP	alternative licensing process
APE	area of potential effects
APLIC	Avian Power Line Interaction Committee
Basin Plan	California Central Valley Region Water Quality Control Board Basin Plan
BCHSHD	Big Creek Hydroelectric System Historic District
ºC	degrees Celsius
Cal Fish & Game	California Department of Fish and Game
CARB	California Air Resources Board
CDWR	California Department of Water Resources
CEQA	California Environmental Quality Act
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
CRLF	California red-legged frog
CTR	California Toxics Rule
DO	dissolved oxygen
EIR	environmental impact report
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
Forest Service	U.S. Department of Agriculture, Forest Service
FPA	Federal Power Act
FWS	U.S. Fish and Wildlife Service
FYLF	foothill yellow-legged frog
GIS	geographic information system
HPMP	Historic Properties Management Plan
IHA	indicators of hydraulic alteration
Interior	U.S. Department of the Interior
kV	kilovolt
Legacy	Pacific Legacy, Inc.
LWD	large woody debris
μ/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MIF	minimum instream flow
msl	mean sea level
MW	megawatt
MWh	megawatt-hours
MYLF	mountain yellow-legged frog
National Register	National Register of Historic Places

NEPA	National Environmental Policy Act
NMFS	U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NTR	National Toxics Rule
PA	Programmatic Agreement
PDEA	preliminary draft environmental assessment
SCE	Southern California Edison
SRO	specific resource objective
USGS	U.S. Geological Survey
VELB	valley elderberry longhorn beetle
VQO	Visual Quality Objective
Water Board	State Water Resources Control Board (California)
WECC	Western Electricity Coordinating Council
WUA	weighted usable area

EXECUTIVE SUMMARY

On November 29, 2005, Southern California Edison (SCE) filed a license application for the Mammoth Pool Project (SCE, 2005) with the Federal Energy Regulatory Commission (FERC or the Commission). On February 23, 2007, SCE filed license applications for Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3 (SCE, 2007a).

The Big Creek Project Nos. 2A, 8, and Eastwood (FERC No. 67) is located in Fresno County, California. The project affects 2,388.80 acres of federal lands administered by the Sierra National Forest. The Big Creek Nos. 1 and 2 Hydroelectric Project (FERC No. 2175) also is located in Fresno County, California, within the Sierra National Forest. The project affects 2,017.78 acres of federal land administered by the Sierra National Forest. The Mammoth Pool Hydroelectric Project (FERC No. 2085) is located in both Fresno and Madera counties, California, and affects 2,029.68 acres of federal land administered by the Sierra National Forest. The Big Creek No. 3 Hydroelectric Project (FERC No. 120) also is located in both Fresno and Madera counties, California, and occupies 508.14 acres of federal land administered by the Sierra National Forest.

SCE is using the alternative licensing process (ALP) for these four projects together and as such filed a comprehensive Settlement Agreement (SCE, 2007b). The four Big Creek ALP Projects considered in this final environmental impact statement (EIS) are part of the Big Creek System. The Big Creek System is an integrated operation of nine major powerhouses, six major reservoirs, numerous small diversions, various conveyance facilities, access roads, electrical transmission lines, and appurtenant facilities. The Big Creek System is authorized under seven Commission licenses with coordinated operations to maximize the value of hydropower produced from the available water supply. The Big Creek ALP Projects and their relationship to the other three projects in the system are described in detail in sections 2.1.1 and 2.1.2. This final EIS evaluates the potential natural resource benefits, environmental effects, and economic costs associated with relicensing the Big Creek ALP Projects.

Proposed Action

SCE proposes no capacity changes at any of the Big Creek ALP Projects, but proposes a comprehensive set of measures covering the full range of resources in the Upper San Joaquin River Basin as specified in a comprehensive Settlement Agreement filed with the Commission in February 2007. Modifications to project operations include provision or modification of minimum instream flow (MIF) releases from several dams and diversions, provision of channel and riparian maintenance flows from some diversions, provision of pre-spill whitewater flow releases from some diversions, and elimination of some flow diversions through diversion decommissioning. In addition, SCE proposes to implement plans and monitoring to manage large woody debris (LWD), sediment, bald eagles, valley elderberry longhorn beetles (VELB) and its habitat, vegetation and noxious weeds, cultural resources, visual resources, transportation, and recreation. The Recreation Management Plan includes provisions to conduct major facility rehabilitations, construct new recreational facilities, provide information to the public regarding project-related recreation, conduct fish stocking, monitor recreational use, and consult with the U.S. Department of Agriculture, Forest Service (Forest Service). SCE also proposes to monitor temperatures, fish populations, and riparian habitat, and implement measures that would protect special status bats, mule deer, and other special status species, and measures that would reduce bear/human interactions. These measures are described in more detail in section 2.2.4.

Alternatives Considered

This final EIS analyzes the effects of continued operation of the Big Creek ALP Projects and recommends conditions for a new license for each project. In addition to SCE's proposal, we consider two alternatives: (1) SCE's proposal with staff modifications (staff alternative); and (2) no action, which would represent continued operation with no changes.

Under the staff alternative, the Big Creek ALP Projects would include SCE's proposal, including the Settlement Agreement except for provisions to manage reservoir water surface elevations for recreational purposes at the Big Creek Nos. 1 and 2 and Mammoth Pool projects and funding rehabilitation of five campgrounds that are outside the existing project boundaries. Additional measures that we recommend for inclusion in any licenses that may be issued for the Big Creek ALP Projects are: (1) assess gravel embeddedness in association with pool depth assessments following flushing flow releases from Dams 4, 5, and 6 (providing an additional assessment of potential habitat degradation beyond pool depth monitoring); (2) include the gravel augmentation feasibility assessment specified in section B.1.2.2 of the Settlement Agreement (measures not to be included in a new license) as a condition of a new license because this feasibility assessment pertains to Mammoth Pool dam spillway functions and the maintenance of a project access road; (3) specify in SCE's Avian Protection Plan that as follow-up to any documented bald eagle mortality at project transmission lines, the most recent Avian Power Line Interaction Committee (APLIC) guidelines would be used to assess appropriate corrective actions (the most recent guidance was issued in 2006 and it is likely to be updated during the life of the project); (4) include a Fire Management Plan in the land resource plans that are approved by the Forest Service (this is a 4(e) condition); (5) include a Sign Plan in the land resource plans that are approved by the Forest Service (this is a 4(e) condition); and (6) include a Spill Prevention and Countermeasure Plan in the land resource plans that are approved by the Forest Service (this is a 4(e) condition). In its comments on the draft EIS, SCE expressed support for the staff alternative. We include all but two of the measures specified by the Forest Service as 4(e) conditions: (1) manage reservoir surface elevations at Huntington and Shaver lakes in accordance with unspecified criteria during the summer recreational season; and (2) fund rehabilitation for five campgrounds located outside the project boundaries of three of the four Big Creek ALP Projects. We include all measures within the scope of section 10(j) recommended by Interior in the staff alternative. No other fish and wildlife agency filed 10(j) recommendations for the Big Creek ALP Projects.

Public Involvement and Areas of Concern

SCE conducted the National Environmental Policy Act scoping process as part of the ALP. SCE held a publicly noticed meeting with interested stakeholders and issued the Initial Information Package for the Big Creek ALP Projects in May 2000. The purpose of this meeting was to outline the ALP goals and objectives; identify process protocols; provide an overview of the Big Creek ALP Projects and associated resources; identify early stakeholder resource interests and issues; and identify opportunities for the public to participate and provide comment. In May 2000, the Plenary was established, which consists of representatives of the state and federal resource agencies, Native American tribes, local and regional authorities, non-governmental organizations, and members of the public. SCE held an additional publicly noticed meeting and a site tour of the Big Creek ALP Projects with interested stakeholders in June 2000. In addition, on July 24, 25, and 26, 2007, Commission and SCE staff held a publicly noticed site visit to the Big Creek ALP Projects. The site visit was open to the public and resource agencies.

SCE and the parties to the Settlement Agreement held more than 300 meetings during the last 5 years for the Big Creek ALP Projects. The Big Creek ALP involved the design and implementation of 67 studies designed to identify effects associated with the Big Creek ALP Projects. Reports were prepared based upon these studies and used to identify potential project effects and serve as the basis for a Settlement Agreement (SCE, 2007b). SCE filed the Settlement Agreement on February 23, 2007, concurrently with the applications for three of the Big Creek ALP Projects (the Mammoth Pool license application was filed on November 29, 2005). The Settlement Agreement was signed by 23 representatives of federal and state agencies, and non-governmental organizations.

The primary issues associated with the relicensing of the four Big Creek ALP Projects include establishment of appropriate flow regimes in project-affected stream reaches, protection of wildlife resources, provision of recreational opportunities, and protection of cultural resources.

Project Effects

Aquatic Resources—Under SCE's proposal: (1) MIFs in project-affected reaches would be enhanced for trout and other aquatic biota; (2) channel and riparian maintenance flows would be released at the Big Creek Nos. 2A, 8, and Eastwood Project, enhancing riparian habitat; (3) the March 1 preliminary water year forecast would be used to determine which category of instream flows would be implemented on April 1, with an option to adjust flows based on the April 1 and May 1 water year forecast updates, if those updates are revised; (4) streamflow measurement capabilities would be enhanced; (5) fish populations would be monitored to assess population trends under the new project operating regimes; (6) provisions to pass sediment downstream of project dams would be implemented, which should enhance habitat diversity and increase spawning gravel; (7) monitoring of pool depths following sediment pass-through events would detect habitat degradation; (8) project diversions would be decommissioned, and the affected stream reaches returned to essentially natural flow conditions; (9) water temperature would be monitored at selected bypassed reaches and reservoirs to ensure that California Central Valley Region Water Quality Control Board Basin Plan water temperature objectives are met to the extent that they are project-controllable effects; and (10) LWD would be passed downstream of the Bear Creek diversion (Big Creek Nos. 2A, 8, and Eastwood Project) thus enhancing downstream aquatic habitat and increasing fisheries productivity.

With our modifications to SCE's proposal: (1) gravel embeddedness would be monitored following flushing flow releases from Dams 4, 5, and 6, thus providing an additional assessment of potential habitat degradation beyond pool depth monitoring; and (2) the gravel augmentation feasibility assessment specified in the Settlement Agreement would be a condition of a new license. In its comments on the draft EIS, SCE expressed support for these modifications to its proposal.

Terrestrial Resources—Under the proposed action, SCE would implement: (1) wildlife habitat enhancements; (2) the Bald Eagle Management Plan; (3) the Vegetation and Integrated Pest Management Plan that would, among other things, control the spread of noxious weeds; (4) proposed license articles that would protect mule deer, special-status species, and bats; and (5) environmental programs for environmental training, avian protection, noxious weeds, environmental compliance, the Endangered Species Alert Program, and the Northern Hydro Special-Status Species Information Program. In addition, under the staff alternative, the Bald Eagle Management Plan would be clarified to ensure that corrective actions following any raptor mortalities at project transmission lines would use current APLIC guidelines for protecting against avian collisions.

Threatened and Endangered Species—Under the proposed action, SCE would implement the VELB Management Plan, including the protection of elderberry shrubs, which would reduce the loss of potential VELB habitat and any VELB inhabiting these shrubs. Vegetation maintenance in areas surrounding potential VELB habitat also would reduce the chance of a brush fire causing widespread loss of habitat.

Recreation—Under SCE's proposal, SCE would be responsible for implementing the following measures at some or all of the Big Creek ALP Projects: (1) operation and maintenance of recreational facilities; (2) rehabilitation of existing recreational facilities; (3) management of reservoir levels to facilitate recreational use while achieving project purposes; (4) fund fish stocking with a 50 percent cost share; and (5) dissemination to the public flow information for whitewater boating. In addition, SCE would (1) construct new recreational facilities at the Big Creek Nos. 2A, 8, and Eastwood Project, including an accessible fishing platform at Jackass Meadows and an accessible boat loading platform at Florence Lake; (2) construct new recreational facilities at the Big Creek Nos. 1 and 2 Project, including a day-use area at Dam 3 and an accessible fishing platform; and (3) provide pre-spill whitewater boating releases at the Mammoth Pool Project, to the extent possible.

With our modifications to SCE's proposal, the Florence Lake day-use area would remain within the project boundary. The existing project boundary would be revised to include all project recreational facilities that are partially outside the existing project boundary. The cost for the rehabilitation of the five Forest Service-managed campgrounds located in the Sierra National Forest that are outside of the project boundary would not be included in the staff alternative. SCE would be responsible for stocking fish, not funding fish stocking, and file a report with the Commission summarizing the fish stocking efforts. In addition, SCE would provide reservoir elevation, boat ramp accessibility information, and parking and campsite capacity as a component of the Form 80 Recreation Report. We do not recommend SCE's reservoir management measures at Huntington and Shaver lakes and Mammoth Pool Reservoir because SCE proposes no specific elevation ranges associated with the reservoir level operations, and as such, the Commission would have no basis to determine whether SCE is in compliance with a reservoir surface water management regime. In its comments on the draft EIS, SCE expressed support for our recommended measures.

Cultural Resources—Under SCE's proposal, cultural resources would be protected under provisions specified in a finalized Historic Properties Management Plan, and SCE would implement environmental programs for cultural resources awareness.

Land Use and Aesthetics Resources—SCE proposes to remove lands from the project boundaries. SCE also proposes to add land to the project boundaries that would include project-related features. The Forest Service concurs with the proposed project boundary changes. In addition, SCE would implement the Transportation Management Plan at the Big Creek ALP Projects, which defines maintenance, monitoring, and rehabilitation responsibilities for project-related roads; interpretive signs would be installed at the Big Creek Nos. 2A, 8, and Eastwood, Big Creek Nos. 1 and 2, and Mammoth Pool projects; and the Visual Resources Plan would be implemented at the Big Creek Nos. 1 and 2 and Mammoth Pool projects, which would target painting project features to be more consistent with applicable Visual Quality Objectives.

With our modifications to SCE's proposal, project-related signage would be consistent with Forest Service standards through the development of a sign plan; fire management responsibilities would be clearly defined in a fire management plan; and a spill prevention and countermeasure plan, which is required by law to be in place where threshold amounts of hazardous materials are stored, would be available for Forest Service review.

Under the no-action alternative, environmental conditions would remain the same, and there would not be any enhancement of environmental resources.

Conclusions

Based on our analysis, we recommend licensing the four Big Creek ALP Projects as proposed by SCE with additional measures (staff alternative). The recommended staff modifications include measures provided by federal land use and resource agencies with an interest in the resources that may be affected by continued operation of the four projects, as well as our independent analysis. Our additional measures are summarized in the previous section.

In section 4.3 of this final EIS, we estimate the annual net benefits of operating and maintaining the Big Creek ALP Projects under the three alternatives identified above. Our analysis shows that the annual net benefit for the staff alternative for the Big Creek Nos. 2A, 8, and Eastwood Project would be $46,792,110 The annual net benefit for the staff alternative for the Big Creek Nos. 1 and 2 Project, Mammoth Pool Project, and Big Creek No. 3 Project would be $29,902,160, $32,175,600, and $42,897,400, respectively.

We recommend the Commission issue new licenses for the Big Creek ALP Projects because: (1) the four projects would provide a dependable source of electrical energy for the region (3,177,093 megawatt-hours annually); (2) the projects may continue to save the equivalent amount of fossil-fueled generation and capacity, thereby continuing to help conserve non-renewable energy resources and reduce atmospheric pollution; and (3) the recommended environmental measures proposed by SCE, as modified by staff, would adequately protect and enhance environmental resources affected by the projects. The overall benefits of the staff alternative would be worth the cost of the proposed and recommended environmental measures.

1.0 INTRODUCTION

1.1 APPLICATION

On November 29, 2005, Southern California Edison (SCE) filed a license application for the Mammoth Pool Project (SCE, 2005) with the Federal Energy Regulatory Commission (FERC or the Commission). On February 23, 2007, SCE filed license applications for Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3 (SCE, 2007a). SCE is using the alternative licensing process (ALP) for these four projects together and as such filed a comprehensive Settlement Agreement (SCE, 2007b). These applications for the Big Creek ALP Projects include a preliminary draft environmental assessment (PDEA).[7]

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The Commission must decide whether to issue licenses to SCE for the Big Creek ALP Projects and what conditions should be placed in any licenses issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (e.g., flood control, irrigation, and water supply), the Commission must give equal consideration to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality.

Issuing new licenses for the Big Creek ALP Projects would allow SCE to generate electricity at the projects for the term of the new licenses, making electric power from a renewable resource available to its customers.

This final environmental impact statement (EIS) assesses the effects associated with operation of the Big Creek ALP Projects, alternatives to the proposed projects, and makes recommendations to the Commission on whether to issue new licenses, and if so, recommends terms and conditions to become a part of any licenses issued.

In this final EIS, we assess the environmental and economic effects of continuing to operate the Big Creek ALP Projects (1) as proposed by SCE, and (2) with our recommended measures. We also consider the effects of the no-action alternative. Important issues that are addressed include establishment of appropriate flow regimes in

[7] The application for the Mammoth Pool Project included a PDEA, but the license applications for the other three of the Big Creek ALP Projects included an amended PDEA that replaces the earlier PDEA.

project-affected stream reaches, protection of wildlife resources, provision of recreational opportunities, and protection of cultural resources.

1.2.2 Need for Power

The Big Creek ALP Projects,[8] with an installed capacity of 865 megawatts (MW) and an annual generation of 3,366,560 megawatt-hours (MWh) per year, play an important role in meeting SCE's power needs. The four projects are also a significant power resource to the state of California and within the Western Electricity Coordinating Council (WECC). The WECC includes the states west of the Rockies; portions of Texas, Nebraska, and Kansas; Alberta and British Columbia, Canada; and a portion of North Baja, California.

Because the Big Creek ALP Projects are located in the California-Mexico Power area of the WECC, we looked at the regional need for power projected by the WECC and reported by the North American Electricity Reliability Corporation (NERC, 2007) to anticipate how the demand for electricity is expected to change in the region.

The California-Mexico Power area, which encompasses most of California and a portion of Baja California in Mexico, has a significant summer peak demand. For the period from 2007 through 2016, the WECC forecasts peak demand and annual energy requirements in the United States portion of the area to grow at annual compound rates of 1.5 and 1.3 percent, respectively. The WECC anticipates that 7,433 MW of new capacity would come on line within the next 10 years in the California-Mexico Power area. The Big Creek ALP Projects could continue to meet part of the existing load requirements within a system in need of resources.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

Licenses for the Big Creek ALP Projects are subject to numerous requirements under the Federal Power Act (FPA) and other applicable statutes. The major regulatory and statutory requirements are summarized in table 1-1 and described below.

[8] For the remainder of this EIS, we discuss the project developments from upstream to downstream in the following order: Big Creek Nos. 2A, 8, and Eastwood, No. 67; Big Creek Nos. 1 and 2, No. 2175; Mammoth Pool, No. 2085; and Big Creek No. 3, No. 120.

Table 1-1. Major statutory and regulatory requirements for the Big Creek ALP Projects.

Requirement	Agency	Status
Section 18 of the FPA (fishway prescriptions)	Department of the Interior (Interior), U.S. Department of Commerce, National Oceanic and Atmospheric Adminstration, National Marine Fisheries Service (NMFS)	Interior reserved its authority to prescribe upstream fish passage facilities for the Mammoth Pool Project on February 2, 2007, and for the Big Creek Nos. 2A, 8, and Eastwood, Big Creek Nos. 1 and 2, and Big Creek No. 3 projects on March 5, 2008,. NMFS reserved its authority to prescribe fishways for the Mammoth Pool Project on February 5, 2007, for the Big Creek Nos. 2A, 8, and Eastwood Project and Big Creek No. 3 Project on August 31, 2007, and for the Big Creek Nos. 1 and 2 Project on September 1, 2007.
Section 4(e) of the FPA (land management conditions)	U.S. Department of Agriculture, Forest Service (Forest Service)	The Forest Service provided preliminary conditions for the Mammoth Pool Project on February 5, 2007, and indicated that it would file its final conditions within 60 days of the close of the comment period on the draft EIS, which would be January 2, 2009. To date, final conditions have not been filed. The Forest Service provided final conditions for the Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3 projects on February 27, 2008. In its comments on the draft EIS, the Forest Service stated that it would be filing revised final 4(e) conditions but did not specify when.

Requirement	Agency	Status
Section 10(j) of the FPA	Interior	Interior provided section 10(j) recommendations, intended to protect fish and wildlife resources for the Mammoth Pool Project on February 2, 2007, and for the Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2 and Big Creek No. 3 projects on March 5, 2008.
Clean Water Act—water quality certification	State Water Resources Control Board	Application for water quality certification for the Big Creek ALP Projects was received by the State Water Resources Control Board on March 7, 2008. Action on the application is due by March 7, 2009.
Endangered Species Act Consultation	U.S Fish and Wildlife Service (FWS)	Completed; SCE consulted with FWS beginning in 2000 and submitted a preliminary Biological Assessment/Biological Evaluation for the Big Creek ALP Projects to FWS on October 25, 2004. In response to our request for formal consultation regarding the valley elderberry longhorn beetle, FWS stated that no further action pursuant to the ESA is necessary by letter dated December 16, 2008.
Coastal Zone Management Act Consistency	California Coastal Commission	We conclude that relicensing the Big Creek ALP Projects would not influence resources in the designated coastal zone and will seek concurrence from the California Coastal Commission.

1.3.1 Federal Power Act

1.3.1.1 Section 18 Fishway Prescriptions

Section 18 of the FPA states that the Commission is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the secretaries of Commerce or the Interior. Interior, by letter filed on February 2, 2007, for the Mammoth Pool Project, and by letter filed on March 5, 2008, for the Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3 projects, requests that a reservation of authority to prescribe fishways under section 18 be included in any licenses issued for the Big Creek ALP Projects. The U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) also requests that a reservation of authority to prescribe fishways be included in any project licenses by letters filed on February 5, 2007, for the Mammoth Pool Project, August 31, 2007, for the Big Creek Nos. 2A, 8, and Eastwood Project and Big Creek No. 3 Project, and September 1, 2007, for the Big Creek Nos. 1 and 2 Project.

1.3.1.2 Section 4(e) Conditions

Section 4(e) of the FPA provides that any license issued by the Commission for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation. The U.S. Department of Agriculture, Forest Service (Forest Service) provided preliminary conditions on February 5, 2007, for the Mammoth Pool Project, and final conditions on February 27, 2008, for the Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3 projects. The Forest Service indicated that it would file its final conditions for the Mammoth Pool Project within 60 days of the close of comments on the Commission's draft EIS, which was January 2, 2009. To date, no final conditions have been filed.

1.3.1.3 Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

Interior timely filed on February 2, 2007, recommendations under section 10(j) for the Mammoth Pool Project, and March 5, 2008, for the Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3 projects. In section 5.4 we discuss how we address the agency recommendations and compliance with section 10(j).

1.3.2 Clean Water Act

Under section 401of the Clean Water Act, a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the Act. SCE filed its application for water quality certification with the California State Water Resources Control Board (Water Board) by letter dated March 4, 2008. SCE documented that the Water Board received the application on March 7, 2008. Consequently, action on the application is due by the Water Board by March 7, 2009.

The Water Board has indicated its intention to issue a single certification to cover all of the Big Creek projects currently undergoing relicensing in the Upper San Joaquin Watershed. These include the Vermilion Valley Hydroelectric Project (FERC No. 2086), Portal (FERC No. 2174), and the Big Creek ALP Projects considered in this final EIS.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. SCE requested to be designated as the non-federal representative for the purpose of conducting section 7 consultations pertaining to the Big Creek ALP Projects on December 7, 2000, and was granted this request by the Commission on December 21, 2000. SCE included a Biological Assessment/Biological Evaluation with its license applications. Our analyses of project effects on threatened and endangered species are presented in section 3.3.3, *Threatened and Endangered Species*, and our recommendations are presented in section 5.2, *Comprehensive Development and Recommended Alternative*. We conclude that the only federally listed species that could potentially be affected by the projects is the valley elderberry longhorn beetle (VELB). Even with implementation of the proposed VELB Management Plan, there would still be loss of elderberry habitat and potential adverse effects on VELB during the term of the licenses. Therefore, we conclude that relicensing the Big Creek ALP Projects may adversely affect this federally listed species. We requested formal consultation with the U.S. Fish and Wildlife Service (FWS) by letter dated September 18, 2008. In response to our request, FWS comments that the VELB Management Plan has already been implemented and SCE has already compensated for the loss of VELB habitat by planting 30 elderberry seedlings (rather than the originally proposed eight seedlings), and no additional compensation or a biological opinion are necessary (letter from C.C. Goude, Acting Field Supervisor, FWS, Sacramento, CA, to the Commission dated December 16, 2008). FWS states that unless new information that has not been considered is presented, no further action pursuant to the ESA is necessary.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act, 16 U.S.C. §1456(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state coastal zone management agency concurs with the license applicant's certification of consistency with the state's coastal zone management program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

The Big Creek ALP Projects are not located within the state-designated coastal zone, which extends from a few blocks to 5 miles inland from the sea (www.ceres.ca.gov/coastal.com), and relicensing the projects would not affect California's coastal resources. Our assessment is that the Big Creek ALP Projects are not subject to California coastal zone program review and that no coastal zone consistency certification is needed.

1.3.5 National Historic Preservation Act

Section 106 requires that every federal agency "take into account" how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

To meet the requirements of section 106, the Commission intends to execute a Programmatic Agreement (PA) for the protection of historic properties from the effects of the operation of the Big Creek ALP Projects. The terms of the PA would ensure that SCE addresses and treats all historic properties identified within the projects' area of potential effects (APE) through the finalization of the existing draft Historic Properties Management Plan (HPMP). We plan to circulate a final PA for signature in April 2009.

1.3.6 California Environmental Quality Act

The California Environmental Quality Act (CEQA) is the California counterpart to the National Environmental Policy Act (NEPA). CEQA went into effect in 1970 for the purpose of monitoring land development in California through a permitting process. This statute, enacted to protect the health of the environment from current and future development, requires state and local agencies to identify the significant environmental effects of their actions and to avoid or mitigate those effects, if feasible. CEQA applies to all discretionary activities proposed to be undertaken or approved by California state and local government agencies. The Water Board must act on SCE's request for a water quality certificate for the Big Creek ALP Projects (see section 1.3.2, *Clean Water Act*), making CEQA applicable to this licensing proceeding.

Under CEQA, an environmental impact report (EIR) is prepared when the public agency finds substantial evidence that the project may have a significant effect on the environment. An EIR is the public document used to analyze the significant environmental effects of a proposed project, to identify alternatives, and to disclose possible ways to reduce or avoid the possible environmental damage. CEQA guidelines state that when federal review of a project is also required, state agencies are encouraged to integrate the two processes to the fullest extent possible, which may include a joint

EIS/EIR. While this document is not a joint EIS/EIR, SCE has the opportunity to use this document, as appropriate, to satisfy its responsibilities under CEQA. As such, we invite the Water Board's comments on this EIS as they may pertain to the agency's use of the final EIS for CEQA purposes.

The content requirements for an EIR under CEQA are similar to the requirements for an EIS, although an EIR must contain two elements not typically addressed in a Commission NEPA document. The first element needed in an EIR is a discussion of how the proposed project, if implemented, could induce growth. A project can be considered to have a growth-inducing effect if it directly or indirectly fosters economic or population growth or removes obstacles to population growth, strains existing community service facilities to the extent that the construction of new facilities would be needed, or encourages or facilitates other activities that cause significant environmental effects. In an effort to present information that may be useful should the Water Board decide to use this EIS for its CEQA purposes, we considered whether issuing new licenses for the Big Creek ALP Projects would have any growth-inducing effects, and determined that it would not. Under new licenses, the projects would continue to operate essentially as they have in the past (see section 2.2, *Applicant's Proposal*), continuing to provide electricity to meet existing regional power needs.

The second element needed in an EIR, but not typically presented in a Commission NEPA document in a format compatible to CEQA requirements, is a discussion of a program for monitoring or reporting on mitigation measures that were adopted or made conditions of project approval. The monitoring or reporting program must ensure compliance with mitigation measures during project implementation. The program may also provide information on the effectiveness of mitigation measures. Although discussion of the mitigation reporting or monitoring program can be deferred until the final EIR or, in some cases, after project approval, it is often included in the draft EIR to obtain public review and comment.

In section 3 of this final EIS, *Environmental Analysis*, we describe each potential environmental resource effect, our analysis of each recommended mitigation measure, and our conclusion with respect to the effectiveness of each measure in addressing the effect. In section 5.2, *Comprehensive Development and Recommended Alternative*, we list the mitigation measures and monitoring and reporting requirements we recommend for inclusion in any licenses issued for the Big Creek ALP Projects. Additionally, any conditions of a water quality certificate that may be issued for this project will become an enforceable part of any licenses issued for this project. Appendix A, *Big Creek Projects Mitigation and Monitoring Summary*, identifies each potentially significant effect of relicensing the Big Creek ALP Projects, lists the project changes or mitigation measures that are recommended for inclusion in new licenses to avoid or reduce the effect, and describes the monitoring and reporting measures SCE would undertake to ensure the project changes and mitigation measures are implemented as intended. In order to facilitate the Water Board's potential use of this EIS for CEQA purposes, appendix A also includes the measures contained in the Settlement Agreement that are not within the Commission's jurisdiction and would therefore not be part of any new licenses.

The Water Board could adopt this EIS as satisfying its CEQA requirements or could determine that a separate EIR is required for the Big Creek ALP Projects. On November 3, 2008, the Water Board filed comments on the draft EIS, including suggested modifications that would facilitate its use of the final EIS for its CEQA purposes. This final EIS has been modified accordingly and should address the concerns the Water Board had with the draft EIS.

1.4 PUBLIC REVIEW AND CONSULTATION

Commission regulations (18 CFR §16.8) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, ESA, National Historic Preservation Act, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

1.4.1 Scoping

SCE conducted the NEPA scoping process as part of the ALP. SCE held a publicly noticed meeting with interested stakeholders and issued the Initial Information Package for the Big Creek ALP Projects in May 2000. The purpose of this meeting was to outline the ALP goals and objectives; identify process protocols; provide an overview of the Big Creek ALP Projects and associated resources; identify early stakeholder resource interests and issues; and identify opportunities for the public to participate and provide comment.

In May 2000, the Plenary was established. The Plenary, which consists of representatives of the state and federal resource agencies, Native American tribes, local and regional authorities, non-government organizations, and members of the public, received training regarding the "mutual gains" style of negotiation.

SCE held an additional publicly noticed meeting and a site tour of the Big Creek ALP Projects with interested stakeholders in June 2000. In addition, on July 24, 25, and 26, 2007, Commission and SCE staff held a publicly noticed site visit to the projects. The site visit was open to the public and resource agencies.

Based on the scoping process that was built into the collaborative ALP process, SCE conducted 67 relicensing technical studies addressing issues at the Big Creek ALP Projects. The technical reports for the overlapping issues were all filed with SCE's license applications.

1.4.2 Interventions

On December 5, 2006, the Commission issued a public notice accepting the application for the Mammoth Pool Project, and soliciting motions to intervene and protest. This notice set a 60 day period during which interventions could be filed ending on February 5, 2007. On July 5, 2007, the Commission issued a public notice accepting the applications and soliciting motions to intervene and protest for the remaining three projects. This notice set a 60 day period during which interventions could be filed. This period ended on September 5, 2007. In response, the following entities filed motions to intervene in this proceeding.

Intervenors	**Date Filed**
North Fork Mono Tribe	February 22, 2006
U.S. Department of the Interior (Mammoth Pool)	February 1, 2007
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (Mammoth Pool)	February 5, 2007
U.S. Department of Agriculture, Forest Service (Mammoth Pool)	February 5, 2007
Friant Water Authority (Mammoth Pool)	February 6, 2007
Friends of the River, Trout Unlimited, and American Whitewater (Mammoth Pool)	February 8, 2007
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (Big Creek Nos. 2A, 8, and Eastwood)	August 31, 2007
U.S. Department of the Interior (remaining three projects)	August 31, 2007
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (Big Creek Nos. 1 and 2 and Big Creek No. 3)	September 1, 2007
Friends of the River, Trout Unlimited, and American Whitewater (remaining three projects)	September 4, 2007
U.S. Department of Agriculture, Forest Service (remaining three projects)	September 4, 2007

1.4.3 Settlement Agreement

SCE and the parties to the Settlement Agreement have held more than 300 meetings over the last 5 years in the Big Creek ALP for the Big Creek ALP Projects, which are owned and operated by SCE. The Big Creek ALP involved the design and implementation of 67 studies designed to identify effects associated with the Big Creek ALP Projects. Reports were prepared based upon these studies and were reviewed and commented upon by the Parties. These reports were used to identify potential project effects and serve as the basis for a Settlement Agreement (SCE, 2007b). SCE filed the Settlement Agreement on February 23, 2007, concurrently with the applications for three of the Big Creek ALP Projects (the Mammoth Pool license application was filed on November 29, 2005). The Settlement Agreement was signed by representatives of federal and state agencies, and NGOs listed below. We consider the Settlement Agreement to represent the Proposed Actions for these projects.

Signatories to the Settlement Agreement
American Whitewater
California Department of Fish and Game
Fly Fishers For Conservation
Fresno County Sheriff's Department
Friant Water Authority
Friends of the River
Huntington Lake Association
Huntington Lake Big Creek
Historical Conservancy
Huntington Lake Volunteer Fire Department
Michahai Wuksachi
Natural Resources Defense Council
Sams Coalition
San Joaquin Paddlers Club
San Joaquin River Trail Council
Shaver Crossing
Railroad Station Group
Sierra Mono Museum
Sierra Resource Conservation

Signatories to the Settlement Agreement
District of the County of Fresno
Trout Unlimited
U.S. Department of Agriculture, Forest Service
U.S. Department of the Interior

The Commission issued a notice of the Settlement Agreement on March 7, 2007, and set a comment deadline of April 5, 2007, and a reply comment deadline of April 20, 2007. The following entities filed comments on the Settlement Agreement.

Commenting Entities on Settlement Agreement	Date Filed
North Fork Mono Rancheria (opposing the Settlement Agreement, writing on behalf of the San Joaquin River Tribal Coalition[9])	February 27, 2007
Cold Springs Rancheria (opposing the Settlement Agreement, writing on behalf of the San Joaquin River Tribal Coalition)	February 28, 2007
California Department of Fish and Game	April 5, 2007
U.S. Department of the Interior	April 5, 2007

SCE filed responses to the California Department of Fish and Game (Cal Fish & Game) on May 21, 2007, and to the North Fork Mono Rancheria, Cold Springs Rancheria, and Big Sandy Rancheria (collectively the San Joaquin River Tribal Coalition) on June 18, 2007.

1.4.4 Comments on the Draft EIS

The Commission sent the draft EIS to the U.S. Environmental Protection Agency (EPA) and made the draft EIS available to the public on September 12, 2008. The Commission requested that any written comments on the draft EIS be filed by November 3, 2008. Written comments on the draft EIS were filed by the following entities:

[9] The San Joaquin River Tribal Coalition comprises three federally recognized Tribes: North Fork Mono Rancheria, Cold Springs Rancheria, and Big Sandy Rancheria.

Comments on Draft EIS	Date Filed
U.S. Department of the Interior	October 20, 2008
U.S. Department of Agriculture, Forest Service	October 30, 2008
Southern California Edison	October 30, 2008
State Water Resources Control Board	November 3, 2008
U.S. Environmental Protection Agency	November 4, 2008

Appendix D lists the commenters, summarizes the comments that were filed, includes our responses to those comments, and indicates where we made modifications to the draft EIS. In addition, the Commission accepted oral testimony on the draft EIS at a public meeting held on October 15, 2008, in Fresno, California. The transcript from this meeting was filed in the administrative record for the project. We modified the text of the EIS in response to oral and written comments received, as appropriate.

1.5 RECOMMENDATIONS, TERMS, AND CONDITIONS

On December 5, 2006, the Commission issued a Ready for Environmental Analysis Notice pertaining to the Mammoth Pool Project and requested comments, recommendations, and terms and conditions (subject to sections 10(j) and 18 of the FPA) with a filing deadline of February 5, 2007. On January 8, 2008, the Commission issued a Ready for Environmental Analysis Notice and requested comments, recommendations, and terms and conditions for Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3 with a filing deadline of March 8, 2008. The following entities filed comments, terms, conditions, prescriptions, or recommendations:

Entity	Date Filed
U.S. Department of the Interior (Mammoth Pool)	February 2, 2007
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (Mammoth Pool)	February 5, 2007
U.S. Department of Agriculture, Forest Service (Mammoth Pool)	February 5, 2007
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (Big Creek Nos. 2A, 8, & Eastwood)	August 31, 2007

Entity	Date Filed
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (Big Creek Nos. 1 and 2 and Big Creek No. 3)	September 10, 2007
U.S. Department of Agriculture, Forest Service (Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3)	February 28, 2008
U.S. Department of the Interior (remaining three projects)	March 5, 2008

SCE did not respond to the recommendations, terms, and conditions filed for the Mammoth Pool Project. SCE responded to recommendations, terms, and conditions for the remaining three projects by letter filed on April 9, 2008.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

Under the no-action alternative, the Big Creek ALP Projects would continue to operate under the terms and conditions of the existing licenses, and no new environmental protection, mitigation, or enhancement measures would be implemented. We use this alternative to establish baseline environmental conditions for comparison with other alternatives.

2.1.1 Existing Project Facilities

The Big Creek ALP Projects considered in this final EIS are part of the Big Creek System. The Big Creek System is an integrated operation of nine major powerhouses, six major reservoirs, numerous small diversions, various conveyance facilities, access roads, electrical transmission lines, and appurtenant facilities. The Big Creek System is authorized under seven Commission licenses with coordinated operations to maximize the value of hydropower produced from the available water supply. Table 2-1 shows the average annual generation and dependable capacity of each project. The average annual generation shown in table 2-1 is based on the period from 1991 to 2005. SCE defines dependable operating capacity as "…the capacity that may be available for system use from the individual resources listed under favorable conditions. Where common facilities are shared between units, capacity ratings should be based on the Company's operating experience and exclude capacity associated with auxiliary, house, and fishwater turbine-generators, and emergency engine-generators." SCE's approach to defining dependable capacity is different from that used by the Commission. The Commission defines dependable capacity based on adverse hydrological conditions.

Figure 2-1 presents the locations of the various facilities schematically and table 2-2 describes the project reservoirs. Then, in the following section, we provide detailed descriptions for each of the Big Creek ALP Projects. At the end of the section we describe the existing boundaries for the projects.

Table 2-1. Big Creek System hydroelectric projects that are relevant to this proceeding. (Source: SCE, 2007a, as modified by staff)

Project Name (FERC Project No.)	License Expiration Date	Installed Capacity (MW)	Dependable Operating Capacity (MW)	Average Annual Generation (MWh)
Vermilion Valley (No. 2086)	August 31, 2003 (operating under annual license)	0	0	0
Portal (No. 2174)	March 31, 2005 (operating under annual license)	11	10.5	47,400
Mammoth Pool (No. 2085)	November 30, 2007	151	187.0	603,700
Big Creek No. 3 (No. 120)	February 28, 2009	174	181.9	824,080
Big Creek Nos. 1 and 2 (No. 2175)	February 28, 2009	155	150.0	765,480
Big Creek Nos. 2A, 8, and Eastwood (No. 67)	February 28, 2009	385	370.0	1,173,300

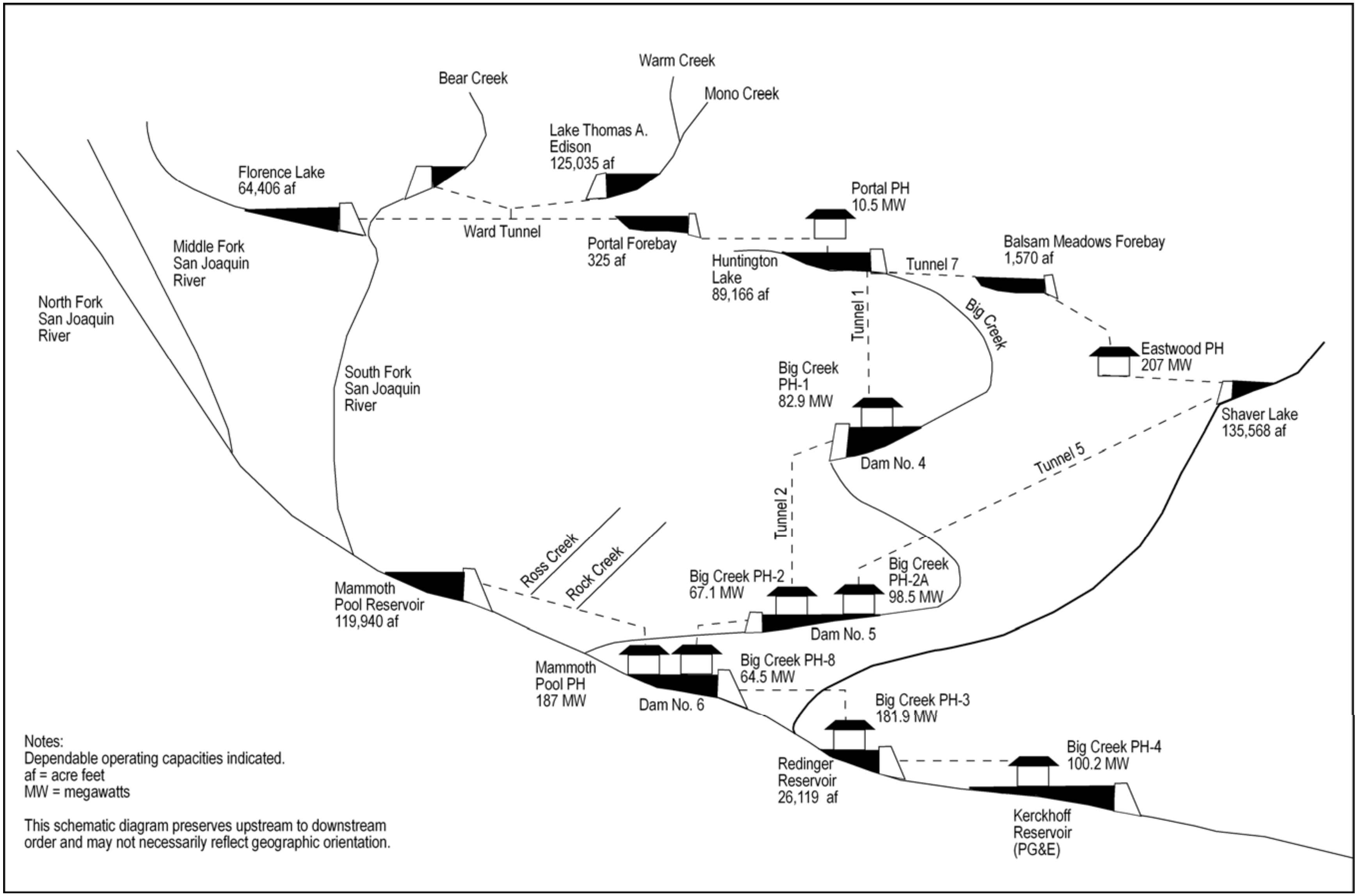

Figure 2-1. Existing facilities in the Big Creek System. (Source: FERC, 2002)

Table 2-2. Reservoir characteristics of the Big Creek ALP Projects. (Source: SCE, 2007a, as modified by staff)

Reservoir	Project No. (Development)	Maximum Pool Elevation (feet, msl)	Usable Storage Capacity at Maximum Pool (acre-feet)	Surface Area at Maximum Pool (acres)
Crater Creek diversion[a]	Project No. 67 (Big Creek 2A)	8,764.6	<1	<1
Tombstone Creek diversion[a]	Project No. 67 (Big Creek 2A)	7,673	<1	<1
Hooper Creek diversion	Project No. 67 (Big Creek 2A)	7,505	3	<1
North Slide Creek diversion[a]	Project No. 67 (Big Creek 2A)	7,501.5	<1	<1
South Slide Creek diversion[a]	Project No. 67 (Big Creek 2A)	7,501.5	<1	<1
Florence Lake	Project No. 67 (Big Creek 2A)	7,327.5	64,406	962
Chinquapin Creek diversion	Project No. 67 (Big Creek 2A)	7,628	<1	<1
Mono Creek diversion	Project No. 67 (Big Creek 2A)	7,350	47	6.7
Bear Creek diversion	Project No. 67 (Big Creek 2A)	7,350	103	13.25

Reservoir	Project No. (Development)	Maximum Pool Elevation (feet, msl)	Usable Storage Capacity at Maximum Pool (acre-feet)	Surface Area at Maximum Pool (acres)
Camp 62 Creek diversion	Project No. 67 (Big Creek 2A)	7,257	<1	<1
Bolsillo Creek diversion	Project No. 67 (Big Creek 2A)	7,532.5	<1	<1
Pitman Creek diversion	Project No. 67 (Big Creek 2A)	6,998	<1	<1
Balsam Meadows	Project No. 67 (Eastwood)	6,670	1,570	60
Shaver Lake	Project No. 67 (Eastwood)	5,370	135,568	2,184
Dam 5	Project No. 67 (Big Creek 8)	2,943	47	3.3
Huntington Lake	Project No. 2175 (Big Creek 1)	6,950	89,166	1,435
Pitman Creek domestic diversion[b]	Project No. 2175 (Big Creek 1)	Approx. 5,210	<1	<1
Snow Slide Creek domestic diversion[b]	Project No. 2175 (Big Creek 1)	Approx. 5,210	<1	<1
Balsam Creek diversion	Project No. 2175 (Big Creek 2)	4,880	<1	<1

Reservoir	Project No. (Development)	Maximum Pool Elevation (feet, msl)	Usable Storage Capacity at Maximum Pool (acre-feet)	Surface Area at Maximum Pool (acres)
Ely Creek diversion	Project No. 2175 (Big Creek 2)	4,844	<1	<1
Adit 8 diversion	Project No. 2175 (Big Creek 2)	4,825	<1	<1
Big Creek Dam 4	Project No. 2175 (Big Creek 2)	4,810	56	<1
Mammoth Pool dam	Project No. 2085 (Mammoth)	3,330	119,940	1,435
Rock Creek diversion	Project No. 2085 (Mammoth)	3,336	<1	<1
Ross Creek diversion	Project No. 2085 (Mammoth)	3,359	<1	<1
Powerhouse 3 forebay	Project No. 120 (Big Creek 3)	2,230	993	23.2

[a] SCE proposes to decommission this diversion as part of this proceeding.

[b] This diversion formerly provided domestic water for the community of Big Creek, but it has not been used in 30 years. SCE proposes to decommission this diversion as part of this proceeding.

2.1.1.1 Big Creek Nos. 2A, 8, and Eastwood Hydroelectric Power Project

The Big Creek No. 2A development was constructed between 1920 and 1928, with additional features added between 1944 and 1948. The two units (Units 1 and 2) were placed into service in 1928. The Big Creek No. 8 development was constructed between 1921 and 1929, and the two units (Units 1 and 2) were placed into service in 1921 and 1929, respectively. The Eastwood development was constructed between 1983 and 1987, and the unit was placed into service in 1987. The project is located within the South Fork San Joaquin River, Big Creek, and Stevenson Creek watersheds which flow into the San Joaquin River. The project's reservoirs and diversions are capable of impounding approximately 201,700 acre-feet of water. There are no transmission lines associated with the Big Creek No. 2A and Big Creek No. 8 developments, but there is one 4.7-mile-long, 230 kilovolt (kV) transmission line associated with the Eastwood development. The project features are located on 2,388.8 acres within the Sierra National Forest (this includes recent mapping corrections). See table 2-2 for reservoir characteristics.

Big Creek No. 2A

The Big Creek No. 2A development consists of two dams, 11 smaller diversion dams, several water conveyances, and a powerhouse. Relevant information about each feature is presented below.

Reservoirs

- Florence Lake dam, a concrete gravity structure that is 3,156 feet long and 149 feet high
- Shaver Lake dam, a concrete gravity structure that is 1,760 feet long and 185 feet high

Diversions

- Tombstone Creek diversion dam, a concrete gravity structure that is 26 feet long and 5 feet high
- Crater Creek diversion dam, a concrete gravity structure that is 21 feet long and 3 feet high
- North Slide Creek diversion dam, a concrete gravity structure that is 19 feet long and 5 feet high
- South Slide Creek diversion dam, a concrete gravity structure that is 22 feet long and 5 feet high
- Hooper Creek diversion dam, a concrete gravity structure that is 158 feet long and 30 feet high
- Chinquapin Creek diversion dam, a concrete gravity structure that is 32 feet long and 8 feet high
- Camp 62 Creek diversion dam, a concrete gravity structure that is 45 feet long and 7 feet high
- Bear Creek diversion dam, a concrete gravity structure that is 293 feet long and 55 feet high
- Mono Creek diversion dam, a concrete gravity structure that is 156 feet long and 64 feet high
- Bolsillo Creek diversion dam, a concrete gravity structure that is 54 feet long and 6 feet high
- Pitman Creek diversion dam, a concrete gravity structure that is 68 feet long and 8 feet high

Conveyances

- Ward Tunnel, a 67,619-foot-long, 15-foot by 15-foot horseshoe-shaped unlined tunnel from Florence Lake to the penstock for the Portal powerhouse (the Portal Project [FERC No. 2174] is not included in the Big Creek ALP Projects)
- Mono-Bear Conduit (a.k.a. Mono-Bear Siphon), a conveyance that consists of: (a) a 7,596-foot-long unlined tunnel from the Bear Creek diversion dam, (b) a 4,538-foot long flowline from the Mono Creek diversion dam that connects to a 3,933-foot unlined tunnel; and (c) a 13,806-foot-long steel pipe that carries the water from the two tunnels to the Ward Tunnel via a construction adit
- Tunnel 7 (a.k.a. Huntington-Pitman Siphon), which conveys water from Huntington Lake to the Balsam Diversion Tunnel and then to Shaver Lake through the Eastwood powerhouse, and consists of four sections: (a) a 680-foot-long, 21-foot diameter steel pipe; (b) a 2,642-foot-long, 14-foot by 14-foot horseshoe-shaped tunnel; (c) a 2,425-foot-long, steel pipe that varies from 120 inches to 96 inches and back to 120 inches in diameter; and (d) a 22,843-foot-long, 14-foot by 14-foot horseshoe-shaped tunnel
- Tunnel 5, a 13,900-foot-long, 11-foot by 11-foot unlined tunnel conveyance from Shaver Lake to the Powerhouse 2A penstock
- A 6,218-foot-long single steel pipe penstock that ranges from 66- to 108-inches in diameter and branches into two 48-inch lines outside of the powerhouse

Construction Adits

- Adit 1 and 2 connected to Tunnel 5

Powerhouse

- A powerhouse containing two generating units

Big Creek No. 8

The Big Creek No. 8 development consists of a dam, conveyance, penstocks, and a powerhouse. Relevant information about each feature is listed below.

- Big Creek dam 5, a concrete arch dam that is 224 feet long and 60 feet high and includes 19 ungated spillway bays with flashboards
- A conveyance from Big Creek dam 5 to Powerhouse 8 that consists of: (a) Tunnel 8, which is 5,570 feet long and 20-feet by 20-feet in cross section, and b) a 35-foot-diameter, 90-foot-high steel surge tank

- Two steel pipe penstocks, one 2,668 feet long and 96 to 72 inches in diameter and one 2,698 feet long and 120 to 84 inches in diameter
- A powerhouse containing two generating units

Eastwood Power Station

The Eastwood development consists of a dam, spillway, two water conveyances, a surge chamber, powerhouse, tailrace tunnel, and a transmission line. Relevant information about each feature is presented below.

- Balsam Meadows forebay dam, a compacted rockfill dam that is 1,325 feet long and 123 feet high
- A spillway with a concrete weir that is 280 feet
- Balsam forebay tunnel, a 5,866-foot-long, 16-foot by 16-foot horseshoe-shaped tunnel that intersects Tunnel 7 (the Huntington-Pitman-Shaver Conduit that is part of the Big Creek No. 2A development)
- A conveyance from the Balsam Meadows forebay to the Eastwood powerhouse consisting of three sections: (a) a 2,832-foot-long, 18-foot by 18-foot horseshoe-shaped upper tunnel; (b) a vertical shaft that is a 1,043-foot-long vertical bore connecting the upper and lower tunnels; and (c) a 1,328-foot-long, 12-foot-diameter lower steel-lined tunnel connected to the turbine shutoff valve
- An underground surge chamber consisting of a 30-foot diameter, 275-foot high vertical shaft connected to the conveyance tunnel by a 33-foot-long, 15-foot diameter shaft
- A powerhouse containing one pump/generating unit
- A tailrace tunnel that conveys water from the draft tube to Shaver Lake (and vice-versa during pumping operations), and consists of three sections: (a) a 35-foot-long draft tube transition; (b) a 440-foot-long, 15-foot diameter concrete-lined section; and (c) a 7,068-foot-long, 18-foot by 18-foot horseshoe-shaped section
- A 4.7-mile-long, 230 kV transmission line extending from the project switchyard at the surface to the Big Creek No. 1 switchyard

2.1.1.2 Big Creek Nos. 1 and 2 Hydroelectric Power Project

The Big Creek Nos. 1 and 2 Project was constructed between 1912 and 1917 and was placed into service between 1913 and 1925. The project's two developments are located in Fresno County, California, along Big Creek, a tributary of the San Joaquin River. The project's five reservoirs are capable of impounding more than 89,222 acre-feet of water, all but 56 acre-feet of which is stored for use by the Big Creek No. 1

development in Huntington Lake. There are no transmission lines associated with the project. The project features are all located on 2,017.78 acres within the Sierra National Forest (including recent mapping corrections). Reservoir characteristics are shown in table 2-2.

Big Creek No. 1

The Big Creek No. 1 development consists of four dams on Huntington Lake, a water conveyance, penstocks, a construction adit, and powerhouse. Relevant information about each feature is provided below.

Dams

- Huntington Lake dam 1, a concrete gravity structure that is 1,335 feet long and 170 feet high
- Huntington Lake dam 2, a concrete gravity structure that is 1,862 feet long and 120 feet high
- Huntington Lake dam 3, a concrete gravity structure that is 640 feet long and 165 feet high
- Huntington Lake dam 3A, a concrete gravity structure that is 263 feet long and 22.5 feet high

Conveyances

- A conveyance that consists of: (a) a 3,946-foot-long, 12-foot-diameter generally unlined tunnel (Tunnel 1); (b) a 409-foot long, 108-inch diameter riveted steel pipe liner in the lower end of the tunnel that branches into two riveted steel pipe branches; a 6,459-foot-long, 84-inch diameter branch to the Unit 1, 2 and 3 penstocks and a 6,478-foot-long, 60-inch diameter branch to the Unit 4 penstock

Penstocks

- Two 4,311-foot-long welded steel pipe penstocks for Units 1 and 2 which begin as a single 44-inch-diameter pipe that reduces in diameter and splits into branches with a final diameter of 24 inches
- A 4,360-foot-long welded steel pipe penstock for Unit 3 which begins as a single 42-inch-diameter that reduces in diameter and then splits into branches with a final pipe diameter of 24 inches
- A 4,301-foot-long welded steel pipe penstock for Unit 4 which begins as a single 54-inch-diameter that reduces in diameter and then splits into branches with a final pipe diameter of 24 inches

Construction Adit

- A construction adit to Tunnel 1

Diversions and Conveyances

- Pitman Creek domestic diversion, a concrete diversion structure and piping that has not been in operation for about 30 years
- Snow Slide Creek domestic diversion, a concrete diversion structure and piping that has not been operational for about 30 years

Powerhouse

- A powerhouse containing four generating units

Big Creek No. 2

The Big Creek No. 2 development consists of a dam, water conveyance penstocks, nine construction adits, three diversion dams with water conveyances, and a powerhouse. Relevant information about each feature is provided below.

Dam

- Big Creek Dam 4, a concrete arch dam that is 287 feet long and 75 feet high and includes 27 ungated spillway bays with flashboards

Conveyances

- A conveyance from Big Creek Dam 4 to the Powerhouse 2 that consists of: (a) Tunnel 2, which is 21,759 feet long and 12 feet in diameter; (b) a 30-foot-diameter, 115-foot-high surge tank; (c) a 255-foot-long, 108-inch-diameter riveted steel pipe from the surge tank to the unit penstocks

Penstocks

- Four steel pipe penstocks that begin as a single 54-inch diameter pipe that reduces in diameter and then splits into branches with a final pipe diameter of 24 inches

Construction Adits

- Nine construction adits for Tunnel 2

Diversions with Conveyances

- Balsam Creek diversion dam, a 72-foot-long, 9-foot-high concrete diversion dam, located across Balsam Creek 2 miles southwest of Big Creek, with a conveyance from the diversion to Tunnel 2 that consists of a 400-foot-long, 12-inch-diameter steel pipe that enters Adit 3
- Ely Creek diversion dam, a 44-foot-long, 7-foot-high concrete diversion dam located approximately 3 miles southwest of Big Creek with a conveyance from the diversion to Tunnel 2 that consists of a 300-foot-long, 12-inch-diameter steel pipe that enters Adit 6

- Adit 8 diversion dam, a 44-foot-long, 30-foot-high concrete diversion dam located on Adit 8 Creek about 3.5 miles southwest of Big Creek, with a vertical borehole into Tunnel 2 at Adit 8

Powerhouse

- A powerhouse containing four generating units

2.1.1.3 Mammoth Pool Project Hydroelectric Power Project

The Mammoth Pool Project was constructed from 1958 to 1960 and placed in service in 1960. The project is located in Fresno County, California, on the San Joaquin River. The project's reservoir is capable of impounding about 119,940 acre-feet of water. There are two transmission lines associated with the project, which are described in more detail below. The project features are all located on 2,029.68 acres within the Sierra National Forest. Reservoir characteristics are shown in table 2-2.

The Mammoth Pool development consists of a dam, two smaller diversion dams, three water conveyances, a small generating unit in the power tunnel, two construction adits, two transmission lines, and a powerhouse. Relevant information about each feature is provided below.

Dam

- Mammoth Pool dam, a compacted earthfill structure that is 828 feet long and 330 feet high

Diversions

- Rock Creek diversion dam, a concrete gravity structure that is 93 feet long and 9 feet high
- Ross Creek diversion dam, a concrete gravity structure that is 53 feet long and 7 feet high

Water Conveyances

- Mammoth power tunnel, a water conveyance from Mammoth Pool dam to the powerhouse (Mammoth power tunnel) consisting of: (a) a 39,350 foot long, 20-foot nominal diameter, horseshoe-shaped tunnel that is partially lined; (b) a 211-foot-long, 13-foot-diameter steel pipe at the Shakeflat Creek crossing; (c) a surge chamber that is 23 feet in diameter and 350 feet high; and (d) a 1,988-foot-long steel pipe penstock that varies from 158 to 129 inches in diameter and bifurcates into two 93-inch-diameter steel pipes just upstream of the powerhouse
- A conveyance from the Rock Creek diversion to the Mammoth Pool power tunnel that consists of a 434-foot-long, 20 to 30-inch-diameter steel pipe to a 20-inch-diameter vertical borehole into the tunnel

- A conveyance from the Ross Creek diversion to the Mammoth Pool power tunnel that consists of a 607-foot-long, 10 to 12-inch-diameter steel pipe to a 10-inch-diameter vertical borehole into the tunnel

Fishwater Generator

- A small generating unit located in the diversion tunnel

Construction Adits

- Two construction adits to the power tunnel

Transmission Lines

- One 230-kV transmission line that extends from the powerhouse to the non-project Big Creek No. 3 switchyard
- One 0.6-mile-long 12-kV line that connects the fishwater turbine to the non-project Stevenson 12-kV transmission line

Powerhouse

- A powerhouse containing two generating units

2.1.1.4 Big Creek No. 3 Hydroelectric Power Project

The Big Creek No. 3 Project was constructed from 1921 to 1923 and placed in service between 1923 and 1980 (Units 1 and 3 – 1923, Unit 4 – 1948, Unit 5 – 1980). The project is located in Fresno and Madera counties, California, along Big Creek, a tributary of the San Joaquin River. The project's reservoir is capable of impounding about 933 acre-feet of water. There are no transmission lines associated with the project. The project features are all located on 508.14 acres within the Sierra National Forest. Reservoir and powerhouse characteristics are shown in tables 2-2 and 2-3.

The Big Creek No. 3 development consists of a dam, water conveyance penstocks, three construction adits, and a powerhouse. Relevant information about each feature is presented below.

Dam

- Dam 6, a constant-radius concrete arch dam that is 495 feet long and 155 feet high that includes six ungated spillway bays

Conveyances

- A conveyance that consists of: (a) a 28,191-foot-long, 21-foot by 21-foot unlined tunnel (Tunnel 3); (b) a 164-foot-tall underground surge chamber that varies in diameter from 60 inches at the base, 25 inches in the middle and 75 inches at the top ; (c) a 310-foot long, 18-foot-diameter riveted steel pipe that divides through two spherical manifolds into five penstocks

Penstocks

- Four 90-inch to 54-inch-diameter steel penstocks for Units 1, 2, 3, and 4
- One 90-inch to 63-inch diameter steel pipe penstock to Unit 5

Construction Adits

- Three construction adits to Tunnel 3

Powerhouse

- A powerhouse containing five generating units

2.1.1.5 Existing Project Boundaries

The current project boundaries for the Big Creek ALP Projects encompass project facilities including dams and diversions, impoundments, water conveyances and associated structures, access roads and trails, transmission, communication and control lines, powerhouses, gaging stations, and helicopter landing sites for access to project structures. The project boundaries include land adjacent to project features; the width of these zones varies depending on the feature. Table 2-3 describes the lands included in the project boundaries for the Big Creek ALP Projects considered in this final EIS.

Table 2-3. Lands included in the project boundaries for the Big Creek ALP Projects. (Source: SCE, 2007a, as modified by staff)

Feature	Associated Lands Included in the Current Project Boundary
Dams and diversion structures	Variable distance of at least 50 feet from the structures
Impoundments	Variable horizontal distance (near zero feet to several hundred feet) from the maximum normal water surface elevation
Water conveyances	Typically the conveyances are located along the center line of a 100-foot-wide right-of-way (ROW)
Water conveyance structures	Typically 50 feet from the structure
Access roads	Typically the roads are located along the center line of a 50- to 100-foot-wide ROW
Access trails	Typically the trails are located within a 10-foot-wide ROW
Transmission lines	Typically the lines are located along the center line of a 100- to 150-foot-wide ROW

Feature	Associated Lands Included in the Current Project Boundary
Communication and control lines	Typically the lines are located along the center line of a 10-foot-wide ROW
Gaging stations	Typically 50 feet from the structure
Helicopter landing sites	Typically a 70 to 400 foot diameter area around the landing site
Recreational sites	Includes the footprint of the recreational area in most cases (some recreational areas are currently located outside of the project boundary)

The land included within the project boundaries currently overlaps at some locations (i.e., land at specific points is within the project boundary of two different projects). Table 2-4 presents those overlapping areas for the Big Creek ALP Projects (and other adjacent projects).

Table 2-4. Project lands overlapping other project lands for the Big Creek ALP Projects. (Source: SCE, 2007a, as modified by staff)

Affected Projects	Location of overlapping project lands
Big Creek Nos. 2A, 8, and Eastwood and Big Creek Nos. 1 and 2	Near Powerhouses 1 and 2 At the outlet of Ward Tunnel on Huntington Lake
Big Creek Nos. 2A, 8, and Eastwood and Mammoth Pool	Where the Mammoth Pool transmission lines passes Powerhouse 8
Big Creek Nos. 2A, 8, and Eastwood and Big Creek No. 3	Near the Big Creek Dam 6
Big Creek Nos. 2A, 8, and Eastwood and the Portal Project	Near the Portal forebay and powerhouse
Big Creek Nos. 2A, 8, and Eastwood and Big Creek No. 4	Near Powerhouse 8 at Redinger reservoir

Affected Projects	Location of overlapping project lands
Mammoth Pool and Big Creek No. 3	Around the Big Creek No. 3 forebay and powerhouse Where the Mammoth Pool transmission lines connect to the Big Creek No. 3 switchyard

In addition, there are features included in the Big Creek ALP Projects that also serve other projects. For example, the Ward Tunnel (part of Big Creek Nos. 2A, 8, and Eastwood), feeds water from Florence Lake, and a series of small diversions on the South Fork San Joaquin River (Big Creek Nos. 2A, 8, and Eastwood) into Huntington Lake (Big Creek Nos. 1 and 2). Huntington Lake (Big Creek Nos. 1 and 2), which serves as the impoundment for the Big Creek No. 1 development, is also a source of water for the Big Creek Nos. 2A and Eastwood developments (Big Creek Nos. 2A, 8, and Eastwood) via the Huntington-Pitman-Shaver conduit.

2.1.2 Existing Project Operations

Operations of SCE's seven licensed projects in the Big Creek System are managed from both a watershed-wide perspective and on an individual project-by-project basis. The Big Creek System consists of six major reservoirs (Thomas A. Edison, Florence, Huntington, Shaver, Mammoth Pool, and Redinger), and nine powerhouses (Portal, Eastwood, Mammoth Pool and Big Creek Powerhouses 1, 2, 2A, 3, 4, and 8). Figure 2-1 presents a schematic of the seven projects and associated reservoirs, water conveyance tunnels, and powerhouse in the Big Creek System.

SCE operates the Big Creek ALP Projects within the Big Creek System in accordance with its current license conditions, which include minimum instream flow (MIF) release requirements that are made by SCE from diversions and impoundments. Stream reaches, including bypassed stream reaches, are discussed later in section 3.3.1 and elsewhere.

SCE manages water through the system in a manner that best meets the operational constraints that are imposed either by contractual operating agreements (i.e., licenses, permits) or by physical limitations of the generating equipment. The Big Creek System is subject to several operating constraints, including: (1) available water supply; (2) electrical system requirements; (3) both planned and unplanned maintenance outages; (4) storage limits (including both recreational minimums and year-end carryover maximums); (5) both minimum and maximum release limits (from storage); (6) various provisions contained in water rights agreements,[10] and (7) California Independent System Operator requirements.

2.1.2.1 Big Creek System Water Management

This section provides a general overview of how SCE manages the seven projects in the Big Creek System.

In all water year types, water released from project reservoirs and diverted from streams is used to generate power. There are subtle differences, however, in the way the system is operated during different water year. Generally, SCE operates the projects so that the Big Creek System generates around the clock in the spring run-off period, except in dry water years. Operational flexibility is limited during normal run-off because the amount of water run-off available exceeds the combined generation and storage capacity of the system, resulting in water flowing over spillways or "spill." When the reservoirs stop spilling, SCE is able to use available inflows and generate power to meet the electric supply requirements and provide both base load and peaking energy.

In the upper basin area, water diverted from the Upper South Fork San Joaquin River drainage is stored in Florence Lake and water from Mono Creek drainage is stored in Lake Thomas Edison. Water is diverted from these two lakes and various other small backcountry diversions into Huntington Lake via the Ward Tunnel and the Mono-Bear Siphon. The volumes of water that can pass through Ward Tunnel and the siphons are limited by the physical size and layout of these conduits.

The Big Creek System has three interlinked water chains or pathways through which water may be transported and used to produce power.

- Huntington Water Chain: Portal powerhouse and Powerhouses 1, 2, 8, 3, and 4.
- Shaver Water Chain: Portal powerhouse, Eastwood powerhouse, and Powerhouses 2A, 8, 3, and 4.
- Mammoth Water Chain: Mammoth Pool powerhouse and Powerhouses 3 and 4.

After passing through, or bypassing, the Portal powerhouse, water entering Huntington Lake is directed either to the Huntington or Shaver chain. Water from Powerhouses 1 and 2 in the Huntington Chain joins water from the Shaver Chain, which

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[10] The most prominent water rights agreement is the Mammoth Pool Operating Agreement between SCE and the U.S. Bureau of Reclamation (Reclamation). It pertains to the storage and release of water from SCE's Big Creek reservoirs upstream of Reclamation-operated Friant dam (Millerton Lake) and the associated Central Valley Project water distribution system operated by Reclamation for downstream irrigators.

has already passed through Eastwood powerhouse and Powerhouse 2A. Water from these two chains is then diverted through Powerhouse 8, after which is joins the waters of the San Joaquin River coming from the Mammoth Chain. Water from all three chains then continues through Big Creek powerhouses 3 and 4.

Water from the Middle Fork and North Fork San Joaquin River drainages and the South Fork San Joaquin River that is not diverted at Florence Lake, Lake Thomas A. Edison, Bear Creek forebay, and the small backcountry diversions, is collected in Mammoth Pool reservoir and becomes part of the Mammoth Chain. Mammoth Pool powerhouse is usually run at maximum during the high flow or run-off period to prevent or delay spill at Mammoth Pool reservoir.

For the most part, Portal, Eastwood, and Big Creek No. 4 operate independently of the other powerhouses in the Big Creek System. Portal powerhouse opportunistically uses water passing through the Ward Tunnel for power generation, but only operates efficiently at moderate flows through Ward Tunnel. Ward Tunnel flows outside of the efficient flow range of Portal powerhouse bypass the powerhouse through a valve into Huntington Lake. Eastwood powerhouse generation normally occurs during the peak demand period of the day, unless water is being moved continuously from Huntington Lake to Shaver Lake for use during peak periods.

During the night, water is typically pumped from Shaver Lake through Eastwood power station into Balsam Meadows reservoir. During the day, the water then passes back through Eastwood power station in generate mode to Shaver Lake during peak demand hours. Maintaining water surface levels for recreational purposes at Huntington Lake and above pump-back minimum water surface elevations in Shaver Lake are important considerations when planning operations at Eastwood. Powerhouse 4 is the last power generation opportunity in the Big Creek System and therefore adjustments in the operation of that powerhouse will not affect the other upstream powerhouses.

Besides inflow, market constraints and pricing, transmission constraints, and weather will affect generation and operations at the Big Creek ALP Projects.

2.1.2.2 Water Management for the Big Creek ALP Projects

Here we describe how SCE operates the reservoirs and powerhouses that are part of or integrally related to the operation of the Big Creek ALP Projects.

Big Creek Project Reservoirs

Lake Thomas A. Edison

Lake Thomas A. Edison, a component of SCE's Vermilion Project, is the highest elevation reservoir in the Big Creek System. The lake is located on, and stores water from, Mono Creek and its tributaries. Water released from storage at the lake is diverted about 1 mile downstream at Mono Creek diversion (part of the Big Creek Nos. 2A, 8, and Eastwood Project) into the Mono-Bear Siphon. Water can also be diverted from the Bear

Creek diversion into the Mono-Bear Siphon. Water from the Mono-Bear Siphon flows into Ward Tunnel. Lake Thomas A. Edison has a relatively large storage capacity compared to its drainage area. Thus, during the spring run-off period in non-spill years, the majority of inflow is stored and not released until late summer. In spill years, however, the inflow to the lake is stored until threat of spill at Florence Lake and Bear Creek diversion has passed, then releases from the lake begin to avoid using the emergency spillway. Peak storage normally occurs sometime during July and August.

Florence Lake

Florence Lake, a component of the Big Creek Nos. 2A, 8, and Eastwood Project, is a high elevation reservoir that stores water from the South Fork San Joaquin River and other small tributaries. Water at Florence Lake is diverted into Ward Tunnel, as is water from Bolsillo, Chinquapin, Camp 62, and Camp 61 creeks. Priority is given to water being diverted from Florence Lake if spill is imminent at that location. Water being diverted from Lake Thomas A. Edison is given last priority because it is the least likely to spill due to its large storage capacity. Water diverted into Ward Tunnel passes under and is hydrologically connected to Portal forebay. The water eventually exits Ward Tunnel through Portal powerhouse or the bypass valve, and is stored in Huntington Lake.

Florence Lake storage is kept near its minimum level (1,000 acre-feet) during the winter months to avoid damage due to freezing water on the dam face. Storage usually begins to increase in late April. After the peak storage level is reached in late spring/early summer, the reservoir elevation gradually declines until it again reaches its minimum storage level in late fall.

Huntington Lake

Huntington Lake, a component of the Big Creek Nos. 1 and 2 Project, is also a relatively high elevation reservoir that stores water from the backcountry lakes and diversions via the Ward Tunnel. Water from Huntington Lake may be sent to either Powerhouse 1 or Shaver Lake via Balsam forebay or North Fork Stevenson Creek. A good faith effort is made by SCE to keep Huntington Lake as full as practicable with minimum fluctuation from Memorial Day through Labor Day weekend, for recreational uses. However, during wet years, it becomes necessary to keep storage lower until after local uncontrolled peak inflows have passed. Spill could occur if local uncontrolled inflows exceed Huntington Lake water diversion capacities. Due to downstream safety issues and domestic water issues for the town of Big Creek, spill is avoided at Huntington Lake, if possible.

Shaver Lake

Shaver Lake, a component of the Big Creek Nos. 2A, 8, and Eastwood Project, is a moderate elevation reservoir that stores water from Huntington Lake via Eastwood or Tunnel 7 (through Gate 2) and local inflows from North Fork Stevenson Creek and other small tributaries. Water storage at Shaver Lake is not noticeably altered on a daily basis by pump-back operations at Eastwood powerhouse, which usually occur during the late-night/early-morning hours from spring through fall, depending on water availability. During this period, the reservoir is generally kept at a high surface elevation to enable the use of pump-back capability. In pump-back mode, the Eastwood powerhouse pumps water from Shaver Lake and returns it to Balsam forebay. This water is used again the following day, for generation through Eastwood powerhouse, and then returned to Shaver Lake. For pump-back generation to occur, Shaver Lake has to be above a minimum elevation of 5,342 feet, or 78,426 acre-feet of storage. During wet water years, Shaver Lake storage will be drawn down below this pump-back minimum elevation in the spring/early summer to create storage space for the upcoming run-off and to minimize the potential for spilling at Shaver dam. Water from Shaver Lake is diverted to Powerhouse 2A through Tunnel 2, and is also released to Stevenson Creek, which is a tributary to the San Joaquin River downstream of Dam 6.

Mammoth Pool

Mammoth Pool reservoir, a component of the Mammoth Pool Project, is a moderate elevation reservoir that stores water from the San Joaquin River and other small tributaries. The drainage area of Mammoth Pool reservoir is by far the largest of all of the system reservoirs, relative to the reservoir size. As a result, Mammoth Pool reservoir spills more often than the other system reservoirs. In most cases, spill at Mammoth Pool dam will also result in spill downstream of Dam 6 and Redinger reservoir. Ideally, minimum storage at Mammoth Pool reservoir will occur just prior to the beginning of spring run-off to maximize storage space availability. After the threat of spill has passed, storage at Mammoth Pool reservoir declines at a rate necessary to ensure compliance with the September 30th storage requirements of the Mammoth Pool Operating Agreement. Consideration is given to flood control issues when determining the optimal storage level at Mammoth Pool reservoir during the winter months.

Big Creek Project Powerhouses

Big Creek Nos. 2A, 8, and Eastwood Project

The Eastwood powerhouse receives water from Balsam Meadows forebay, which is filled via the Huntington-Pitman-Shaver Conduit from Huntington Lake or through water pumped back from Shaver Lake, and discharges to Shaver Lake. Eastwood may operate as a pumped storage project in all water year types after the run-off period has ended and SCE gains control of reservoir inflows in the Big Creek System. Powerhouse 2A receives water from Shaver Lake and discharges to the Dam 5 impoundment on Big Creek. Powerhouse 8 uses water from the Dam 5 impoundment and discharges to the Dam 6 impoundment on the San Joaquin River.

Big Creek Nos. 1 and 2 Project

Big Creek No. 1 uses water from Huntington Lake and discharges into the Dam 4 impoundment on Big Creek. No. 2 receives water from the Dam 4 impoundment and discharges to the Dam 5 impoundment on Big Creek.

Mammoth Pool Project

Mammoth Pool reservoir receives flow from a large watershed that includes: Chiquito, Jackass, Dalton, and Granite creeks, and the North, Middle and South forks of the San Joaquin River. Under existing operations, water from the Mammoth Pool Project is diverted at the Mammoth Pool reservoir on the San Joaquin River and from Rock and Ross creeks (tributaries to the San Joaquin River downstream of Mammoth Pool reservoir). Water passing through the powerhouse enters the San Joaquin River just upstream of the Dam 6 impoundment, also known as Big Creek No. 3 forebay.

Big Creek No. 3 Project

Big Creek No. 3 receives water from the Dam 6 impoundment. The powerhouse discharges into Redinger reservoir (Big Creek No. 4 Project, FERC No. 2017).

2.2 APPLICANT'S PROPOSAL

2.2.1 Proposed Project Facilities

SCE proposes the following modifications to project facilities. These modifications are discussed in more detail under specific resource sections.

Big Creek Nos. 2A, 8, and Eastwood Project

- Install new minimum flow devices and gaging equipment at Dam 5 and Mono Creek diversion.
- Decommission diversions at Crater Creek, Tombstone Creek, North Slide Creek, and South Slide Creek.
- Rehabilitate all existing recreational facilities over the life of the license.
- Construct a new accessible fishing platform at Jackass Meadows campground.
- Construct a new accessible boat landing platform at Florence Lake.
- Install interpretive signage at Florence Lake Store, Jackass Meadows Campground, Mono Campground, and Whitebark Vista.
- Enhance visual aesthetics by painting the Mono-Bear siphon pipeline.

Big Creek Nos. 1 and 2 Project

- Install new minimum flow devices and gaging equipment at Ely Creek diversion, Balsam Creek diversion and Dam 4.

- Decommission domestic diversions at Pitman and Snow Slide creeks.
- Rehabilitate all existing recreational facilities over the life of the license.
- Construct a new Dam 3 day-use area at Huntington Lake.
- Construct a new accessible fishing platform at Huntington Lake.
- Install interpretive signage at Bear Cove day-use picnic area, Dam 3 parking area, Dowville day-use picnic area, and Eastwood Visitor Center.
- Enhance visual aesthetics by painting the Big Creek No. 1 penstock and other structures and providing vegetative screening at the switchyard.

Mammoth Pool Project

- Install new minimum flow devices and gaging equipment at Mammoth Pool dam, Rock Creek diversion and Ross Creek diversion.
- Upgrading the fishwater generator.
- Rehabilitate all existing recreational facilities over the life of the license.
- Install interpretive signage in the Mammoth Pool vicinity and Redinger reservoir overlook.
- Enhance visual aesthetics by painting the Mammoth Pool penstock.

Big Creek No. 3 Project

- Install new minimum flow devices and gaging equipment at Dam 6.
- Rehabilitate all existing recreational facilities over the life of the license.
- Enhance visual aesthetics by painting the Big Creek No. 3 penstock.

2.2.2 Project Safety

The Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; Mammoth Pool; and Big Creek No 3 projects have been operating for 29, 48, 50, and 30 years, respectively under the existing licenses. During this time, Commission staff have conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the licenses, and proper maintenance. In addition, the Big Creek ALP Projects have been inspected and evaluated every 5 years by an independent consultant, and a consultant's safety report has been filed for Commission review. As part of the relicensing process, Commission staff would evaluate the adequacy of all proposed project facilities under a new license. Special articles would be included in any licenses issued, as appropriate. Commission staff would continue to inspect the project during the terms of the new licenses to assure continued adherence to Commission-approved plans relating to operation and maintenance, and accepted engineering practices and procedures.

In addition to the environmental measures proposed by SCE, it also proposes to move the Howell-Bunger valve and fishwater generator located in the Mammoth Pool diversion tunnel to an exterior location at the downstream end of the tunnel for more efficient and safer access, maintenance, and operation. The fishwater generator is used to provide MIFs downstream of Mammoth Pool dam. The Howell-Bunger valve is used to provide releases from the reservoir other than through the powerhouse. The generator and Howell-Bunger valve also would be automated to enable operation from the Big Creek dispatch control center at the Big Creek No. 3 powerhouse for better control, compliance, and operator safety. These modifications would improve overall project safety (SCE, 2006).

2.2.3 Proposed Project Operations

SCE proposes to provide or modify minimum flow releases from several dams and diversions, provide channel and riparian maintenance flows from some diversions, provide pre-spill whitewater flow releases from some diversions, and to eliminate some flow diversions through diversion decommissioning. These modifications to project operations are summarized in the following section and discussed in more detail under specific resource sections.

2.2.4 Proposed Environmental Measures under the Settlement Agreement

SCE proposes a comprehensive set of measures covering the full range of resources in the Upper San Joaquin River Basin. Table 2-5 summarizes those proposed measures under the Settlement Agreement.[11] The Settlement Agreement envisions that all measures listed in appendix A of the agreement would be included in new licenses for the Big Creek ALP Projects, whereas measures listed in appendix B of the agreement would be implemented by SCE, but not included as a condition of new licenses. We only list those measures from appendix A of the agreement with the exception of one measure included in appendix B of the agreement that has a nexus to project purposes.

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[11] The precise wording of the measure summaries in this table differs from the specific language of the Settlement Agreement. Individual measures (Proposed Articles in the Settlement Agreement) include programmatic elements for scheduling and developing plans, monitoring, evaluation, and reporting that are not listed in this table. Characterizations of these measures are primarily the result of our attempt to provide a concise summary of the measures for this draft EIS and are not intended to modify any of the terms of the Settlement Agreement.

Table 2-5. Proposed environmental measures for the Big Creek ALP Projects under the Settlement Agreement. (Source: SCE, 2007b)

Article	Measure	Elements
1.1.1	**Streamflow Requirements**	As set forth in measures 1.1.1.1 through 1.1.1.22, maintain flows downstream of Project diversion dams. Measure instream flow releases as the 24-hour average of the flow and as an instantaneous flow. Instream flows would be the flow set forth below or the natural inflow into the point of diversion, whichever is less. Should the 24-hour average flow as measured, be less than the required 24-hour average flow, but more than the instantaneous flow (instantaneous floor); begin releasing the equivalent under-released volume of water within 7 days of discovery (based on SCE review of flow records) of the under-release. Water year types would be based on the April 1 forecast from the California Department of Water Resources (CDWR) Bulletin No. 120, San Joaquin Valley Water Year Index, or its successor index that is most representative of the Big Creek Watershed. Inform the Forest Service, Water Board, FWS, and the Commission which category of instream flows would be implemented based on the April 1 forecast.
	1.1.1.1 through 1.1.1.20 and 1.1.1.22	**Big Creek Nos. 2A, 8 and Eastwood Project** • Modify minimum flow releases at Stevenson Creek, Upper Balsam Creek (forebay to diversion), Lower Big Creek (Dam 5 to San Joaquin River), North Fork Stevenson Creek, Pitman Creek, Mono Creek (downstream of diversion), Bolsillo Creek, Chinquapin Creek, and Hooper Creek. **Big Creek Nos. 1 and 2 Project** • Provide minimum flows to Lower Balsam Creek (diversion to Big Creek), Middle Big Creek (Dam 4 to Dam 5), and Ely Creek and modify minimum flow releases to Upper Big Creek (Huntington Lake to Dam 4).

Article	Measure	Elements
		Mammoth Pool Project • Provide minimum flows to Rock Creek and Ross Creek and modify minimum flows to the San Joaquin River (Mammoth Pool dam to Dam 6). **Big Creek No. 3 Project** • Modify minimum flows to the San Joaquin River (Dam 6 to Redinger reservoir).
	1.1.1.21 Crater Creek /1.1.1.23 North Slide Creek/ 1.1.1.24 South Slide Creek/1.1.1.25 Tombstone Creek and 1.6 Small Diversions Decommissioning Plan	Remove from Service. The Licensee would implement the Small Diversions Decommissioning Plan (Crater Creek diversion, Tombstone Creek diversion, South Slide Creek diversion, North Slide Creek diversion, Pitman Creek domestic diversion, and Snow Slide Creek domestic diversion), included as appendix G in the Settlement Agreement.
	1.1.2/1.12 Flow Monitoring and Reservoir Water Level Measurement Plan	Measure and document all instream flow releases in publicly available and readily accessible formats. For the purposes of measuring and documenting compliance with the required instream flows in Project bypassed reaches, the Licensee would implement the Flow Monitoring and Reservoir Water Level Measurement Plan included as appendix L in the Settlement Agreement.
1.2	**Channel Riparian Maintenance Flow Plans**	By March 15 of each year, use March 1 preliminary water year forecast to inform the Forest Service, Water Board, FWS, Cal Fish & Game, and the Commission which category of instream flows would be implemented on April 1, with the option to adjust flows based on the April 1 and May 1 DWR Water Year forecast updates, if those updates are revised.

Article	Measure	Elements
	1.2.1 Bear Creek	Starting between May 15 and June 30 in Wet Years, do not divert water at the Bear Creek diversion for 10 consecutive days.
	1.2.2 Bolsillo Creek	Between April 1 and June 30 in Wet Years, do not divert water at the Bolsillo Creek diversion.
	1.2.3 Camp 62 Creek	Between April 1 and June 30 in Wet Years, do not divert water at the Camp 62 Creek diversion.
	1.2.4 Chinquapin Creek	Between April 1 and June 30 in Wet Years, do not divert water at the Chinquapin Creek diversion.
1.3	**Mono Creek Channel Riparian Maintenance Flow Plan**	Implement the Mono Creek Channel Riparian Maintenance Flow Plan, included as appendix D in the Settlement Agreement.
1.4	**Camp 61 Creek Channel Riparian Maintenance Flow Plan**	Implement the Camp 61 Creek Channel Riparian Maintenance Flow Plan, included as Settlement Agreement, appendix E. The objective of this Camp 61 Creek Channel Riparian Maintenance Flow Plan is to determine an appropriate channel and riparian maintenance flow regime to maintain reduced accumulations of fine sediment in Camp 61 Creek downstream of Portal forebay to the confluence with the South Fork San Joaquin River.
1.5	**Channel and Riparian Maintenance Flows for the South Fork San Joaquin River Downstream of Florence Reservoir**	Implement the channel and riparian maintenance flows for the South Fork San Joaquin River downstream of Florence reservoir, included as appendix F in the Settlement Agreement.

Article	Measure	Elements
1.7	**Large Woody Debris Management**	Return large wood to Bear Creek by allowing large woody debris to pass over the Bear Creek diversion dam spillway during spill.
1.8	**Temperature Monitoring and Management Plan**	Implement the Temperature Monitoring and Management Plan, included as appendix H in the Settlement Agreement.
1.9	**Fish Monitoring Plan**	Implement the Fish Monitoring Plan, included as appendix I in the Settlement Agreement.
1.10	**Sediment Management Prescriptions**	Implement the Sediment Management Prescriptions for certain small, moderate, and large diversions, included in Settlement Agreement, appendix J.
1.11	**Riparian Monitoring Plan** **(Camp 61 Creek, Mono Creek, and South Fork San Joaquin River)**	Implement the Riparian Monitoring Plan, included as appendix K in the Settlement Agreement.
2.1	**Historic Properties Management Plan**	Complete the draft HPMP filed with the Commission on November 29, 2005, pursuant to section 106 of the National Historic Preservation Act. To the extent required by the Commission or applicable law, consult with the Commission, interested governmental agencies, the Settlement Parties, and the Tribal Community for the completion of the draft HPMP. The final HPMP would include: • Provisions for coordination with the Vegetation Management Plan, Recreation Management Plan, Riparian Monitoring Plan, and any other plan referenced in the HPMP. • Provisions for including a Forest Service representative on the Big Creek Heritage Advisory Committee. Provisions to consult with the

Article	Measure	Elements
		Advisory Committee on the development of management and monitoring plans for cultural resources, review and evaluation of cultural resource data, the development of cultural resource protection measures, implementation of protection measures, or other recommendations as required by any Programmatic Agreement developed for the HPMP. The Advisory Committee would address specific issues or concerns that arise during the implementation of the licenses. • Provisions for continued management of National Register ineligible sites as important sites, as per the draft HPMP. Provide geographic information system (GIS) compatible electronic data through "Arc GIS coverage/shapefiles" whereby archaeological survey coverage and site locations can be entered into the Forest Service database. Implement the HPMP upon execution of a Programmatic Agreement.
3.1	**Visual Resources Plan**	Implement the Visual Resources Plan, included as appendix M in the Settlement Agreement.
3.2	**Transportation System Management Plan**	Implement the Transportation System Management Plan, included appendix N in the Settlement Agreement.
4.1	**Recreation Management Plan**	Implement the Recreation Management Plan, included as appendix O in the Settlement Agreement.
5.1	**Special-Status Bat Species Protection**	Prior to conducting any non-routine maintenance activities that could result in harm to special status bat species or their habitat, in structures that are known to support maternal or roosting bat species (including but not limited to, reconstruction and painting) (Settlement Agreement, table 5.1-1), consult with the Forest

Article	Measure	Elements
		Service, Cal Fish & Game, and FWS. Based on the consultation, implement appropriate avoidance and protection measures if necessary to minimize disturbance of special status bat species or habitat.
5.2	**Mule Deer Protection** **1. Mammoth Pool Reservoir**	To protect deer crossing Mammoth Pool reservoir during spring migration, maintain (i) the fences around the Mammoth Pool dam spillway; (ii) the Daulton Creek bridge; and (iii) a device to discourage deer from crossing the reservoir near the spillway. During the peak migration period (May 1 through June 15), ensure sand is present on the dam road to encourage deer to use the dam road to cross, and close the road during the peak migration period to reduce any adverse effects from recreation. Additionally, to ensure that the presence of debris that may impede deer migration across Mammoth Pool reservoir is monitored and that any build up of debris is removed in a timely manner, provide annual photo documentation to the Forest Service, Cal Fish & Game, and FWS of the area at the floating boom above the spillway (i.e., area of concern) along with an estimate of the extent of any debris present. This is especially important in years when Mammoth Pool reservoir spills. If agencies determine—based on review of the photograph and the estimate of the aerial extent of debris buildup—that the debris would impede deer migration, remove sufficient levels of debris to allow deer to migrate without impediment.
	2. Eastwood (Balsam Meadows)	Implement road closures within Big Creek Nos. 2A, 8, and Eastwood Project to prevent the disturbance of mule deer and other wildlife. Specific roads and road closure requirements are provided in appendix A in the Settlement Agreement, table 5.2-1.

Article	Measure	Elements
5.3	**Special-Status Species Protection**	Prior to construction of new project features on National Forest Service land that may affect Forest Service special-status species and their habitat (i.e., Forest Service sensitive and/or management indicator species), prepare a Biological Evaluation to describe the potential effect of the action on the species or its habitat. For state or federally listed species, federal candidate species, California species of special concern, and California fully protected species, prepare a Biological Assessment or other required document and obtain any necessary permits or approvals.
5.4	**Bald Eagle Management Plan**	Implement the Bald Eagle Management Plan, included as appendix P in the Settlement Agreement.
5.5	**Valley Elderberry Longhorn Beetle Management Plan**	Implement the VELB Management Plan, included as appendix Q in the Settlement Agreement.
5.6	**Vegetation And Integrated Pest Management Plan**	Implement the Vegetation and Integrated Pest Management Plan, included as appendix R in the Settlement Agreement.
5.7	**Bear/Human Interaction License Article**	Install and maintain bear-proof dumpsters at the Big Creek No. 1 administrative offices and company housing, and other project facilities where food waste may be disposed of or stored. The Forest Service, Cal Fish & Game, and FWS would review and approve dumpster design prior to installation. Implement a program to educate SCE personnel about proper food storage and garbage disposal to reduce bear/human incidents. The education program would consist of written materials (educational pamphlet) and employee training.
	Appendix B - (Non-FERC Settlement Agreement Provisions) – 1.2.2	During reconstruction and modification of the flow release structures for the Mammoth Pool dam, in consultation with agencies named above, assess the feasibility of adding gravel into or immediately below

Article	Measure	Elements
	Gravel Augmentation Feasibility Assessment	the spillway channel. Provide a written explanation of its determination to the Forest Service, FWS, Cal Fish & Game, and the Water Board. Schedule a meeting with these agencies, and any other interested government agencies to discuss the determination. The assessment would determine whether gravel augmentation in or below the spillway channel would: 1. impair the Mammoth Pool dam spillway function; 2. result in erosion and undermining of the access road to Mammoth dam; or 3. result in dam instability, impair operation of the release structures or hinder inspections to the dam and the release structures.

2.2.5 Proposed Project Boundary

2.2.5.1 Big Creek Nos. 2A, 8, and Eastwood

SCE proposes to add some lands to the area within the project boundary and to remove other lands from the project area. The exhibit G drawings have been revised to show these changes. Project boundary changes are summarized below.

SCE proposes to expand the area within the project boundary to include the following lands:

- The trail to the gage on Big Creek below Dam 5 from FS Road No. 8S05;
- The segment of FS Road No. 8S08A, leading to the upper penstock valves for Tunnel 5 from Railroad Grade Road (FS Road No. 8S08);
- The helicopter landing sites at: the summit at Shaver Hill near the junction of FS Road Nos. 2710 and 9S32; Tiffany Pines at Camp Edison; Mount Givens telecom site near the terminus of FS Road No. 7S32, near the Bear Creek diversion used to access the Bear Creek diversion and stream gage; Mono Creek diversion near FS No. 5S80Z, used to access the Mono Creek diversion and forebay; Mono Creek below Lake Thomas A. Edison, used to access the stream gage SCE gage no. 119; and the South Fork San Joaquin River below Hooper Creek, used to access SCE stream No. 129 at the

South Fork San Joaquin River at Florence Spill Station that provides access to SCE stream gage No. 128S, and to access the Florence Lake dam;

- The access road FS Road No. 9S58 to the North Fork Stevenson Creek gage from State Highway 168;
- The access road from FS Road No. 9S58 to the Eagle Point boat-in day-use area;
- The access road FS Road No. 9S17 to the Eastwood-Big Creek 1 Transmission Line tower M0-T3 from State Highway 168;
- The access road FS Road No. 9S312 to the Eastwood powerhouse from State Highway 168;
- The access road FS Road No. 9S58K from FS Road No. 9S58 to the Eastwood powerhouse entrance tunnel;
- The access roads FS Road Nos. 8S02 and 8S02B from State Highway 168 to the Huntington-Pitman-Shaver Tunnel Adit;
- The segment of FS Road No. 8S83 that accesses the Huntington-Pitman-Shaver Siphon from the junction of FS Road No. 8S83A;
- The Pitman Creek diversion access road (FS No. 8S94) from State Highway 168;
- The Bolsillo Creek diversion and Stream Gage Trail from FS Road No. 5S80H to the Bolsillo Creek diversion;
- The Chinquapin Creek diversion and Stream Gage Trail from FS Road No. 7S01 (Florence Lake Road) to the Chinquapin Creek diversion;
- The Bear Creek Stream Gage Trail from the Bear Creek diversion pool to the instream gage located upstream on Bear Creek;
- The land associated with the gaging station on Hooper Creek below Hooper Creek diversion (SCE gage no. 114) and the Hooper Creek diversion helicopter landing site;
- The land surrounding the gaging station on the South Fork San Joaquin River below the Hooper Creek confluence (SCE gage No. 129), increasing the existing diameter of project lands around the stream gage from 20 feet to 100 feet;
- The gaging station and ancillary equipment (cable way and housing structure) on the South Fork San Joaquin River above Hooper Creek confluence (SCE gage no. 128S;

- The access road FS Road No. 9S32C and associated spur roads to the Eastwood-Big Creek No. 1 Transmission Line towers M1-T2, M1-T3, M1-T4, M1-T5, M1-T6, M2-T1 and M2-T2; and
- The access road FS Road No. 8S47 from the gate to the Eastwood-Big Creek No. 1 Transmission Line towers M3-T1 and M2-T5.

SCE proposes to reduce the project area by removing:

- Excess land located southwest of Powerhouses 2 and 2A;
- A segment of FS Road No. 9S311 from the State Highway 168 to the Eastwood Switchyard;
- Excess land located along the southern side of Rancheria Creek from approximately 500 feet upstream of Portal powerhouse downstream to Huntington Lake;
- The Eastwood Overflow Campground located east of the Portal powerhouse;
- The Eastwood Overlook located along Rancheria Creek upstream of the confluence with Huntington Lake;
- The access road FS Road No. 5S80H to the Bolsillo Creek diversion from FS Road No. 5S80;
- The Chinquapin diversion piping near Camp 62 along a co-aligned segment of FS Road No. 7S01;
- The Florence Lake day-use area.

The net change in area would be a reduction of 24.79 acres, revising the total federal land acreage to 2,364.01 acres.

2.2.5.2 Big Creek Nos. 1 and 2

SCE proposes to add some lands to the area within the project boundary and to remove other lands from the project area. Specifically, SCE proposes to expand the area within the project boundary to include the following lands:

- The Eastwood Overflow Campground located east of Portal powerhouse;
- The Eastwood Overlook along Rancheria Creek upstream of the confluence with Huntington Lake;
- The access road beginning from the gate located at the terminus of Fresno County Road 3380 (Huntington Lodge Road) to the west end of Dam 2 (FS Road No. 8S66);
- The segment of FS Road No. 8S83 from the junction with FS Road No. 8S83A to the current project boundary.

SCE proposes to reduce the project area by removing:

- The area surrounding Rancheria Creek from Portal powerhouse to the high water line of Huntington Lake (Portal Tailrace);
- A portion of the right-of-way along the access road to the gaging station located on Big Creek below Huntington Lake (FS Road Nos. 8S66 and 8S66A), narrowing it from 100 feet to 50 feet (25 feet from the centerline along both sides of the road);
- The former company housing area near Powerhouses 2 and 2A;
- The segment of FS Road No. 8S13 between the gate near the top of the penstocks for Powerhouses 2 and 2A and FS Road No. 8S08 (Railroad Grade Road);
- Excess land located southwest of Powerhouses 2 and 2A; and
- The communication line ROW from the dispatcher's office near Powerhouse 3 to Powerhouse 2 and the Northern Hydro offices near Powerhouse 1.

The net change in project area would be a reduction of 118.63 acres, revising the total federal land acreage to 1,899.15 acres.

2.2.5.3 Mammoth Pool

SCE proposes to expand the existing project boundary to include 0.7 acres of federal lands associated with Shakeflat Trail to provide access to the San Joaquin River gaging station upstream of Shakeflat Creek and to include 2.90 acres of federal land for the helicopter landing site adjacent to the San Joaquin River above Shakeflat Creek. The revised total federal land acreage would be 2,033.28 acres.

2.2.5.4 Big Creek No. 3

SCE proposes to remove 44.17 acres of federal land above the high water line around the Dam 6 forebay that are not needed for access to the forebay or for the operation and maintenance of the project or other specified project purposes. The revised total federal land acreage would be 377.16 acres.

2.2.6 Proposed Action with Modifications

Section 4(e) Federal Land Management Conditions

Section 4(e) of the FPA states that the Commission may issue a license for a project on a federal reservation only if it finds that the license will not interfere or be inconsistent with the purpose for which the reservation was created or acquired. Such a reservation includes, without limitation, Forest Service-administered land. Section 4(e) of the FPA requires that a Commission license for a project located on a reservation include the conditions that the Secretary of the department under whose supervision the reservation falls deems necessary for the adequate protection and use of such reservation.

The Forest Service filed preliminary 4(e) conditions on February 5, 2007, for the Mammoth Pool Project and final conditions on February 27, 2008, for the remaining three projects. The measures proposed in the Settlement Agreement are consistent with the 4(e) conditions with the exception of minor variations in wording in the 4(e) conditions and the inclusion of standard general conditions by the Forest Service. Because the preliminary and final conditions filed by the Forest Service are consistent with the provisions of the Settlement Agreement, we discuss these terms and conditions in the context of our discussions of the Settlement Agreement measures throughout this final EIS.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the Big Creek ALP Projects would include SCE's proposal, including the Settlement Agreement and the terms and conditions filed pursuant to sections 4(e) and 10(j) of the FPA. Additional measures that we recommend for inclusion in any licenses that may be issued for the Big Creek ALP Projects are detailed below (in its comments on the draft EIS, SCE stated that it supports the staff alternative):

Aquatic Resources

Spawning Gravel Embeddedness Assessment Following Release of Flushing Flows–Assess gravel embeddedness in association with pool depth assessments following flushing flow releases from Dams 4, 5, and 6.

Sediment Management–Include the gravel augmentation feasibility assessment specified in section B.1.2.2 of the Settlement Agreement (measures not to be included in a new license) as a condition of a new license because this assessment pertains to Mammoth Pool dam spillway functions and maintenance of a project access road.

Terrestrial Resources

Bald Eagles–Specify in SCE's Avian Protection Plan that as follow-up to any documented bald eagle mortality at project transmission lines, the most recent APLIC guidelines would be used to assess appropriate corrective actions (the most recent guidance was issued in 2006 and it is likely to be updated during the life of the project).

Recreation

Funding Rehabilitation of Campgrounds–SCE would not be required to fund rehabilitation of five campgrounds that are located outside the existing and proposed project boundaries.

Report on Recreational Resources–SCE would provide reservoir elevation, boat ramp accessibility information, and parking and campsite capacity as a component of the Form 80 Recreation Report.

Land Use

Fire Management Plan–Include a Fire Management Plan in the Land Resource Plans that are approved by the Forest Service.

Sign Plan–Include a Sign Plan in the Land Resource Plans that are approved by the Forest Service.

Spill Prevention and Countermeasure Plan–Include a Spill Prevention and Countermeasure Plan in the Land Resource Plans approved by the Forest Service.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

2.4.1 Issuing a Non-Power License

A non-power license is a temporary license that the Commission terminates when it determines that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered by the license. At this point, no agency has suggested a willingness or ability to do so. No party has sought non-power licenses, and we have no basis for concluding that the Big Creek ALP Projects should no longer be used to produce power. Thus, we do not consider a non-power license a realistic alternative to relicensing in this circumstance.

2.4.2 Federal Government Takeover of the Projects

We do not consider federal takeover to be a reasonable alternative. Federal takeover and operation of the Big Creek ALP Projects would require Congressional approval. Although that fact alone would not preclude further consideration of this alternative, there is no evidence to indicate that federal takeover should be recommended to Congress. No party has suggested federal takeover would be appropriate, and no federal agency has expressed an interest in operating the projects.

2.4.3 Project Retirement

Retiring the Big Creek ALP Projects would require denying SCE’s license applications and require the surrender and termination of the existing licenses with any necessary conditions. The projects would no longer be authorized to generate power. Retiring the projects would involve significant cost and would foreclose any opportunity to add environmental enhancements to the existing Big Creek ALP Projects. For these reasons, we do not consider project retirement to be a reasonable alternative.

3.0 ENVIRONMENTAL ANALYSIS

In this section, we first describe the general environmental setting in the project vicinity and any environmental resources that could be cumulatively affected by relicensing the Big Creek ALP Projects. Then, we address each affected environmental resource. For each resource, we first describe the affected environment—the existing condition and the baseline against which to measure the effects of the proposed project and any alternative actions—and then the environmental effects of the proposed projects, including the proposed measures in section 2.2.4. We have not identified any substantive issues related to geology and soils, beyond sediment management in project-related waterways (addressed in section 3.3.1, *Aquatic Resources*), and socioeconomics associated with the proposed action; therefore, these topics are not assessed in separate sections of this final EIS. Unless otherwise identified, the sources of our information are the license applications for the Big Creek ALP Projects (SCE, 2005; 2007a) and the Settlement Agreement (SCE, 2007b). We provide citations for information obtained from subsequent filings related to the projects.

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The Big Creek ALP Projects are located in the Upper San Joaquin River Watershed, which drains a 1,600-square-mile area situated between the Sierra Nevada crest to the east and the Central Valley foothills to the west. The San Joaquin River Watershed in the area of the projects is bordered generally by the Merced River Watershed to the north and the Kings River Watershed to the south. The San Joaquin River headwaters are in John Muir Wilderness area at elevations greater than 14,000 feet mean sea level (msl), and the river flows in a general southwesterly direction through the Sierra Nevada and foothills to the Central Valley region. Precipitation within the Upper San Joaquin River Watershed occurs mostly during the late fall, winter, and early spring and is mostly in the form of snow above elevation 5,000 feet msl. Average yearly precipitation varies greatly with elevation with about 50 inches at 5,000 feet msl. Streamflow normally peaks during the late spring and/or early summer from snowmelt runoff. Low flows within this watershed typically occur in late summer or early fall, after the snowmelt and before the runoff from the fall storms moving in from the Pacific.

3.2 CUMULATIVELY AFFECTED RESOURCES

According to the Council on Environmental Quality's regulations for implementing NEPA (50 CFR §1508.7), an action may cause cumulative effects on the environment if its effects overlap in space or time with the effects of other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time, including hydropower and other land and water development activities.

Based on information in the license applications, agency comments, other filings related to the Big Creek ALP Projects, and preliminary staff analysis, we identified the following resources that have the potential to be cumulatively affected by the continued operation of the projects, in combination with other activities: aquatic resources (water quantity, water temperature, sediment transport, and resident fish), native amphibians, and recreation.

Anadromous fish may have historically ascended the San Joaquin River to at least portions of the lower elevation reaches of some of the Big Creek ALP Projects, but currently Friant and Kerckhoff dams represent impassable barriers to anadromous fish access to the project area.[12] The timing and magnitude of flows passing through the Big Creek System would not influence anadromous fish downstream of Friant dam because Millerton Lake has the capacity to store nearly all releases from upstream projects, and the commitment of nearly all releases from Friant dam to irrigation and other consumptive uses would make any possible shift in Big Creek System operations irrelevant to anadromous fish downstream of Friant dam. Consequently, we conclude that the proposed action would have no cumulative effect on anadromous fish.

Relicensing the Big Creek ALP Projects would have effects on other resources, including vegetation, wildlife other than native amphibians, land use, aesthetics, and cultural resources. However, we consider those effects, both positive and negative, to be project-specific in nature and not influenced by other past, present, or reasonably foreseeable actions at other projects or by other parties.

3.2.1 Geographic Scope

The geographic scope of the analysis defines the physical limits or boundaries of the proposed action's effects on the resources. Because the proposed action would affect resources differently, the geographic scope for each resource may vary. We consider the geographic scope for water temperature and sediment transport to be the San Joaquin Watershed upstream of Redinger reservoir. Redinger reservoir has a total capacity of 35,033 acre-feet and is relatively narrow and over 200 feet deep. Therefore, any changes in the temperature and sediment transport of water entering Redinger reservoir from the proposed action at upstream projects would be overcome by influences in Redinger reservoir. For water quantity, resident fish, and recreation, we consider the geographic scope of cumulative effects to be the San Joaquin Watershed upstream of Friant dam. Changes in flow related to any modifications of project operations would be muted by the large storage capacity of Millerton Lake and releases for irrigation and other consumptive uses. Increases or decreases in resident fish (either native or introduced) in project waters can influence aquatic community dynamics in downstream waters, but the large volume

[12] Kerckhoff dam is located about 9 river miles downstream of the dam at Redinger reservoir, and Friant dam (which creates Millerton Lake) is located about 26 river miles downstream of the dam at Redinger reservoir.

of Millerton Lake would make further downstream cumulative effects of resident fish unlikely. Recreational enhancements at the Big Creek ALP Projects could serve to attract recreational users, thus deflecting overcrowding conditions that may occur elsewhere in the San Joaquin Watershed.

3.2.2 Temporal Scope

The temporal scope of our cumulative analysis in the final EIS includes a discussion of past, present, and future actions and their effects on each resource that could be cumulatively affected. Based on the terms of new licenses, the temporal scope looks 30 to 50 years into the future, concentrating on the effects on the resources from reasonable foreseeable future actions. The historical discussion, by necessity, is limited by the amount of available information for each resource.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

3.3.1 Aquatic Resources

3.3.1.1 Affected Environment

Water Resources

Water Quantity

Table 2-2, in section 2.1.1, *Existing Project Facilities*, gives characteristics of the Big Creek ALP Project reservoirs. Figure 3-1 provides a general schematic of the projects' key storage reservoirs, diversions, powerhouses, and gage locations. The most downstream point on figure 3-1 is Redinger reservoir which is part of the Big Creek No. 4 Project. Downstream of Redinger reservoir, the San Joaquin River flows to the small Kerckhoff reservoir with 4,140 acre-feet of storage operated by the Pacific Gas and Electric Company. Millerton Lake, operated by the U.S. Bureau of Reclamation, has more than 500,000 acre-feet of storage and is located downstream of Kerckhoff reservoir.

<u>Reservoirs</u>

Florence Lake – The highest elevation storage reservoir in the Big Creek ALP Projects[13] is Florence Lake located on the South Fork San Joaquin River about 28 miles upstream of the confluence with the San Joaquin River. From Florence Lake, water is diverted into Ward Tunnel (capacity 1,760 cubic feet per second [cfs]) which leads to Portal powerhouse and then to Huntington Lake. However, before Ward Tunnel reaches Portal powerhouse, it also receives diverted water from a series of small diversion dams on Chinquapin, Camp 62, and Bolsillo creeks. MIFs from Florence Lake are measured at

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[13] Lake Thomas A. Edison, part of the Vermilion Valley Project (Project No. 2086), is at a slightly higher elevation than Florence Lake.

U.S. Geological Survey (USGS) gage no. 11230215 South Fork San Joaquin River below Hooper Creek, located about 3.5 miles downstream from Florence Lake, and range between 11 and 27 cfs depending on the water year type and month (tables 3-1 and 3-2). Table 3-3 shows historical flows at this gage.

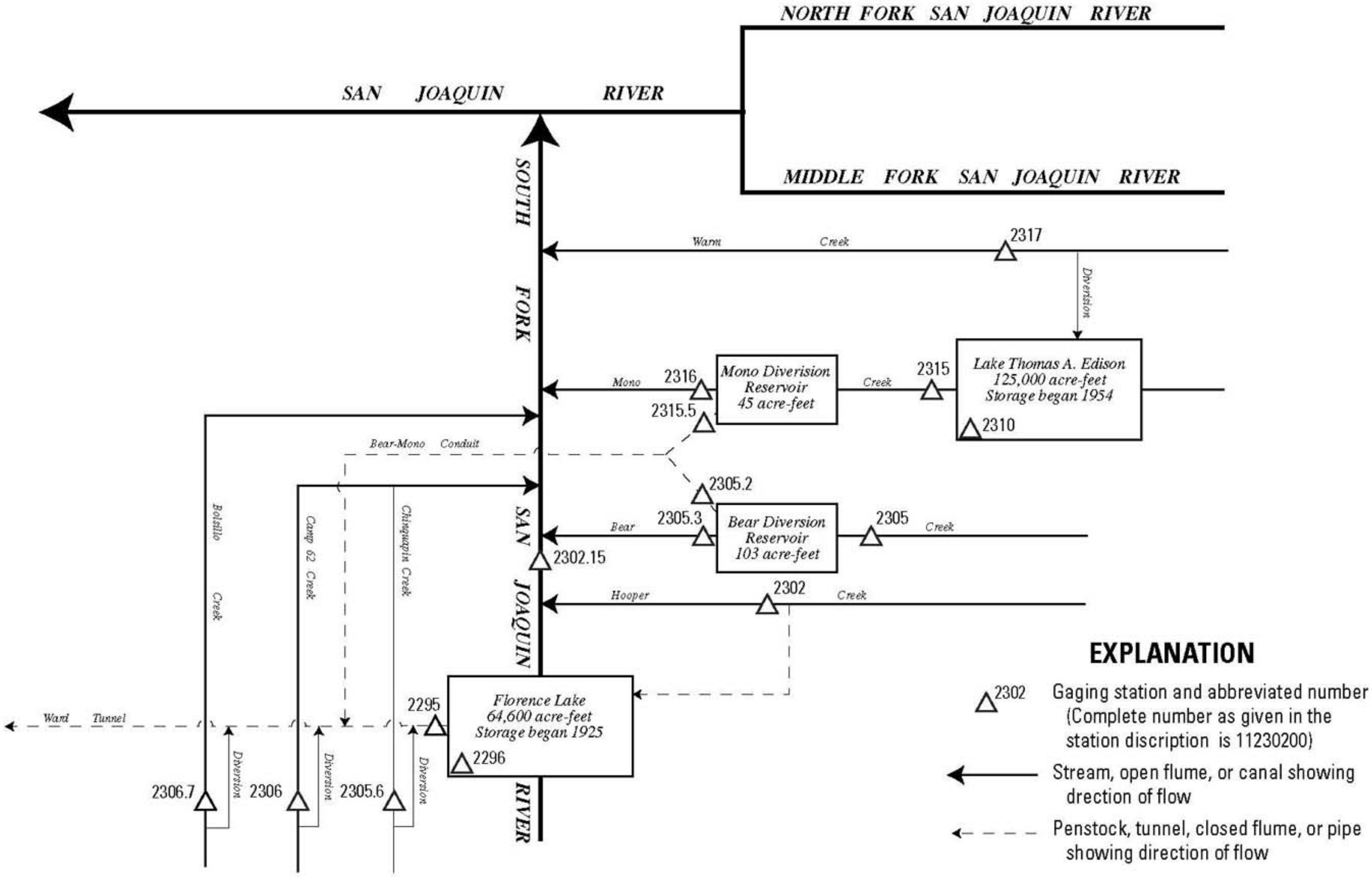

Figure 3-1. Schematic of the San Joaquin River Watershed area (page 1 of 2). (Source: USGS, 2004)

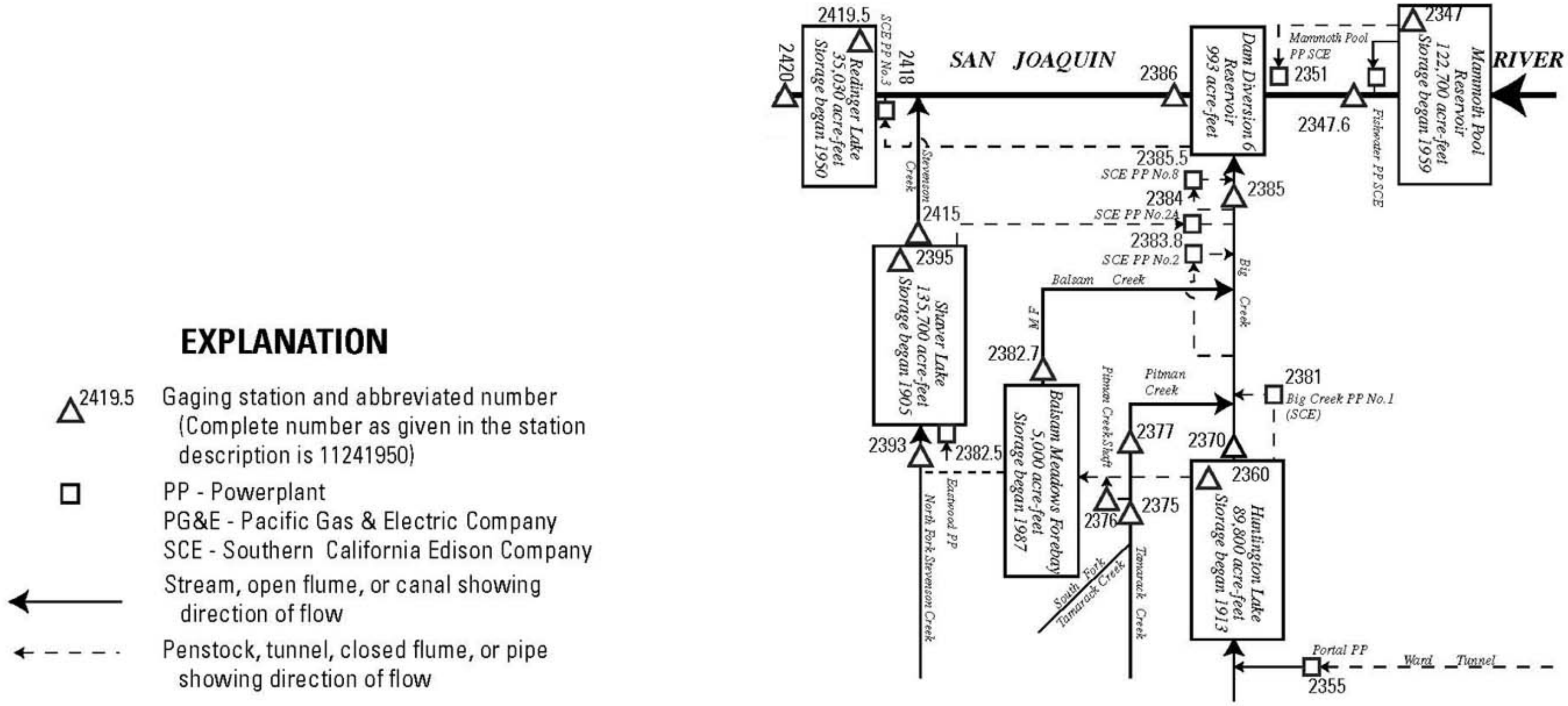

Figure 3-1. Schematic of the San Joaquin River Watershed area (page 2 of 2). (Source: USGS, 2004)

Table 3-1. Existing instream flow requirements for normal water year. (Source: SCE, 2007a; 2005)

USGS Gage	Stream Reach	Existing Instream Flow Release Requirement (cfs)											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Big Creek Nos. 2A, 8, and Eastwood (FERC No. 67)													
11230530	Bear Creek below diversion	2	2	2	2	2	2	2	3	3	3	3	3
11231600	Mono Creek below diversion	9	7.5	7.5	7.5	7.5	7.5	7.5	13	13	13	13	13
11230215	South Fork San Joaquin River below Hopper Creek	17	15	15	15	15	15	15	27	27	27	27	27
11237700	Pitman Creek near Tamarack Mountain[a]	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
11241500	Stevenson Creek below Shaver Lake	3	3 , 2	2	2	2	2	3	3	3	3	3	3
11238500	Lower Big Creek near mouth (below Dam 5)	3	3 , 2	2	2	2	2	3	3	3	3	3	3
11230600	Camp 62 Creek below diversion	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
11230560	Chinquapin Creek below diversion	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	1	1
11230670	Bolsillo Creek below diversion	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
11230120	North Slide Creek below diversion[b]	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
11230100	South Slide Creek below diversion[b]	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
11230200	Hooper Creek below diversion[c]	2	2	2	2	2	2	2	2	2	2	2	2
11239300	North Fork Stevenson Creek above Shaver Lake[d]	4	4	4	3.5	3.5	3.5	5	5	5	4.5	4.5	4.5

USGS Gage	Stream Reach	Existing Instream Flow Release Requirement (cfs)											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
11238270	Upper Balsam Creek below Balsam Meadows Forebay[e]	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	1
Big Creek No. 3 (FERC No. 120)													
11238600	San Joaquin River Stevenson reach (below Dam 6 above Stevenson Creek)	3	3	3	3	3	3	3	3	3	3	3	3
Mammoth Pool (FERC No. 2085)													
11234760	San Joaquin River Mammoth reach above Shakeflat Creek	25	10	10	10	10	10	10 , 25	25	25	30	30	30 , 25
Big Creek Nos. 1 and 2 (FERC No. 2175)													
11237000	Upper Big Creek 0.9-mile below Huntington Lake	2	2	2 , -	-	-	-	- , 2	2	2	2	2	2

Notes: When natural flow is at or below the MIF requirement, the diversions are turned out. Therefore, flows in a diverted reach may drop below the MIF requirement when SCE is not diverting.

When two values are listed for a specific month, the first value is for the first half of the month and the second value is for the second half of the month.

[a] When gaging is not possible due to freezing water (Dec 15 to Apr 15), record daily at downstream weir.

[b] Stream gages on North Slide and South Slide creeks have been inactive for more than 25 years.

[c] Included in South Fork San Joaquin River below Hooper.

[d] Intersection of North Fork Stevenson Creek and Shaver perimeter road.

[e] West Fork Balsam Creek. As measured in downstream channel immediately below project boundary.

Table 3-2. Existing instream flow requirements for dry water year. (Source: SCE, 2007a; 2005)

USGS Gage	Stream Reach	Existing Instream Flow Release Requirement (cfs)											
		Oct	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Big Creek Nos. 2A, 8, and Eastwood (FERC No. 67)													
11230530	Bear Creek below diversion	1	1	1	1	1	1	1	2	2	2	2	2
11231600	Mono Creek below diversion	6	5	5	5	5	5	5	9	9	9	9	9
11230215	South Fork San Joaquin River below Hopper Creek	13	11	11	11	11	11	11	20	20	20	20	20
11237700	Pitman Creek near Tamarack Mountain[a]	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
11241500	Stevenson Creek below Shaver Lake	3	3 , 2	2	2	2	2	3	3	3	3	3	3
11238500	Lower Big Creek near mouth (below Dam 5)	2	2 , 1	1	1	1	1	2	2	2	2	2	2
11230600	Camp 62 Creek below diversion	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
11230560	Chinquapin Creek below diversion	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	1	1
11230670	Bolsillo Creek below diversion	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
11230120	North Slide Creek below diversion[b]	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
11230100	South Slide Creek below diversion[b]	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
11230200	Hooper Creek below diversion[c]	2	2	2	2	2	2	2	2	2	2	2	2
11239300	North Fork Stevenson Creek above Shaver Lake[d]	3	3	3	3	3	3	4	4	4	3.5	3.5	3.5

		Existing Instream Flow Release Requirement (cfs)											
USGS Gage	**Stream Reach**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
11238270	Upper Balsam Creek below Balsam Meadows Forebay[e]	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	1
Big Creek No. 3 (FERC No. 120)													
11238600	San Joaquin River Stevenson reach (below Dam 6 above Stevenson Creek)	3	3	3	3	3	3	3	3	3	3	3	3
Mammoth Pool (FERC No. 2085)													
11234760	San Joaquin River Mammoth reach above Shakeflat Creek	12.5	10	10	10	10	10	10, 12.5	12.5	12.5	30	30	30, 12.5
Big Creek Nos. 1 and 2 (FERC No. 2175)													
11237000	Upper Big Creek below Huntington Lake	2	2	2 , -	-	-	-	- , 2	2	2	2	2	2

Notes: When natural flow is at or below the MIF requirement, the diversions are turned out. Therefore, flows in a diverted reach may drop below the MIF requirement when SCE is not diverting.

A value of 10, 25 indicates a flow of 10 cfs in the first half of the month and 25 cfs in the last half of the month.

[a] When gaging is not possible due to freezing water (Dec 15 to Apr 15), record daily at downstream weir.

[b] Stream gages on North Slide and South Slide creeks have been inactive for more than 25 years.

[c] Included in South Fork San Joaquin River below Hooper.

[d] Intersection of North Fork Stevenson Creek and Shaver perimeter road.

[e] West Fork Balsam Creek. As measured in downstream channel immediately below project boundary.

Table 3-3. Monthly discharge (cfs) statistics for gaging stations downstream of reservoirs. (Source: USGS, 2008; SCE, 2005, 2007a, 01CAWG-06)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
South Fork San Joaquin River below Hooper Creek (11230215) Period of record: 10/1/1982 to 9/30/2002. Drainage area: 184 square miles.												
Mean	20.3	17.7	16.7	18.6	20.3	26.5	28.3	45	322.4	244.4	69.3	28.1
Median	18	16	16	17	18	23	25	29	28	28	27	27
Max.	123	79	141	366	153	202	116	2,190	4,010	5,020	1,650	118
Min.	8.1	7.4	11	7.5	11	11	12	20	19	19	7.3	21
10% Exceed.	29	28	20	22	27	39	44	68	1180	717	46	32
90% Exceed.	14	13	13	13	13	17	17	23	23	23	23	22
Stevenson Creek below Shaver Lake (11241500) Period of Record: 10/1/1986 to 9/30/2002. Drainage area: 29.4 square miles.												
Mean	12.6	3.3	2.8	18.4	27.1	42.1	44.4	75.8	120.1	78.3	14.1	3.6
Median	3.5	3.5	2.6	2.6	2.8	3.0	3.8	3.6	3.6	3.5	3.4	3.5
Max.	278	11.0	10.0	340	305	317	307	650	688	672	434	37.0
Min.	3.1	1.6	1.2	1.9	2.1	2.1	3.0	3.1	3.0	3.0	3.0	3.0
10% Exceed.	4.5	3.8	3.8	4.1	51.0	203	256	317	350	441	4.7	4.0
90% Exceed.	3.3	2.5	2.2	2.2	2.4	2.5	3.3	3.3	3.2	3.1	3.1	3.1

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Big Creek below Huntington Lake (11237000) Period of Record: 10/1/1986 to 9/30/2002. Drainage area: 81.1 square miles.												
Mean	3.3	3.2	3.1	3.0	2.5	3.0	4.1	6.3	8.7	4.0	3.9	3.7
Median	2.9	2.9	2.9	2.6	2.4	2.6	4.0	4.5	4.2	3.8	3.6	3.4
Max.	5.7	6.6	5.9	29.0	5.4	13.0	19.0	51.0	115.0	8.6	13.0	8.5
Min.	2.1	2.1	2.0	1.2	0.8	1.2	1.6	2.5	2.5	2.2	2.1	2.1
10% Exceed.	4.6	4.2	4.1	4.1	3.5	4.0	6.1	11.0	12.0	5.2	5.2	4.8
90% Exceed.	2.4	2.4	2.4	2.0	1.8	2.0	2.6	2.7	2.8	2.5	2.4	2.7
San Joaquin River above Shakeflat Creek (11234760) Period of Record: 10/1/1982 to 9/30/2002. Drainage area: 1,003 square miles/												
Mean	24.3	13.5	15.0	159.6	66.5	126.0	223.0	1,210.5	2,066.5	1,074.9	119.5	25.2
Median	27.0	13.0	12.0	13.0	14.0	14.0	17.0	32.0	31.0	29.0	29.0	28.0
Max.	62.0	53.0	106	26,000	2,350	10,100	12,900	18,100	15,500	13,500	3,830	50.0
Min.	7.0	10.0	4.9	9.2	4.4	4.2	10.0	14.0	14.0	13.0	14.0	13.0
10% Exceed.	32.0	16.0	19.0	56.0	64.0	57.0	59.0	4,500	8,020	4,510	52.0	35.0
90% Exceed.	14.0	11.0	11.0	11.0	12.0	12.0	12.0	14.0	14.0	14.0	14.0	14.0

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Balsam Creek below Balsam Meadows Forebay (11238270) Period of Record: 1/24/1989 to 9/30/2002												
Mean	0.8	0.7	0.8	0.8	0.8	0.9	1.0	0.8	1.2	1.3	1.3	1.3
Median	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	1.2	1.3	1.3	1.3
Max.	1.6	2.1	2.2	1.3	1.5	3.2	3.4	1.4	2.1	1.5	1.6	1.7
Min.	0.5	0.5	0.6	0.5	0.3	0.5	0.5	0.5	0.8	1.1	1.0	1.0
10% Exceed.	1.2	1.0	1.2	1.1	1.1	1.3	1.3	1.2	1.4	1.4	1.5	1.4
90% Exceed.	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	1.1	1.1	1.1	1.2

Notes: The period of record indicated in this table was the time period used to develop the table, not the complete period of record at a specific gage.
Because daily data were used to develop this table, the minimum and maximum values shown are the daily minimum and maximum values within each month for the stated period of record, not the minimum and maximum monthly values.

The average maximum yearly storage was 60,096 acre-feet and the average minimum yearly storage was 1,008 acre-feet over a 21-year period (1980 to 2001) (SCE, 2003c). These averages correspond to the range of water levels shown in figure 3-2 (water levels within Florence Lake for water years 1981 to 2007). Due to snowmelt runoff in spring and early summer, Florence Lake normally begins to refill in April and May, reaches its maximum water level and storage in late June or July, then falls to its minimum level by December. Under the existing license, SCE is required to maintain a minimum reservoir elevation of 7,276.6 feet msl from July 1 until August 31 and a minimum reservoir elevation of 7,232.6 feet msl during the reminder of the year. These elevations have usually been met as shown in figure 3-2. Historically, during the July 1 to August time period, the decrease in the reservoir level is less than 1 foot per day.

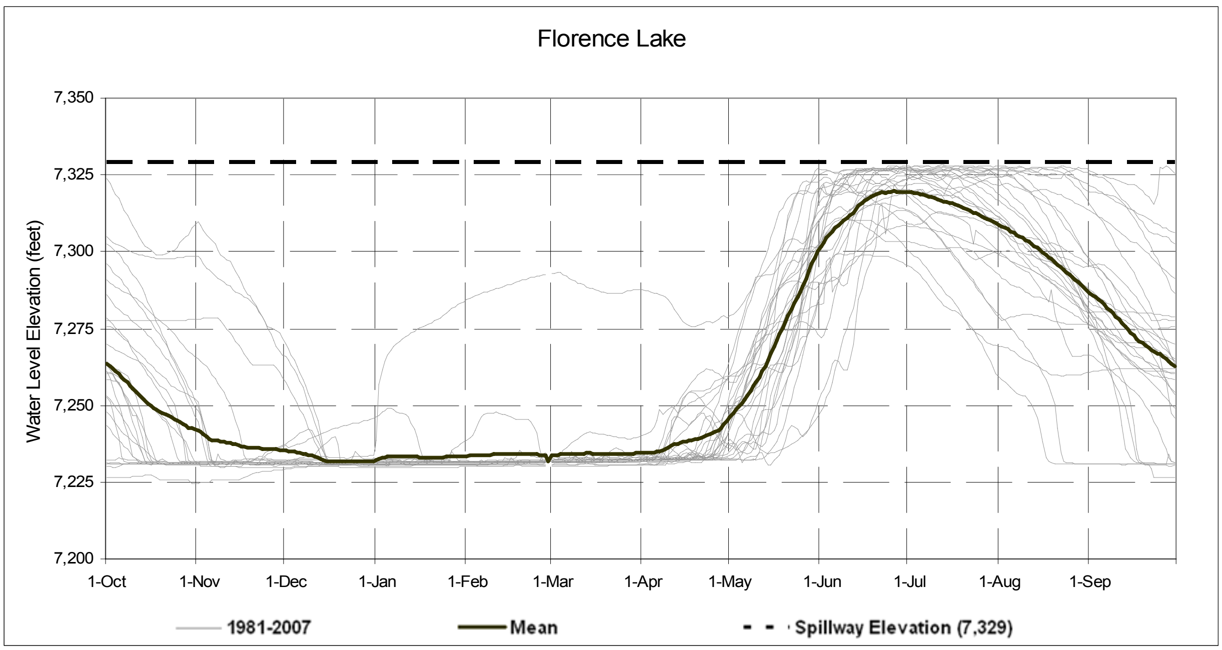

Figure 3-2. Florence Lake reservoir water levels 1981 to 2007. (Source: SCE, 2007a; USGS, 2008)

Shaver Lake – Shaver dam, which creates Shaver Lake, is located on Stevenson Creek about 4 miles upstream of its confluence with the San Joaquin River. Natural inflow occurs from Stevenson and North Fork Stevenson creeks. However, most inflow is from Huntington Lake via the Balsam Meadows forebay and Eastwood powerhouse. Inflow from the Eastwood powerhouse normally peaks in June in the 900 cfs range (table 3-4) and in the 200 cfs range during winter. From Shaver Lake, water passes through Tunnel 5 (capacity 650 cfs) to Powerhouse 2A, or during pump-back operations, is pumped to Balsam Meadows forebay via Eastwood powerhouse. Minimum flow releases to Stevenson Creek are made from near the bottom of Shaver dam, measured 0.3 mile downstream of the dam at USGS gage no. 11241500 Stevenson Creek below Shaver Lake, and range between 2 and 3 cfs for both normal and dry water year types (see tables 3-1 and 3-2). Table 3-3 shows historical flows at this gage.

Table 3-4. Monthly discharge statistics (cfs) for powerhouses. (Source: USGS, 2008)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Big Creek Powerhouse 2A near Big Creek (11238400) Period of record 10/1/1980 to 9/30/2007 missing water year 1984												
Mean	287	235	236	227	253	299	312	390	439	464	447	420
Median	269	197	211	215	214	256	269	371	470	463	449	436
Max.	731	655	655	655	656	706	669	721	716	671	825	677
Min.	0	0	0	0	0	0	0	0	0	0	0	0
10% Exceed.	597	563	536	475	608	628	642	645	649	646	640	632
90% Exceed.	14	0	0	0	0	0	1	91	150	234	232	198
Big Creek Powerhouse 8 near Big Creek (11238550) Period of record: 10/1/1980 to 9/30/2007 missing water year 1984												
Mean	572	487	498	502	541	659	757	898	953	986	915	836
Median	526	471	479	481	486	597	645	867	1,030	1,005	930	856
Max.	1,210	1,200	1,220	1,280	1,370	1,390	1,450	1,430	1,410	1,400	1,440	1,320
Min.	0	0	0	0	0	0	0	30	47	1	17	0
10% Exceed.	996	918	867	906	1,170	1,180	1,330	1,370	1,370	1,335	1,245	1,200
90% Exceed.	203	101	190	125	86	220	279	425	529	618	522	404

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Eastwood Powerhouse above Shaver Lake near Big Creek (11238250) Period of record: 10/1/1987 to 9/30/2007												
Mean	304	256	281	266	242	240	380	780	931	700	557	469
Median	322	239	285	267	204	187	317	769	879	644	565	484
Max.	913	972	812	1,210	1,260	996	1,560	1,910	1,900	1,720	1,370	1,160
Min.	0	0	0	0	0	0	0	0	0	0	0	0
10% Exceed.	606	574	553	543	523	587	913	1,410	1,540	1,190	896	771
90% Exceed.	0	0	0	0	0	0	0	134	378	304	196	143
Big Creek Powerhouse 3 near Shaver Lake (11241800) Period of record: 10/1/1980 to 9/30/2007 missing water year 1984												
Mean	962	826	970	1,069	1,301	1,968	2,509	2,687	2,471	2,197	1,824	1,486
Median	914	732	793	943	1,210	1,770	2,585	2,880	2,690	2,010	1,690	1,265
Max.	3,300	2,670	3,270	3,250	3,280	3,490	3,460	4,890	3,660	3,420	3,520	3,340
Min.	0	0	0	0	0	328	394	166	444	235	330	198
10% Exceed.	1,620	1,440	1,870	2,190	2,668	3,240	3,321	3,350	3,330	3,315	3,055	2,600
90% Exceed.	348	227	339	244	342	989	1,560	1,725	1,370	1,255	1,040	728

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mammoth Pool Powerhouse near Big Creek (11235100) Period of record: 10/1/1980 to 9/30/2007 missing water year 1984												
Mean	355	310	391	573	776	1,297	1,737	1,852	1,678	1,286	917	631
Median	288	236	247	411	602	1,135	1,920	2,070	1,935	1,030	752	496
Max.	2,080	1,590	2,510	2,510	2,550	2,650	2,580	2,660	2,630	2,600	2,500	2,090
Min.	0	0	0	0	0	0	49	0	27	0	8	0
10% Exceed.	754	726	971	1,190	2,026	2,340	2,450	2,490	2,470	2,440	1,855	1,401
90% Exceed.	26	0	11	38	43	498	900	1,000	655	514	365	74
Big Creek Powerhouse 1 at Big Creek (11238100) Period of record: 10/1/1980 to 9/30/2007 missing water year 1984												
Mean	306	258	292	287	273	339	406	489	503	518	473	418
Median	310	218	270	230	226	323	421	559	575	565	510	447
Max.	617	594	605	736	723	722	756	797	731	728	736	711
Min.	0	0	0	0	0	0	0	3	1	101	9	9
10% Exceed.	578	569	573	580	575	599	690	696	695	687	620	587
90% Exceed.	52	2	79	35	3	40	126	228	275	323	259	178

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Big Creek Powerhouse 2 near Big Creek (11238380) Period of record: 10/1/1980 to 9/30/2007 missing water years 1984 and 1995												
Mean	311	281	312	286	266	335	383	455	462	485	454	409
Median	314	254	282	222	210	317	386	490	529	531	487	429
Max.	639	636	653	666	639	621	621	650	638	655	696	727
Min.	0	0	0	0	0	0	0	10	0	99	10	0
10% Exceed.	602	600	602	606	601	606	605	608	610	607	605	605
90% Exceed.	42	63	94	36	12	66	127	228	271	315	250	175

Note: The period of record indicated in this table was the time period used to develop the table, not the complete period of record at a specific gage.

Because daily data were used to develop this table, the minimum and maximum values shown are the daily minimum and maximum values within each month for the stated period of record, not the minimum and maximum monthly values.

Figure 3-3 shows water levels within Shaver Lake for water years 1981 to 2007. Due to snowmelt runoff in the spring and early summer and the rate of inflow from the Eastwood powerhouse, Shaver Lake normally reaches its maximum water levels in July, and its lowest levels are normally in the winter and early spring. Under the existing license, SCE maintains a minimum reservoir elevation of 5,268.73 feet msl from September 1 to June 15. During the remainder of the year, the existing license specifies a reservoir level dependent on the April 1 forecast for the natural runoff of the San Joaquin River at Friant dam from April through July as shown in table 3-5. Historically, from June 15 through September 1, the decrease in the reservoir level is less than about 0.25 foot per day.

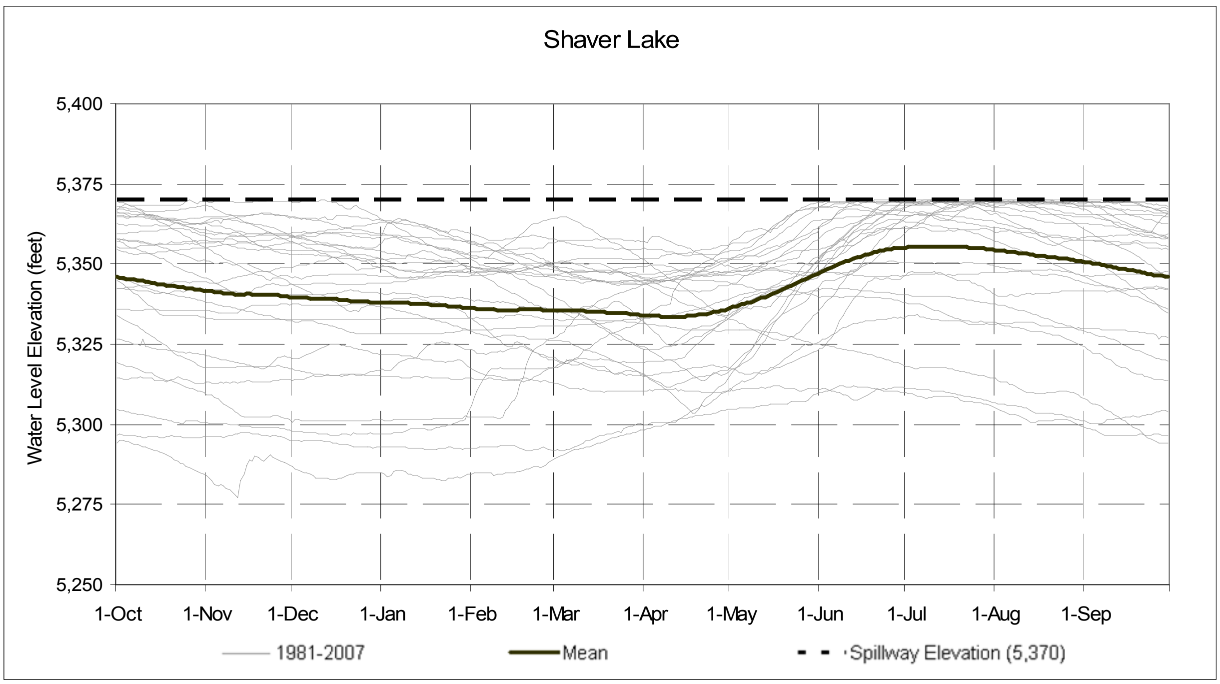

Figure 3-3. Shaver Lake reservoir water levels 1981 to 2007. (SCE, 2007a; USGS, 2008)

Table 3-5. Shaver Lake minimum reservoir elevations under the existing license from June 15 through September 1. (Source: FERC, 1978)

Forecast Runoff (acre-feet)	**Minimum reservoir elevation (feet)**
Above 900,000	5,348.56
700,000 to 900,000	5,330.37
550,000 to 700,000	5,306.97
Less than 550,000	5,268.73

Huntington Lake – Huntington Lake is on Big Creek about 10 miles upstream from its confluence with the San Joaquin River. Huntington Lake receives most of its inflow from the Portal powerhouse and Big Creek. Water is diverted to Powerhouse 1 via Tunnel 1 (capacity 690 cfs), and to Shaver Lake via Balsam Meadows forebay. Minimum flow releases to Big Creek are measured about 1 mile downstream of Huntington Lake dam at USGS gage no. 11237000 Big Creek below Huntington Lake. The existing release requirement is 2 cfs (see tables 3-1 and 3-2) from late April to mid December and 0 the rest of the year for both normal and dry water year types. Table 3-3 shows historical flows at this gage. Figure 3-4 shows water levels within Huntington Lake for water years 1981 to 2007. Due to snowmelt runoff and inflow from Portal powerhouse, Huntington Lake normally reaches its maximum elevation by the end of June (figure 3-4) and is held at near its spillway elevation of 6,950 feet msl until slightly after Labor Day for recreational use. Water levels then normally drop to an annual low by April 1. Under the existing license, SCE is required to make every reasonable effort to maintain the water surface of Huntington Lake as high as possible and with as little fluctuation as possible during May 1 to September 10. Historically, other than the refill of the reservoir in May and June, as figure 3-4 shows, the water levels remain stable from July through early September.

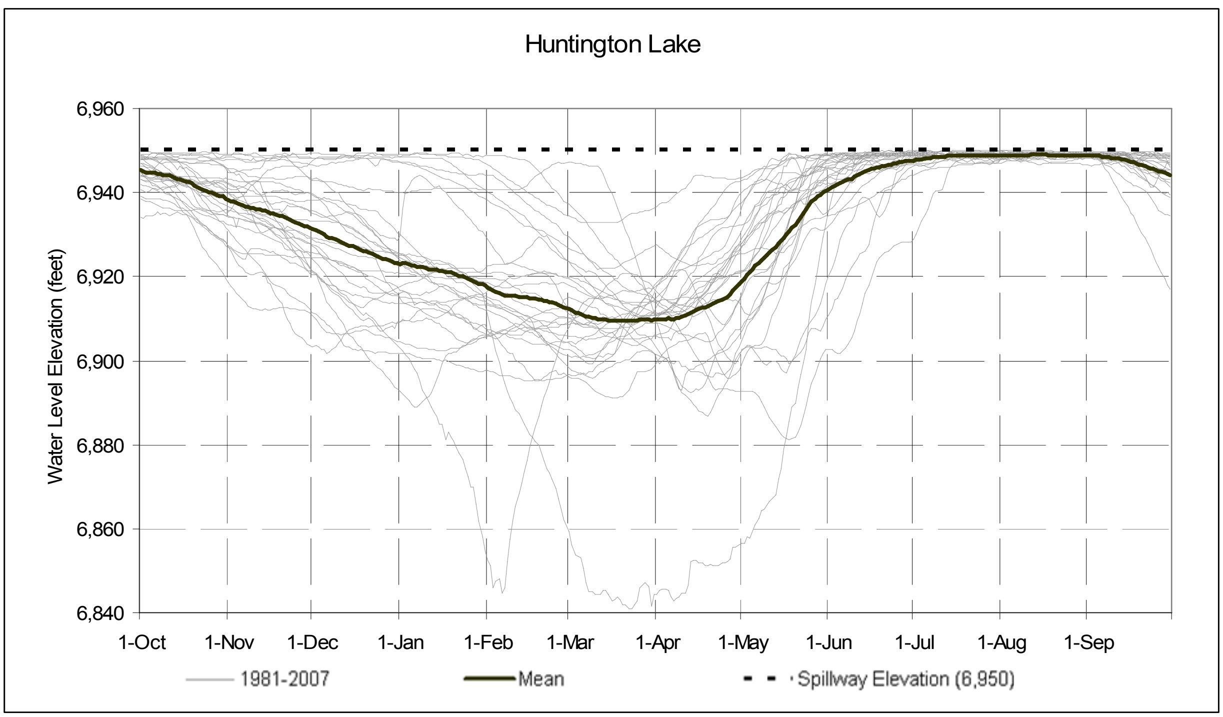

Figure 3-4. Huntington Lake reservoir water levels 1981 to 2007. (Source: SCE, 2007a; USGS, 2008)

Balsam Meadows Forebay – Balsam Meadows forebay is a small reservoir with a usable storage capacity of 1,570 acre-feet on Balsam Creek, 2.75 miles upstream from its confluence with Big Creek. This reservoir receives diverted flows from Huntington Lake and Pitman Creek with the water then diverted via a tunnel (capacity 1,500 cfs) to the Eastwood powerhouse. However, to add to generation capacity during peak demand periods, water is pumped via the Eastwood powerhouse to Balsam Meadows forebay during low electric demand periods and then released back to Eastwood powerhouse during higher electric demand periods. Minimum flow releases downstream of Balsam Meadows forebay are measured about 80 feet below at the dam at USGS gage no. 11238270 on Upper Balsam Creek below Balsam Meadows forebay and are 0.5 to 1.0 cfs during normal and dry water year types (see tables 3-1 and 3-2). Table 3-3 shows historical flows at this gage.

Mammoth Pool Reservoir – Mammoth Pool reservoir is located on the San Joaquin River about 10 miles downstream of the confluence of the South and Middle Forks of the San Joaquin River. A large portion of the watershed at Mammoth Pool reservoir is from the undeveloped Middle Fork of the San Joaquin River. Jackass and Chiquito creeks flow directly into the Mammoth Pool reservoir area. During normal operations, the majority of the flow from the reservoir is diverted via the Mammoth tunnel (capacity 2,100 cfs) to the Mammoth Pool powerhouse. Additional flows are released via the fishwater turbine at the base of the dam and by a Howell-Bunger valve with a capacity of 1,800 cfs. The minimum flow releases are measured about 1 mile below Mammoth Pool dam at USGS gage no. 11234760 San Joaquin River upstream of Shakeflat Creek. The existing MIF (see tables 3-1 and 3-2) ranges between 10 and 30 cfs for this location depending on the water year type and month. Table 3-3 shows historical flows at this gage.

Mammoth Pool reservoir typically fills during April and May (figure 3-5) and reaches its maximum water level by early June. Afterwards the water level normally decreases to its lowest level by November 1 where it generally remains until early April. However, with the lower elevation than the other main storage reservoirs, fluctuations during the winter months are much more common in Mammoth Pool reservoir due to inflow from rain events or melting snow at lower elevations. Due to the large drainage area and lack of storage facilities on a substantial portion of its watershed, Mammoth Pool reservoir spills more often than the other project reservoirs. In most cases, spill at Mammoth Pool dam also results in spill downstream of Dam 6 and Redinger reservoir. SCE attempts to have the minimum storage at Mammoth Pool reservoir occur just prior to the beginning of spring runoff to maximize storage space availability. After the threat of spill has passed, storage at Mammoth Pool reservoir and other reservoirs within the Big Creek System declines at a rate necessary to ensure compliance with the September 30th storage requirement in the Mammoth Pool Operating Agreement (table 3-6). SCE states that it also considers flood control issues when determining the optimal storage level at Mammoth Pool reservoir during the winter months. The existing license requires SCE to make every effort to maintain the water surface elevation at the maximum level and with a minimum amount of fluctuation from June 1 to September 1. According to historical records, the average decrease in water levels during the last half of the summer is between 1 and 1.5 feet per day.

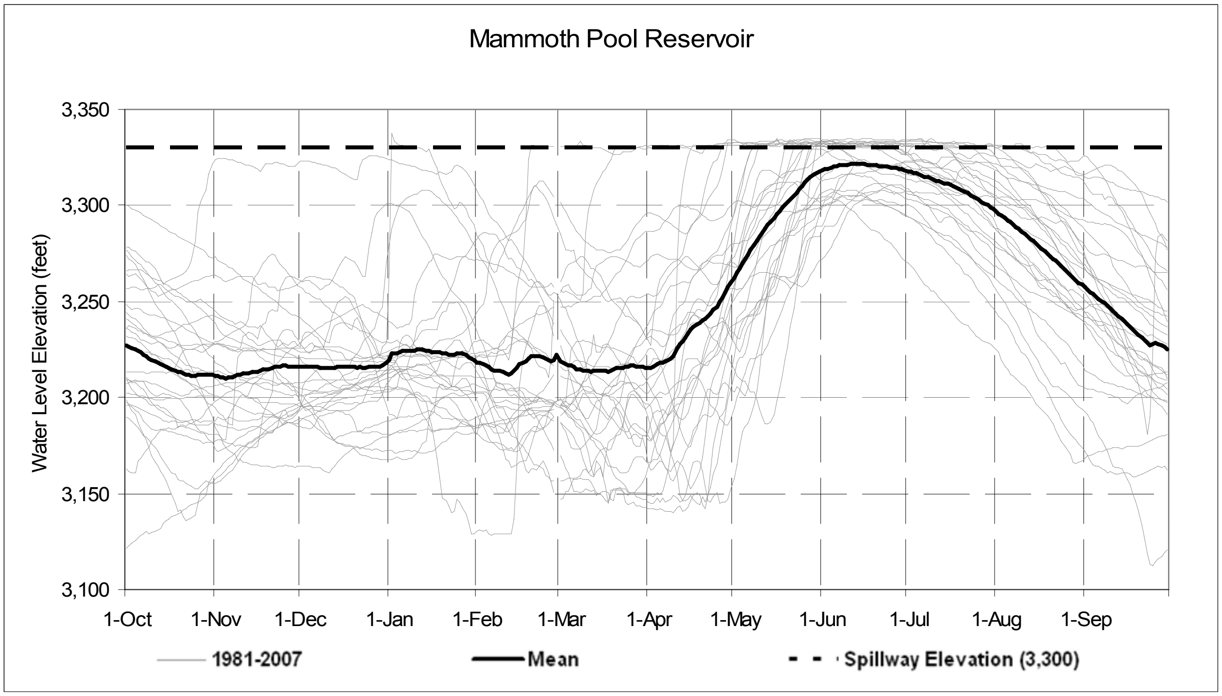

Figure 3-5. Mammoth Pool reservoir water levels 1981 to 2007. (Source: SCE, 2005; USGS, 2008)

Table 3-6. Mammoth Pool Operating Agreement summary September 30 storage constraints and minimum flow constraints. (Source: SCE, 2005)

Computed Natural Runoff at Friant dam (acre-feet)	Oct 1 Beginning Storage (acre-feet)	September 30 Maximum Allowable Year-ending Storage (acre-feet)[a]	Minimum Allowable Flow Past Dam 7 (acre-feet)[a]
A-J = April to June FWY = Full Water Year			
A-J < 650,000	(1st year)	< 152,500	-
A-J < 650,000	(2nd sequential year)	Not to exceed beginning storage	-
A-J > 650,000 FWY < 1,200,000	>202,500 & <325,000	Equal as nearly as possible to beginning storage	-
A-J > 650,000 FWY <	>325,000	Not more than	-

Computed Natural Runoff at Friant dam (acre-feet)	Oct 1 Beginning Storage (acre-feet)	September 30 Maximum Allowable Year-ending Storage (acre-feet)[a]	Minimum Allowable Flow Past Dam 7 (acre-feet)[a]
1,200,000		beginning storage and not less than 325,000	
A-J > 650,000 FWY < 1,200,000	<202,500	Not more than beginning storage (plus amount computed A-J runoff at Friant exceeds 750,000) but not to exceed 202,500	-
FWY > 1,200,000 FWY < 1,600,000	>202,500	Not less than beginning storage plus amount of FWY computed run-off at Friant less 1,200,000	> 615,000 Jun 1 - Sep 30 > 450,000 Jul 1 - Sep 30 (shall be reduced if necessary to meet storage criteria)
FWY > 1,200,000 FWY < 1,600,000	< 202,500	Not less than 202,500 but may exceed beginning storage by up to 50,000 but total cannot exceed 325,000	> 615,000 Jun 1 - Sep 30 > 450,000 Jul 1 - Sep 30 (shall be reduced if necessary to meet storage criteria)
FWY > 1,600,000		>350,000	> 465,000 Jul 1 - Sep 30 (shall be reduced if necessary to meet storage criteria)

[a] The storage volumes listed in columns two and three are for Mammoth Pool and the other reservoirs within the Big Creek System upstream of Friant dam.

Bypassed Reaches

In this section we describe flow in reaches affected by project operations, in the following order: (1) the South Fork San Joaquin River and its tributaries; (2) the San Joaquin River and its tributaries with the exception of Big Creek; and (3) Big Creek and its tributaries.

South Fork San Joaquin River – The South Fork San Joaquin River bypassed reach extends about 28 miles from Florence Lake dam to its confluence with the middle fork of the San Joaquin River, with elevations ranging from 7,218 to 3,721 feet msl (see figure 3-1). The north side of the upper part of this reach receives inflow from four small tributaries: Tombstone, North Slide, South Slide, and Hooper creeks. There are small diversions that lead to Florence Lake on each of these creeks, but none are currently in operation except the Hooper Creek diversion which has a capacity of 85 cfs. The diversions are at elevations greater than 7,500 feet msl, and the creeks are generally very steep with a combination of boulder and bedrock channels. The MIFs for Hooper Creek downstream of the diversion dam (see tables 3-1 and 3-2) are measured about 300 feet below the diversion dam at USGS gage no. 11230200, and table 3-7 provides a summary of the historical monthly flow regime. Hooper Creek enters the South Fork San Joaquin River upstream of USGS gage no. 11230215 located about 3.5 miles downstream of Florence Lake. The MIFs for North Slide and South Slide creeks are shown in tables 3-1 and 3-2. Stream gages on North Slide and South Slide creeks have been inactive for more than 25 years.

The south side of the Upper South Fork San Joaquin River bypassed reach receives inflow from these small high elevation tributaries: Crater, Camp 61, Camp 62, Chinquapin, and Bolsillo creeks (see figure 3-1). The Crater Creek diversion channel (capacity 80 cfs) carries flows to Florence Lake, and Chinquapin, Camp 62, and Bolsillo creeks are diverted (each diversion has a capacity of 30 cfs) directly into the Ward Tunnel. The Camp 61 Creek diversion dam (part of SCE's Portal Project) also diverts up to approximately 84 cfs to the Ward Tunnel which goes to Portal powerhouse. There are no MIF requirements in Crater or Camp 61 creeks in the current license, but seepage from the diversion provides flow to the creek when the diversion is in operation. The MIFs for Chinquapin, Camp 62, and Bolsillo creeks downstream of their diversion dams are shown in tables 3-1 and 3-2. A summary of the historical monthly flow regimes downstream of these three diversions is provided in table 3-7. Chinquapin Creek enters Camp 62 Creek about 1 mile upstream from its confluence with the South Fork San Joaquin River, which is 7.7 miles downstream of Florence Lake. Bolsillo Creek enters the South Fork San Joaquin River about 8.3 miles downstream of Florence Lake.

Table 3-7. Monthly discharge (cfs) statistics for gaging stations downstream of diversion structures. (Source: USGS, 2008; SCE, 2007a, 01CAWG-06)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Bear Creek below diversion (11230530) Period of Record: 10/1/1983 to 9/30/2002. Drainage area 52.8 square miles.												
Mean	2.8	2.4	2.6	5	3.2	5.3	9.3	31.4	119.8	91.4	11	3.7
Median	2.1	2.1	2.1	2.2	2.2	2.3	2.4	3.2	3.2	3	3	3
Max.	88	19	36	603	24	122	228	923	1,250	1,420	490	37
Min.	0.9	1	1	1.1	1.1	1.2	1.2	2.2	2.2	2.1	2.1	2.1
10% Exceed.	5	3.1	3.3	4	4.4	4.8	4.8	86	537	493	4.5	4.5
90% Exceed.	1.4	1.3	1.3	1.4	1.4	1.5	1.5	2.4	2.4	2.3	2.3	2.3
Mono Creek below diversion (11231600) Period of Record: 10/1/1983 to 9/30/2002. Drainage area 92.8 square miles.												
Mean	10.3	9.4	9.1	8.5	8.7	8.3	9.2	12.9	36.9	65.8	20.6	12.9
Median	9.5	7.7	7.7	7.7	7.7	7.4	8.1	13.0	13.0	14.0	13.0	13.0
Max.	68.0	56.0	45.0	26.0	26.0	25.0	115	62.0	604	1,300	1,070	46.0
Min.	6.0	5.2	4.1	4.4	5.4	2.6	5.4	7.9	9.1	8.8	8.9	8.1
10% Exceed.	14.0	13.0	13.0	13.0	12.0	12.0	14.0	15.0	24.0	113.0	16.0	16.0
90% Exceed.	6.7	5.7	5.6	5.7	5.8	5.7	5.8	9.5	9.9	9.9	9.8	9.6

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Pitman Creek near Tamarack Mountain below diversion (11237700) Period of Record: 10/1/1986 to 9/30/2002. Drainage area 23.0 square miles.												
Mean	0.7	1.3	1.5	1.6	2.9	5.1	17.6	33.7	44.1	14.1	1.0	0.7
Median	0.6	0.9	0.9	1.1	1.2	1.6	1.7	1.7	1.3	1.1	0.5	0.4
Max.	4.5	56.0	205	40.0	418	100	297	762	746	384	18.0	5.1
Min.	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.1
10% Exceed.	1.5	2.0	1.8	2.5	3.4	13.0	75.0	143	137	17.0	1.7	1.5
90% Exceed.	0.2	0.3	0.3	0.3	0.1	0.1	0.2	0.8	0.6	0.6	0.2	0.1
Big Creek near Mouth near Big Creek (11238500) Period of Record: 10/1/1982 to 9/30/2002. Drainage area 131 square miles.												
Mean	9.0	41.3	57.9	54.9	25.6	41.2	11.7	34.0	58.7	26.0	5.4	5.2
Median	3.5	3.3	2.6	3.6	3.0	4.2	4.3	4.8	3.9	3.9	3.9	3.6
Max.	516	800	871	3540	972	1,430	578	1,030	999	886	222	298
Min.	2.3	1.3	1.0	1.2	1.4	1.3	2.0	2.1	2.1	2.1	2.1	2.2
10% Exceed.	5.7	13.0	6.6	8.5	12.0	35.0	15.0	78.0	106.0	26.0	6.3	6.1
90% Exceed.	2.5	1.9	1.5	1.6	1.7	1.7	2.3	2.5	2.5	2.4	2.4	2.4

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Camp 62 Creek below diversion (11230600) Period of Record: 10/1/1983 to 7/15/2002. Drainage area 1.97 square miles.												
Mean	0.6	0.6	1	0.9	0.8	0.8	0.9	1.8	0.9	0.4	0.4	0.3
Median	0.4	0.3	1	0.8	0.8	0.8	0.5	0.5	0.5	0.4	0.4	0.3
Max.	2.7	2	1	1	0.8	1	8.1	27	18	1	0.6	0.5
Min.	0.1	0.2	1	0.8	0.8	0.5	0	0	0	0	0	0
10% Exceed.	1.5	1.5	1	1	0.8	1	2	3.7	0.9	0.6	0.6	0.5
90% Exceed.	0.3	0.2	1	0.8	0.8	0.5	0.2	0.3	0.4	0.2	0.1	0
Chinquapin Creek below diversion (11230560) Period of Record: 5/12/1986 to 6/26/2002. Drainage area 1.65 square miles.												
Mean	0	0	0	0	0	0.7	1.2	3.3	3.7	1.9	0.9	0.4
Median	0	0	0	0	0	0	0.7	1.3	1.3	1.2	1.1	0.4
Max.	0	0	0	0	0	0.8	13	40	34	8	1.5	1
Min.	0	0	0	0	0	0	0.2	0.9	0.7	0.3	0.5	0
10% Exceed.	0	0	0	0	0	0	1.4	4.3	12	3	1.2	0.6
90% Exceed.	0	0	0	0	0	0	0.6	1.1	1.2	1	0.5	0.1
Bolsillo Creek below diversion (11230670) Period of Record: 10/1/1985 to 9/30/2002. Drainage area 1.4 square miles.												
Mean	0.2	0.2	0.2	2.2	0.9	1.2	1.1	2.4	2.7	2.1	0.5	0.3
Median	0.2	0.2	0.2	0.9	0.7	1.1	0.3	0.6	0.6	0.5	0.5	0.3

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Max.	0.3	0.5	0.4	27.0	4.9	4.8	8.4	16.0	15.0	14.0	0.6	0.6
Min.	0.1	0.2	0.2	0.1	0.1	0.3	0.2	0.4	0.3	0.4	0.3	0.1
10% Exceed.	0.2	0.2	0.3	4.3	1.3	2.2	2.8	9.6	10.0	8.7	0.6	0.6
90% Exceed.	0.1	0.2	0.2	0.1	0.1	0.4	0.5	0.5	0.5	0.4	0.3	0.1
Hooper Creek below diversion (11230200) Period of record: 10/1/1986 to 9/30/2002. Drainage area 7.22 square miles.												
Mean	2.7	2.6	2.4	2.8	2.6	3.7	6.6	10.7	13	12.3	4.7	2.8
Median	2.5	2.5	2.1	2.2	2.3	3	4.6	3.6	4	4	3.2	2.4
Max.	6.2	5	8.4	43	7.7	15	52	86	110	112	57	11
Min.	1.3	1.4	1.4	1.4	1.4	1.5	1.2	2.1	1.6	2.2	1.9	1.7
10% Exceed.	4.5	3.7	3.3	3.3	4.2	6.5	12	27	42	46	5.3	4
90% Exceed.	1.7	1.8	1.7	1.6	1.6	2.1	2.7	2.5	2.5	2.6	2.4	1.9
North Fork Stevenson Creek near Perimeter Road (11239300) Period of Record: 1/25/1989 to 9/30/2002. Drainage area 4.42 square miles.												
Mean	5.7	7.4	6.8	11.7	10.8	15.1	26.7	28.7	24.9	9.0	6.1	5.8
Median	4.8	4.7	5.2	5.9	7.2	9.6	16.0	16.0	7.3	5.9	5.4	5.3
Max.	167	87.0	45.0	836	107	151	209	1,750	1,300	603	79.0	57.0
Min.	1.9	2.1	3.5	3.5	1.6	2.6	6.0	4.3	4.0	3.7	3.8	3.8
10%	7.2	8.9	10.0	15.0	14.0	28.0	45.0	51.0	54.0	12.0	7.7	7.3

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Exceed.												
90% Exceed.	3.8	3.8	4.2	4.5	4.8	6.1	9.3	6.0	4.9	4.2	4.1	4.1
San Joaquin River above Stevenson Creek (11238600) Period of Record: 10/1/1982 to 9/30/2002. Drainage area 1,197 square miles.												
Mean	5.9	5.9	39.4	509.5	379.4	398.8	299.7	1,503.2	2,593.7	884.0	136.2	4.5
Median	3.5	3.5	3.5	3.5	3.5	4.1	4.3	211.0	531.0	3.5	3.5	3.5
Max.	60.0	598	4,400	32,000	5,570	12,000	3,620	20,500	16,000	13,300	4,320	109
Min.	3.0	3.1	3.0	3.1	3.0	3.1	3.1	3.2	3.3	3.2	3.3	3.1
10% Exceed.	4.6	4.3	7.3	402	1,510	1,470	870	4,330	9,310	3,350	89.0	4.1
90% Exceed.	3.3	3.2	3.2	3.3	3.3	3.3	3.4	3.4	3.4	3.3	3.3	3.3

Notes: The period of record indicated in this table was the time period used to develop the table, not the complete period of record at a specific gage.

Because daily data were used to develop this table, the minimum and maximum values shown are the minimum and maximum daily values within each month for the stated period of record, not the minimum and maximum monthly values.

During some winter months, data for gaging stations on Camp 62 Creek (11230600), Bolsillo Creek (11230670), and Chinquapin Creek below the diversion dam (11230560) were based on data synthesized for the SCE license application, since the diversions and gages were not always in operation.

Bear Creek is part of a large watershed located on the northeast side of the South Fork San Joaquin River between Florence Lake and Lake Edison (part of the Vermilion Valley Project). Bear Creek diversion (capacity 450 cfs) is located 1.6 miles upstream of the confluence with the South Fork San Joaquin River. The Mono diversion (capacity 450 cfs) is located 5.9 miles upstream of the confluence of Mono Creek with the South Fork San Joaquin River (see figure 3-1). The MIFs for Bear and Mono creeks downstream of their diversion dams are shown in tables 3-1 and 3-2. A summary of the historical monthly flow regimes downstream of these diversions as recorded at USGS gage no. 11230530 Bear Creek below diversion and USGS gage no. 11231600 Mono Creek below diversion are is provided in table 3-7. Both of these stream gages are located 60 feet or less downstream of the diversion dams. Water diverted from the Bear and Mono Creek diversions is routed through the Bear-Mono conduit to the Ward Tunnel to the Portal powerhouse and then Huntington Lake.

San Joaquin River – The San Joaquin River Mammoth reach extends 8.4 miles from Mammoth Pool dam downstream to Mammoth Pool powerhouse at the head of the Dam 6 impoundment (see figure 3-1). The MIF for this reach is measured at USGS gage no. 11234760 which is about 0.5 mile downstream of Mammoth Pool dam (see tables 3-1 and 3-2). Table 3-3 shows a summary of the historical monthly flow regimes downstream this diversion.

Rock Creek enters the San Joaquin River thereabout 3 miles downstream from Mammoth Pool dam. The Rock Creek bypassed reach extends about 0.4 mile from the Rock Creek diversion to the creek's confluence with the San Joaquin River. Ross Creek enters the San Joaquin River about 7 miles downstream of Mammoth Pool dam. The bypassed reach extends about 0.85 mile from the Ross Creek diversion to its confluence with the San Joaquin River. Neither the Rock nor Ross Creek bypassed reaches are currently gaged or have MIFs.

Dam 6 impounds the Powerhouse 3 forebay, which inundates the confluence of Big Creek with the San Joaquin River (see figure 3-1). In addition to flows from the San Joaquin River and Big Creek, the forebay receives outflows from Powerhouse 8 and the Mammoth Pool powerhouse. Flow is then diverted through Tunnel 3 (capacity 2,431 cfs) to Powerhouse 3 at the upper end of Redinger reservoir. Flow from Redinger reservoir is diverted to Powerhouse 4 (part of Big Creek No. 4 Project).

The Stevenson reach of the San Joaquin River extends 5.7 miles from Dam 6 downstream to Powerhouse 3 at the upper end of Redinger reservoir (see figure 3-1). Stevenson Creek enters the bypassed reach 3.45 miles downstream of Dam 6 and below USGS gage no. 11238600 which measures the MIF downstream of Dam 6 (tables 3-1 and 3-2). Table 3-7 summarizes the historical monthly flow regime for this gage.

The natural flow in the North Fork Stevenson Creek bypassed reach is augmented by instream flow releases from Tunnel 7 at river mile 3.55. Prior to construction of the Eastwood powerhouse, this reach was used to transport water to Shaver Lake. The MIFs for this reach are shown in tables 3-1 and 3-2. The MIF for North Fork Stevenson Creek is measured at USGS gage no. 11239300. Table 3-7 shows a summary of the historical monthly flow regime for this gage.

The Stevenson Creek bypassed reach extends 4.3 miles downstream from Shaver dam to the confluence with the San Joaquin River (see figure 3-1). Flow at Shaver Lake is diverted to Powerhouse 2A. The MIF for the Stevenson Creek bypassed reach is measured at USGS gage no. 11241500 (see tables 3-1 and 3-2). Table 3-3 summarizes the historical monthly flow regime for this gage.

Big Creek – The Upper Big Creek bypassed reach extends 3.6 miles from Huntington Lake to Dam 4. The MIF for the reach downstream of Huntington Lake is measured at USGS gage no. 11237000 (see tables 3-1 and 3-2). Table 3-3 shows a summary of the historical monthly flow regime for this gage. Dam 4 forms a small 3.2-acre impoundment at the downstream end of the bypassed reach, and the impoundment also receives inflow from Upper Big Creek, Powerhouse 1, and Pitman Creek. Water in the impoundment is diverted through Tunnel 2 (capacity 600 cfs) to Powerhouse 2, upstream of Dam 5 on Big Creek. Additional flow is diverted into Tunnel 2 from Balsam and Ely creeks.

The Middle Big Creek bypassed reach extends 4.3 miles from Dam 4 downstream to Powerhouses 2 and 2A, both of which discharge into the 3.3-acre (surface area) Dam 5 forebay on Big Creek. There is no MIF requirement from Dam 4 in the current license, and it is not currently gaged. Dam 5 serves as the forebay for the tunnel diversion (capacity 600 cfs) to Powerhouse 8.

The Lower Big Creek bypassed reach extends from Dam 5, 1.65 miles to the Big Creek confluence with the San Joaquin River (see figure 3-1) at an impoundment created by Dam 6. Powerhouse 8 also discharges into the Dam 6 impoundment. The current MIF requirements downstream of Dam 5 are shown in tables 3-1 and 3-2. USGS gage no. 1238500 Big Creek near mouth (historical data shown in table 3-7) is located 0.6 mile upstream of the confluence and about 1 mile downstream of Dam 5.

The diversion (capacity 800 cfs) on Pitman Creek is located about 1.5 miles upstream of the stream's confluence with Big Creek (see figure 3-1). Flow is diverted through Tunnel 7 (capacity 1,480 cfs), which conveys water from Huntington Lake to Balsam forebay and North Fork Stevenson Creek. The MIFs for this reach are measured at USGS gage no. 11237700 (see tables 3-1 and 3-2). Table 3-7 shows a summary of the historical monthly flow regime for this gage.

The very small natural flow in Upper Balsam Creek is augmented by releases from the Balsam Meadows forebay, which is located 2.75 miles upstream of the confluence with Big Creek. Balsam Creek enters Big Creek 1 mile downstream of Dam 4. The bypassed reach, or Lower Balsam Creek, extends 0.74 mile from the Balsam Creek diversion downstream to the confluence with Big Creek. Water diverted from Balsam Creek is conveyed through Tunnel 2 to Powerhouse 2 on Big Creek at the impoundment behind Dam 5. There are no MIFs or gages on Lower Balsam Creek.

Ely Creek flows into Big Creek about 2.6 miles downstream of Dam 4. The Ely Creek diversion (capacity 9 cfs) is located less than 1 mile upstream of the confluence with Big Creek. Diverted water is conveyed to Tunnel 2, which it enters through Adit 6. Flows are intermittent upstream of the diversion. There is no MIF release requirement below the diversion in the current license, and no gages downstream of this diversion.

SCE has a diversion on Adit 8 Creek that can be used to transfer water from Tunnel 5 to Tunnel 2 in the event of an outage at Powerhouse 2A, but this diversion has not been used since about 1980.

Water Use

Water rights in the state of California are administered by the Water Board. Each of the four Big Creek ALP Projects either has a separate water right or shares one or more water rights with the other hydroelectric projects for the diversion, use, and storage of water. The vast majority of the water rights are for nonconsumptive uses associated with power generation. To protect the rights of downstream water rights holders, SCE entered into agreements that restrict the use of water within the area of the four Big Creek ALP Projects to non-consumptive purposes, i.e., hydroelectric generation. Certain agreements limit the length of time and amount of water that SCE can store in its project reservoirs. A few locations, such as SCE's administrative offices and company housing near Powerhouse 1, have minor consumptive water rights. SCE does not hold water rights for the consumptive use of water by any party other than SCE, nor does SCE sell any water rights associated with the Big Creek ALP Projects to others. SCE states that certain water rights were acquired under state law, prior to the formation of the Water Board's predecessor in 1914, which are not documented by licenses or permits. Additional water rights were obtained through appropriation of water prior to the implementation of the Water Commission Act of 1914, and by prescriptive use against other parties. SCE also holds other water rights as a riparian land owner, which authorizes it to divert and use water on its own land.

Water Quality

This section describes the water quality in the vicinity of the Big Creek ALP Projects. Project surface waters are naturally low in mineral and nutrient content, which is characteristic of regions composed of granitic bedrock with shallow infertile granitic soils of the western Sierra Nevada. The waters tend to be clear, with high water quality.

Project reservoirs are oligotrophic (limited primary productivity) due to their size and depth, and the relatively infertile granitic soils of their drainage area. Reservoir stratification is generally weak to moderate with temperatures ranging from 6 to 25ºC, depending on water depth and season.

SCE conducted water quality studies in 2002 to characterize the physical and chemical properties of water upstream, within, and downstream of project reservoirs, forebays, and diversions. The study included a review of existing data, in situ water quality measurements, and field collection and laboratory analysis of water quality samples. The water quality sampling and laboratory analysis portion of the study included three programs: spring (runoff flow) and fall (baseflow) stream sampling, fecal coliform sampling, and reservoir/forebay sampling.

Spring Runoff and Fall Baseflow Stream Sampling Program

Water quality sampling was conducted during spring, summer, and fall of 2002 to assess water quality in project area streams during the snowmelt runoff period and baseflow period. Spring sampling was conducted at 78 stream locations from May 20 to June 14, 2002. Three locations, Tombstone diversion channel (dry), Ross Creek upstream of the San Joaquin River confluence (dry), and the South Fork San Joaquin River upstream of the confluence of the San Joaquin River (inaccessible due to high flows), were not sampled.

Fall sampling was conducted at 78 stream locations from June 12 through September 6, 2002. Three locations, Tombstone diversion channel, Ross Creek upstream of the San Joaquin River confluence, and Ely Creek downstream of the diversion, were dry and could not be sampled. Forty of the 78 sampling stations that were located on 13 small tributary streams with small diversions were sampled during mid-summer in order to obtain data prior to the end of their diversion periods. Water quality sampling stations were established at locations upstream and downstream of the diversion structures. The remaining 38 stream stations were sampled during late summer/early fall.

Water quality conditions at each surface water sampling location were evaluated by collecting in-situ measurements of temperature, pH, dissolved oxygen (DO), turbidity, and specific conductance. Samples were submitted for laboratory analysis of 34 chemical and/or physical constituents. Several parameters/constituents could not be evaluated due to analytical laboratory detection limits that were too high to allow comparison to the regulatory standard. Laboratory analysis indicated that some samples did not meet California Central Valley Region Water Quality Control Board Basin Plan (Basin Plan) (CVRWQCB, 1998) objectives for some parameters (SCE, 2003h).

The laboratory results indicate that the concentrations of mercury, copper, lead, silver, and zinc in all of the water samples are below the Basin Plan objectives [(copper (1 milligram per liter [mg/L]), lead (15 micrograms per liter [µg/L]), mercury (2 µg/L), silver (100 µg/L), and zinc (5 mg/L)]. However, the California Toxics Rule (CTR) and National Toxics Rule (NTR) have established more stringent criteria for these metals to protect freshwater aquatic life. The CTR and NTR set acute and chronic criteria that are hardness-dependent[14] and must be calculated on a station-by-station basis. Due to the naturally low hardness of water in the project area (hardness as $CaCo_3$ concentrations were 2.2 to 25 mg/L), the calculated standards for the five metals were extremely low and were below the laboratory detection limits for reporting (SCE, 2003h).

[14] The water quality criterion decreases with decreasing water hardness.

To allow comparison to the regulatory standard, SCE requested that the laboratory review the raw data files and report concentrations down to the minimum detection limits, which would be low enough to enable a comparison to the CTR and NTR standards. The laboratory reports these results as J-qualified trace values, which are considered estimated values. These estimated values exceeded the hardness-based CTR and NTR criteria for these metals in some instances both upstream and downstream of project facilities. Estimated lead concentrations exceeded hardness-based criteria in five samples, silver exceeded hardness-based criteria in two samples, and zinc exceeded hardness-based criteria in one sample. SCE reported that the source of lead and silver contamination is not known, but these low concentrations do not adversely influence water quality and neither of these contaminants are project-related.

Estimated concentrations (J-qualified trace values) of mercury exceeded hardness-based criteria at a majority of the study sites in the project area, including locations both upstream and downstream of project facilities. SCE reported that the widespread, low level mercury concentrations found in much of the Upper San Joaquin River Watershed are not project-related and do not adversely influence aquatic resources.

All parameters in project area streams during the spring and fall sampling program met Basin Plan, CTR, and NTR objectives with the exception of pH, DO, ammonia, nitrate/nitrite, arsenic, total iron, and total manganese. Location and timing of exceptions varied with each parameter. Only the water quality results that did not meet water quality criteria are reported below.[15]

Values of pH lower than 6.5 (the Basin Plan objective) were recorded at locations both upstream and downstream of active diversions, indicating that the low pH conditions are generally not project-related. The low pH in streams that flow from the base of reservoirs and forebays appears to reflect the lower pH values observed in the lower water column of these waterbodies.

Three locations had pH values slightly greater than 8.5 (the Basin Plan objective) in the spring, but the high pH values were observed both upstream and downstream of project facilities indicating that they are generally not project-related. Alkalinity, dissolved carbon dioxide reactions, oxidation of dissolved ferrous iron, dissolved organic matter, and acidic snowmelt can influence natural pH values. Alkalinity is usually the primary factor that controls pH values, and surface waters within igneous rock basins typically contain low alkalinity values (low buffering capacity), resulting in more acidic pH values (usually <7.0). The alkalinity of project area surface waters are generally very low and can be quickly modified by acidic water, such as rapidly melting snow that has accumulated acidity from atmospheric sources or organic acids that are produced in coniferous forests (Wetzel, 2001, in SCE, 2003h). The pH values were particularly low

[15] Detailed water quality results are available in SCE, 2003h.

during the spring snowmelt period, suggesting that slight acidity of the runoff may be influencing pH values.

According to the Basin Plan objectives, DO concentrations shall not be reduced below a minimum level of 7.0 mg/L for waters designated as Cold at any time. DO concentrations below the Basin Plan objective were observed at one Ely Creek station in the spring (6.57 mg/L) and at 10 stations in the fall (5.29 to 6.97 mg/L) (SCE, 2003h). DO concentrations below the Basin Plan objective were observed in Ely, Bear, and South Slide creeks upstream of the diversions, and in Ross Creek downstream of the diversion (SCE, 2003h). Ross Creek is an ephemeral stream[16] and has low DO levels upstream of the diversion during the summer months. This is a naturally occurring condition in Ross Creek and is not a project-related effect. DO concentrations below Basin Plan objectives occurred in the South Fork San Joaquin River and Pitman, Stevenson, Mono, and Bear creeks in 2002 (SCE, 2003h).

The Basin Plan does not specify an objective for ammonia (NH_3), but the NTR has set criteria, which must be calculated using ambient pH and temperature specific to each site. During the spring and summer/fall sampling periods, ammonia concentrations were all non-detectable at a detection limit of reporting of 1.0 mg/L (SCE, 2003h, tables CAWG-4-6 and CAWG-4-7). One hundred forty-six of the 153 stream samples had an ammonia criterion greater than 1 mg/L. The remaining seven samples (five spring and two fall samples) had calculated criteria less than 1.0 mg/L. Five of these samples were from natural waters located upstream of any project facilities. It could not be determined if these seven samples met the criteria because the laboratory method detection limit is greater than the calculated criterion.

The Basin Plan nitrate/nitrite (NO_3/NO_2) objective (10 mg/L) is based on a secondary maximum contaminant level derived for the protection of drinking water sources (CCR, 1996, in SCE, 2003h). EPA has recommended a value of 1.0 mg/L for the protection of freshwater aquatic life. The EPA value was not exceeded during the spring and summer/fall sampling periods. All spring concentrations were below the Basin Plan objective (SCE, 2003h, table CAWG-4-6). Two results exceeded the Basin Plan objective during the August sampling period. There is no known project-related source that could contribute nitrates in these stream reaches, and the observed exceedances were not considered project-related.

The Basin Plan specifies an objective for arsenic (10 ug/L) based on a primary maximum contaminant level for drinking water. In the spring 2002, three samples exceeded the arsenic objective. The arsenic objective was exceeded in five samples during the late summer-fall sampling period. Arsenic is a naturally occurring, widely

[16] Ephemeral streams flow only for short-durations in response to seasonal or storm runoff.

distributed metallic element; although the sources of arsenic at these locations are unknown it is unlikely they are project-related.

The Basin Plan specifies an objective for iron of 0.3 mg/L, based on secondary maximum contaminant levels for drinking water. This objective is of aesthetic (taste and staining) rather than toxicological significance and does not pertain to levels that will protect freshwater aquatic organisms. EPA has recommended a value of 1.0 mg/L for the protection of freshwater aquatic life. During the 2002 spring and fall sampling periods, the 0.3 mg/L objective was exceeded at 11 locations (SCE, 2003h). None of the 11 samples exceeded the EPA-recommended iron value for the protection of freshwater aquatic life (1.0 mg/L). Iron occurs in project area rocks and is commonly found in surface water so that at least some of the iron content is attributable to background sources and is not project-related.

The Basin Plan specifies a manganese objective of 0.05 mg/L, based on secondary maximum contaminant levels for drinking water. This objective is of aesthetic (taste and odor) significance rather than toxicological. No aquatic life objective has been developed for manganese. In the spring of 2002, one sample from Ely Creek upstream of the diversion exceeded the drinking water objective, and another single sample from Stevenson Creek downstream of Shaver Lake dam exceeded the objective during the late summer-fall. Manganese occurs in project area rocks and is commonly found in surface water so that at least some of the manganese content is attributable to background sources and is not project-related.

The Basin Plan objective for turbidity is based on increases above the natural turbidity that are attributable to controllable water quality factors.[17] To determine compliance with this objective, comparisons of turbidity measurements downstream of project features were compared to those obtained upstream of project features. Turbidity was above the Basin Plan objective in Hooper Creek downstream of the diversion, in Camp 62 Creek downstream of the diversion, and in Balsam Creek downstream of the forebay. Turbidity exceedances in Camp 62 Creek and Balsam Creek occurred only once and are not considered project-related.

Fish Tissue Sampling for Silver and Mercury

EPA and the Centers for Disease Control both report that silver does not cause toxic effects in humans; and the Basin Plan does not specify an objective for silver in fish tissue. Filets from ten fish (three brown trout and seven rainbow trout) collected from Mammoth Pool reservoir were evaluated for silver content, and no samples had silver concentrations at detectable levels (>0.02 milligrams per kilogram [mg/kg]). Three

[17] Where natural turbidity is between: 0-5 NTUs (nephelometric turbidity units) increases shall not exceed 1 NTU; 5-50 NTUs increases shall not exceed 20 percent; 50-100 NTUs increases shall not exceed 10 NTUs; and greater than 100 NTUs increases shall not exceed 100 percent.

composite liver samples obtained from two groups of six rainbow trout and one group of three brown trout sampled from Mammoth Pool reservoir had silver concentrations ranging between 0.491 and 2.346 mg/kg. Subsamples sent to a second laboratory for verification had concentrations ranging from 0.047 to 1.99 mg/kg.

The Basin Plan does not specify an objective for methylmercury in fish tissue, but EPA has established a screening level criterion of 0.3 mg/kg. Two out of ten fish sampled and analyzed from Mammoth Pool reservoir contained mercury concentrations in fish filets that exceeded the screening level (one of three brown trout sampled and one of seven rainbow trout sampled). SCE reported that the source of mercury in Mammoth Pool reservoir is not known, but it is likely not project-related. It also reported that the existing mercury levels at Mammoth Pool reservoir do not warrant issuance of a public health advisory (personal communication from B. Brodberg, (California) Office of Environmental Health Hazard Assessment, as cited by SCE, 2007a).

Fecal Coliform Sampling Program

The fecal coliform sampling program consisted of a screening level assessment and a 30-day, five-sample assessment. A threshold of 200/100 milliliters was used as a screening level criterion for all water samples obtained during the stream-sampling program. Any sample that exceeded this value would have been included in the more rigorous 30-day, five-sample program. None of the screening level samples exceeded the 200/100 milliliter threshold and were not incorporated into the more rigorous 30-day, five sample fecal coliform sampling program (SCE, 2003h).

The 30-day, five sample fecal coliform sampling program was conducted at locations that were approved by the Combined Aquatics Working Group during the development of the study plan, including Shaver and Huntington lakes that receive significant amounts of contact recreation. The remaining large reservoirs and moderate-sized impoundments were only sampled monthly. None of the monthly reservoir samples contained concentrations greater than the screening level concentration of 200/100 MPN,[18] and were not added to the more rigorous sampling program (SCE, 2003h).

The 30-day, five-sample fecal coliform sampling was conducted between June 26 and July 24, 2002, in the nearshore areas of Huntington and Shaver lakes and in associated creeks. The Fourth of July period was chosen to characterize fecal coliform concentrations before, during, and after a heavy recreational use period. The results of this study show that both the geometric mean of all values and the highest values obtained from all study locations were well below Basin Plan thresholds (SCE, 2003h).

[18] MPN is a measurement of the most probable number of bacterial colonies per 100 ml of water.

Monthly Reservoir and Forebay Profile Program

The 2002 monthly reservoir and forebay profile program sampling was conducted at 19 stations in Florence, Huntington, and Shaver lakes, Mammoth Pool reservoir, and Mono, Balsam, Bear, Dam 4, Dam 5, and Dam 6 forebays.[19]

Depth profiles were performed in each reservoir of five in-situ measurements - pH, DO, temperature, specific conductance, and turbidity. Water quality samples were collected at each location for laboratory analysis of 34 chemical and/or biological tests. Six additional analyses were performed on samples collected from reservoirs where motorized craft are allowed, to test for the occurrence of methyl tertiary butyl ether, total petroleum hydrocarbons as gasoline and diesel, benzene, toluene, ethylbenzene, and xylene. Field and laboratory results indicate that pH values and DO, methyl tertiary butyl ether, and total petroleum hydrocarbons-diesel were occasionally detected at values that did not meet Basin Plan objectives (SCE, 2003h). Benzene, toluene, ethylbenzene, and total xylene occasionally were also detected, but at concentrations that did not exceed Basin Plan objectives (SCE, 2003h).

Water Temperature

A number of bypassed stream reaches had occurrences when the mean daily water temperature exceeded the evaluation objective for trout, and/or downstream stream water temperatures increased by more than 2.8 degrees Celsius (°C) and exceeded the evaluation objective for trout (table 3-8). The water temperatures in these bypassed reaches are described later in *Bypassed Reaches*.

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[19] The CAWG-4 Chemical Water Quality Study Plan identifies Lake Thomas A. Edison, Redinger reservoir, and Portal forebay as water bodies that have or are currently undergoing the Traditional Licensing Process and are not included in the ALP sampling program.

Table 3-8. Number of days that thermal warming exceeded 2.8°C in bypassed reaches when daily mean temperatures exceeded 18, 19, and 20°C. (Source: SCE, 2007a, as modified by staff)

Downstream Site	2000			Days Temperature Increase is >2.8°C (5°F) and Daily Mean is				2001			Days Temperature Increase is >2.8°C (5°F) and Daily Mean is			
	Days >2.8°C (5°F)	No. Days Monitored	% Days >2.8°C (5°F)	≤15°C and ≤18°C	>18°C and ≤19°C	>19°C and ≤20°C	>20°C	Days >2.8°C (5°F)	No. Days Monitored	% Days >2.8°C (5°F)	≤15°C and ≤18°C	>18°C and ≤19°C	>19°C and ≤20°C	>20°C
Mammoth Pool Project (FERC Project No. 2085)														
SJR Mammoth Pool Reach Downstream of Mammoth Pool Dam	37	46	80%	21	16	0	0	34	133	26%	10	5	7	12
SJR Mammoth Pool Reach Upstream of Rock Creek	33	46	72%	33	0	0	0	21	132	16%	4	6	9	2
SJR Mammoth Pool Reach Upstream of Ross Creek	28	46	61%	25	1	2	0	34	133	26%	1	2	8	23
SJR Mammoth Pool Reach Upstream of Mammoth Pool Powerhouse	22	41	54%	22	0	0	0	33	133	25%	1	3	8	21
Rock Creek Upstream of SJR Confluence	0	138	0%	0	0	0	0	17	103	17%	0	1	0	16
Ross Creek Upstream of SJR Confluence	0	11	0%	0	0	0	0	47	73	64%	8	9	9	21
Big Creek Nos.1 and 2 (FERC Project No. 2175)														
Big Creek Downstream of Dam 1	37	108	34%	37	0	0	0	32	149	21%	32	0	0	0
Big Creek Canyon Site	3	102	3%	3	0	0	0	7	149	5%	7	0	0	0
Big Creek Upstream of Powerhouse 1	1	108	1%	1	0	0	0	21	177	12%	21	0	0	0
Big Creek Downstream of Dam 4	24	101	24%	24	0	0	0	66	177	37%	66	0	0	0
Big Creek Downstream of Dam 4	41	128	32%	41	0	0	0	135	183	74%	134	1	0	0
Big Creek Upstream of Balsam Creek	33	129	26%	29	4	0	0	166	183	91%	87	17	23	39
Big Creek Upstream of Powerhouse 2	80	154	52%	70	8	2	0	171	183	93%	130	24	15	2
Ely Creek Upstream of Big Creek Confluence [a]	1	121	1%	1	0	0	0	0	94	0%	0	0	0	0
Balsam Creek Upstream of Big Creek Confluence [a]	0	127	0%	0	0	0	0	10	183	5%	10	0	0	0
Big Creek Nos. 2A, 8, and Eastwood (FERC Project No. 67)														
SFSJR Downstream of Florence Lake Dam	4	77	5%	4	0	0	0	7	50	14%	7	0	0	0
SFSJR Downstream of Jackass Meadow	42	113	37%	42	0	0	0	4	57	7%	4	0	0	0
SFSJR Upstream of Hooper Creek	30	107	28%	30	0	0	0	1	57	2%	1	0	0	0
SFSJR Upstream of Crater Creek	34	109	31%	34	0	0	0	25	76	33%	25	0	0	0
SFSJR Upstream of Bear Creek	15	85	18%	15	0	0	0	30	76	39%	30	0	0	0
SFSJR Upstream of Mono Hot Spring	27	114	24%	27	0	0	0	5	37	14%	5	0	0	0
SFSJR Upstream of Camp 62 Creek	35	114	31%	35	0	0	0	52	74	70%	44	8	0	0
SFSJR Upstream of Bolsillo Creek	37	114	32%	37	0	0	0	56	74	76%	47	7	2	0
SFSJR Upstream of Camp 61 Creek	41	95	43%	35	5	1	0	54	67	81%	34	11	7	2

	2000			Days Temperature Increase is >2.8°C (5°F) and Daily Mean is				2001			Days Temperature Increase is >2.8°C (5°F) and Daily Mean is			
Downstream Site	**Days >2.8°C (5°F)**	**No. Days Monitored**	**% Days >2.8°C (5°F)**	**≤15°C and ≤18°C**	**>18°C and ≤19°C**	**>19°C and ≤20°C**	**>20°C**	**Days >2.8°C (5°F)**	**No. Days Monitored**	**% Days >2.8°C (5°F)**	**≤15°C and ≤18°C**	**>18°C and ≤19°C**	**>19°C and ≤20°C**	**>20°C**
SFSJR Upstream of Mono Creek	45	95	47%	39	4	2	0	60	73	82%	35	14	8	3
SFSJR Upstream of Warm Creek	-	0	-	-	-	-	-	35	52	67%	30	5	0	0
SFSJR Upstream of Rattlesnake Creek	23	51	45%	22	1	0	0	62	76	82%	49	10	3	0
SFSJR Upstream of Hoffman Creek	22	78	28%	21	1	0	0	61	76	80%	52	8	1	0
SFSJR Upstream of SJR Confluence	74	76	97%	59	9	6	0	76	76	100%	44	10	15	7
Pitman Creek Upstream of Big Creek Confluence	0	44	0%	0	0	0	0	8	61	13%	8	0	0	0
NF Stevenson Creek Upstream of Shaver Lake	42	147	29%	42	0	0	0	59	150	39%	59	0	0	0
Crater Creek Upstream of SFSJR Confluence	30	41	73%	30	0	0	0	8	38	21%	8	0	0	0
Crater Creek Diversion Inflow to Florence Lake	5	41	12%	5	0	0	0	14	38	37%	14	0	0	0
Bear Creek Downstream of Diversion	0	74	0%	0	0	0	0	0	107	0%	0	0	0	0
Bear Creek Upstream of SFSJR Confluence	2	116	2%	2	0	0	0	5	108	5%	5	0	0	0
Mono Creek Downstream of Diversion	0	128	0%	0	0	0	0	0	85	0%	0	0	0	0
Mono Creek Upstream of SFSJR	60	108	56%	60	0	0	0	71	122	58%	71	0	0	0
Camp 62 Creek Upstream of SFSJR Confluence	-	-	-	-	-	-	-	54	54	100%	54	0	0	0
Camp 62 Creek Upstream of SFSJR Confluence	-	-	-	-	-	-	-	27	27	100%	27	0	0	0
Bolsillo Creek Upstream of SFSJR Confluence [2]	21	152	14%	21	0	0	0	0	116	0%	0	0	0	0
Big Creek Downstream of Dam 5	37	94	39%	37	0	0	0	55	177	31%	55	0	0	0
Big Creek Upstream of Powerhouse 8	31	68	46%	22	5	4	0	112	177	63%	92	10	6	4
Big Creek Downstream of Dam 5	26	121	21%	26	0	0	0	5	184	3%	5	0	0	0
Big Creek Upstream of Powerhouse 8	14	94	15%	5	5	4	0	12	184	7%	10	2	0	0
Stevenson Creek Downstream of Shaver Lake Dam	43	128	34%	43	0	0	0	44	108	41%	44	0	0	0
Stevenson Creek at Railroad Grade	36	106	34%	36	0	0	0	47	122	39%	47	0	0	0
Stevenson Creek Upstream of SJR	68	127	54%	62	3	3	0	115	113	102%	112	3	0	0

	2000			Days Temperature Increase is >2.8°C (5°F) and Daily Mean is				2001			Days Temperature Increase is >2.8°C (5°F) and Daily Mean is			
Downstream Site	**Days >2.8°C (5°F)**	**No. Days Monitored**	**% Days >2.8°C (5°F)**	**≤15°C and ≤18°C**	**>18°C and ≤19°C**	**>19°C and ≤20°C**	**>20°C**	**Days >2.8°C (5°F)**	**No. Days Monitored**	**% Days >2.8°C (5°F)**	**≤15°C and ≤18°C**	**>18°C and ≤19°C**	**>19°C and ≤20°C**	**>20°C**
Stevenson Creek Downstream of Shaver Lake Dam	18	147	12%	18	0	0	0	21	179	12%	21	0	0	0
Stevenson Creek at Railroad Grade	0	117	0%	0	0	0	0	15	179	8%	15	0	0	0
Stevenson Creek Upstream of SJR	1	127	1%	0	0	1	0	34	179	19%	29	0	5	0
Big Creek No. 3 (FERC Project No. 120)														
SJR Downstream of Dam 6	-	0	-	-	-	-	-	0	184	0%	0	0	0	0
SJR Upstream of Stevenson Creek	0	61	0%	0	0	0	0	0	184	0%	0	0	0	0
SJR Downstream of Big Creek Powerhouse 3	1	64	2%	1	0	0	0	6	163	4%	6	0	0	0

Notes: SJR=San Joaquin River; SFSJR=South Fork San Joaquin River; °C=degrees Celsius; °F=degrees Fahrenheit

[a] Water temperature monitoring was conducted when diversions were not diverting.

Fishery Resources

This section describes the fisheries resources in the vicinity of the Big Creek ALP Projects, including special status fishes, historic and current fish assemblages, and current aquatic habitat conditions.

Special Status Fishes

No state or federally listed threatened or endangered fish species have been documented in the project area. Hardhead is the only aquatic species known to occur in the project area with a special management status. Hardhead is a Forest Service Region 5 sensitive species and a Cal Fish & Game species of concern (Class 3 Watch List).

Historical Fish Assemblages

Historically, most of the streams above 5,000 feet msl were fishless due to steep gradients that prevented upstream fish passage (Moyle, 2002; Yoshiyama et al., 1998). This includes most of the project area, with the exception of the San Joaquin River downstream of Mammoth Pool and the lower sections of several tributary streams, including Big Creek and Stevenson Creek. In the past, the San Joaquin River supported runs of anadromous salmonids and a native rainbow trout assemblage (Moyle, 2002). Central Valley spring-run Chinook salmon and Central Valley steelhead[20] both occurred in the San Joaquin Basin as far upstream as the vicinity of the present-day Mammoth Pool dam (Yoshiyama et al., 1998). Dams that prevented upstream fish passage were constructed on the San Joaquin River downstream of the project area prior to the construction of Mammoth Pool dam, including Friant dam (river mile 267) and Kerckhoff dam (river mile 292). As a result, these ESA-listed species no longer occur in the project area.

Similar to current conditions, the San Joaquin River in the vicinity of Redinger reservoir was likely a transition zone between species adapted to warm water and those adapted to colder water prior to construction of the Big Creek ALP Projects. In the San Joaquin River, the pikeminnow-hardhead-sucker assemblage generally occurs in lower elevation streams than the rainbow trout assemblage, although rainbow trout can occur in the upper limits of the native transition zone. Sacramento pikeminnow, Sacramento sucker, hardhead, rainbow trout, brown trout and prickly sculpin were found in project bypassed reaches within the transition zone. Moyle (2002) reports that this native California assemblage of the Sacramento-San Joaquin rivers is currently in decline, especially in the San Joaquin River Valley. However, this assemblage has been relatively

[20] Steelhead are the anadromous form of rainbow trout.

stable over a number of years in both Redinger reservoir and in the San Joaquin River reach downstream.[21]

The species composition in the San Joaquin River in the vicinity of Redinger reservoir most likely shifted both seasonally and annually depending on water supply and water temperature. The San Joaquin River downstream of Mammoth reach was probably dominated by native Sacramento sucker, Sacramento pikeminnow, hardhead, and prickly sculpin with some rainbow trout, similar to the pikeminnow-hardhead-sucker assemblage described by Moyle (2002). The pikeminnow-hardhead-sucker assemblage currently occupies a narrow altitude range in the Sierra Nevada foothill streams of the San Joaquin Basin (Moyle, 2002).

Rainbow and Non-native Trout

Beginning in the 1800s, native and non-native trout were stocked in many of the upper reaches of the basin by settlers, soldiers, fishermen, and government agencies, with the intent to establish consumptive use and sport fisheries (SCE, 2003b). As a result, there are wide-spread, established populations of rainbow trout and non-native brown, brook, and golden trout in previously fishless areas of the basin (Moyle, 2002). Some remote reaches of the basin are still naturally fishless.

Currently, depending on the stream reach, the project area streams are dominated by combinations of four species of trout: rainbow, brown, brook, and rainbow x golden trout hybrids. Brook trout are among the most cold-tolerant of the trout species, and are often the only species in the small, high elevation project area streams.

Rainbow trout and rainbow x golden trout hybrids are spring spawners. Most wild rainbow trout reach sexual maturity in their second or third year and usually spawn between February and June, depending on water temperature and strain (McAfee, 1966, in SCE, 2003c). In colder waters at high altitudes, spawning may occur as late as July or early August. Rainbow trout in other similar South Fork San Joaquin River tributary streams have been found to spawn from April through June (Loudermilk, 2001, in SCE, 2003c). The eggs hatch in 15 weeks at 3.5ºC and 11 weeks at 5ºC (Stickney, 1991, in SCE, 2003c). The fry emerge from the gravel beginning 2 to 3 weeks later, depending upon temperature. Juvenile and adult rainbow trout may migrate into a lake or other downstream areas or remain in the stream defending a small home range (Moyle, 2002).

Golden trout spawn when water temperatures reach 7 to 10ºC, or as early as May in the project area. It is not known whether the spawning period of rainbow x golden trout hybrids is similar to that of rainbow trout or golden trout (SCE, 2003c). Golden trout eggs hatch in about 20 days at 14ºC (Moyle, 2002).

[21] Redinger reservoir is located downstream of Big Creek Powerhouse 3, and is not part of the four Big Creek ALP Projects.

Brown trout spawn in the fall or winter and may begin spawning migration as soon as early September, depending on water levels and stream temperature in the project area (SCE, 2003c). Spawning sites are not chosen until stream temperatures begin to significantly cool; peak spawning activity generally does not occur until October and November and tapers off in December (Moyle, 2002). Eggs hatch after 11 to 16 weeks (Loudermilk, 2001, in SCE, 2003c). Large brown trout are highly piscivorous and can prey on young of their own or of other trout species.

Brook trout may begin their spawning migration in mid-September, depending on water temperatures; peak spawning period lasts from October to December (SCE, 2003c). Eggs hatch after 12 to 16 weeks at water temperatures of 2 to 5°C. Brook trout may also spawn in lakes if there is suitable habitat.

Native Transition Zone Fishes

Within the project area, the Stevenson reach of the San Joaquin River (Dam 6 downstream to Redinger reservoir) typically has warmer summer water temperatures than streams in the upper basin, and supports a native transition-zone fish community (also called a pikeminnow-hardhead-sucker assemblage), and low numbers of trout. The native transition-zone community exists between the native cyprinid-catostomid zone community on the San Joaquin River valley floor and the rainbow trout zone community in the higher elevations (Moyle, 2002).

In 1995, native species comprised about 91 percent of the fish collected in Redinger reservoir, and hardhead comprised 46 percent of the total catch (SCE, 2003b). Adult hardhead probably migrate into the Stevenson reach of the San Joaquin River to spawn, and utilize stream habitat for fry and juvenile rearing. Hardhead spawn mainly in April and May (Reeves, 1964, and Grant, 1992, in SCE, 2003c). However, hardhead spawning is reported to occur from May through August in the upper San Joaquin River (Wang, 1986, in SCE, 2003c). Fish from larger rivers or reservoirs may migrate 30 to 75 kilometers or more upstream in April and May, usually into smaller tributary streams (Reeves, 1964, in SCE, 2003c). Hardhead usually occur in the same habitats as Sacramento suckers and Sacramento pikeminnow, and are almost never found in areas where pikeminnow are absent (Moyle and Nichols, 1973; Moyle, 1995 and 2002, in SCE, 2003c). They are rarely found in reservoirs, with the exception of Redinger and Kerckhoff reservoirs in Fresno County, and in reservoirs of the Pit River system in Shasta County (Moyle, 2002).

Sacramento suckers are found in the lower elevation project streams and in tributaries to Huntington Lake, as well as Huntington Lake and Shaver Lake (SCE, 2003c). Larval suckers concentrate in the warm, quiet, protected stream margins (Moyle, 2002). Juvenile suckers were more commonly found in the tributary streams where they hatched, than in reservoirs and downstream areas. Sub-adult and adult suckers are usually found in the deep water of pools, in runs, or beneath undercut banks near riffles during the day. Adult suckers prefer water greater than 3 feet deep where they are relatively safe from avian predators such as herons, osprey, and bald eagles. Spawning generally takes place in February through June, depending on water temperatures, and may continue into July or August in some systems (Moyle, 2002). The spawning migration is triggered when water temperatures warm to 5.6 to 10.6°C (SCE, 2003c). Adults swim up to 20 kilometers upstream to spawn, and a sudden cooling of the water can stop the run until warmer temperatures return (Moyle, 2002).

Sacramento pikeminnow prefer water temperatures ranging from 18 to 28ºC (Moyle, 2002). Adults migrate to spawning areas in April and May, generally when water temperatures reach 14°C (SCE, 2003c). Spawning occurs when water temperatures rise to 15 to 20°C (Moyle, 2002). The presence of small larvae found in some streams indicates that spawning may occur through June (Wang, 1986; Mulligan, 1975, in SCE, 2003c). Pikeminnow migrate upstream to spawn in gravel riffles in streams or on gravel areas near shore, in lakes or reservoirs. The eggs of Northern pikeminnow, a closely related species, hatch in four to seven days at 18°C (Burns, 1966, in SCE, 2003c).

Reservoir Fishes

Reservoir fish in the project area include trout, Sacramento sucker, and prickly sculpin, as well as non-native kokanee salmon,[22] smallmouth bass, bluegill, crappie and carp, among others. Project reservoirs occur at a wide range of elevations, and include alpine lakes, such as Florence Lake and Huntington Lake, that support coldwater trout and kokanee (in Huntington Lake).

Other project reservoirs, such as Shaver Lake and Mammoth Pool reservoir, are characterized by Moyle (2002) as mid-elevation, Central Valley reservoirs. Moyle describes these reservoirs as often supporting warmwater fish species near the surface and in edgewater habitat, and coldwater species (trout and kokanee) in deeper, colder water. Warmwater species include smallmouth bass and other centrarchids such as bluegill and crappie. Coldwater species found in Mammoth Pool and Shaver Lake include trout and kokanee (in Shaver Lake).

Kokanee spawn between September and February, depending on the genetic stock and lake and stream temperatures. Kokanee require water temperatures between 6 and 13°C to spawn, and may spawn in streams or lakes with suitable gravel substrate. Spawning kokanee attempt to return to the stream in which they were hatched; spawners congregate at the mouths of streams or in the vicinity of suitable lake spawning areas. The fry emerge in April through June and immediately migrate downstream and generally do not start feeding until they reach a lake.

Smallmouth bass are normally found in water approximately 20 to 27°C, and prefer pools with abundant cover (SCE, 2003c). In rivers and streams, they are usually found in the same habitat as the pikeminnow-hardhead-sucker native transition zone fish

[22] Kokanee are the land-locked, resident form of sockeye salmon.

community (Moyle, 2002). Hardhead are almost never found in areas that have well-established centrarchid populations such as smallmouth bass (Moyle and Nichols, 1973; and Moyle, 1995 and 2002, in SCE, 2003c). In the project area, smallmouth bass are generally found in Shaver Lake. Spawning occurs when water temperatures reach 13 to 16°C, usually in April (SCE, 2003c). Young fry are typically present during early summer (Moyle, 2002).

Benthic Macroinvertebrates

The project area streams support diverse communities of benthic macroinvertebrates. A few taxa are abundant, regardless of site location or stream; many of these are members of families within the order Diptera (flies) including Orthocladiinae, Tanytarsini, and Simuliidae (SCE, 2003c). The most common family of Ephemeroptera (mayflies) is Baetidae; of Plecoptera (stoneflies) is Nemouridae; and of Trichoptera (caddisflies) is Hydropsychidae. Other families and genera of these groups are abundant in some streams. Based on fish condition factors measured in the applicant's studies, productivity does not appear to be a limiting factor for trout populations in the project area.

Visual surveys for mollusks located a few individuals, generally small in size, at a limited number of locations downstream of the project area. The results of crayfish trapping in Shaver Lake and Mammoth Pool reservoir suggest that crayfish are well distributed in these reservoirs (SCE, 2003c).

Bypassed Reaches

In this section we describe aquatic habitats and fish populations in reaches affected by project operations, in the following order: (1) South Fork San Joaquin River and its tributaries; (2) San Joaquin River and its tributaries with the exception of Big Creek; and (3) Big Creek and its tributaries.

South Fork San Joaquin River

The South Fork San Joaquin River bypassed reach extends 28 miles from Florence Lake dam to South Fork San Joaquin River's confluence with the middle fork of the San Joaquin River, with elevations ranging from 7,218 to 3,721 feet msl over the length of the reach (figure 3-6). The upstream half of this reach is a mix of small canyon and open channel types. The lower half is in a deep, bedrock dominated canyon. There are several potential barriers to upstream fish migration in this reach, including a 36-foot high waterfall located 6.9 miles upstream of the confluence with the San Joaquin River.

Historically, Cal Fish & Game and other entities have stocked or introduced several species of fish to the South Fork San Joaquin River, including brown trout, brook trout, rainbow trout/steelhead, cutthroat trout, and golden trout (SCE, 2003c). Cal Fish & Game currently manages the river as a put-and-take rainbow trout fishery to supplement the wild trout population. During the period 1998 through 2002, Cal Fish & Game stocked an average of 4,798 adult rainbow trout per year.

Fish sampling conducted in 2002 indicated that the South Fork San Joaquin River, downstream of Florence Lake, also supports abundant, self-sustaining populations of brown and rainbow trout (SCE, 2003c). Multiple age classes of brown and rainbow trout were present, including young-of-the-year although densities and age class structure varied by geomorphic reach type. Brown trout densities were greater in the bypassed reach than they were in a reference site[23] sampled upstream of Florence Lake (see appendix C). In the bypassed reach, higher densities of brown trout occurred upstream of Bear Creek, while the furthest sites downstream were dominated by rainbow trout (see appendix C). The lowest rainbow trout densities were in the confined, canyon between Bear Creek and Mono Crossing.

The rainbow trout age class structure was skewed toward young-of-the-year (54 percent) (SCE, 2003c). Only 9 percent of the brown trout population were young-of-the-year fish. Most of the rainbow trout collected in this area were presumed to be wild fish based on their appearance and scales (SCE, 2003c). Brown trout was the only species collected upstream of Florence Lake.

Small Tributaries on the North Side of the South Fork San Joaquin River – Tombstone, North Slide, South Slide, and Hooper Creeks

The small tributaries on the north side of the South Fork San Joaquin River include Tombstone, North Slide, South Slide, and Hooper creeks (figure 3-6). There are small diversions on each of these creeks, but only the Hooper Creek diversion is in operation. The diversions are at elevations between 7,502 and 7,673 feet msl. These creeks are very steep, headwater boulder/bedrock channels. Cascades and bedrock sheets, which provide little or no quality trout habitat, predominate (SCE, 2003b).

Tombstone Creek – There are smaller components of complex habitat types in Tombstone Creek, some spawning gravel, and deep pools downstream of the diversion (SCE, 2003b). Farther downstream where Tombstone Creek passes through Jackass Meadow, run and pool habitats predominate (stream length not available). The meadow segment has fine sediment and a well developed floodplain. These types of channels support productive fisheries when they are in good condition, and are relatively rare in headwater areas. No fish were found in Tombstone Creek upstream of the diversion during sampling conducted in 2002; although brown trout were found downstream of the diversion. Mean density and biomass for brown trout were relatively high (see appendix C). Multiple age classes were present including young-of-the-year (14 percent) (SCE, 2003c).

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[23] A reference site is a comparable stream that is unaffected by the project.

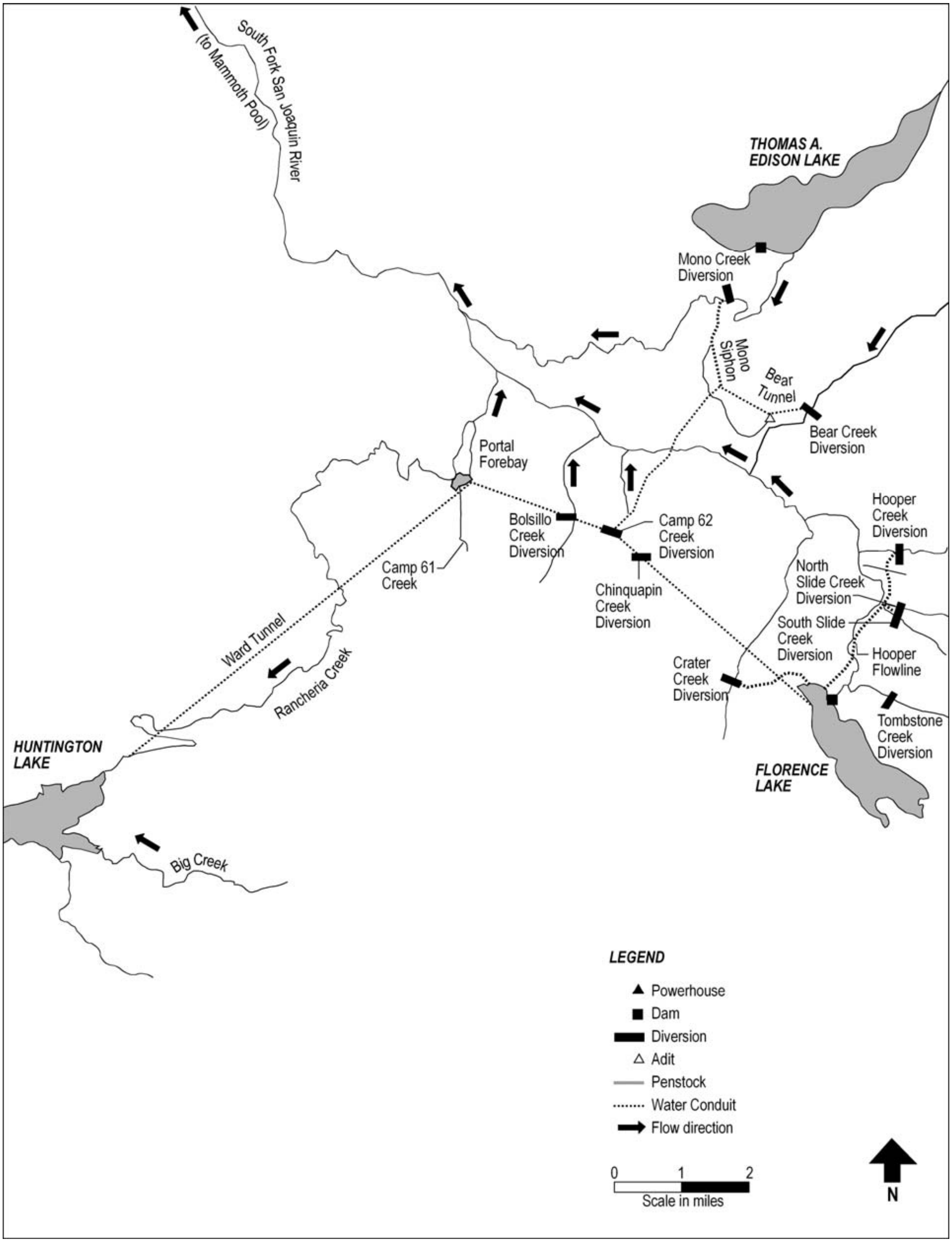

Figure 3-6. Big Creek System (page 1 of 2). (Source: SCE, 2007a, as modified by staff)

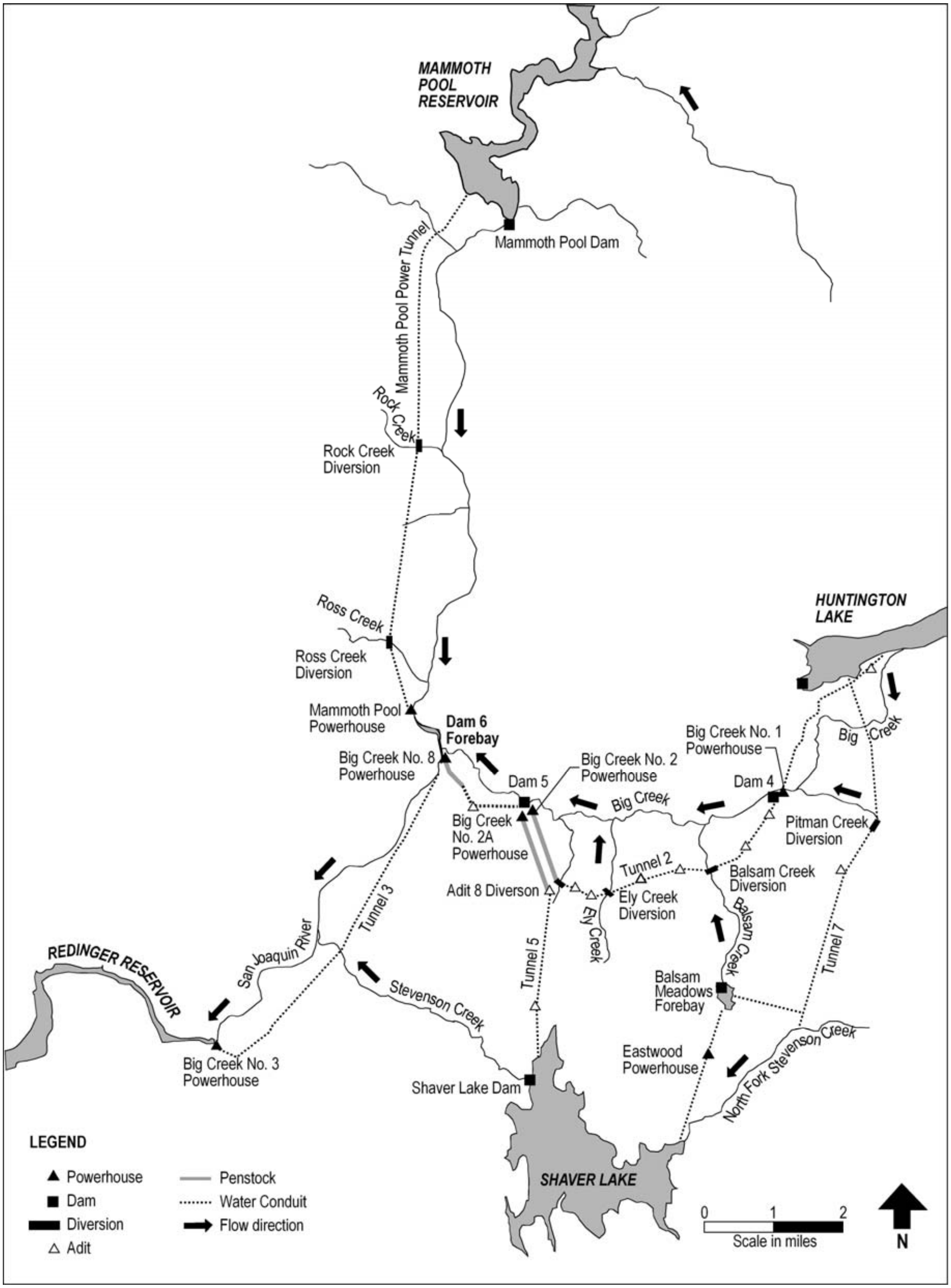

Figure 3-6. Big Creek System (page 2 of 2). (Source: SCE, 2007a, as modified by staff)

North Slide and South Slide Creeks – North Slide and South Slide creeks are fishless. The fisheries potential in these creeks is very limited in these 0.3 mile long bypassed reaches because (1) there are no pools in either creek; (2) there is no suitable spawning gravel in North Slide Creek; (3) a short stream segment downstream of the North Slide Creek diversion was dry during the survey; and (4) in North Slide Creek there is a 15-foot high waterfall in a cascade series about 17 feet upstream from its confluence with the South Fork San Joaquin River that is a total barrier to upstream fish migration (SCE, 2003d).

Hooper Creek –Hooper Creek bypassed reach is 0.6 miles long. Multiple natural fish migration barriers including cascades located 0.1 mile from the confluence of the South Fork San Joaquin River limit access to Hooper Creek (SCE, 2003d). These natural features limit the potential for brown and brook trout[24] to migrate past these barriers during their fall spawning period, but are less likely to be spawning migration barriers for rainbow trout and rainbow x golden trout hybrids, which spawn in higher spring flows.

Self-sustaining populations of rainbow x golden trout hybrids, including multiple age classes and young-of-the-year (24 percent) were found in Hooper Creek upstream and downstream of the diversion in 2002 (SCE, 2003c). Rainbow x golden trout density and biomass were higher downstream of the diversion than they were upstream of the diversion (see appendix C).

Small Tributaries on the South Side of the South Fork San Joaquin River – Crater, Camp 61, Camp 62, Chinquapin, and Bolsillo Creeks

The small headwater tributaries on the south side of the South Fork San Joaquin River are Crater, Camp 61, Camp 62, Chinquapin, and Bolsillo creeks (figure 3-6). The Crater Creek diversion channel carries flows to Florence Lake, and Chinquapin, Camp 61, Camp 62, and Bolsillo creeks are diverted directly into the Ward Tunnel.

Upper Crater, Chinquapin, Camp 61, Camp 62, and Bolsillo creeks are steep, boulder/bedrock streams, none of which are currently stocked (SCE, 2003c). Fish sampling conducted in 2002 indicated that Crater, Camp 62, Chinquapin, and Bolsillo creeks had self-sustaining populations of brook trout upstream and downstream of the diversions (SCE, 2003c). Mean brook trout densities and biomasses were high in all reaches except for Crater Creek upstream and downstream of the diversion (see appendix C). Camp 61 Creek had the highest estimated brown trout density among the Portal Project streams (SCE, 2003g).

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[24] Although these species were not collected in Hooper Creek during SCE's fish population surveys, brown trout do occur in the South Fork San Joaquin River, and brook trout occur in several of its tributaries near Hooper Creek.

Crater Creek and Crater Creek Diversion Channel – The 2.85 mile-long Crater Creek bypassed reach has an elevation of 8,762 feet msl at the diversion and 6,814 feet msl at the confluence with the South Fork San Joaquin River. Upper Crater Creek has mostly cascade and step-run habitats, and large amounts of spawning gravel. The numerous cascades upstream of the diversion provide relatively low quality fish habitat. Lower Crater Creek has a short segment of more complex habitat types and a substantial amount of shallow pool habitat where it passes through Hell Hole Meadow.

Crater Creek diversion channel, which extends 1.38 miles from Crater Creek diversion to Florence Lake, is a combination of ditch and natural channel. The Crater Creek diversion channel has an elevation of 8,762 feet msl at the diversion and 7,343 feet msl at the confluence with Florence Lake. It is a steep, bedrock channel dominated by cascade or bedrock sheet that has little or no fish habitat value, and small amounts of the more complex habitat types (SCE, 2003b).

There is no MIF requirement in Crater Creek in the current license, but seepage from the diversion provides flow to the creek when the diversion is in operation. There is flow in Crater Creek diversion channel during the spring when rainbow trout spawn, but there are few rainbow trout in Florence Lake. Channel flow declines when operation of the diversion ceases, so that Crater Creek diversion channel provides little or no spawning habitat for brown and brook trout in Florence Lake.

Total brook trout density and biomass in Crater Creek during 2002 were lower downstream of the diversion than upstream of the diversion (see appendix C). Higher trout densities were found in Crater Creek diversion channel than in Crater Creek. Multiple age classes including young-of-the-year were found in both the creek and the diversion channel (21 and 33 percent, respectively) (SCE, 2003c).

Camp 62 and Chinquapin Creeks – The 1.35 mile-long Camp 62 Creek bypassed reach has and elevation of 7,371 feet msl at the diversion and 6,523 feet msl at the confluence with the South Fork San Joaquin River. Lower Camp 62 Creek has two complete barriers to upstream fish migration in addition to the diversion. The lowest barrier is a 45-foot high waterfall about 400 feet upstream of the confluence with the South Fork San Joaquin River that limits recruitment from the river (SCE, 2003c). There is spawning gravel in the lowest reach, but the waterfall prevents migration from the river to relatively large amounts of good to excellent quality spawning gravel in the bypassed reach. Camp 62 Creek has fair amounts of complex habitat types. Large woody debris (LWD)[25] was observed in five of the nine habitat units in the reach upstream of the Camp 62 diversion (SCE, 2003d). One unit had 5 to 10 pieces of LWD and one unit had 15 to 20 pieces. The other units had zero to five pieces of LWD. Both creeks have MIF requirements under the current license (see tables 3-1 and 3-2).

[25] LWD is wood that is greater than 6 inches in diameter with approximately 33 percent or greater of the total length of the wood situated within the stream channel.

Chinquapin Creek enters Camp 62 Creek about 1 mile upstream from its confluence with the South Fork San Joaquin River, which is 7.7 miles downstream of Florence Lake. The 0.9 mile-long Chinquapin Creek bypassed reach has an elevation of 7,641 feet msl at the diversion and 6,976 msl at the confluence with Camp 62 Creek. Chinquapin Creek has a waterfall 785 feet upstream of the confluence with Camp 62 Creek that is a barrier to upstream fish passage. Chinquapin Creek has mostly step-pool, step-run, and cascade habitats. Total brook trout densities in both creeks were greater downstream of the diversions than upstream of the diversions in 2002, although catchable-sized brook trout density was lower downstream of the diversion at Camp 62 Creek (see appendix C). The age class structure of Chinquapin and Camp 62 creeks was skewed toward young-of-the-year (63 and 46 percent, respectively) (SCE, 2003c). Fair amounts of spawning gravel were found in both creeks (SCE, 2003d).

Bolsillo Creek – The 1.6 mile-long Bolsillo Creek bypassed reach has an elevation of 7,623 feet msl at the diversion and 6,521 feet msl at the confluence with the South Fork San Joaquin River. Bolsillo Creek enters the South Fork San Joaquin River about 8.3 miles downstream of Florence Lake. Bolsillo Creek has approximately equal amounts of steep to moderate gradient habitat downstream of the diversion. Step-pool, step-run, and cascade are the primary habitat types, and there is a fair amount of spawning gravel. Bolsillo Creek has a large waterfall 0.2 mile from the confluence with the South Fork San Joaquin River that is a complete upstream migration barrier and prevents recruitment from the river (SCE, 2003d). Brook trout densities were lower downstream of the diversion compared to upstream of the diversion (see appendix C). Multiple age classes, including young-of-the-year (27 percent), were present downstream of the diversion (SCE, 2003c).

Camp 61 Creek – Camp 61 Creek extends approximately 2 miles from Portal forebay dam (7,117 feet msl) to its confluence with the South Fork San Joaquin River (6,413 feet msl). Channel gradients range from 2 to 10 percent, and step runs, step pools, and lateral pools are the dominant habitat types. The majority of the pools in the reach are less than 2 feet deep. Substrates are mainly boulders (37 percent), sand (19 percent), and bedrock (12 percent), with lesser amounts of cobble, gravel, and fines. A moderate amount of spawning gravel is present in run, pool, and riffle habitats. Although quantitative data are limited, lower Camp 61 Creek (downstream of the confluence with Adit 2 Creek) was reported as having 90 to 100 percent embeddedness. In addition, accumulations of fine sediment in pools in Camp 61 Creek downstream of Portal forebay dam were nearly 2.5 times greater than that observed in East Fork Camp 61 and West Fork Camp 61 creeks.

LWD is only intermittent within the active channel, and, where present, has a minimal influence on channel morphology. In 2000, 2001, and 2003, the maximum water temperature in Camp 61 Creek, upstream from its confluence with Adit 2 Creek, was 19.3 °C (table 3-8). The maximum water temperate in Camp 61 Creek downstream of its confluence with Adit 2 Creek was 16.8 °C.

Four fish passage barriers are present in Camp 61 Creek downstream of Portal forebay. All four are complete barriers to upstream fish migration at low flows (SCE, 2003g). Three of the barriers are short waterfalls located 8,117, 7,040, and 5,247 feet upstream of the confluence with the South Fork San Joaquin River; the fourth barrier is a bedrock sheet located 5,194 feet upstream of the confluence with the South Fork San Joaquin River. The barrier at 7,040 feet is a barrier at all flows.

Under existing conditions, Camp 61 Creek has no MIF requirement. Flow downstream of the forebay is present as a result of seepage emanating from Portal forebay dam and from accretion and surface runoff during the spring snowmelt or precipitation events. Additional water is also provided to Camp 61 Creek from leakage from Adit 2 (via Adit 2 Creek). Adit 2 Creek converges with Camp 61 Creek approximately 1 mile downstream of Portal forebay dam; upstream from the Adit 2 Creek confluence. Camp 61 Creek is often completely dry. Based on limited weir data collected from 1997 through 2002, flows in Camp 61 Creek immediately downstream of Portal forebay dam are typically less than 0.123 cfs (SCE, 2003g).

Brown trout was the only fish species captured in Camp 61 Creek, and they were only present in the reach downstream of the confluence with Adit 2 Creek. Downstream of Adit 2 Creek, the density of brown trout was estimated to be 1,439 fish per mile in 2001 and 1,513 fish per mile in 2002 (SCE, 2003g). Several age classes of brown trout were captured during sampling in Camp 61 Creek; however, age 0+ fish were relatively rare, possibly indicating a lack of suitable spawning habitat or a lack of access to suitable spawning habitat due to low flows (SCE, 2003g).

Bear Creek

Bear Creek is part of a large watershed located on the northeast side of the South Fork San Joaquin River between Florence Lake and Lake Edison (figure 3-6). Bear Creek diversion is located 1.6 miles upstream of the confluence with the river. The bypassed reach drops from an elevation of 7,350 feet msl at the diversion to 6,715 feet msl at the confluence with the river. Bear Creek is a bedrock/boulder controlled stream (SCE, 2003b). The reach upstream of the diversion has a large amount of riffle, run, and shallow pool habitats. The reach downstream of the diversion is predominantly step-pool and high gradient riffle habitats. A fair amount of LWD and spawning gravel is present.

Bear Creek has self-sustaining populations of brown trout upstream and downstream of the diversion. Fish densities and biomass in 2002 were substantially higher in the reach downstream of the diversion compared to upstream of the diversion (see appendix C), and fish density in the bypassed reach was one of the highest of the project reaches (brown trout 1,406 fish/km). Multiple age classes including young-of-the-year (15 percent) were present downstream of the diversion (SCE, 2003c).

Mono Creek (Mono Diversion to the South Fork San Joaquin River)

The Mono diversion is located 5.8 miles upstream of the confluence of Mono Creek with the South Fork San Joaquin River (figure 3-6). Mono Creek has an elevation of 7,333 feet msl at the diversion and drops to an elevation of 6,313 feet msl at the confluence with the river. The reach is mostly a boulder/bedrock channel with pool, step-run, and cascade habitats, and lesser amounts of pocket water and riffle habitat (SCE, 2003b). Many pools are deeper than those found in other South Fork San Joaquin River tributaries and large amounts of spawning gravel are present in local concentrations.

Brown trout and catchable-sized hatchery rainbow trout were collected in the impoundment upstream of Mono Creek diversion in 2002. Cal Fish & Game has regularly stocked rainbow trout in Mono Creek upstream of the diversion for many years. It is likely that there is little to no recruitment of wild rainbow trout in or upstream of the impoundment, as indicated by the absence of young rainbow trout and only catchable-size rainbow trout of hatchery origin (SCE, 2003c). The presence of numerous young-of-the-year brown trout, despite the lack of stocking, indicates successful spawning of this species takes place upstream of the Mono diversion dam.

Cal Fish & Game does not stock trout in the Mono Creek bypassed reach. Five brown and one rainbow trout were collected in the bypassed reach during fish sampling conducted in 2002 (SCE, 2003c). Therefore, the mean density and biomass were low for both species and the populations are not self-sustaining (see appendix C). Mono Creek historically supported higher fish densities, even though MIFs have not changed (SCE, 2003c). At the time that SCE conducted its habitat and fisheries surveys in Mono Creek, habitat conditions were adversely affected by the abundance and distribution of fine sediments. SCE reported that fine sediments have been less abundant in pools since high flows occurred in 2005 and 2006.

The San Joaquin River Mammoth Reach

The San Joaquin River Mammoth reach extends 8.4 miles from Mammoth Pool dam downstream to Mammoth Pool powerhouse at the head of the Dam 6 impoundment (figure 3-6). The Mammoth reach has an elevation of 3,052 feet msl at the Mammoth Pool dam and 2,222 feet msl at the Mammoth Pool powerhouse.

Mammoth reach is moderate (2 to 4 percent) to low gradient (0 to 2 percent), with boulder/bedrock controlled and gully channel types in a deep, steep-walled bedrock canyon (SCE, 2003b). Habitats include large deep pools with long runs and complex habitats such as pocket water and riffles. Pools are the dominant habitat type in the reach. There are small amounts of spawning gravel and areas of finer substrate.

Fish sampling was conducted at two sites in the Mammoth reach during 2002. One site was in the vicinity of Rock Creek and the other was downstream of Ross Creek (SCE, 2003c). Sampling results indicated that the reach has self-sustaining populations of Sacramento sucker, rainbow trout, and brown trout (see appendix C), although the population densities of all three species were greater downstream of Ross Creek than they were near Rock Creek.[26] Rainbow trout had greater density in the lower site than brown trout and brown trout had greater density in the upper site. Multiple age classes were present for all three species, although there were few young-of-the-year of any species near Rock Creek (SCE, 2003c). The age class distributions of rainbow trout, brown trout, and Sacramento sucker were skewed toward young-of-the-year (37, 62, and 75 percent, respectively) downstream of Ross Creek (SCE, 2003c). Sacramento sucker was 76 percent of the total fish collected at both sites combined.

Dam 6 impounds Powerhouse 3 forebay, which inundates the confluence of Big Creek with the San Joaquin River (figure 3-6). In addition to flows from the San Joaquin River and Big Creek, the forebay receives outflows from Powerhouse 8 and the Mammoth Pool powerhouse, and it diverts flow through Tunnel 3 to Big Creek Powerhouse 3. The forebay has a volume of 993 acre-feet and a surface area of 23.2 acres at the spill elevation of 2,230 feet msl. The water level in the forebay rarely varies significantly but occasionally drops to elevations as low as 2,214 feet msl (587 acre-feet of storage) (SCE, 2003b). Sampling conducted in 2002 indicated that Sacramento sucker was the most abundant species (79 percent of the total catch). Brown trout comprised 15 percent of the catch and rainbow trout comprised 6 percent (SCE, 2003c).

The composition of the fish community in the forebay found during the 2002 sampling resembled that of the San Joaquin River upstream and immediately downstream of the forebay, with the exception of hardhead, which were only found downstream of Stevenson Creek. Mean condition factors for trout species were greater than 1 (see appendix C), indicating sufficient food sources, and multiple age classes were represented for all fish species.

The San Joaquin River Stevenson Reach

The Stevenson bypassed reach of the San Joaquin River extends 5.7 miles from Dam 6 downstream to Powerhouse 3 at Redinger reservoir (figure 3-6). Stevenson Creek enters the bypassed reach 3.45 miles downstream of Dam 6. The Stevenson reach has an elevation of 2,222 feet msl at Dam 6 and 1,432 feet msl at Powerhouse 3.

The Stevenson bypassed reach is a moderate gradient (2 to 4 percent) stream with a gully channel (SCE, 2003b). Substrate in the reach is composed primarily of boulder, bedrock and sand, and small amounts of widely distributed spawning gravels. Habitat surveys revealed moderately to very deep pools, complex pocket water, and small riffle areas. Canopy cover was low and there was no LWD.

The Stevenson bypassed reach has a native fish assemblage of hardhead, Sacramento pikeminnow, and Sacramento sucker, in addition to low densities of rainbow trout and brown trout (see appendix C). Fish communities differed between sampling sites in the upper and lower portion of the reach (see appendix C). The upper site,

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[26] Only 10 brown trout and 10 rainbow trout were collected near Rock Creek.

located 1.6 miles downstream of Dam 6, was dominated by Sacramento sucker (76 percent of the total catch). Rainbow trout comprised 9 percent of the catch, brown trout and Sacramento pikeminnow each comprised 2 percent, and prickly sculpin comprised 11 percent. There were multiple age classes of Sacramento sucker including young-of-the-year (36 percent); one juvenile Sacramento pikeminnow; and no hardhead collected at the upper site (SCE, 2003c).

Sampling conducted at the lower site, 0.7 mile upstream of the Powerhouse 3, indicated that this section supports populations of Sacramento pikeminnow and hardhead, as well as small numbers of Sacramento sucker, all representing components of the native transition zone community. One brown trout also was collected. The lower site was dominated by a single age class of juvenile Sacramento pikeminnow (18 of 19 fish collected) (SCE, 2003c). There were only two adult Sacramento sucker at the lower site. Hardhead comprised 40 percent of the fish collected in the lower site and there were multiple age classes including young-of-the-year (7 percent) (SCE, 2003c). This is the only reach in the project area that has a population of hardhead.

Large numbers of small unidentified cyprinids[27] were also found in the margins of the pool habitats. Based on their morphological features, the cyprinids are thought to be juvenile Sacramento pikeminnow or hardhead. Hardhead and other members of the native transition zone assemblage in Redinger reservoir probably spawn in the Stevenson reach of the San Joaquin River, and potentially in other tributaries. Hardhead also occur downstream of the project area in Redinger reservoir, and in the reach downstream from Redinger reservoir. It is likely that the adult fish from the Stevenson bypassed reach return to Redinger reservoir after spawning.

Rock Creek

Rock Creek enters San Joaquin River approximately 3 miles downstream from Mammoth Pool dam (figure 3-6). The bypassed reach extends approximately 0.4 mile from the Rock Creek diversion to the creek's confluence with the San Joaquin River. Rock Creek is a steep gradient (>10 percent), bedrock/boulder controlled channel (SCE, 2003b). The stream drops steeply from an elevation of 3,336 feet msl at the diversion to 2,670 feet msl at its confluence with the San Joaquin River.

Habitat in the bypassed reach is mostly step-pools, cascades, and bedrock sheets with small amounts of other pool habitats. The cascades provide low quality habitat and bedrock sheets have no habitat value. No spawning gravel was found during habitat surveys conducted in 2000 and 2001, which indicates reproduction may occur in upstream locations or in tributaries.

Cal Fish & Game manages Rock Creek as a put-and-take fishery for rainbow trout, which have been stocked every year from 1956 to the present. An average of 2,688

[27] Unidentified minnow species.

catchable rainbow trout were stocked in Rock Creek from 1998 through 2002. Fish sampling conducted in 2002 indicated that Rock Creek also supported self-sustaining populations of rainbow and brown trout (SCE, 2003c). Brown trout density was higher upstream of the diversion, and rainbow trout density was higher downstream of the diversion (see appendix C). Rainbow and brown trout densities were relatively high for a stream of this size. There were multiple age classes of brown trout upstream and downstream of the diversion, indicating that successful recruitment occurs in Rock Creek or its tributaries. No young-of-the-year rainbow trout were collected upstream of the diversion and only three young-of-the-year rainbow trout were collected downstream of the diversion (SCE, 2003c). Young-of-the-year brown trout were 26 percent of the age class structure upstream of the diversion. Only one young-of-the-year brown trout was collected downstream of the diversion.

Ross Creek

Ross Creek enters San Joaquin River about 7 miles downstream of Mammoth Pool dam (figure 3-6). The bypassed reach extends approximately 0.85 mile from the Ross Creek diversion to its confluence with the San Joaquin River. Ross Creek was probably also historically fishless due to steep stream gradients (>20 percent) that prevent the upstream migration of fish from the San Joaquin River (SCE, 2003b). The bedrock/boulder controlled channel drops steeply from an elevation of 3,359 feet msl at the diversion to 2,289 feet msl at its confluence with the San Joaquin River.

Habitat in the bypassed reach is composed mostly of shallow step-pools upstream and downstream of the diversion with substantial components of cascades and bedrock sheets, with little or no spawning gravel. Ross Creek has a relatively small drainage area, and the creek was dry upstream of the diversion by mid-June or early July in 2000 and 2001. Flows in Ross Creek are affected by upstream, non-project diversions.

Rainbow and brown trout have been planted in Ross Creek historically, and both species are reported to persist (SCE, 2003b). Ross Creek was not sampled for fish because the reach upstream of the diversion and a large segment downstream of the diversion were dry during the summer of 2002, when fisheries sampling was conducted.

North Fork Stevenson Creek

The natural flow in the North Fork Stevenson Creek bypassed reach is augmented by instream flow releases from Tunnel 7 at river mile 3.55 (figure 3-6). Prior to construction of the Eastwood power station, this reach was used to transport water to Shaver Lake. Approximately 16,081 feet upstream of the confluence with Shaver Lake, North Fork Stevenson Creek has an elevation of 7,082 feet msl. At the confluence with Shaver Lake the creek elevation is 5,434 feet msl.

North Fork Stevenson Creek has steep gradient (>10 percent), high gradient (4 to 10 percent), moderate gradient (2 to 4 percent), low gradient (0 to 2 percent), and moderate gradient gully channel types (SCE, 2003b). The reach upstream of the Tunnel

7 outlet is a narrow channel, primarily composed of cascade and bedrock sheet, with smaller components of shallow pools, limiting the habitat value of this reach. Much of the reach downstream of the outlet is step-pool and cascade or step-run with small riffles and other pool habitat. The reach downstream of the outlet contains distinct sections of either steep or lower gradient habitats, and many pools downstream of the outlet are up to three feet deep. Small amounts of fair to good quality spawning gravels are distributed downstream of the outlet and there is a small amount of poor quality gravel upstream.

Fish population monitoring studies were conducted downstream of the Tunnel 7 outlet beginning in October 2000, after a gate failure resulted in higher than normal streamflows. Sampling indicated that fish populations were reduced following this high flow event, but populations of rainbow trout began to recover in 2001. In 2002 the dominant species were brown trout, rainbow trout, and rainbow x golden trout hybrids; and the overall density and biomass of trout species were high (see appendix C). Young-of-the-year were 55 percent of the brown trout population and 20 percent of the rainbow trout population (SCE, 2003c). No young-of-the-year rainbow x golden trout hybrids were collected. Sacramento sucker was a small component of the catch (3 percent) and all four fish were 4+ years of age.

Stevenson Creek

The Stevenson Creek bypassed reach extends 4.3 miles downstream from Shaver dam to the confluence with the San Joaquin River (figure 3-6). Stevenson Creek has an elevation of 5,252 feet msl at Shaver dam and 1,638 feet msl at its confluence with the San Joaquin River. More than half of the bypassed reach is steep gradient (>10 percent); the rest is high gradient (4 to 10 percent) and moderate gradient (2 to 4 percent), (SCE, 2003b). Cascades and pools are the dominant habitat types. Some pools are moderately to very deep, many areas have LWD, and pools have small amounts of spawning gravel. Stevenson Creek Falls and a series of other waterfalls create 13 natural migration barriers within the first 0.5 mile upstream of the San Joaquin River confluence (SCE, 2003d). No spawning gravels were found in this stream section.

Rainbow trout was the only species collected in 2002. Multiple age classes of rainbow trout were collected including young-of-the-year (17 percent) (SCE, 2003c). The mean rainbow trout density and biomass were high (see appendix C).

Upper Big Creek

The Upper Big Creek bypassed reach extends 3.6 miles from Huntington Lake to Dam 4 (figure 3-6). Upper Big Creek has an elevation of 6,950 feet msl at the release point downstream of Dam 1 and 4,836 feet msl at the confluence with the Big Creek Powerhouse 1 tailrace. Upper Big Creek lies in a deep, steep-walled bedrock canyon and has long step-pool and step-run habitats (SCE, 2003b). The channel types are primarily steep gradient (>10 percent) with lesser amounts of high gradient (4 to 10 percent), moderate gradient (2 to 4 percent), and moderate gradient gully channel. Big Creek has a mixture of habitat types, including some that are fairly complex, and there is a considerable amount of riparian vegetation encroachment in the lower gradient areas. Pools are mostly shallow and there are small amounts of spawning gravel (SCE, 2003b). There are many waterfalls located in the steep gradient channel upstream of Powerhouse 1 that form barriers to upstream fish migration at all flows (SCE, 2003d). Fish sampling conducted in 2002 indicated Upper Big Creek supports self-sustaining populations of brown trout and prickly sculpin, including multiple age classes and young-of-the-year (brown trout young-of-the-year, 17 percent) (SCE, 2003c). There were no rainbow trout in Upper Big Creek. Mean brown trout density and biomass were high (see appendix C).

Dam 4 forms a 3.2 acre impoundment at the downstream end of the bypassed reach (figure 3-6). The impoundment receives inflow from Upper Big Creek, No. 1 tailrace, and Pitman Creek. Water in the impoundment is diverted through Tunnel 2 to Powerhouse 2, upstream of Dam 5 on Big Creek. Additional flow is diverted into Tunnel 2 from Balsam and Ely creeks. Sampling conducted in 2002 indicated that the forebay had self-sustaining populations of rainbow and brown trout and prickly sculpin (SCE, 2003c). Multiple age classes were present, including young-of-the-year rainbow and brown trout.

Middle Big Creek

The Middle Big Creek bypassed reach extends 4.3 miles from Dam 4 downstream to Powerhouse 2/2A, which discharges into the Dam 5 forebay on Big Creek (figure 3-6). Middle Big Creek has an elevation of 4,811 feet msl downstream of Dam 4 and 2,972 feet msl at Big Creek Powerhouse 2. There is no MIF requirement from Dam 4 in the current license. Flow in the reach derives from dam seepage, local run-off, tributaries, and accretion.

The Middle Big Creek bypassed reach is a high gradient (4 to 10 percent), bedrock/boulder channel, with a small segment of moderate gradient (2 to 4 percent) channel (SCE, 2003b). The primary habitats are step-pools and cascades. There are also substantial amounts of pool, riffle, and flatwater habitats. Generally, the pools are moderately deep to very deep, but fine sediments affect pool depth. A small amount of spawning-sized gravel is present, mostly located in the step-pools and plunge pools. Relatively small amounts of gravel are found in the high gradient riffles that are often used by spawning trout.

Fish sampling conducted in 2002 indicated that there were equal densities of rainbow and brown trout in the Middle Big Creek bypassed reach (see appendix C). The brown trout young-of the-year age class (12 percent) and density were lower in Middle Big Creek compared to the brown trout population in Upper Big Creek. However, the total trout density (brown and rainbow trout combined) was comparable to the brown trout density in Upper Big Creek; the total average adult trout density was lower than Upper Big Creek (see appendix C). Young-of-the-year were 12 percent of the rainbow trout population.

Dam 5 forms a 3.3-acre impoundment at the downstream end of the reach. The impoundment receives water from Upper Big Creek and from Powerhouse 2/2A, and serves as the forebay for the diversion to Big Creek Powerhouse 8. Water surface elevation in the forebay rarely varies by more than 5 feet. During fish sampling conducted in 2002, brown trout comprised 84 percent of the total catch and rainbow trout and prickly sculpin each comprised 8 percent in the impoundment.

Lower Big Creek

Dam 5 is 1.65 miles upstream of the confluence with the San Joaquin River (figure 3-6). The Lower Big Creek bypassed reach extends 1.65 miles from Dam 5 to its confluence with the San Joaquin River, in the impoundment formed by Dam 6. The reach drops from an elevation of 2,910 feet msl at the release point downstream of Dam 5 to 2,284 feet msl at Powerhouse 8.

The Lower Big Creek bypassed reach is moderately steep and bedrock/boulder controlled. Most of the reach is high gradient (4 to10 percent) and the lower end of the reach is very steep (>10 percent) (SCE, 2003b). The primary habitat is step-pool and other pool types, with small amounts of riffle and flatwater habitats. Most of the pools are shallow, but many pools are moderately to very deep. There are small amounts of spawning gravel in the pools. Transient fine sediments are generally associated with material discharged during tunnel inspections. A tall, vertical waterfall located 0.1 mile upstream of the confluence with the San Joaquin River prevents upstream migration from the San Joaquin River into Big Creek (SCE, 2003d).

Multiple age classes of brown and rainbow trout were collected in the Lower Big Creek bypassed reach in 2002 (SCE, 2003c). Mean rainbow and brown trout densities were high (see appendix C). There was a higher abundance of rainbow trout than brown trout, and numerous young-of-the-year rainbow trout (54 percent) were collected in the high gradient channel, which suggests reproduction occurs in or near this reach. Young-of-the-year fish made up 23 percent of the brown trout population.

Pitman Creek

The diversion on Pitman Creek is located about 1.5 miles upstream of the stream's confluence with Big Creek (figure 3-6). Flow is diverted through Tunnel 7, which transports water from Huntington Lake to Balsam forebay and North Fork Stevenson Creek. The Pitman diversion has a spill elevation of 6,998 feet msl. Pitman Creek drops steeply to an elevation of 4,843 feet msl at its confluence with Big Creek.

Pitman Creek is bedrock/boulder controlled and has a moderate gradient (2 to 4 percent) channel upstream of the diversion and a very steep channel downstream of the diversion (SCE, 2003b). The most common habitat types upstream of the diversion are step-pools and flatwater habitats (runs and glides), and there are small components of complex habitats such as pocket water and riffles. The steep gradient (>10 percent) and moderate gradient channels downstream of the diversion are almost entirely step-pool, cascade, and bedrock sheet habitats, with small components of other pool types and pocket water. Many of the pools are moderately to very deep. The only spawning gravels are small amounts upstream of the diversion, mostly in runs (SCE, 2003c). A non-project weir 0.16 mile upstream of the confluence with Big Creek blocks upstream fish migration from Big Creek (SCE, 2003d).

Catchable-sized rainbow trout have been stocked in Pitman Creek almost every year since 1956 (SCE, 2003c). In 2002 brook, rainbow, and brown trout were collected upstream of the diversion (6, 73, and 21 percent of the catch respectively). Rainbow trout comprised 94 percent of the total catch downstream of the diversion, brown trout and brook trout were each 3 percent (SCE, 2003c). The rainbow trout population may be self-sustaining, based on the presence of young-of-the-year (15 percent) and older fish. Only two brown trout and two brook trout were collected downstream of the diversion (see appendix C).

Upper Balsam Creek

The natural flow in Upper Balsam Creek is augmented by releases from the Balsam Meadows forebay, which is located 2.75 miles upstream of the confluence with Big Creek (figure 3-6). Only a small, ephemeral stream flows into the forebay. Upper Balsam Creek drops from an elevation of 6,517 feet msl at the forebay to an elevation of 4,865 feet msl at the Balsam Creek diversion.

The 2.05 mile-long Upper Balsam Creek bypassed reach is a predominantly steep, bedrock channel with some moderate gradient channels (SCE, 2003b). The predominant habitats are step-pools and high gradient riffles. There also is a substantial amount of run, step-run, and trench chute habitat. Bedrock sheets and cascades are also common, and there are small amounts of spawning gravel. There are numerous natural migration barriers throughout Balsam Creek (SCE, 2003d).

Multiple age classes of rainbow trout, including young-of-the-year (15 percent), were collected upstream of the diversion in 2002, indicating the population is self-sustaining (SCE, 2003c). Fish density and biomass were high (see appendix C).

Lower Balsam Creek

Balsam Creek enters Big Creek 1 mile downstream of Dam 4. The bypassed reach extends 0.74 mile from the Balsam Creek diversion, downstream to the confluence with Big Creek (figure 3-6). Balsam Creek has an elevation of 4,872 feet msl at the base of the diversion dam and 4,140 feet msl at the confluence with Big Creek. Water diverted from Balsam Creek is conveyed through Tunnel 2 to Powerhouse 2 on Big Creek.

Lower Balsam Creek is a steep, bedrock controlled channel (SCE, 2003b). It is mostly composed of step-pool, bedrock sheet, and high gradient riffle habitats with some cascade, step-run, run, trench chute, and other pool habitats. Nearly all of the pools are shallow. Numerous natural barriers to upstream migration fragment fish habitat in the creek. Low quality habitat, migration barriers, and small amounts of spawning gravel probably limit reproduction in the reach downstream of the diversion. Only one rainbow trout (age 2+) was collected downstream of the diversion during 2002 sampling.

Ely Creek

Ely Creek flows into Big Creek about 2.6 miles downstream of Dam 4 (figure 3-6). The Ely Creek diversion is located less than 1 mile upstream of the confluence with Big Creek. Diverted water is conveyed to Tunnel 2, which it enters through Adit 6. The diversion spill elevation is 4,844 feet msl, and the elevation of Ely Creek at its confluence with Big Creek is 3,454 feet msl. Flows are intermittent upstream of the diversion, and there is no MIF release requirement downstream of the diversion in the current license.

Ely Creek is a very steep gradient (>10 percent), granitic channel (SCE, 2003b). The reach upstream of the diversion is dominated by cascade and bedrock sheet habitats that provide low quality or no habitat and a small amount of plunge pool and flatwater habitats. The reach downstream of the diversion was dry when the stream was surveyed in 2001. The wetted segments were primarily step-runs, shallow step-pools, and high gradient riffles. Small amounts of spawning gravel were present downstream of the diversion in flatwater habitats and pools.

Rainbow trout age 3+ and greater were the only fish collected upstream of the diversion during sampling conducted in 2002 (SCE, 2003c). Multiple age classes of rainbow trout, including young-of-the-year (15 percent), and rainbow x golden trout hybrids age 1+ or greater were collected downstream of the diversion. Total rainbow and hybrid trout and adult trout densities were higher downstream of the diversion than upstream of the diversion (see appendix C). Total rainbow and hybrid trout biomass was slightly lower downstream of the diversion.

Adit 8 Creek

Adit 8 Creek is a small, intermittent and fishless stream that enters middle Big Creek downstream of Ely Creek (figure 3-6). SCE has a diversion on Adit 8 Creek that can be used to transfer water from Tunnel 5 to Tunnel 2 in the event of an outage at Powerhouse 2A. This diversion structure has not been used in since 1980. Adit 8 Creek has an elevation of 4,825 feet msl at the diversion and an elevation of 3,242 feet msl at the confluence with Big Creek.

Adit 8 Creek has a very steep gradient (>10 percent), boulder channel (SCE, 2003b). A substantial component of the habitat is cascade that has relatively low habitat value. The perennial reaches contain some components of more complex habitat (e.g. riffles) and some shallow pools. Canopy cover is high and there is a fair amount of spawning gravel. The creek is dry most of the year upstream of the diversion. The flow in Adit 8 Creek downstream of the diversion results from minor leakage from Tunnel 2.

Reservoirs

Florence Lake

The intake in Florence Lake is connected to Ward Tunnel, which carries water from Florence Lake and diverted flow from tributaries to the South Fork San Joaquin River. Flow from Ward Tunnel is discharged through either a Howell-Bunger valve or Portal powerhouse to Huntington Lake. The intake is near the bottom of the lake at an elevation of 7,200 feet msl. The intake is in a depth of 107 feet of water when the lake is full, and discharges relatively cool water during the summer months when the lake is thermally stratified.

There is no powerhouse or other source of turbine mortality upstream of Portal powerhouse. Therefore, Portal powerhouse represents the potential entrainment mortality for the Upper Basin, and was studied in support of the Portal Project. A large surface area at the intake structure (3,325.5 square feet) results in low approach velocities. Based on flow records at the Ward Tunnel intake (USGS gage no. 11229500) between 1982 and 2002, the maximum monthly, 50 percent exceedance value of associated intake approach velocity was 0.17 foot per second in July. Monthly 20 percent exceedance values also were far below the maximum swimming capability of juvenile trout (SCE, 2003g).

The relatively small amount of shallow habitat available in Florence Lake is indicative of the steep sides of the reservoir, typical of most alpine reservoirs. Sampling conducted in 2002 indicated there were abundant, self-sustaining populations of brown trout in Florence Lake and its tributaries. Rainbow trout were not collected in 2002. The ability to sample Florence Lake was limited during fall because of low lake level. The Ward Tunnel intake in Florence Lake was not submerged within the lake in the late fall. There was very little flow from the South Fork San Joaquin River upstream and the residual lake was located well upstream of the intake. Flow to the intake during October is through a shallow, slow moving stream and must pass over a weir to reach the intake. A hydroacoustic survey conducted in Florence Lake near the Ward Tunnel intake in August of 2002 showed that most fish were concentrated above a depth of 50 feet, and that substantially lower densities were found near the depth of the intake (invert elevation 7,220 feet msl) (SCE, 2003b). Therefore, entrainment mortality is low due to low intake velocities (less than 1 foot per second) and low density of trout near the Ward Tunnel intake (SCE, 2003g).

Shaver Lake

Shaver Lake has a relatively large amount of shallow habitat available at most reservoir elevations. Shallow, reef-like areas that become islands at lowered lake elevations are scattered around the edges of the reservoir. SCE has also constructed shallow water reefs and spawning terraces near the lake margin to provide additional habitat for smallmouth bass (SCE, 2003b).

Relatively cool water is released to Stevenson Creek during the summer when there are thermal gradients (SCE, 2004a). Water from Shaver Lake that is not released to Stevenson Creek is diverted through Tunnel 5 to Big Creek Powerhouse 2A. Powerhouse 2A has a Pelton Impulse turbine and a high head of 2,418 feet. The intake to Powerhouse 2A is at the bottom of the dam, with an invert elevation of 5,225 feet msl. If fish were entrained, the potential for turbine mortality would be high due to pressure changes alone (Franke et al., 1997).

The large surface area of the intake results in low approach velocities. Based on flow records at Powerhouse 2A near Big Creek gage (USGS gage no. 11238400) between 1982 and 2002 (discontinuous record), the maximum monthly intake approach velocity associated with the 50 percent exceedance flow was calculated to be 0.11 feet per/second in June through August (SCE, 2004a). Twenty percent exceedance values did not exceed 0.14 foot per second. These low approach velocities put this intake in the category of very low risk for vulnerability to entrainment because most trout have sustained swimming speeds of between five and seven body lengths per second (Bell, 1991).

A hydroacoustic survey conducted in July of 2002 showed fish at the dam end, which is the deepest portion of the lake, concentrated in the upper layers of the lake, above a depth of 71 feet. Low fish densities were found at greater depths near the intake, which has an invert elevation of 5,225 feet msl, was at a depth of 136 feet at the time of sampling, and is at a depth of 96.5 feet when the reservoir is at minimum pool. Another hydroacoustic survey conducted in October 2002 showed all fish at depths shallower than the intake (SCE, 2003a). Therefore, fish vulnerability to entrainment at the intake is low because calculated intake velocities are low (less than 1 foot per second) and fish presence near the intake face is low (SCE, 2004a).

Cal Fish & Game manages Shaver Lake as a put-and-take catchable rainbow trout fishery and a stock-and-grow fingerling and sub-catchable rainbow trout and kokanee fishery, and the populations of these species are largely of hatchery origin. Cal Fish & Game stocked an average of 35,383 catchable-sized rainbow trout, 26,082 fingerling rainbow trout, and 50,133 fingerling kokanee per year in Shaver Lake between 1998 and 2002. In addition, Shaver Lake supports a warmwater fishery for smallmouth bass, bluegill, and crappie.

During surveys conducted in 2002, rainbow trout comprised 37 percent, smallmouth bass comprised 27 percent, kokanee comprised 19 percent, and Sacramento sucker comprised 3 percent of the total catch. Small numbers of bluegill, crappie, unidentified centrarchids, and carp were also collected (SCE, 2003c). A hydroacoustic survey conducted in July of 2002 showed fish at the dam end, which is the deepest portion of the lake, concentrated in the upper layers of the lake, above a depth of 71 feet. Low fish densities were found at greater depths near the intake, which has an invert elevation of 5,225 feet msl, was at a depth of 136 feet at the time of sampling, and is at a depth of 96.5 feet when the reservoir is at minimum pool. Another hydroacoustic survey conducted in October 2002 showed all fish at depths shallower than the intake (SCE, 2003c; 2003e).

Huntington Lake

A relatively large amount of shallow habitat is available at most reservoir elevations (SCE, 2003b). Huntington Lake has two major intakes, the Tunnel 7 intake and the Powerhouse 1 intake. Powerhouse 1 is the only powerhouse directly connected to the intakes in Huntington Lake. The Tunnel 7 intake can divert water to Balsam Meadows forebay and Shaver Lake via North Fork Stevenson Creek.

During the summer when the lake is thermally stratified, the instream flow releases to Big Creek and diversions to Powerhouse 1 are from cool water deep in the reservoir. Powerhouse 1 has a Pelton Impulse turbine and a high head of 2,131 feet. The intake to the powerhouse is on the bottom of Huntington Lake with an invert elevation of 6,821 feet msl and the calculated approach velocities were low (SCE, 2004a). If fish were entrained to the intake, the potential for turbine mortality would be high due to pressure changes alone (Franke et al., 1997).

Based on flow records at Powerhouse 1 at Big Creek gage (USGS gage no. 11238100) between 1982 and 2002 (discontinuous record), the maximum monthly, 50 percent exceedance value of associated intake approach velocity was 0.45 foot per second in June and July. Calculated intake velocities in October were generally lower than during the summer months. Monthly 20 percent exceedance values over the period of record were near 0.5 foot per second during months of peak diversion. These calculated approach velocities indicate the intake has a low risk for vulnerability to entrainment because most trout have sustained swimming speeds of between five and seven body lengths per second (Bell, 1991). Therefore, despite the relatively large numbers of fish in the lake, fish vulnerability to entrainment at the Tunnel 1 intake is low because intake velocities are generally low (less than 1 foot per second) and fish presence near the intake face is low.

The Tunnel 7 intake is shallower than the intake to Tunnel 1 (invert elevation 6,885 feet msl) (SCE, 2004a). Hydroacoustic surveys conducted in 2002 showed that most fish were concentrated at depths shallower than the intake in June. In October, when calculated approach velocities were lower, a higher density of fish was found at depths similar to the intake. The calculated approach velocities at the Tunnel 7 intake were also low, based on flow records at the Huntington-Shaver Conduit at Huntington Lake gage (USGS gage no. 11236080) for the period between 1974 and 1983 (SCE, 2004a). The maximum, monthly intake approach velocity associated with the 50 percent exceedance flow was 0.32 foot per second in June. The 50 percent exceedance flow intake approach velocity in October was 0 foot per second. Twenty percent exceedance flow intake velocities did not exceed 0.58 foot per second. These velocities indicate that vulnerability to entrainment is also low (less than 1 foot per second). Fish entrained into Tunnel 7 from Huntington Lake to Balsam Meadows forebay would not experience turbine passage, but subsequent entrainment to the Eastwood power station intake in Balsam Meadows forebay potentially may result in turbine passage (SCE, 2004a).

Cal Fish & Game manages Huntington Lake as a put-and-take fishery for catchable rainbow trout, and as a stock-and-grow fishery for fingerling and sub-catchable rainbow trout. A stock-and-grow fishery for kokanee also is maintained. From 1998 through 2002, Cal Fish & Game stocked an average of 30,320 catchable-sized rainbow trout and 18,407 rainbow fingerlings per year, and an average of 4,103 fingerling kokanee. Huntington Lake also has a self-sustaining population of brown trout and some naturally-produced rainbow trout.

During fisheries surveys in 2002, prickly sculpin comprised 40 percent of the catch, Sacramento sucker comprised 39 percent, brown trout comprised 11 percent, and rainbow trout and kokanee comprised 5 percent each (SCE, 2003c). Mean condition factors were greater than 1 for trout and 2.94 for kokanee (see appendix C).

Balsam Meadows Forebay

Water is diverted to the forebay by the Balsam Meadows diversion conduit, a shunt of Tunnel 7 that carries water from Huntington Lake and Pitman diversion to the forebay and to North Fork Stevenson Creek. The majority of flow from Balsam Meadows forebay is routed through Eastwood power station and discharged to Shaver Lake. Eastwood power station also may operate in pumpback mode at night to supplement peak generation during the day. The water pumped from Shaver Lake passes through Eastwood power station tunnel, the same conduit that draws water from Balsam Meadows forebay. The intake has an invert elevation of 6,600 feet msl.

The Eastwood power station has a Francis reaction/pump turbine and a high head of 1,338 feet. These turbines have a lower potential for turbine mortality than Pelton Impulse turbines; however, head at this location is relatively high and potential turbine mortality would be low to high if fish were entrained due to pressure changes alone (Franke et al., 1997).

Based on flow records at the Eastwood power station between 1987 and 2002, the monthly, 50 percent exceedance value flows have associated intake approach velocities of 0.15 to 0.67 foot per second. These velocities indicate that vulnerability to entrainment would be low because most trout have sustained swimming speeds of between five and seven body lengths per second (Bell, 1991). The highest monthly value occurred in June when velocities resulting from 20 percent exceedance flows were 1.06 feet per second (June) or less. Therefore, fish vulnerability to entrainment at the intake is low to medium because intake velocities are low (less than 1 foot per second), fish presence near the intake face is low, and fish near the intake are likely to be larger adults.

The Eastwood power station intake is located on the north side of the forebay and contains suitable habitat for fish, but the shallow water habitat is limited by the small size and relatively steep shoreline (SCE, 2004a). Only a small ephemeral stream flows into the forebay. The reservoir can be thermally stratified during the summer, although thermal stratification does not occur often and does not persist.

The forebay is not currently stocked. During fisheries surveys conducted in the forebay in 2002, prickly sculpin comprised 41 percent of the catch, kokanee comprised 28 percent of the catch, and Sacramento sucker comprised 19 percent of the catch. Rainbow trout, smallmouth bass, and brown trout comprised 7, 3, and 2 percent of the catch, respectively (SCE, 2003c). Multiple age classes including younger fish were represented for most species, except for brown trout. Only age 6+ and older brown trout were identified in this location.

Mammoth Pool Reservoir

The reservoir has steep sides and shallow water habitat is relatively rare at all reservoir elevations. The amount of deep water habitat is relatively unchanged by changes in reservoir elevation.

Water from Mammoth Pool that is not released to the San Joaquin River is diverted through a water conduit, consisting of the Mammoth Pool power tunnel and a penstock that connects Mammoth Pool to Mammoth Pool powerhouse. The intakes for the Howell-Bunger valve, the fishwater turbine, and the diversion to the Mammoth Pool powerhouse are at considerable depth near the dam, where the coolest water is found during periods of thermal stratification. The intake to the Mammoth Pool powerhouse is near the bottom of the reservoir, with an invert elevation of 3,100 feet msl. The powerhouse has two Francis reaction turbines and high head of 1,100 feet. Potential turbine mortality would be low to high if fish were entrained due to pressure changes alone (Franke et al., 1997).

Based on flow records at the Mammoth Pool power plant near Big Creek (USGS gage no. 11235100) between 1982 and 2002 (discontinuous record), intake approach velocity associated with the maximum, monthly, 50 percent exceedance flow value was calculated as 0.73 foot per second in May (SCE, 2004a). Twenty percent exceedance values did not exceed 0.81 foot per second. This suggests that when fish are near the intake, vulnerability to entrainment would be low (Bell, 1991).

Very few fish were found near the powerhouse intake during hydroacoustic surveys, indicating that there is little potential for fish to encounter the intakes (SCE, 2004a). The reservoir trout population is primarily composed of larger fish (most juveniles rear in accessible tributaries) and the powerhouse intake approach velocities are well within the swimming capabilities of adult fish. Therefore, fish vulnerability to entrainment at the intake is low due to low intake velocities (less than 1 foot per second) and low fish presence near the intake face.

Cal Fish & Game manages Mammoth Pool reservoir as a put-and-take fishery for catchable rainbow trout, and as a stock-and-grow fishery for fingerling and sub-catchable rainbow trout. From 1998 to 2002, Cal Fish & Game stocked an average of 7,975 catchable-sized rainbow trout, 4,002 sub-catchable rainbow, and 12,070 rainbow fingerlings per year in Mammoth Pool reservoir (SCE, 2003c).

Mammoth Pool reservoir also supports a self-sustaining population of brown trout (SCE, 2003c). Brown trout comprised 71 percent of the fish sampled in 2002, and rainbow trout, probably of hatchery origin, comprised 29 percent (SCE, 2003c). The brown trout collected were all age 3+ or older. No other species were collected. The rainbow trout appeared to be of hatchery origin, based on physical appearance and scale analysis (SCE, 2003c).

3.3.1.2 Environmental Effects

This section discusses the effects of relicensing the Big Creek ALP Projects under the terms of the Settlement Agreement, with additional measures specified or recommended by the Forest Service or Interior. Proposed and recommended measures are discussed in the order they are presented in the Settlement Agreement.

General Streamflow Requirements

Under Settlement Agreement measure A1.1.1, SCE would maintain MIFs in the bypassed reaches downstream of project diversion dams. Instream flows would be the flows set forth below or the natural inflow into the point of diversion, whichever is less.

Rock Creek (A1.1.1.1)

All water year types

- August 1-December 31: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs[28]
- January 1-March 31: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs
- April 1-June 30: 24-hour average of 2 cfs with an instantaneous floor of 1.5 cfs
- July 1-July 31: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs

Ross Creek (A1.1.1.2)

Wet, above normal, below normal water year types

- October 1-September 30: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs

Dry, critical water year types

[28] The instantaneous flow is the flow value used to construct the average daily flow value and would be measured in time increments that SCE has proposed of at least once every 15 minutes. The 24-hour average flow is the average of the incremental readings from midnight of one day to midnight of the next day.

- July 1-November 30: Not diverting
- December 1-June 30: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs

San Joaquin River (Dam 6 to Redinger reservoir – "Stevenson Reach") (A 1.1.1.3)

All water year types

- August 1-October 31: 24-hour average of 50 cfs with an instantaneous floor of 45 cfs
- November 1-November 30: 24-hour average of 25 cfs with an instantaneous floor of 22 cfs
- December 1-February 28: 24-hour average of 20 cfs with an instantaneous floor of 18 cfs
- March 1- March 31: 24-hour average of 50 cfs with an instantaneous floor of 45 cfs
- April 1-June 30: 24-hour average of 80 cfs with an instantaneous floor of 72 cfs
- July 1-July 31: 24-hour average of 60 cfs with an instantaneous floor of 54 cfs

San Joaquin River (Mammoth Pool Dam to Dam 6) (A1.1.1.4)

All water year types

- September 1-November 30: 24-hour average of 80 cfs with an instantaneous floor of 72 cfs
- December 1-February 28: 24-hour average of 55 cfs with an instantaneous floor of 50 cfs
- March 1-March 31: 24-hour average of 80 cfs with an instantaneous floor of 72 cfs
- April 1-June 30: 24-hour average of 125 cfs with an instantaneous floor of 112 cfs
- July 1-August 31: 24-hour average of 100 cfs with an instantaneous floor of 90 cfs

Lower Stevenson Creek (A1.1.1.5)

All water year types

- October 1-March 31: 24-hour average of 5 cfs with an instantaneous floor of 4 cfs
- April 1-June 30: 24-hour average of 10 cfs with an instantaneous floor of 8 cfs
- July 1-September 30: 24-hour average of 8 cfs with an instantaneous floor of 6 cfs

Lower Balsam Creek (Diversion to Big Creek) (A1.1.1.6)

All water year types

- October 1-June 30: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs
- July 1-September 30: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs

Upper Balsam Creek (Forebay to Diversion) (A1.1.1.7)

All water year types

- July 1-March 31: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs
- April 1-June 30: 24-hour average of 2 cfs with an instantaneous floor of 1.5 cfs

Middle Big Creek (Dam 4 to Dam 5) (A1.1.1.8)

All water year types

- October 1-October 31: 24-hour average of 8 cfs with an instantaneous floor of 6 cfs
- November 1-March 31: 24-hour average of 7 cfs with an instantaneous floor of 5 cfs
- April 1-September 30: 24-hour average of 12 cfs with an instantaneous floor of 10 cfs

Lower Big Creek (Dam 5 to San Joaquin River) (A1.1.1.9)

All water year types

- October 1-October 31: 24-hour average of 8 cfs with an instantaneous floor of 6 cfs
- November 1-March 31: 24-hour average of 7 cfs with an instantaneous floor of 5 cfs
- April 1-September 30: 24-hour average of 12 cfs with an instantaneous floor of 10 cfs

Upper Big Creek (Huntington Lake to Dam 4) (A1.1.1.10)

All water year types

- October 1-March 31: 24-hour average of 2 cfs with an instantaneous floor of 1.5 cfs
- April 1-June 30: MIF release valve to be fully open
- July 1-September 30: 24-hour average of 3 cfs with an instantaneous floor of 2 cfs

Ely Creek (A1.1.1.11)

All water year types

- June 1-February 28: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs
- March 1-March 31: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs
- April 1-May 31: 24-hour average of 2 cfs with an instantaneous floor of 1.5 cfs

North Fork Stevenson Creek (A1.1.1.12)

All water year types

- October 1-September 30: The minimum release would be 12 cfs, or the flow through the instream flow valve when that valve is wide open

Pitman Creek (A1.1.1.13)

All water year types

- July 1-March 31: 24-hour average of 0.8 cfs with an instantaneous floor of 0.5 cfs
- April 1-June 30: 24-hour average of 2.5 cfs with an instantaneous floor of 2.0 cfs

Bear Creek (A1.1.1.14)

All water year types

- July 1-November 30: 24-hour average of 7 cfs with an instantaneous floor of 5 cfs
- December 1-December 31: 24-hour average of 6 cfs with an instantaneous floor of 4 cfs
- January 1-March 31: 24-hour average of 4 cfs with an instantaneous floor of 3 cfs
- April 1-Jun 30: 24-hour average of 10 cfs with an instantaneous floor of 8 cfs

Mono Creek (Downstream of Mono Diversion) (A1.1.1.15)

All water year types

- September 1-December 31: 24-hour average of 25 cfs with an instantaneous floor of 22 cfs
- January 1-March 31: 24-hour average of 18 cfs with an instantaneous floor of 16 cfs
- April 1-June 30: 24-hour average of 25 cfs with an instantaneous floor of 22 cfs

- July 1-August 31: 24-hour average of 30 cfs with an instantaneous floor of 27 cfs

South Fork San Joaquin River (A1.1.1.16)

All water year types

- October 1-October 31: 24-hour average of 30 cfs with an instantaneous floor of 27 cfs
- November 1-March 31: 24-hour average of 25 cfs with an instantaneous floor of 22 cfs
- April 1-June 30: 24-hour average of 40 cfs with an instantaneous floor of 36 cfs
- July 1-September 30: 24-hour average of 35 cfs with an instantaneous floor of 32 cfs

Bolsillo Creek (A1.1.1.17)

All water year types

- July 1-March 31: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs
- April 1-June 30: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs

Camp 61 Creek (A1.1.1.18)

Wet, above normal, below normal water year types

- October 1-March 31: 24-hour average of 2 cfs with an instantaneous floor of 1.5 cfs
- April 1-June 30: 24-hour average of 4 cfs with an instantaneous floor of 3 cfs
- July 1-September 30: 24-hour average of 3 cfs with an instantaneous floor of 2 cfs

Dry, critical water year types

- October 1-September 30: 24-hour average of 1.25 cfs with an instantaneous floor of 0.75 cfs

Camp 62 Creek (A1.1.1.19)

All water year types

- July 1-March 31: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs
- April 1-June 30: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs

Chinquapin Creek (A1.1.1.20)

All water year types

- July 1-March 31: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs
- April 1-June 30: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs

Hooper Creek (A1.1.1.22)

All water year types

- October 1-March 31: 24-hour average of 2 cfs with an instantaneous floor of 1.5 cfs
- April 1-June 30: 24-hour average of 4 cfs with an instantaneous floor of 3 cfs
- July 1-September 30: 24-hour average of 3 cfs with an instantaneous floor of 2 cfs

Crater Creek (A1.1.1.21), North Slide Creek (A1.1.1.23), South Slide Creek (A1.1.1.24), and *Tombstone Creek (A1.1.1.25)*

All water year types

- Removed from service

Other Recommendations

The Forest Service filed a 4(e) condition and Interior filed a 10(j) recommendation for all the Big Creek ALP Projects that are consistent with Settlement Agreement measure A1.1.1, General Instream Flow Requirements. For Big Creek Nos. 1 and 2, the Forest Service also filed a 4(e) condition and Interior filed a 10(j) recommendation that suggest that Adit 8 and Rancheria creeks be removed from license.

Our Analysis

In this section, we evaluate the effects of MIF provisions included in Settlement Agreement measure A1.1.1 for each reach, based on fish population and habitat assessments conducted by SCE and presented in the amended PDEA (SCE, 2007a). Many bypassed reaches were naturally fishless, but most currently support self-sustaining populations of introduced rainbow, brown, and/or brook trout. The results of SCE's fisheries surveys, conducted in coordination with the Combined Aquatics Working Group, found that fish condition factors in bypassed reaches were consistently greater than or equal to 1 (see appendix C), indicating that stream productivity is generally not a limiting factor. In a number of reaches, a lack of high quality spawning gravel and LWD was observed, which may be attributed to trapped materials in project reservoirs. A scarcity of these features may limit trout productivity and recruitment. Proposed and recommended measures designed to address these factors are discussed in sections 3.3.1.2, *Sediment Management and Large Wood Debris Management*.

In some of the project reaches, low flows from project operations create barriers to fish passage, limit available fish habitat, reduce DO levels, and contribute to daily mean and maximum water temperatures that exceed optimal levels for trout growth. The objectives of the Basin Plan (CVRWQCB, 1998) include maintaining temperatures that do not impair beneficial uses and limiting thermal warming to ≤2.8 ºC above the natural receiving water temperature. The Water Board considers temperatures needed to protect cold freshwater habitat to be met when daily mean water temperatures are 20ºC or less and daily maximum temperatures are 22ºC or less. These conditions are considered sufficient to protect the beneficial use (J. Canaday, Water Board, cited from SCE, 2007a, attachment C). A review of water temperature requirements of Central Valley rainbow trout included in the amended PDEA supported a conclusion that daily mean summer water temperatures of 20ºC or less would be suitable for rainbow trout growth. The review also indicated that the incipient upper lethal temperature for rainbow trout is in the range of 25 to 30ºC. Moyle (2002) reports preferred temperatures ranges of 12 to 20ºC for brown trout and 14 to 19 ºC for brook trout. He also reports that brown trout can survive for short periods of time at temperatures up to 28 to 29°C, and that brook trout can survive at temperatures of up to 26°C, but that growth is poor at temperatures much above 19°C.

Water temperature data collected by SCE in 2000 and 2001 indicated that the 20ºC daily average and ≤2.8ºC thermal warming criteria were only rarely exceeded in 2000, but that the thermal warming and the daily mean temperature criteria were frequently exceeded in 2001 in (1) Mammoth Pool reach; (2) Ross and Rock creek bypassed reaches; and (3) Big Creek bypassed reach upstream of Balsam Creek (table 3-8). Although condition factors indicated that thermal stress was not having a pronounced adverse effect on trout growth rates in most reaches, it is likely that maintaining mean daily water temperatures ≤20ºC would improve trout growth and survival.

The bypassed reaches have numerous barriers to upstream fish migration, including some natural barriers (e.g., waterfalls and cascades) that may be passable at higher flows (SCE, 2003d). Natural seasonal runoff conditions affect passage of migrating fish, particularly prior to or during spawning periods. Native rainbow trout spawning migrations occur in April through June during the spring runoff period, and therefore are less likely to be affected by flow-related passage barriers than brown and brook trout, which spawn in the fall, during low flow conditions.

The proposed increases in MIFs would generally meet the Forest Service's aquatic management goals, objectives, and direction and Interior's general resource objectives for improving aquatic habitat and conserving aquatic species. They would also improve compliance with the Basin Plan objectives for coldwater beneficial uses in many of the bypassed reaches by decreasing the prevailing seasonal water temperatures. The environmental effects of the proposed MIFs in specific bypassed reaches (table 3-9), and attainment of the Forest Service and Interior's specific resource objectives (SROs), are discussed below. The Forest Service and Interior identified SROs for the project reaches with the specified and recommended terms and conditions they filed for each project. Identification of both daily average and instantaneous minimum flows, as SCE does for most reaches, would provide some allowance for variations in the accuracy of flow releases and measurements, while avoiding the potential for adverse effects from large variations in flow.

Table 3-9. Miles of project stream affected by the proposed MIFs. (Source: SCE, 2007, PDEA table 5.2.3-1)

Bypassed Stream Reach	Miles of Increased MIF	Reaches with Temperatures >20ºC
Rock Creek	0.4	0.4
Ross Creek	0.85	0.85
San Joaquin River Stevenson reach	5.7	5.7
San Joaquin River Mammoth reach	8.4	8.4
Stevenson Creek	4.3	
Lower Balsam Creek	0.74	
Upper Balsam	2.05	
Middle Big Creek	4.3	
Lower Big Creek	1.65	1.65
Upper Big Creek	3.6	3.6
Ely Creek	1.0	
North Fork Stevenson Creek	3.6	
Pitman Creek	1.5	
Bear Creek	1.6	
Mono Creek	5.8	
South Fork San Joaquin River	28.0	28.0
Bolsillo Creek	1.6	
Camp 61 Creek	2.0	
Camp 62 Creek	1.35	
Chinquapin Creek	0.9	

Bypassed Stream Reach	Miles of Increased MIF	Reaches with Temperatures >20ºC
Crater Creek	2.85	
Crater Creek Diversion Channel	1.38	
Hooper Creek	0.6	
North Slide Creek	0.3	
South Slide Creek	0.3	
Tombstone Creek	1.0	
Total Stream Miles	**85.77**	**48.60**

Rock Creek (A1.1.1.1)[29]

Historically, Rock Creek was most likely fishless, due to steep stream gradients (>20 percent), and three waterfalls that form a complete barrier to fish migration at all flows (two of them are located only several hundred feet upstream of the confluence with the San Joaquin River) that prevent the upstream migration of fish from the San Joaquin River. Rainbow, brown, and brook trout have been planted in Rock Creek in the past, and Cal Fish & Game continues to stock rainbow trout. The fishery downstream of the diversion dam has less fish density, biomass, and habitat compared to upstream of the dam. Recruitment to early life stages appears to be limited both upstream and downstream of the dam. Habitat downstream of the dam is limited by topography, lack of spawning sites (no spawning gravel observed), and low flow. A large segment (37 percent; about 1,000 feet) of the reach downstream of the diversion was not surveyed because of difficult access and safety concerns. This section is dominated by cascades and waterfalls.

There is no MIF requirement for the Rock Creek bypassed reach under the current license and it is probable that the magnitude of peak flows has decreased substantially because of diversions during the spring. Daily mean and maximum water temperatures measured in 2000 and 2001 were >20ºC in the bypassed reach in the summer and early fall months. Excessive thermal warming (>2.8ºC) occurred downstream of the dam (see table 3-8), which was likely attributable to project operations, although air temperatures were also warmer than normal during much of the monitoring period in both years. Review of modeled data for mid-August to mid-September indicates that the unregulated 30-day minimum flow was about 0.1 cfs.

[29] The bypassed reaches downstream of project diversion dams are discussed in the order in which they appear in the Settlement Agreement.

Although the Forest Service did not provide SROs for Rock Creek, it did state that increased flows from Rock Creek may assist with providing cooler water temperatures in Mammoth reach. Interior contends there are no fish in Rock Creek downstream of FS Road No. 4S81. Interior's applicable fisheries SROs for Rock Creek bypassed reach are listed below.[30]

- Provide a MIF in Rock Creek bypassed reach that is greater than the 30-day minimum flow.
- Improve habitat for trout species in terms of water temperature and flow.
- Emphasize habitat improvements for harvest species.

There is currently no MIF for Rock Creek. The proposed MIF of 0.5 to 2 cfs (24-hour average) and 0.35 to 1.5 cfs (instantaneous), depending on water year type and season, would be substantially higher than the unregulated 30-day minimum flow (0.1 cfs). The proposed MIF would reduce thermal warming in 0.4 mile of stream (see table 3-9),consistent with Interior's SRO to emphasize habitat improvements for harvest species (hatchery rainbow trout, naturally reproducing rainbow, and brown trout). A weighted usable area (WUA[31]) analysis was not completed for this reach due to extremely low amounts of riffle habitat. However, the proposed MIFs would provide year-round wetted habitat, and increase habitat connectivity and pool depths. The proposed MIFs would have little effect on existing spawning habitat, recruitment, and productivity that are naturally limited due to steep gradients and lack of spawning gravel.

Ross Creek (A1.1.1.2)

Ross Creek was historically fishless due to steep stream gradients (>20 percent) that prevent the upstream migration of fish from the San Joaquin River. Rainbow and brown trout have been planted in Ross Creek, and both species are reported to persist, although fish populations were not sampled by SCE because the reach was dry in 2002 when sampling occurred.

There is no MIF requirement for the Ross Creek bypassed reach under the current license, and Ross Creek is dry upstream and downstream of the diversion during most of the summer and fall, due in part to an upstream non-project diversion. The synthetic unregulated hydrograph also indicates a 30-day minimum of 0 cfs between mid-August to mid-September. Daily mean and maximum water temperatures were >20ºC in the bypassed reach during the summer and early fall months of 2000 and 2001, and excessive thermal warming (>2.8ºC) occurred downstream of the dam (table 3-8).

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[30] Interior's additional SROs for Rock Creek pertain to western pond turtle habitat.

[31] WUA is an index of fish habitat generated by the Physical Habitat Simulation Model (PHABSIM).

Although the Forest Service did not provide SROs for Ross Creek, it did state that increased flows from tributary streams may assist with providing cooler water temperatures in the Mammoth reach. Interior contends there are no fish in Ross Creek downstream of FS Road No. 4S81. Interior's only fisheries SROs for Ross Creek are to provide an MIF that is greater than the 30-day minimum flow and to emphasize habitat improvements for harvest species.[32]

The proposed MIF of 0.5 cfs (24-hour average) and 0.35 cfs (instantaneous) except July through November of critically dry water years (not diverting) is higher than the unregulated 30-day minimum flow (0 cfs) and would reduce thermal warming in 0.85 mile of Ross Creek (see table 3-9) and in the lower 4 miles of the Mammoth reach (the San Joaquin River from Mammoth Pool dam to Dam 6) (A1.1.1.4)

Stevenson Reach (the San Joaquin River from Dam 6 to Redinger) (A1.1.1.3)

All fish species found in the Stevenson reach were in good condition (see appendix C); however, the fish communities differed between the upper and lower portions of the reach. The upper portion of the reach was dominated by Sacramento sucker, but also included smaller numbers of rainbow and brown trout, Sacramento pikeminnow, and prickly sculpin. The lower portion of the reach supported more species associated with the native transition zone fish community including Sacramento pikeminnow, hardhead, and Sacramento sucker, with almost no trout.

The native transition zone species found in the Stevenson reach are also found in Redinger reservoir, and it is likely adults of these species spawn in the Stevenson reach and then return to the lake after spawning. Interior reports that hardhead numbers, particularly adults, were lower in this reach than in other locations in the system where they occur.

Indicators of hydraulic alteration (IHA)[33] analysis estimates the 30-day minimum unregulated flow during dry water years was 69 cfs and during wet water years was 192 cfs. The current year-round MIF for the Stevenson bypassed reach is 3 cfs (see tables 3-1 and 3-2), indicating the current flow regime is substantially lower than historic drought conditions. Daily mean water temperatures were >20ºC and exceeded Basin Plan objectives during the summer and early fall months of 2000 and 2001.

SCE's studies indicated that the difference in fish communities between the Upper and Lower Stevenson reach was largely due to differences in water temperatures (SCE, 2003f). Cool water released from Dam 6 resulted in daily maximum water temperatures ≤20ºC in the upper end of the Stevenson reach in 2000 and 2001 (see table 3-8).

[32] Interior's additional SROs for Ross Creek pertain to western pond turtle habitat.

[33] IHA is an analysis technique that evaluates the effect of a project on flow levels and recurrence intervals.

Water temperatures increased rapidly downstream to the next monitoring site just upstream of the Stevenson Creek confluence. Summer daily mean temperatures were >20ºC at this site in both 2000 and 2001 (see table 3-8). Inflow from Stevenson Creek and the Powerhouse 3 tailrace provide relatively cool water to the lower section of the Stevenson reach in the summer months (see table 3-8).

Summer water temperatures in the reach are frequently above the optimal ranges for rainbow and brown trout, but are close to or within the reported optimal ranges identified for hardhead.[34] Water temperatures near the Big Creek Powerhouse 3 tailrace were generally more favorable for trout growth than temperatures in the lowermost portion of the Stevenson reach, which were more suitable for hardhead.

Forest Service and Interior's SROs for the Stevenson reach are as follows.

- Provide cooler water temperatures during July and August.
- Provide more habitat for hardhead and Sacramento pikeminnow.
- Provide more habitat for adult rainbow and brown trout.

The proposed MIF would range seasonally[35] from 20 to 80 cfs (24-hour average) and 18 to 72 cfs (instantaneous). The proposed MIF also would increase the physical habitat (WUA) that is available for all life stages of rainbow and brown trout, Sacramento pikeminnow, and adult hardhead in Stevenson reach. The existing adult rainbow trout habitat under the current MIF is 44 percent WUA[36] and brown trout habitat is 56 percent WUA during normal and dry water years. The proposed MIF would increase adult rainbow trout habitat to 75 to 84 percent WUA and brown trout habitat to 86 to 93 percent WUA during the spring and summer months (April through September) when habitat is most likely limiting trout production.

The existing rainbow and brown trout spawning habitat is 18 and 15 percent WUA, respectively. The proposed MIF would increase rainbow trout spawning habitat to 100 percent WUA and brown trout spawning habitat to 72 to 91 percent WUA.

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[34] Moyle (2002) notes hardhead prefer water temperature 24 to 28°C. Preliminary work by Cech suggests that adult hardhead acclimated to water temperatures below 20°C prefer temperatures at or above 20°C (J. Cech, University of California at Davis, personal communication 2006, cited in SCE, 2007c).

[35] Proposed MIFs in some reaches vary by season and water year type. For specific MIFs proposed for each season and water year type, refer to the comprehensive listing of proposed MIF requirements provided at the beginning of this section.

[36] WUA percentages presented in this EIS are the percentage of the maximum WUA over the entire range of flows that were modeled.

The existing adult hardhead habitat is 58 percent WUA; juvenile hardhead habitat is 78 percent. The proposed MIF would increase adult hardhead habitat to 70 to 87 percent WUA and juvenile hardhead habitat to 90 to 100 percent WUA.

The existing adult Sacramento sucker habitat is 48 percent WUA; juvenile Sacramento sucker habitat is 90 percent. The proposed MIF would increase adult Sacramento sucker habitat to 61 to 81 percent WUA, and juvenile Sacramento sucker habitat to 95 to 100 percent WUA.

The existing adult Sacramento pikeminnow habitat is 76 percent WUA; juvenile Sacramento pikeminnow habitat is 90 percent. The proposed MIF would increase adult Sacramento pikeminnow habitat to 90 to 100 percent WUA and juvenile Sacramento pikeminnow habitat to 94 to 100 percent WUA.

Increased flow should also provide a more consistent water temperature regime that would benefit all trout life stages and reduce thermal warming in 5.7 miles of stream (see table 3-9). Although increased flows may contribute to water temperatures that are lower than optimal for hardhead growth, reduced daily fluctuations may be beneficial to this species as well. Water temperature monitoring would determine if the proposed MIFs bring Stevenson reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*). Fish monitoring would determine if the Stevenson reach is an important transitional zone habitat and whether it would be more appropriately classified as warmwater habitat (see section 3.3.1.2, *Fish Monitoring*).

Mammoth Reach (the San Joaquin River from Mammoth Pool Dam to Dam 6) (A1.1.1.4)

Mammoth reach currently supports self-sustaining populations of Sacramento sucker, rainbow and brown trout. Recruitment appears to be occurring, but there are low numbers of young trout.

The current MIFs range seasonally and by water year from 10 to 30 cfs (tables 3-1 and 3-2) and are substantially lower than historic drought conditions (30-day minimum flow 67 cfs). Temperature monitoring conducted by SCE indicated that daily mean and maximum water temperatures upstream of Ross Creek exceeded 20ºC in 23 days in 2001, and excessive thermal warming (>2.8 ºC) occurred during the summer and early fall months of 2001 (see table 3-8).

Forest Service and Interior's SROs for Mammoth reach are as follows.

- Ensure that the MIF in Mammoth reach is sufficient to enhance trout life stages and maintain adult trout populations (≥ 6 inches in length) where a coldwater fishery is the designated beneficial use and surveys indicate the presence of trout (Interior).

- Enhance habitat in Mammoth reach. Provide 80 percent of maximum WUA for spawning and 90 percent of maximum WUA for adult trout during the summer (Interior). Provide 95 percent of maximum summer WUA for adult rainbow and brown trout (Forest Service).
- Ensure that the MIF in Mammoth reach is sufficient to maintain preferable stream temperatures defined as mean daily temperature of 17ºC and daily maximum of ≤20ºC from May 1 through October 31 in stream reaches where a coldwater fishery is the designated beneficial use (Interior).
- Ensure that the MIF in Mammoth reach during July and August is no lower than the 30-day minimum flow identified for the reach by IHA analysis (Interior).
- Provide cooler water temperatures within Mammoth reach during July and August.
- Provide more spawning gravels within Mammoth reach.

The proposed MIFs, which range seasonally from 55 to 125 cfs (24-hour average) and from 50 to 112 cfs (instantaneous) would reduce thermal warming in 8.4 miles of stream and provide cooler water temperatures in July and August (see table 3-9). However, the proposed MIF would be lower than 30-day unregulated minimum flows (67 cfs in dry water years and 182 cfs in wet water years) in July and August. Water temperature monitoring would determine if the proposed MIF for Mammoth reach complies with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

The existing adult rainbow trout spring-summer habitat (April through September) in Mammoth reach, under current flows, is 53 to 70 percent WUA, and adult brown trout is 69 to 84 percent WUA during normal and dry water years. The proposed MIF would increase adult rainbow trout habitat to 89 to 95 percent WUA and adult brown trout to 98 to 100 percent during the spring and summer months when habitat is most likely limiting trout production. These increases essentially would meet the Forest Service and Interior's SROs to provide 90 to 95 percent maximum summer WUA for adult trout.

The existing rainbow trout spawning habitat is 22 to 38 percent WUA, under current flows; brown trout spawning habitat is 26 to 40 percent. The proposed MIF would increase rainbow trout spawning habitat to 63 percent and brown trout spawning habitat to 60 to 66 percent WUA. The proposed MIF substantially would increase spawning habitat for rainbow and brown trout, although it would not meet the Forest Service and Interior's SROs to provide 80 percent of maximum spawning habitat for rainbow and brown trout.

Fish monitoring would determine if trout life stages are enhanced and adult trout populations (≥ 6 inches in length) are maintained where a coldwater fishery is the designated beneficial use and surveys indicate the presence of trout in the Mammoth reach (see section 3.3.1.2, *Fish Monitoring*).

The need for spawning gravel supplementation within the Mammoth reach is discussed later in this section, in *Sediment Management, Mammoth Pool*, and addressed again in the staff alternative (see section 5.2.4, *Comprehensive Development and Recommended Alternative, Mammoth Pool Project*).

Stevenson Creek (A1.1.1.5)

Stevenson Creek bypassed reach supports a self-sustaining rainbow trout fishery despite the presence of an estimated 13 natural barriers to upstream fish migration. Current flows are greater during summer and early fall than the 30-day historic drought conditions as a result of minimum flows released from Shaver Lake. Cold water is released when Shaver Lake stratifies in summer. By the end of summer, when the lake begins to lose its thermal stratification, warmer mixed water is released. Summer water temperatures are within the desired range for rainbow trout.

Mean daily water temperatures were ≤20ºC in 2000 and 2001, although thermal heating >2.8ºC occurred during early fall (see table 3-8). Water warms over the length of the reach during summer months and then cools starting in October.

The MIF requirement under the current license is 2 to 3 cfs, which provides less than 50 percent of the maximum WUA for adult rainbow trout. The instream flow transect data indicates that 5 to 6 cfs is necessary for fish passage where passage is not restricted by total barriers.

Forest Service and Interior's SROs for Stevenson Creek bypassed reach are as follows.

- Provide more spawning and adult habitat for rainbow trout.
- Provide for fish passage.
- Provide a sufficient MIF such that water temperatures do not exceed 2.8ºC thermal warming through the reach during the summer and fall.

The proposed MIF of 5 to 10 cfs (24-hour average) and 4 to 8 cfs (instantaneous) would be substantially larger than the 30-day unregulated minimum flow (0.2 dry water years and 0.8 wet water years). The proposed MIFs would also reduce thermal warming in 4.3 miles of stream (see table 3-9), and maintain consistency with water temperature objectives in the Basin Plan. Water temperature monitoring would determine if the proposed MIFs for Stevenson Creek reach comply with Basin Plan objectives for coldwater beneficial uses (section 3.3.1.2, *Temperature Monitoring and Management*).

The proposed MIF would increase adult rainbow trout spring-summer habitat (April through September) from an existing condition of 41 percent WUA to 64 to 71 percent WUA during normal and dry water years. Rainbow trout spawning habitat would increase from 18 to 88 percent WUA. The proposed April 1 to June 30 MIF of 10 cfs (24-hour average) would also improve passage during spawning.

DO concentrations that did not meet the state water quality objectives occurred in Stevenson Creek bypassed reach in 2002 (SCE, 2003h). Increased MIFs would lower instream water temperatures and increase DO concentrations in this reach. Implementation of the proposed *Temperature Monitoring and Management Plan* in appendix H of the Settlement Agreement would help determine if the water temperature and the related DO levels associated with the proposed flow increases meet Basin Plan DO objectives (see section 3.3.1.2, *Temperature Monitoring and Management*).

Lower Balsam Creek (Diversion to Big Creek) (A1.1.1.6) and Upper Balsam Creek (Forebay to Diversion) (A1.1.1.7)

Upper Balsam Creek bypassed reach has a self-supporting rainbow trout population that offers a better fishing opportunity than Lower Balsam Creek bypassed reach. Only one rainbow trout was collected in Lower Balsam Creek bypassed reach during sampling conducted in 2002. Ten natural barriers to upstream migration, including a 27-foot waterfall, 0.02 mile upstream of the reach's confluence with Big Creek, prevent upstream recruitment of fish from Big Creek and fragment fish habitat in this small creek. Steep stream gradients and a small amount of spawning gravel (4 percent) also limit trout populations in both bypassed reaches (SCE, 2003b).

There is no MIF release requirement downstream of the diversion in the current license, and there is little or no instream flow in Lower Balsam Creek bypassed reach other than leakage or seasonal overflow at the Lower Balsam Creek diversion. Water temperatures measured in the upper bypassed reach did not exceed Basin Plan objectives. Daily mean water temperatures in the lower bypassed reach exceeded 18°C for only three days in 2002, although excessive thermal warming (>2.8°C) did occur (see table 3-8). Daily maximum water temperatures in the lower bypassed reach were <22°C.

Forest Service and Interior's SROs for Upper and Lower Balsam Creek bypassed reaches follow. The SROs apply mainly to Upper Balsam Creek, which has more consistent instream flows than Lower Balsam Creek.

- Provide a MIF.
- Improve spawning habitat for rainbow trout during spring.
- Provide more habitat and fish passage for adults during the remainder of the year.
- Provide a higher flow during the spring and summer to correspond with expected peak flows that would occur if the project were not in place and to provide cold water to assist cooling of Middle Big Creek (Forest Service).

The current MIF in Upper Balsam Creek downstream of the forebay is 0.5 cfs from October through May and 1 cfs from June through September. Lower Balsam

Creek does not have an MIF. Upper Balsam Creek would have a proposed 1 to 2 cfs MIF (24-hour average) all year and Lower Balsam Creek would have a proposed 0.5 to 1 cfs MIF (24-hour average) all year. No IHA or WUA analyses were done for the Upper or Lower Balsam Creek bypassed reaches; however, the proposed MIFs would improve fish passage and likely provide more spawning and adult habitat for rainbow trout.

The proposed MIF would also decrease thermal warming in 2.75 miles of stream (see table 3-9). Water temperature monitoring would determine if the proposed Balsam Creek MIF helps to decrease water temperature in Middle Big Creek (see section 3.3.1.2, *Temperature Monitoring and Management*).

Middle Big Creek (Dam 4 to Dam 5) (A1.1.1.8)

Middle Big Creek bypassed reach has a self-sustaining fishery for rainbow and brown trout; however, recruitment seems to be limited and populations of all life stages appear to be very low.

Water temperatures were suitable for trout growth in the upper portion of the bypassed reach. However, mean daily temperatures in some sections of the bypassed reach were >20°C; particularly during summer months in 2001 (see table 3-8). Summer water temperatures upstream of the confluence with Balsam Creek (1 mile downstream of Dam 4) were often >20ºC, and occasionally reached stressful levels in 2001. Thermal warming in excess of 2.8 ºC occurred.

Water temperatures upstream of Powerhouse 2/2A reflected the influence of cooler inflows from Balsam and Ely creeks. Cool inflows from Balsam and Ely creeks were beneficial when they were present and temperatures in Middle Big Creek upstream of Powerhouse 2/2A were cooler than upstream of Balsam Creek (see table 3-8).

There is no MIF for Middle Big Creek in the current license; the only flow into this reach is provided from leakage at Dam 4 (estimated at less than 1 cfs), local runoff, and tributary inflows. The results of SCE's instream flow studies indicated that 1.75 cfs would be necessary for fish passage (where passage is not restricted by total barriers), and would also provide increased habitat.

Forest Service and Interior's SROs for Middle Big Creek bypassed reach are as follows.

- Provide a new MIF to enhance fish habitat.
- Reduce effects of thermal warming within the bypassed reach due to project operations.
- Provide more habitat for adult rainbow trout.
- Provide enhanced flow during spawning periods for both rainbow and brown trout.

The proposed MIFs, which range seasonally from 7 to 12 cfs (24-hour average) and 5-10 cfs (instantaneous), would be substantially higher than the 30-day minimum unregulated flow that was less than 1 cfs in dry water years and approximately 4 cfs in wet water years. The proposed MIF would also enhance fish habitat and provide more adult rainbow trout habitat. The existing adult rainbow trout spring-summer habitat (April through September) in the Middle Big Creek reach is 18 percent WUA, and adult brown trout is 29 percent WUA during normal and dry water years. The proposed MIF would increase adult rainbow trout habitat to 54 percent WUA and adult brown trout to 76 WUA percent during the spring and summer months when habitat is most likely limiting trout production.

The existing rainbow trout spawning habitat is 4 percent WUA and brown trout spawning habitat is 13 percent WUA. The proposed MIF would increase rainbow trout spawning habitat to 87 percent WUA and brown trout spawning habitat to 83 to 89 percent WUA. The proposed MIFs would also exceed the 1.75 cfs that SCE flow studies determined would be necessary for fish passage during trout spawning periods.

The proposed MIF would also reduce thermal warming in 4.3 miles of stream (see table 3-9). Water temperature monitoring would determine if the proposed Middle Big Creek, Pitman Creek, Balsam Creek, and Ely Creek MIFs bring Middle Big Creek bypassed reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

Lower Big Creek (Dam 5 to San Joaquin River) (A1.1.1.9)

Lower Big Creek bypassed reach supports a self-sustaining fishery for brown and rainbow trout. Recruitment seems to be occurring, although less successfully in the upstream, higher gradient portion of the reach. A vertical waterfall 475 feet upstream from its confluence the San Joaquin River prevents upstream passage and recruitment from downstream areas. There are numerous other natural passage barriers that prevent upstream migration under some flow conditions. Trout density per acre is high, which may be an indication of overcrowding in the limited amount of accessible habitat. Overwintering habitat may also be an issue in dry water years due to low flows and the dominance of shallow habitats.

Water temperatures in Lower Big Creek bypassed reach directly downstream of Dam 5 are affected by releases of cooler water from Powerhouse 2/2A. Water temperatures were <20ºC in the upper portion of the bypassed reach, but sometimes exceeded 20ºC during summer low flows in the lower end of the reach (see table 3-8).

The current MIF (2 to 3 cfs) is higher than the 30-day unregulated minimum flows during dry water years (0.9 cfs) and slightly lower during wet water years (3.7 cfs). The instream flow transect data indicate that 1.5 to 3.5 cfs is necessary for fish passage, where passage is not restricted by total barriers.

Forest Service and Interior's SROs for Lower Big Creek bypassed reach are as follows:

- Provide more habitat for adult rainbow and brown trout.
- Provide MIFs sufficient to maintain water temperatures within the desired range for coldwater trout species.

The proposed MIFs, which range seasonally from 7 to 12 cfs (24-hour average) and 5 to 10 cfs (instantaneous), would be substantially higher than the historic 30-day unregulated minimum flow (0.9 to 3.7 cfs) and the existing MIF (2 to 3 cfs). The proposed MIF would provide more adult trout habitat and fish passage where passage is not restricted by total barriers. The existing adult rainbow and brown trout spring-summer habitat (April through September) in the Lower Big Creek bypassed reach are 46 to 50 percent WUA and 63 to 67 percent WUA, respectively during normal and dry water years. The proposed MIF would increase adult rainbow trout habitat to 73 percent WUA and adult brown trout habitat to 89 percent WUA during the spring and summer months when habitat is most likely limiting trout production.

The existing rainbow trout spawning habitat is 24 to 34 percent WUA and brown trout spawning habitat is 28 to 55 percent WUA. The proposed MIF would increase rainbow trout spawning habitat to 90 percent WUA and brown trout spawning habitat to 83 to 88 percent WUA.

The proposed MIF would also reduce thermal warming in 1.65 miles of stream (see table 3-9) to help meet Basin Plan objectives for coldwater beneficial uses. Water temperature monitoring would determine if the proposed MIFs bring Lower Big Creek bypassed reach into consistency with the Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

Upper Big Creek (Huntington Lake to Dam 4) (A 1.1.1.10)

Upper Big Creek bypassed reach has self-sustaining populations of brown trout and prickly sculpin. The brown trout population is dominated by adult fish, indicating limited recruitment. Channel morphology and a reduction in habitat due to current MIFs are the probable causal factors.

Releases from the deep strata of Huntington Lake to Upper Big Creek bypassed reach are very cool for most of the summer; but water temperatures warm downstream of the release point (SCE, 2003f). In September and October when the lake mixes, release temperatures are warmer but are still relatively cool, and temperatures cool over the length of the bypassed reach.

Air temperatures heavily influence water temperatures in this reach. Water temperatures were ≤20°C in 2000 and 2001; however, some excessive thermal warming (>2.8ºC) occurred in the lower sections of the bypassed reach (see table 3-8). There is no winter MIF requirement in Upper Big Creek bypassed reach under the current license although SCE releases some flow during that period. A 2 cfs MIF is required the rest of the year. The existing MIF (0 to 2 cfs) is less than the historic 30-day unregulated minimum flow, which ranged from 0.4 to 3.5 cfs in dry and wet water years, respectively.

Historic bankfull flows would have exceeded 800 cfs, while existing bankfull flows are only 6.1 cfs due to constriction of the stream channel caused by substantial reduction from historic flow levels. As a result, the stream rarely overtops its original banks and is constrained to a much narrower low-flow channel.

Forest Service and Interior's SROs for Upper Big Creek bypassed reach are as follows.

- Provide a new year-round MIF.
- Provide spawning passage for brown trout.
- Contribute to spring runoff in Upper Big Creek bypassed reach to provide environmental cues for the aquatic and riparian ecosystem.
- Contribute to spring runoff in Upper Big Creek bypassed reach to provide channel maintenance and sediment transport (Forest Service).

The proposed MIF (2 to 5 cfs) typically would be higher than the 30-day unregulated minimum flow (0.4 to 3.5 cfs). The April 1 to June 30 MIF (release valve fully open) would improve the amount and quality of trout rearing habitat and meet Interior's 10(j) recommendation for a 5-cfs MIF (the current capacity of the Huntington Lake MIF pipe) during this period. The increased MIF would also improve environmental cues, channel maintenance, and sediment transport in the Upper Big Creek bypassed reach.

Fish passage was not evaluated, but fish population monitoring would determine whether the proposed MIFs are sufficient to improve passage during brown trout spawning migrations and increase recruitment (see section 3.3.1.2, *Fish Monitoring*).

Ely Creek (A1.1.1.11)

Rainbow trout and rainbow x golden trout hybrid occur in Ely Creek bypassed reach. The rainbow trout density was higher and biomass was lower downstream of the diversion dam compared to the reference populations upstream of the dam (see appendix C). There are no hybrid trout upstream of the diversion. The channel morphology naturally limits trout populations, and a lack of MIF also reduces trout habitat and restricts trout spawning migrations.

There is no MIF requirement for Ely Creek. The bypassed reach has little or no instream flow other than leakage or seasonal overflow at the dam, and intermittent flow may occur in some years. The diversion was not in operation during 2000 and 2001 when water temperature monitoring was conducted. Water temperatures appeared suitable for trout (≤20ºC) and there was no excessive warming downstream of the dam (see table 3-8).

Forest Service and Interior's SROs for Ely Creek bypassed reach are as follows.

- Provide a MIF.
- Provide better spawning passage for rainbow trout.
- Contribute to spring runoff in Middle Big Creek bypassed reach to provide channel maintenance, sediment transport, and environmental cues for aquatic and riparian ecosystem.

IHA and WUA analyses were not done for the Ely Creek bypassed reach. However, a wetted perimeter analysis was completed which indicated that the amount of wetted streambed increased most rapidly as flows increased up to 0.5 cfs, indicating that the proposed MIF of 0.5 to 2 cfs (24-hour average) would improve habitat conditions and invertebrate production in Ely Creek downstream of the diversion. In addition, increased flows also would contribute to environmental cues downstream in Middle Big Creek bypassed reach.

The proposed MIF would also reduce thermal warming in 1 mile of Ely Creek bypassed reach (see table 3-9). Water temperature monitoring would determine if the proposed Ely Creek MIF cumulatively helps bring Middle Big Creek bypassed reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

North Fork Stevenson Creek (A1.1.1.12)

North Fork Stevenson Creek has self-sustaining rainbow, rainbow x golden hybrid, and brown trout fisheries. The stream is only accessible to fish from Shaver Lake when the reservoir is at maximum elevation. There is a complete upstream migration barrier 457 feet upstream from the lake. Trout population densities are low, and habitat and recruitment are limited in the steeper stream segments. There are small amounts of fair to good quality spawning gravels in the bypassed reach.

Prior to the construction of Eastwood power station, this reach was used to transport water to Shaver Lake. The current stream channel was severely altered and is oversized as a result of much higher flows that were released from Tunnel 7 prior to completion of the Eastwood portion of the project.

Natural flow in North Fork Stevenson Creek bypassed reach is augmented by instream flow releases from Tunnel 7, so that inflow from Huntington Lake controls water temperatures in the bypassed reach downstream from the tunnel outlet. Meteorological conditions have more influence on water temperature near the confluence with Shaver Lake (SCE, 2003f). As a result of exposure to warm air temperatures, water temperatures are warmer from May through August near Shaver Lake than they are below the Tunnel 7 outlet, while cooling occurs later in the season, starting between mid-August and mid-September. Average daily water temperatures in North Fork Stevenson Creek bypassed reach were <20ºC in 2000 and 2001 (SCE, 2003f).

IHA analysis was not done for the North Fork Stevenson Creek bypassed reach; however, review of the unregulated historic data indicates the current MIF (5 cfs) is greater than the 30-day historic low flows. The current flows are greater during the summer and early fall than the historic unregulated conditions. The modeled unregulated data indicates that 30-day minimum flows would have been less than 0.1 cfs historically.

Forest Service and Interior's SROs for North Fork Stevenson Creek bypassed reach are as follows.

- Provide a MIF that provides more habitat for adult rainbow trout.
- Provide a MIF that occupies the oversized channel that was created by past project operations.

The proposed MIF (12 cfs year-round, or flow with the instream flow valve wide open) would be substantially larger than the historic unregulated 30-day minimum flow (<0.1 cfs). The proposed MIF would also increase the existing adult rainbow trout habitat from 41 to 47 percent WUA to 68 percent WUA and the adult brown trout habitat from 58 to 65 percent WUA to 85 percent WUA, respectively, during the spring and summer months (April through September) of normal and dry water years. Rainbow trout spawning habitat would increase from 75 to 84 percent WUA to 99 percent WUA, and brown trout spawning habitat would increase from 79 to 90 percent WUA to 95 percent WUA. The higher MIFs would also improve passage conditions during the rainbow and brown trout spawning periods. The proposed MIF would increase the wetted perimeter of the stream by approximately 15 percent during the summer low flow season, wetting more of the stream channel and increasing the amount of habitat that is available for invertebrate production.

The proposed MIF would reduce thermal warming and increase DO levels in 3.6 miles of North Fork Stevenson Creek (see table 3-9) and contribute flow to enhance environmental cues in the South Fork San Joaquin River bypassed reach.

Pitman Creek (A1.1.1.13)

Pitman Creek bypassed reach has self-sustaining rainbow, brown, and brook trout fisheries. There is very limited spawning gravel, all of which appears to be upstream of the diversion dam. An abundance of young-of-the-year trout downstream of the dam indicates successful recruitment is occurring in Pitman Creek (presumably from upstream of the dam), although fish populations and biomass are lower downstream of the dam. The steep channel morphology combined with low instream flow are impairing trout habitat, and the low instream flow does not provide fish passage during either spring or fall spawning periods. Recruitment into Pitman Creek bypassed reach from Big Creek may be affected by a non-project weir that is 0.16 mile upstream of the confluence.

The MIF required under the current license is 0.3 cfs. The unregulated hydrographs compared to the current hydrographs indicate that substantial changes occurred in the magnitude of flows, especially during the spring runoff period. The IHA analysis suggests that bankfull flows rarely occur under current operations.

Daily mean water temperatures were ≤19ºC in both 2000 and 2001, but excessive thermal warming >2.8°C occurred in 2001 (see table 3-8).

Forest Service and Interior's SROs for the Pitman Creek bypassed reach are as follows.

- Provide an increased MIF.
- Provide better passage for spawning rainbow trout.
- Contribute to spring runoff in Middle Big Creek bypassed reach to provide environmental cues for the aquatic and riparian ecosystems.

WUA analyses were not conducted for the Pitman Creek bypassed reach. However, wetted perimeter analysis indicated that the amount of wetted streambed increased most rapidly as flows increased up to 0.5 cfs, indicating that the proposed MIF of 0.8 cfs July through March and 2.5 cfs (24-hour average) April through June would increase invertebrate production and trout habitat, and improve upstream passage of rainbow trout during spring.

The proposed MIF would also reduce thermal warming in 1.5 miles of Pitman Creek (see table 3-9) and contribute flow to enhance seasonal environmental cues in Middle Big Creek bypassed reach.

Non-compliant DO concentrations occurred in Pitman Creek bypassed reach in 2002 (SCE, 2003h). Lower instream water temperatures would increase oxygen concentrations in this reach. Implementation of the proposed Temperature Monitoring and Management Plan in appendix H of the Settlement Agreement would help determine if the water temperature and related DO levels associated with the proposed flow increases meet Basin Plan DO objectives (see section 3.3.1.2, *Temperature Monitoring and Management*).

Bear Creek (A1.1.1.14)

Bear Creek bypassed reach supports a self-sustaining brown trout fishery. Population numbers are comparable to or greater than reference sites upstream of the diversion, and there is annual recruitment. The limiting factors analysis conducted for this reach in the amended PDEA suggests that adult rearing and spawning habitat is heavily used by an abundant trout population, and physical habitat may be approaching limiting values.

Instream flow study results for this reach indicate that available habitat for brown trout never exceeds 36 percent of the maximum habitat under existing MIFs. The 2 to 3 cfs MIFs under the current license is less than half of the 30-day historic low flow, indicating a flow regime less than was historically available during drought conditions.

The highest mean monthly temperatures were 14.2°C in August 2000, and 18.2°C in August 2001, although some thermal warming >2.8°C occurred (see table 3-8). Daily maximum temperatures did not exceed 22°C (SCE, 2003f).

Forest Service and Interior's SROs for Bear Creek bypassed reach are as follows.

- Provide an increased MIF to provide more rearing habitat for juvenile and adult brown trout and more spawning habitat for brown trout.
- Reduce water temperatures in Bear Creek bypassed reach.
- Provide cool water to the South Fork San Joaquin River bypassed reach.
- Provide a portion of cooler water to Mammoth reach.

The proposed MIF of 4 to 10 cfs (24-hour average) would be larger than existing conditions (2 to 3 cfs), and less than historic unregulated flow (6.1 cfs dry water years; 19 cfs wet water years).

The proposed MIF would increase brown trout carrying capacity, and improve brown trout spawning, rearing, and overwintering habitats. Adult brown trout habitat would increase from 23 to 36 percent WUA under the existing flow regime to 54 to 63 percent WUA under the proposed flow regime during the spring-summer months (April through September) of normal and dry water years. Brown trout spawning habitat would increase from 53 to 62 percent WUA under the existing flow regime to 74 to 77 percent WUA under the proposed flow regime. WUA would also be increased for fry and juvenile brown trout. This would meet Interior's objective to provide more rearing habitat for juvenile and adult brown trout and more spawning habitat for brown trout.

The proposed MIFs would also reduce thermal heating in 1.6 miles of Bear Creek and provide cool water to the South Fork San Joaquin River bypassed reach (28 miles) (see table 3-9). In turn this would cumulatively provide additional water to Mammoth Pool reservoir and help provide cooler water to Mammoth reach (8.4 miles). Water temperature monitoring would determine if the proposed Bear Creek MIF helps bring the South Fork San Joaquin River bypassed reach and Mammoth reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

Non-compliant DO concentrations occurred in Bear Creek bypassed reach in 2002 (SCE, 2003h). Lower instream water temperatures would result in increased oxygen concentrations in this reach. Implementation of the proposed Temperature Monitoring and Management Plan in appendix H of the Settlement Agreement would help determine if the water temperature and related DO levels associated with the proposed flow increases meet Basin Plan DO objectives (see section 3.3.1.2, *Temperature Monitoring and Management*).

Mono Creek (Downstream of Mono Diversion) (A1.1.1.15)

Mono Creek bypassed reach has a self-sustaining brown trout fishery and a small rainbow trout population. Fish population densities and biomass are very low for all trout life stages. Large amounts of spawning gravel are present in a few local concentrations. The abundance and widespread distribution of sand reduces the habitat value for trout and macroinvertebrates. Sedimentation, including loss of pool depth and embeddedness of spawning gravels, likely cause adverse effects on trout habitat, recruitment, and overwinter survival in this reach.

The current MIF (5 to 13 cfs) is less than the 30-day historic low flows, suggesting a flow regime that is lower than historic drought conditions. The current summer MIF is providing moderate levels of adult brown trout habitat (78 percent of maximum WUA); however, the instream flow study results indicate that this bypassed reach has the ability to provide more habitat for all trout life stages.

Monthly mean stream temperatures ranged from 9 to 14.8°C in 2000 and 10.6 to 16°C in 2001. Daily maximum temperatures were ≤18.7°C and daily mean temperatures were <17°C. Thermal warming in excess of 2.8°C occurred in 2000 and 2001 (table 3-8).

Forest Service and Interior's SROs for Mono Creek bypassed reach are as follows.

- Provide more habitat for adult brown trout, specifically >90 percent of maximum WUA during summer and ≥80 percent of maximum WUA throughout the year.
- Provide sufficient MIF such that warming does not exceed 2.8ºC in the Mono Creek bypassed reach during the summer.
- Improve the availability of spawning gravels.
- Provide higher flows during fall for brown trout spawning.
- Provide cool water to South Fork San Joaquin River.
- Provide a portion of cooler water to Mammoth reach.

The proposed MIFs, which range seasonally from 18 to 30 cfs (24-hour average all water year types) and 16 to 27 cfs (instantaneous) would be similar to the historic 30-day unregulated minimum flow (11 cfs in dry years, 34 cfs in wet years), and substantially higher than the existing MIF (5-13 cfs). The proposed MIF would increase adult brown trout habitat from 53 to 78 percent WUA to 90 to 92 percent WUA. Adult brown trout winter habitat would be a minimum of 85 percent of maximum WUA. These habitat increases would meet the Forest Service and Interior's SRO for adult brown trout habitat.

The proposed MIF would increase adult rainbow trout habitat from 32 to 56 percent WUA to 77 to 83 percent WUA during the spring-summer months (April through September) of normal and dry water years. The proposed MIF would increase rainbow trout spawning habitat from 44 to 80 percent WUA to 99 percent WUA in normal and dry water years.

Mono Creek derives most of its flow from Lake Edison, and has the potential to provide cool water to the South Fork San Joaquin River bypassed reach. The proposed MIFs would reduce thermal heating in 5.8 miles of Mono Creek and should provide additional cool water to the South Fork San Joaquin River bypassed reach (28 miles), that in turn would cumulatively provide additional water to Mammoth Pool and help provide cooler water to Mammoth reach (8.4 miles) (see table 3-9). Water temperature monitoring would determine if the proposed Mono Creek MIF helps bring the South Fork San Joaquin River bypassed reach and Mammoth reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

Non-compliant DO concentrations occurred in Mono Creek bypassed reach in 2002 (SCE, 2003h). Lower instream water temperatures would result in increased oxygen concentrations in this reach. Implementation of the proposed Temperature Monitoring and Management Plan in appendix H of the Settlement Agreement would help determine if the water temperature and related DO levels associated with the proposed flow increases meet Basin Plan DO objectives (see section 3.3.1.2, *Temperature Monitoring and Management*).

South Fork San Joaquin River (A1.1.1.16)

The 28-mile long South Fork San Joaquin River bypassed reach is the longest bypassed reach in the project area and receives inflow from 11 tributaries downstream of Florence dam, that have flows reduced by hydroelectric diversions and from other tributaries which are undiverted. Flows are diverted from nine tributaries by the Big Creek ALP Projects. In addition, flows from Warm Creek are diverted by the Vermilion Valley Project and flows are diverted from Camp 61 Creek by the Portal Project.

There is a 36-foot high waterfall approximately 6.9 miles upstream of the confluence with the San Joaquin River, which isolates the Upper South Fork San Joaquin River Subbasin from the San Joaquin River Basin. Five more natural barriers occur downstream of Mono Creek, only one of which is a complete barrier at all flows.

The South Fork San Joaquin River bypassed reach has self-sustaining rainbow and brown trout fisheries. Brown trout dominate the fish composition in the upper two subreaches from Florence Lake to Mono Creek. Downstream of Mono Creek, rainbow trout become the dominant species in the lower three subreaches. Across all subreaches, trout population numbers are low. Populations are unbalanced by lifestage, recruitment appears to be low, little spawning gravel is present, and water temperatures are not favorable to trout due to downstream thermal warming.

Water is released from near the bottom of Florence Lake, which means that relatively cool water is released during the summer when the lake is thermally stratified. Mixing of cool water from deeper strata and warmer surface water occurs by late August or mid-September; after which water temperatures in the South Fork San Joaquin River downstream of Florence Lake equal or exceed temperatures upstream of the lake due to the release of mixed water from the reservoir.

During summer months, water temperatures observed in 2000 and 2001 increased fairly rapidly in the first 12 miles downstream of Florence Lake, then stabilized or decreased slightly between Warm and Hoffman creeks (SCE, 2003f). The cooling trend in this segment of the South Fork San Joaquin River may be due in part to constriction of the river in a deep, narrow canyon, where it is less subject to warming from solar radiation and summer air temperatures. Coldwater additions from tributaries to this reach also may contribute to cool water temperatures. A less dramatic trend of temperature increase was apparent from downstream of the canyon reach, between Hoffman Creek and the San Joaquin River confluence. Water temperatures decreased substantially in September and October throughout the South Fork San Joaquin River.

The current MIF (11 to 27 cfs) is less than half of the 30-day historic low flows, indicating the current flow regime is lower than historic drought conditions. Low flows result in summer water temperatures that were >20ºC and thermal warming >2.8ºC that occurred in the South Fork San Joaquin River bypassed reach (see table 3-8).

The current MIF generally provides high levels of adult brown trout habitat in the upper subreaches during the summer (>90 percent of maximum WUA); but there is less habitat for adult rainbow trout in the lower subreaches (≤74 percent of maximum WUA).

Forest Service and Interior's SROs for the South Fork San Joaquin River bypassed reach are as follows.

- Provide cooler water temperatures during July and August.
- Provide a new MIF to increase habitat for adult rainbow and brown trout within the South Fork San Joaquin River bypassed reach.
- Provide 95 percent adult trout summer WUA (Forest Service).
- Provide more spawning gravel.
- Provide more inflow to Mammoth Pool (Interior).

The proposed MIFs to be released from Florence Lake, which range seasonally from 25 to 40 cfs (24-hour average all water year types) and 22 to 36 cfs (instantaneous), would be similar to the historic 30-day unregulated minimum flow (25 to 37 cfs in dry years; 56 to 77 cfs in wet years) and the existing MIF (11 to 27 cfs). The proposed MIF would provide more adult rainbow and brown trout habitat. The existing adult rainbow and brown trout spring-summer habitat (April through September) are 56 to 83 and 77 to 97 percent WUA, respectively in normal and dry water years. The proposed MIF would increase adult rainbow trout habitat to 90 to 93 percent WUA and adult brown trout habitat to 99 to 100 percent WUA during the spring and summer months, when habitat is most likely limiting production.

The existing rainbow trout spawning habitat is 59 to 97 percent WUA. The proposed April through June MIF (40 cfs) would increase rainbow trout spawning habitat to 100 percent WUA. The existing brown trout spawning habitat is 70 to 91 percent WUA, and the proposed MIF would increase brown trout spawning habitat to 99 to 100 percent WUA.

Temperature modeling shows that during July of a dry water year with warm air temperatures, maximum daily water temperatures frequently approach those that may be stressful for trout, and daily mean temperatures are occasionally warmer than is suitable for trout growth in the 2.5 mile reach upstream of Mono Creek (see table 3-8). The proposed tributary MIFs would increase flows into and through the South Fork San Joaquin River bypassed reach from the 12 impoundments that affect this reach (particularly Bear, Mono, and Camp 61 creeks), and would enhance trout habitat and provide a water temperature regime more suitable for trout because the Bear, Mono, and Camp 61 creek bypassed reaches have reservoirs that would provide cool water to the South Fork San Joaquin River bypassed reach. The proposed South Fork San Joaquin River MIF in conjunction with the increased tributary MIFs would cumulatively reduce thermal warming in the South Fork San Joaquin bypassed reach (28 miles), and would provide more water to Mammoth Pool reservoir, which would in turn provide cooler water to Mammoth reach (8.4 miles) (see table 3-9).

Water temperature monitoring downstream of Florence dam would determine if the proposed MIFs would achieve consistency with the Basin Plan objectives for coldwater beneficial uses and achieve Forest Service and Interior's SRO to provide cooler water temperatures in the South Fork San Joaquin River bypassed reach and Mammoth reach during July and August (see section 3.3.1.2, *Temperature Monitoring and Management*).

Non-compliant DO concentrations occurred in South Fork San Joaquin River bypassed reach in 2002 (SCE, 2003h). Lower instream water temperatures would increase oxygen concentrations in this reach. Implementation of the proposed Temperature Monitoring and Management Plan in appendix H of the Settlement Agreement would help determine if the water temperature and related DO levels associated with the proposed flow increases meet Basin Plan DO objectives (see section 3.3.1.2, *Temperature Monitoring and Management*).

Bolsillo Creek (A1.1.1.17)

Bolsillo Creek bypassed reach has a self-sustaining brook trout fishery. There is a large waterfall approximately 0.2 miles upstream from the confluence of Bolsillo Creek with the South Fork San Joaquin River that is a fish passage barrier and prevents upstream recruitment of fish past the falls. There is no spawning gravel downstream of the waterfall. An abundance of young-of-the-year trout downstream of the diversion dam indicates that successful recruitment is occurring in Bolsillo Creek.

The year-round MIF under the current license is 0.4 cfs. Water is diverted from the peak of the hydrograph, but it appears that 30-day minimums are not affected by project operation (both are 0 cfs). IHA analysis indicates the timing and magnitude of the maximum 1-day flow is unchanged because this diversion is not operated during wet water years when peak flows occur, although diversion of spring runoff does occur during other water year types. The IHA suggests that bankfull 2-year recurrence flows of 18 cfs are not occurring (currently 3.7 cfs), and 5-year recurrence flows of 27 cfs are even more diminished (currently 11 cfs) under current operations.

Daily mean temperatures were ≤16°C, and daily maximum temperatures were ≤18.4° in 2000 and 2001, although excess thermal warming >2.8°C occurred in the bypassed reach (see table 3-8). The diversion is not operated during the fall brook trout spawning period.

Forest Service and Interior's SROs for Bolsillo Creek bypassed reach are as follows.

- Provide an increased MIF.
- Contribute to spring runoff in the South Fork San Joaquin River to provide environmental cues for aquatic and riparian ecosystems.

The proposed MIF of 0.5 to 1 cfs (24-hour average) and 0.35 to 0.75 cfs (instantaneous) would be substantially greater than the 30-day unregulated minimum or the 30-day minimum existing, both 0 cfs.

The proposed MIF would decrease thermal warming in 1.6 miles of Bolsillo Creek (see table 3-9), and contribute flow to enhance seasonal environmental cues in the South Fork San Joaquin River.

Camp 61 Creek (A1.1.1.18)

Flows in Camp 61 Creek are diverted into Ward Tunnel by the Portal Project, and diverted flows are delivered into Huntington Lake via the Portal powerhouse. Camp 61 Creek has one of the highest densities of brown trout among streams in this part of the Portal Project area.

The current license for the Portal Project does not include a minimum flow release to Camp 61 Creek. The Settlement Agreement would provide the following MIFs in Camp 61 Creek, which are consistent with the final 4(e) conditions for the Portal Project filed by the Forest Service on October 29, 2006.

Wet, Above Normal, Below Normal Water Year Types

- October 1 through March 31: 24-hour average of 2 cfs, instantaneous floor of 1.5 cfs
- April 1 through June 30: 24-hour average of 4 cfs, instantaneous floor of 3 cfs

- July 1 through September 30: 24-hour average of 3 cfs, instantaneous floor of 2 cfs

Dry, Critical Water Year Types

- October 1 through September 30: 24-hour average of 1.25 cfs, instantaneous floor of 0.75 cfs

The Commission's Portal Project environmental assessment determined that the availability of aquatic habitat in this reach is limited by the lack of an instream flow release. In 2000 and 2001, the estimated trout densities (all ages) in Camp 61 Creek downstream of the Adit 2 Creek confluence were substantially lower than estimated trout densities observed in both the unregulated East and West forks of Camp 61 Creek (FERC, 2006). In addition to higher trout densities, the East and West forks also support three species of trout (rainbow, brook, and brown trout), while brown trout was the only species captured in Camp 61 Creek. Although brown trout were fairly abundant in Camp 61 Creek downstream of the confluence with Adit 2 Creek and exhibited several age classes, age 0+ fish were relatively rare, possibly indicating a lack of suitable spawning habitat. In addition, the extent of upstream movement of brown trout likely is limited because of low-flow related migration barriers within the stream channel.

The proposed MIFs, plus leakage from the dam, would; substantially increase the amount of wetted area in Camp 61 Creek compared to existing conditions; (2) provide perennial flow and fish passage throughout the creek; and (3) decrease thermal warming in 2 miles of Camp 61 Creek (see table 3-9). This increase in instream flow over existing conditions would likely increase the distribution and abundance of brown trout, expand the abundance and diversity of important benthic macroinvertebrate species, and provide cold-water refugia for native aquatic species residing in the South Fork San Joaquin River (28 miles). The increase in flow may also facilitate rainbow trout colonization of Lower Camp 61 Creek. Water temperatures in Camp 61 Creek immediately downstream of Portal forebay dam would be frequently reduced during the summer, compared to existing conditions, and would remain well within the preferred range for brown and rainbow trout.

Increased MIFs also would enhance seasonal environmental cues and help meet Basin Plan temperature objectives in the South Fork San Joaquin River. Increased flows in the river also would provide additional water to Mammoth Pool reservoir that in turn would provide cooler water to Mammoth reach. Water temperature monitoring would determine if the proposed Camp 61 Creek MIF helps bring the South Fork San Joaquin River bypassed reach and Mammoth reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

Camp 62 Creek (A1.1.1.19)

Camp 62 Creek bypassed reach has a self-sustaining brook trout fishery with successful recruitment. A 45-foot-tall waterfall 370 feet upstream of its confluence with the South Fork San Joaquin River prevents fish passage to upstream areas, where there are relatively large amounts of good to excellent quality spawning gravel.

The MIF under the current license is 0.3 cfs. Water is diverted from the peak of the hydrograph, but it appears that 30-day minimums are not affected by project operation (both are 0 cfs). IHA analysis suggests the timing and magnitude of maximum 1-day flow is unchanged because the diversion is not operated during wet water years when peak flows occur. Diversion of spring runoff currently occurs during other water year types.

Daily mean temperatures were ≤17°C, and daily maximum temperatures were ≤18.2°C in 2000 and 2001. Some thermal warming >2.8°C occurred in 2001 (see table 3-8). The diversion is not operated in the fall during brook trout spawning.

Forest Service and Interior's SROs for Camp 62 Creek bypassed reach are as follow.

- Provide an increased MIF (Interior).
- Contribute to spring runoff in the South Fork San Joaquin River to provide environmental cues for aquatic and riparian ecosystem.
- Provide enhanced flows to dissipate arsenic, mercury, pH, and turbidity (Forest Service).
- Contribute to spring runoff in the South Fork San Joaquin River to provide channel maintenance and transport sediment (Forest Service).

The proposed MIF of 0.5 to 1.0 cfs (24-hour average) and 0.35 to 0.75 cfs (instantaneous) would be greater than the 30-day unregulated minimum or the 30-day minimum existing, both 0 cfs. The IHA analysis suggests that bankfull 2-year recurrence flows of 62 cfs are not occurring (currently 3.2 cfs), and 5-year recurrence flows of 95 cfs are even more diminished (currently 12 cfs) under current operations (MIF 0.3).

The proposed MIF would reduce thermal warming in 1.35 miles of Camp 62 Creek (see table 3-9) and contribute flow to enhance seasonal environmental cues in the South Fork San Joaquin River aquatic and riparian ecosystems. Flow would be measured at USGS gage no. 11230600, and water temperature monitoring would determine if the proposed Camp 62 Creek MIF helps bring the bypassed reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

The proposed MIF may also contribute to the cumulative increase of flow in the South Fork San Joaquin River to help provide channel maintenance and sediment transport, however Camp 62 Creek enters the river downstream of USGS gage no. 11230215, the compliance gage below Florence Lake.

It is unlikely that increased flows would affect any changes in the pH, arsenic, mercury, or turbidity values in Camp 62 Creek. Values of pH lower than 6.5 were recorded at surface water locations both above and below active diversions, including Camp 62 Creek, indicating that the low pH conditions are generally not project-related. The pH values were particularly low during the spring snowmelt period, suggesting that slight acidity of the runoff may be influencing pH values.

A number of project surface water samples exceeded the drinking water criteria for arsenic, including Camp 62 Creek. The sources of arsenic at these locations are unknown; however, arsenic is a naturally occurring, widely distributed metallic element and it is unlikely the occurrence of arsenic in Camp 62 Creek is project-related.

Low concentrations of mercury were found in many of the surface water samples both upstream and downstream of project facilities, including Camp 62 Creek (SCE, 2003h). The sources of mercury are unknown; however, mercury is a naturally occurring, widely distributed element. The low level mercury concentrations are not considered project-related, nor do they adversely affect aquatic resources.

Turbidity exceedances above the Basin Plan standard in Camp 62 Creek downstream of the diversion (11 NTUs) occurred only once and were not considered project-related.

Chinquapin Creek (A1.1.1.20)

Chinquapin bypassed reach, which is located on a tributary to Camp 62 Creek, has a self-sustaining brook trout fishery. A 45-foot high waterfall 370 feet upstream of the South Fork San Joaquin River and Camp 62 Creek confluence prevents recruitment from the river to Chinquapin Creek. Another waterfall approximately 785 feet upstream of the Camp 62 Creek and Chinquapin Creek confluence prevents recruitment to Upper Chinquapin Creek. Individual fish condition factors are lower in the bypassed reach than upstream of the diversion dam. Abundance of young-of-the-year trout downstream of the dam indicates successful recruitment is occurring in Chinquapin Creek.

There is no MIF requirement under the current license. Water is diverted from the peak of the hydrograph, but it appears that 30-day minimums are not affected by project operation (both are 0 cfs). Little spring runoff currently occurs except during wet water years. The IHA analysis notes that bankfull 2-year recurrence flows of 24 cfs are not occurring (currently 4 cfs), and 5-year recurrence flows of 45 cfs are even more diminished (currently 11 cfs) under current operations. Daily mean temperatures were ≤17°C in 2000 and 2001, although some thermal warming occurred in the bypassed reach.

Forest Service and Interior's SROs for Chinquapin Creek bypassed reach are as follows.

- Provide a MIF.
- Contribute to spring runoff in the South Fork San Joaquin River bypassed reach to provide environmental cues for aquatic and riparian ecosystems.

- Contribute to spring runoff in the South Fork San Joaquin River bypassed reach to provide channel maintenance and assist in transport of fine material (Forest Service).

There is no current MIF in Chinquapin Creek. The proposed MIFs of 0.5 to 1 cfs (24-hour average) and 0.35 to 0.75 (instantaneous) would be greater than the 30-day unregulated minimum or the 30-day minimum existing, both 0 cfs. The proposed fall MIF (0.5 cfs) would improve adult brook trout passage during the spawning season. The proposed summer MIF (1 cfs) would decrease thermal warming and provide more fish habitat in 0.9 mile of Chinquapin Creek and 1.35 miles of Camp 62 Creek[37] (table 3-9).

Increased spring-summer flows would also help meet Basin Plan objectives by reducing thermal warming in 28 miles of the South Fork San Joaquin River bypassed reach (see table 3-9). Water temperature monitoring would determine if the proposed Chinquapin Creek MIF cumulatively helps bring the South Fork San Joaquin River bypassed reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

Increased flows would help enhance seasonal environmental cues in the South Fork San Joaquin River aquatic and riparian ecosystems, and help provide channel maintenance and assist in the transport of fine material.

Hooper Creek (A1.1.1.22)

Hooper Creek bypassed reach has a relatively healthy, self-sustaining rainbow x golden trout fishery. Cascades located approximately 0.1 mile from the confluence of the South Fork San Joaquin River are barriers to brown and brook trout migrations during low flows that occur in the fall spawning season. The cascades would probably not be barriers to spring spawning rainbow trout and rainbow x golden trout hybrids; however, the current MIF does not provide passage during the spring spawning period.

The current MIF (2 cfs) is approximately the same as 30-day historic low flows during dry water years, indicating a flow regime that approximates what would be available during drought conditions. Little spring runoff currently occurs except during wet water years. The IHA analysis indicates that historically, bankfull flows of 58 cfs had a 1.5-year recurrence, overbank flows of 68 cfs had a 2-year recurrence, and flows of 18 cfs were exceeded 50 percent of the time. These flows would have provided fish passage on an annual basis. Daily mean water temperatures in the bypassed reach were ≤12.9°C in 2000 and 2001.

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[37] WUA analysis was not done for Chinquapin or Camp 62 creeks.

Forest Service and Interior's SROs for Hooper Creek bypassed reach are as follows.

- Provide a MIF that provides increased habitat and fish passage for spring spawning rainbow trout and rainbow x golden trout hybrids.
- Contribute to spring runoff in the South Fork San Joaquin River to provide environmental cues for aquatic and riparian ecosystems.
- Provide cool water to the South Fork San Joaquin River bypassed reach (Interior).
- Provide a portion of cooler water to Mammoth reach (Interior).
- Provide higher flows to help dissipate iron and turbidity (Forest Service).

The proposed MIFs of 2 to 4 cfs (24-hour average) and 1.5 to 3 cfs (instantaneous) would be greater than the 30-day unregulated minimum (1.8 cfs in dry water years and 4.1 cfs in wet water years). The proposed spring MIF (4 cfs) would provide rainbow trout and rainbow trout x golden trout passage during the spawning season. The proposed summer MIF (3 to 4 MIF) would decrease thermal warming and provide more fish habitat in 0.5 miles of Hooper Creek[38] (see table 3-9).

The proposed MIF would also help achieve consistency with the Basin Plan objectives for coldwater beneficial uses in the South Fork San Joaquin River and the Mammoth reach. Water temperature monitoring would determine if the proposed Hooper Creek MIF cumulatively helps bring the South Fork San Joaquin River bypassed reach and Mammoth reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

The non-compliant turbidity level in Hooper Creek was attributed to current sediment management practices. Implementation of the proposed *Sediment Management Prescriptions* in appendix J of the Settlement Agreement includes the operation of the Hooper diversion low level outlet during the spring run-off period in wet water years to allow sediment pass through and reduce the accumulation of sediment behind the diversion dam (see section 3.3.1.2, *Sediment Management*).

Crater Creek (A1.1.1.21), North Slide Creek (A1.1.1.23), South Slide Creek (A1.1.1.24), and Tombstone Creek (A1.1.1.25)

Under the Settlement Agreement, these four diversions and two domestic diversions (Pitman Creek and Snow Slide Creek domestic diversions) would be decommissioned because they (1) are currently not in service; (2) are no longer needed for the operation and maintenance of the project; or (3) have been requested to be removed by resource agencies participating in the ALP. Of these four diversions, only

[38] WUA analysis was not done for Hooper Creek.

the Crater Creek diversion is currently in service. Decommissioning these diversions would ensure that the natural flow to the four affected bypassed reaches is maintained, which would provide cooler water temperatures to these streams and the South Fork San Joaquin River bypassed reach than would occur if water diversion was continued or resumed. We discuss other aspects of decommissioning these diversions later in section 3.3.1.2, *Small Diversions Decommissioning*.

Adit 8 Creek

The diversion on Adit 8 Creek has not been used for several decades, but this dam gives SCE the flexibility to divert water from Tunnel 5 to Tunnel 2 in the event of an outage at Powerhouse 2A. This short, very steep reach drops almost 1,600 feet in elevation from the base of the dam downstream to its confluence with Big Creek. Adit 8 Creek is intermittent and there is little or no instream flow other than leakage from Tunnel 2 or seasonal overflow at the dam. There is no MIF requirement under the current license, and Adit 8 Creek is dry upstream of the diversion dam for most of the year. No fisheries issues have been identified in Adit 8 Creek bypassed reach which is naturally intermittent and fishless.

The Forest Service suggests that Adit 8 Creek be removed from the license. The lack of identified aquatic issues in the reach and its infrequent use indicate that a decision to include or remove Adit 8 Creek and the diversion would have little if any effect on aquatic resources.

Rancheria Creek

Rancheria Creek conveys outflows from the Portal powerhouse and any flows that pass from the Portal surge chamber into Huntington Lake. Both of these facilities are part of the Portal Project. The stream supports self-sustaining populations of rainbow, brown, and brook trout and Sacramento sucker. Kokanee from Huntington Lake have been observed spawning in the Portal powerhouse tailrace and in the lower portion of Rancheria Creek upstream of the tailrace confluence (FERC, 2006).

The Forest Service suggests that Rancheria Creek be removed from the license. The Portal surge chamber and powerhouse are not part of the Big Creek ALP Projects, so removal of Rancheria Creek would not have any effect on the ability of the Commission to implement measures needed to protect aquatic and other resources in Rancheria Creek downstream of the Portal surge chamber and powerhouse.

Determination of Water Year Type

Under Settlement Agreement measure A1.1.1, SCE would base Water Year Types on the April 1 forecast for the California Department of Water Resources (CDWR), Bulletin No. 120, San Joaquin Valley Water Year Index, or its successor index that is most representative of the Big Creek Watershed. SCE would inform the Forest Service, the Water Board, Interior, and the Commission which category of instream flows would be implemented based on the April 1 water year forecast.

Under Settlement Agreement measure A1.2, by March 15 of each year, SCE would use the March 1 preliminary water year forecast to inform the Forest Service, the Water Board, Interior, Cal Fish & Game, and the Commission which category of instream flows would be implemented on April 1. SCE would have the option to adjust flows based on the April 1 and May 1 DWR water year forecast updates, if those updates are revised. SCE would notify the Forest Service, the Water Board, Interior, Cal Fish & Game, and the Commission if instream flows are to be modified to conform to the revised forecast water year type.

Other Recommendations

Interior filed 10 (j) recommendations and the Forest Service filed 4(e) conditions that are consistent with the Settlement Agreement.

Our Analysis

Currently, CDWR classifies water years for the San Joaquin Valley water year index by the following formula (CDWR, 2008):

- 0.6 x current April through July runoff forecast (in million acre-feet);
- plus 0.2 x current October through March runoff (in million acre-feet); and
- plus 0.2 x previous water year's index.

Resulting San Joaquin Valley water year classifications (million acre-feet) are:

- Wet ≥ 3.8
- Above normal > 3.1, and < 3.8
- Below normal > 2.5, and ≤ 3.1
- Dry > 2.1, and ≤ 2.5
- Critical ≤ 2.1

Table 3-10 shows the drainage areas and average annual unregulated inflows within the four drainage areas that make up the four subwatersheds within the San Joaquin Watershed.

Table 3-10. San Joaquin subwatershed information. (Source: EA Engineering, 1999)

Watershed	Drainage area(square miles)	Annual average unregulated runoff (million acre-feet)	Drainage area to runoff ratio
Tuolumne River inflow to New Don Pedro reservoir	1,540	1.8	856
Merced River inflow to Lake McClure	1,273	1.0	1,273
San Joaquin River inflow to Millerton Lake	1,676	1.7	986
Stanislaus River inflow to New Melones reservoir[a]	900	1.056	852
Total	5,389	5.6	962

[a] Interchangeably referred to as Stanislaus River below Goodwin reservoir in CDWR Bulletin 120 (as cited in EA Engineering, 1999).

The drainage area to Redinger reservoir, which acts as a forebay for Powerhouse 3, the furthest downstream powerhouse in the Big Creek System, has a drainage area of about 1,295 square miles. This drainage area makes up the majority of the drainage area to Millerton Lake shown in table 3-10. The drainage area to runoff ratio shown in table 3-10 for the inflow to the farther downstream Millerton Lake is also representative of the larger San Joaquin Watershed area used in the CDWR forecast.

Snowmelt within the Upper San Joaquin River Watershed produces roughly 90 percent of the yearly runoff, most of which (about 70 percent) occurs between April 1 and the end of July. For more than 50 years, CDWR has predicted yearly runoff based on a large number of snow pack measurements and other methods within the Sierra Nevada. CDWR's runoff predictions are highly reliable because of the snowmelt-based runoff of the Sierra Nevada and CDWR's extensive monitoring, analysis, and records. This forecast is already used for water management purposes on other watersheds within the San Joaquin Watershed. Incorporating the water year classification for the project facilities would help ensure that project operations meet important resource objectives, such as enhancing aquatic and riparian habitat, and maintaining reservoir levels at a reasonable level for recreational use.

Use of the March 1 forecast for the initial determination of water year type is necessary to determine minimum flows and channel and riparian maintenance flows that would begin on April 1. SCE would have the ability to adjust the water year type based on the April 1 and May 1 forecast if the water year forecast is revised which would be useful during years of unexpected precipitation or snowmelt during the months of March and April.

Instream Flow and Water Level Monitoring

SCE proposes to implement the Flow Monitoring and Reservoir Water Level Measurement Plan in appendix L of the Settlement Agreement to monitor compliance with streamflows and water levels that may be required in a new license. This plan contains the following components:

- location and design of flow monitoring equipment;
- instream flow monitoring, and recording of flow data;
- operation, maintenance, and calibration of flow monitoring equipment;
- schedule for designing, permitting and installing infrastructure changes and associated flow monitoring equipment;
- flow data dissemination to resource agencies; and
- reservoir water surface elevation measurement.

Consistent with the Settlement Agreement, SCE plans to add or upgrade gages within the project area to ensure compliance with MIFs and other flow requirements that may be part of the license conditions. Table 3-11 provides information for the gages within the project area that would be used for compliance where the MIF is expected to change and or areas where gages are proposed to be constructed. Table 3-12 provides a summary of the existing water-stage recording gages on the major reservoirs (SCE plans to continue this monitoring).

Table 3-11. Status of compliance gages for streams with proposed changes in MIF. (Source: SCE, 2007a)

	Current Status of Gaging				Proposed Flow Monitoring		Type of New Gage Proposed	
	Streams with proposed changes in infrastructure at diversion	**Currently Gaged**	**Not Currently Gaged**	**Existing USGS Gage Number**	**Current Gage**	**New Gage Proposed**	**Acoustic Velocity Meter**	**Float Type**
Mammoth Pool (No. 2085)								
San Joaquin River (Mammoth Pool to Dam 6)	X	X		11234760	X	X	X	
Rock Creek	X		X			X	X	
Ross Creek	X		X			X		X
Big Creek Nos. 1 and 2 (No. 2175)								
Upper Big Creek (Huntington Lake to Dam 4)		X		11237000	X			
Middle Big Creek (Dam 4 to Dam 5)	X		X			X	X	
Lower Balsam Creek (Diversion to Big Creek)	X		X			X		X

Ely Creek	X		X			X		X
Big Creek Nos. 2A, 8, and Eastwood (No. 67)								
South Fork San Joaquin River		X		11230215	X[a]			
Bear Creek		X		11230530	X		X	
Mono Creek (downstream of Mono Diversion)	X	X		11231600	X	X[b]	X	
Bolsillo Creek		X		11230670	X			
Camp 62 Creek		X		11230600	X			
Chinquapin Creek[c]		X		11230560	X			
Hooper Creek		X		11230200	X			
Lower Big Creek (Dam 5 to San Joaquin River)	X	X		11238500	X	X[d]	X	
Pitman Creek		X		11237700	X			
Upper Balsam Creek (forebay to diversion)		X		11238270	X			

North Fork Stevenson Creek		X	11239300	X
Stevenson Creek		X	11241500	X
Big Creek No. 3 (No. 120)				
San Joaquin River (Dam 6 to Redinger)	X	X	11238600	X

[a] A new gage has been installed and would be calibrated to better characterize high flow events.

[b] A new acoustic velocity meter gage would be installed to monitor increased MIFs under a new license.

[c] 24-hour average flows remain the same, but an instantaneous floor is added.

[d] An acoustic velocity gage would be installed at Dam 5 to monitor MIF releases. The existing downstream gage (USGS gage no. 11238500) would be operated to monitor higher flow events.

Table 3-12. Current reservoir water-stage recorders at the major reservoirs. (Source: SCE, 2007a)

Reservoir	USGS gage number
Mammoth Pool reservoir	11234700
Huntington Lake	11236000
Florence Lake	11229600
Shaver Lake	11239500

During operation of its facilities, SCE would need to monitor the required 24-hour average and instantaneous (instantaneous floor) instream flows at its compliance locations. The instantaneous flow is the flow value used to construct the average daily flow value and would be measured in time increments that SCE has proposed of at least once every 15 minutes. The 24-hour average flow is the average of the incremental readings from midnight of one day to midnight of the next day. Except for malfunctions or occurrences beyond SCE's control, 24-hour average, instantaneous flows would be measured at each site during the period the location is diverting water. SCE proposes in the Settlement Agreement to compensate for an unplanned under release by releasing the equivalent under-released volume of water within 7 days of discovery of the under-release. The 24-hour average flow values would be reported to the USGS on an annual basis. The 15-minute recordings used to construct the 24-hour average flows would be available from SCE upon request from the Commission, agencies, or other parties. Operational dates of the small diversions would also be available upon request.

SCE would consult with the USGS, at a minimum, during the development of the flow monitoring scheme for all locations to ensure accurate measurements would be recorded during the term of a new license. Calibration of the acoustic velocity meters would be performed by SCE biannually using a portable acoustic velocity meter. SCE calibration of the float level recorders or bubblers would include the collection of current meter measurements to verify the rating tables. Float level recorders and bubblers would be checked on a monthly basis by SCE by comparing the inside recorder reading to the outside permanent staff gage reading for any discrepancies.

SCE would use the March 1 preliminary water year forecast to inform the Forest Service, Water Board, Interior, Cal Fish & Game, and the Commission which category of MIF and channel and riparian maintenance flow would be implemented by March 15 of each year. SCE would have the option to adjust flows based on the April 1 and May 1 DWR water year forecast updates, if those updates are revised. SCE would notify the agencies and the Commission if changes to the MIFs and channel and riparian maintenance flows are to be modified to conform to the revised forecast water year type.

Our Analysis

Flow compliance monitoring for many of the new gages listed in table 3-11 would require development of new measuring schemes. We expect that infrastructure changes at Dam 4, Mammoth Pool dam, and Dam 6 may involve the most extensive engineering and construction work. Site access downstream of Dam 4 and Dam 6 is particularly difficult, and access is likely to necessitate additional construction, or, depending upon site-specific conditions, alternative design strategies. SCE plans to construct gaging weirs at the Ross, Balsam, and Ely creeks gaging locations, which would require in-channel construction. Installation of flow gaging stations in these locations would result in environmental effects associated with the construction of the gage station itself, the associated access, and provision of electricity to operate the gaging station instrumentation (e.g., potential erosion and sedimentation, destabilization of existing steep slopes, disturbance of aquatic habitat, and degradation of local visual quality).

The type and frequency of maintenance activity on the flow monitoring equipment, and the methods and frequency used to calibrate the flow measuring devices, would depend on the equipment chosen to monitor streamflows, and the quality assurance requirements of USGS would ensure the accurate measurements would be recorded during the term of a new license. Due to low flows, cold temperatures, and deep snowpack during the winter generally above 5,000 feet msl in the project area, it may not be feasible to operate flow measuring equipment in smaller streams during winter months, when SCE is not diverting flow from those streams.

The gaging and water level monitoring proposed by SCE would be sufficient to ensure compliance with MIFs and other flow and water level requirements proposed for the area of the Big Creek ALP Projects. The coordination of the collection and reporting of these data would ensure that compliance is continually checked and confirmed by the Commission and other agencies.

Channel and Riparian Maintenance Flows - Bear, Bolsillo, Camp 62, and Chinquapin Creeks

Habitat in these bypassed reaches has the potential to be affected by (1) disruption of natural geomorphic processes including sediment retention behind dams; and (2) flow regulation that alters the timing, magnitude, and duration of peak flows and base flows. Under Settlement Agreement measure A1.2, Channel Riparian Maintenance Flow Plan, SCE would implement the following channel and riparian maintenance flows for Bear, Bolsillo, Camp 62, and Chinquapin creeks.

Bear Creek (A1.2.1)

Starting between May 15 and June 30 in wet water years, SCE would not divert water at Bear Creek diversion for 10 consecutive days.

Bolsillo Creek (A1.2.2), Camp 62 Creek (A1.2.3), and Chinquapin Creek (A.1.2.4)

Between April 1 and June 30 in wet water years, SCE would not divert water at the Bolsillo, Camp 62, or Chinquapin creek diversions.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations consistent with Settlement Agreement measure A1.2, Channel Riparian Maintenance Flow Plan for Bear, Bolsillo, Camp 62, and Chinquapin creeks.

Our Analysis

No riparian resource issues were identified in these bypassed reaches in the amended PDEA. However, current project operations have decreased the duration, magnitude, and frequency of high spring flows in all four of these bypassed reaches. During the period of record, the maximum recorded discharge downstream of the Bear Creek diversion (gage no. 11230530) in May and June was 923 to 1,250 cfs; downstream of the Bolsillo Creek diversion (gage no. 11230670) in April through June was 8.4 to 16 cfs; downstream of the Camp 62 Creek diversion (gage no. 11230600) in April through June was 8.1 to 27 cfs; and downstream of the Chinquapin Creek diversion (gage no. 11230560) in April through June was 13 to 34 cfs (see table 3-9). The proposed channel and riparian maintenance flows (natural discharge) would increase the magnitude and duration of spring peak flows and ensure that overbank flows occur during most wet water years because water would not be diverted for 10 consecutive days between May 15 and June 30 in Bear Creek and no diversions would occur at Bolsillo, Camp 62, and Chinquapin creeks between April 1 and June 30 in wet water years. Overbank flows would benefit riparian vegetation that requires periodic scouring to regenerate and maintain a variety of age classes over time.

Fish would benefit from increased riparian vegetation because many aquatic and terrestrial macroinvertebrates that serve as the prey base depend on riparian vegetation during their life cycles. In addition, riparian vegetation provides streambank stability to reduce erosion which can be a large source of instream sediment. It also provides canopy cover to reduce thermal heating and moderate daily temperature fluctuations, structure and overhead cover from predators, a source for LWD recruitment, and velocity breaks for fish during high flow. Riparian vegetation also traps overland sediment before it enters waterways to replenish riparian vegetation and protect aquatic habitat. Therefore, the proposed channel and riparian maintenance flows would protect and benefit the riparian and fish, as well as riparian-dependent wildlife resources in the Bear, Bolsillo, Camp 62, and Chinquapin creeks bypassed reaches.

Channel and Riparian Maintenance Flows - Mono Creek

Mono Creek bypassed reach is primarily a moderate gradient, bedrock/boulder channel, although a lower gradient, depositional section occurs where the stream flows through Mono Meadow. Streambank erosion in Mono Meadow due to livestock results in large amounts of fine sediment deposition and degraded fish habitat.

Other riparian resource issues in the bypassed reach include the occurrence of non-riparian species on depositional bars; riparian encroachment into the formerly active channel; loss of age class structure (regeneration); and changes in the timing, duration, and magnitude of peak flows. Under current project operations, inundation of the channel bars and floodplains occurs infrequently, and riparian vegetation is encroaching on the formerly active stream channel.

Under Settlement Agreement measure A1.3, SCE would implement the Mono Creek Channel Riparian Maintenance Flow Plan included in Settlement Agreement appendix D. The plan would establish an appropriate channel and riparian maintenance flow to reduce accumulations of sand in Mono Creek bypassed reach. During wet water years, the peak flows would either be 450 or 800 cfs depending on the results of sediment monitoring. Total flow volume would be at least 10,800 acre-feet over 11 days (Schedule 1) or at least 7,700 acre-feet over 10 days (Schedule 2). The Schedule 1 flow would be ramped up to at least 400 cfs over 3 days from the MIF to 800 cfs, and down ramped over 5 days (2 days at 500 cfs, 2 days 300 cfs, and 1 day to MIF). The Schedule 2 flow would be ramped up over 1 day to at least 450 cfs and down ramped over 1 day to MIF.

The volume of wet water year channel and riparian maintenance flow releases to Mono Creek would be determined from pool monitoring results (Hilton and Lisle, 1993), or a similar peer-reviewed sediment monitoring tool approved by SCE, the Forest Service, Interior, Cal Fish & Game, and the Water Board. The monitoring locations for the pools in Mono Meadow would be approved by the Forest Service in consultation with other interested agencies.

During above normal water years flows would be ramped up from the MIF over 2 days to 450 cfs. The 450 cfs peak flow would be maintained for 2 days then flows would be ramped down to the MIF over 3 days to achieve a flow volume of at least 4,100 acre-feet over the 7-day period. The first day flow would be ramped down to 345 cfs; the second day 240 cfs; and ramped down to the MIF on the third day.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations consistent with Settlement Agreement measure A1.3, Mono Creek Channel Riparian Maintenance Flow Plan.

Our Analysis

The Mono Creek Channel Riparian Maintenance Flow Plan would use monitoring and adaptive management to establish a channel and riparian maintenance flow that would reduce the large accumulations of sand and fine sediment in Mono Creek bypassed reach and transport sediment downstream to the South Fork San Joaquin River bypassed reach, which has a sediment deficit. The proposed Mono Creek bypassed reach channel and riparian maintenance flows would increase the magnitude, duration, and frequency of peak flows.

Flows of at least 450 cfs would provide partial mobilization of particles on the bed and bars. Under current operations, flows exceeding 800 cfs occurred for 17 days during a single wet water year (1995). Flows greater than 450 cfs occurred in three out of seven wet water years between 1983 and 2002. A flow of 450 cfs never occurred in above normal water years. The maximum daily flow in the above normal water years was 443 cfs, and occurred for 1 day in 1984. Other maximum daily flows that were greater than 50 cfs only occurred three times, all in 1984.

The proposed maximum 800 cfs wet water year flows would increase the wetted width by an average of 130 feet. The proposed 450 cfs above normal water year flows would increase the wetted width by about 43 feet. As a result, the proposed channel and riparian maintenance flows would inundate areas adjacent to the channel in all wet and above normal water years and restore floodplain connectivity and processes.

The proposed channel and riparian maintenance flows would (1) scour encroaching upland and riparian vegetation in the formerly active channel and on the channel bars; (2) deposit fresh alluvium; (3) regenerate and establish riparian vegetation; (4) provide higher soil moisture and water table to support riparian vegetation; (5) transport excessive accumulations of sand and fine sediment downstream to the sediment deficit South Fork San Joaquin River bypassed reach; (6) discourage continued encroachment of upland species on the channel bars; (7) cause some localized bank erosion in response reaches, and (8) increase LWD recruitment to the stream channel. The banks damaged by livestock in Mono Meadow, however, may be susceptible to increased bank erosion under flows of this magnitude. Monitoring would allow a determination of the extent of bank erosion and the potential need to modify channel and riparian maintenance flows or implement bank stabilization measures. In addition, the monitoring results would establish follow-up actions and may establish the party responsible for implementation.

Channel and Riparian Maintenance Flows – Camp 61 Creek

Under Settlement Agreement measure A1.4, SCE would implement the Camp 61 Creek Channel Riparian Maintenance Flow Plan included as Settlement Agreement appendix E. The plan is consistent with the final 4(e) conditions for the Portal Project filed by the Forest Service on November 29, 2006.

The objective of the Camp 61 Creek Channel Riparian Maintenance Flow Plan is to determine an appropriate flow regime to reduce accumulations of fine sediment in the Camp 61 Creek bypassed reach from Portal forebay to the South Fork San Joaquin River. The pool monitoring locations would be approved by the Forest Service in consultation with other interested agencies. Pool monitoring would occur within 6 months following any wet water year channel and riparian maintenance flow release, except the following:

- If channel and riparian maintenance flows are released in consecutive wet years and the pool monitoring V*w[39] values after the first year's release are ≤0.25, no measurement would be required after the second wet year channel and riparian maintenance flow release.
- If pool monitoring V*w values following each wet year channel and riparian maintenance flow release for three successive years are ≤0.25, then the pool monitoring regime would be modified so that monitoring occurs after every third wet year release or at a lesser frequency agreed to by the interested resource agencies.
- No pool monitoring would be required following above normal water year channel and riparian maintenance flow releases.

The pool monitoring results, or a similar peer-reviewed sediment monitoring tool approved by SCE, the Forest Service, Interior, Cal Fish & Game, and the Water Board would be used to determine which channel and riparian maintenance flow schedule would be implemented. Channel and riparian maintenance flows would be within 90 percent of the 24-hour average flow identified in table 3-13. SCE would make up any deficiency in total channel and riparian maintenance flow release volume within the existing release period. To the extent feasible, SCE would release channel and riparian maintenance flows for a 10-day consecutive period between May 1 and June 30.

[39] The weighted mean value of the level of fine sediments.

Table 3-13. Proposed Camp 61 Creek 24-hour average channel and riparian maintenance flows. (Source: SCE, 2007b)

Channel and Riparian Maintenance Flow Release Day	Above Normal Water Year (cfs)	Wet Water Year (cfs)
1	ramp up from MIF to 22	ramp up from MIF to 28
2-3	22	28
4-7	30	40
8-9	22	28
10	ramp back to MIF	Ramp back to MIF

If the pool monitoring V*w value is >0.25 following the release of two wet water year flows, SCE would increase the duration of the channel and riparian maintenance flows by adding two more days of channel and riparian maintenance flows at 30 cfs in above normal years and two days at 40 cfs in wet years.

If the V*w continues to be greater than 0.25 after at least two modified channel and riparian maintenance flows in wet water years, the licensee would consult with the above listed agencies on the need for additional flow modifications to reduce fine sediment recruitment.

Our Analysis

Channel and riparian maintenance flows would help to flush fine sediments out of the Camp 61 Creek system to improve aquatic habitat conditions. The channel and riparian maintenance flows included in Settlement Agreement measure A1.4 would be of a slightly higher magnitude (30 versus 28 cfs in above normal years; 40 versus 29 cfs in wet water years) and the same duration as channel and riparian maintenance flows that were recommended in the Commission's environmental assessment for the Portal Project (FERC, 2006). The proposed higher flows would have a somewhat greater capacity to mobilize and transport accumulated sediments and contribute to the formation of physical habitat features such as riffles, pools, runs, and point bars. The flows also would support dynamic geomorphic processes over time and decrease spawning gravel embeddedness.

The Camp 61 Creek channel and riparian maintenance flows would occur between May 1 and June 30. These releases would occur during the peak spring hydrograph to maximize the channel's ability to mobilize and transport sediment and increase riparian vegetation regeneration. Spring releases would also contribute flow to the South Fork San Joaquin River to benefit spring spawning trout.

The channel and riparian maintenance flows would include specific ramping rates to be implemented over the 10-day release period that would better enable juvenile brown trout to seek cover from high flows and reduce the possibility of stranding following releases. As spawning and substrate conditions improve over time, brown trout recruitment and benthic macroinvertebrate productivity would increase and young-of-the-year trout would have increased access to interstitial spaces, which provide cover and refugia from high velocity flows, within the substrate.

Channel and Riparian Maintenance Flows – South Fork San Joaquin River downstream of Florence Reservoir

Riparian resource issues along the South Fork San Joaquin River bypassed reach and specifically in the Jackass Meadow complex and other low gradient response reaches include age class structure (low regeneration), community composition, encroachment of upland species, stress (high willow decadence, livestock, and recreational effects), loss of floodplain connectivity, and infrequent channel bar, floodplain, and meadow inundation.

Under Settlement Agreement measure A1.5, SCE would implement the proposed channel and riparian maintenance flows for the South Fork San Joaquin River downstream of Florence reservoir, included as Settlement Agreement appendix F. Wet year and above normal water year types would be based on the April 1 forecast.[40] During wet years, SCE would, within the extent of its control, release sufficient flow or augment a natural spill event which meets all of the following characteristics:

- Gradually ramp flows from the base flow to 1,600 cfs over 3 days, in as even increments as feasible.
- Maintain an average daily flow of at least 1,600 cfs for 3 consecutive days.
- Decrease flow from 1,600 cfs to the MIF over the next 8 days according to the schedule below:
    1. decrease flow to approximately 1,000 cfs for 1 day,
    2. decrease flow to approximately 750 cfs for 2 days,
    3. decrease flow to approximately 500 cfs for 3 days,
    4. decrease flow to approximately 150 cfs for 1 day, and
    5. decrease flow to the MIF over 1 day.
- Release a total flow volume of at least 22,000 acre-feet.

To the extent feasible, channel and riparian maintenance flows in wet years would be implemented starting between June 1 and July 7.

If the channel and riparian maintenance flow peak and volume release requirements are met by natural spill, then SCE would make a good faith effort to provide down ramping releases on the descending limb of the hydrograph to accommodate whitewater boating:

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[40] Based on DWR, Bulletin No. 120, San Joaquin Valley Water Year Index, or its successor index that is most representative of the Big Creek watershed.

- Approximately 750 cfs for 3 days,
- Approximately 500 cfs for 2 days, and
- SCE would make a good faith effort to provide at least 1 day of flow between approximately 500 and 750 cfs during a weekend.

SCE would make a good faith effort to stabilize these flow releases between 10:00 a.m. and 4:00 p.m. for whitewater boating purposes, if the area is accessible to boaters.

During above normal water years,[41] to the extent within its control, SCE would release sufficient flow, augment a natural spill event, or document a natural spill event that meets all of the following characteristics:

- Gradually increase flow over 1 day from the base flow to a peak flow that would provide approximately 75 percent of the areal extent of inundation measured at 1,600 cfs.
- Maintain an average daily flow at the level of the peak flow for 2 consecutive days.
- Decrease flow from the peak flow to the MIF over the next 5 days according to the schedule below:
    1. maintain flow of approximately 700 cfs for 1 day,
    2. maintain flow of approximately 500 cfs for 3 consecutive days, and
    3. decrease flow to the MIF over 1 day.
- Release a total flow volume of at least 6,000 acre-feet plus the volume of the 2 day peak flow. In no event would SCE be required to increase the flow release volume above 13,000 acre-feet.
- SCE would make a good faith effort to provide at least 1 day of flow between approximately 500 and 700 cfs during a weekend.

To the extent feasible, above normal water year channel and riparian maintenance flows would be completed before Memorial Day weekend.

Within the first year after license issuance, SCE would implement the proposed Jackass Meadow Inundation Study described in the amended PDEA. The microtopography of the Jackass Meadow complex would be surveyed at a scale and in a level of detail sufficient to evaluate the areal extent of inundation that would occur based on the proposed channel and riparian maintenance flows. In the first 2 wet years that occur after issuance of the new license, SCE would map and calculate the areal extent of

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[41] Beginning in the first above normal water year after SCE completes consultation with the Forest Service regarding the calculation of the channel and riparian maintenance flow necessary to inundate 75 percent of the areal extent inundated by 1,600 cfs.

inundation for at least three flow levels between and including 1,000 and 1,600 cfs. This information would be used to determine (1) whether a flow less than 1,600 cfs would provide the same level of inundation as provided at 1,600 cfs, and (2) the flow necessary to inundate approximately 75 percent of the area inundated at 1,600 cfs. If SCE and the Forest Service agree that a lower flow provides the same level of inundation provided by 1,600 cfs, the peak flow and amount of stored water released for the channel and riparian maintenance flow in future years may be reduced.

If above normal water years occur prior to completion of the Jackass Meadow Inundation Study, SCE would provide at least four consecutive days of flow between 500 and 750 cfs for whitewater boating purposes, including 2 weekend days.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations consistent with Settlement Agreement measure A1.5, Channel and Riparian Maintenance Flows for the South Fork San Joaquin River downstream of Florence Reservoir.

Our Analysis

The proposed South Fork San Joaquin River Channel Riparian Maintenance Flow Plan would use monitoring and adaptive management to establish a channel and riparian maintenance flow that would improve meadow and riparian ecosystems and floodplain function in the South Fork San Joaquin River bypassed reach. Historically, portions of the Jackass Meadow complex were probably inundated in most years. Under current operations, the meadow complex is inundated 4 out of 6 wet water years, and rarely during above normal water years. The current inundation flows are associated with spill events and recede very quickly. During uncontrolled wet water year spills, flows often exceeded 1,600 cfs. During above normal water years, spills occur only rarely.

The maximum average discharge in the South Fork San Joaquin River downstream of Hooper Creek (gage no. 11230215) for the period of record was 2,190 cfs in May; 4,010 cfs in June; and 5,020 cfs in July (see table 3-3). The proposed channel and riparian maintenance flows would increase the magnitude, duration, and frequency of peak flows above the current levels according to the above schedules. In wet years, a maximum of 1,600 cfs and total volume at least 22,000 acre-feet would be released over 14 days. In above average years, a maximum of 1,600 cfs and total volume not more than 13,000 acre-feet would be released over 8 days. The proposed wet water year channel and riparian maintenance flow would inundate channel bars, the meadow complex, and other floodplains for longer periods, and the recession rate would be slower than existing conditions. The proposed above normal water year channel and riparian maintenance flow would inundate about 75 percent of the area that would be inundated during wet water years. These more frequent, longer inundation periods would help recharge the underlying water table and saturate meadow soils to maintain moisture content for longer periods of time.

The proposed channel and riparian maintenance flows would (1) scour encroaching upland and riparian vegetation in the formerly active channel and on the channel bars; (2) deposit fresh alluvium; (3) regenerate and establish riparian vegetation; (4) provide higher soil moisture and water table to support riparian vegetation; (5) transport excessive accumulations of sand and fine sediment downstream to the sediment deficit South Fork San Joaquin River bypassed reach; (6) discourage continued encroachment of upland species on the channel bars; (7) cause some localized bank erosion in response reaches; and (8) increase LWD recruitment to the stream channel. The banks damaged by livestock and recreational users in the Jackass Meadow complex would be highly susceptible to increased bank erosion under flows of this magnitude.

Small Diversions Decommissioning

Under Settlement Agreement measure A1.6, SCE would implement the proposed Small Diversions Decommissioning Plan included as Settlement Agreement appendix G. SCE proposes to complete the decommissioning of the six small diversions within five years following issuance of the new licenses, assuming required permits are obtained. SCE identifies the following permits and approvals that may be required prior to beginning decommissioning work: (1) wilderness variance from the Forest Service (Carter and Tombstone diversion dams); (2) special-use permit from the Forest Service; (3) streambed alteration agreement from Cal Fish & Game; (4) water quality certification from the Water Board; and (5) a nationwide 404 permit from the U.S. Army Corps of Engineers. The small diversions that would be decommissioned include four backcountry hydroelectric generation diversions on North Slide, South Slide, Tombstone, and Crater creeks, and two domestic water diversions on Pitman and Snow Slide creeks.

All decommissioning work would be completed during the late summer and early fall months after the snow has melted to allow crews safe access to these back-country facilities after the peak recreational season.

The decommissioning would include the dismantling of five diversions and abandoning one diversion in place (South Slide Creek) that currently does not obstruct natural geomorphic processes. The diversions would be decommissioned because they are either: (1) currently not in service, (2) no longer needed for the operation and maintenance of the project, or (3) have been requested to be removed by resource agencies. Natural flow and sediment transport would be maintained or restored to the affected streams.

All above-ground facilities associated with the diversions (e.g., water conveyance pipes, support structures, stream gages) and other associated material would be removed. The decommissioning activities and removal of materials would be conducted in an appropriate manner depending on the location of the diversion (e.g., designated Wilderness, type of material).

A brief summary report would be prepared at the conclusion of each diversion decommissioning that includes pre- and post-decommissioning photographs to document the completed activities. The report would be provided to the Commission and appropriate regulatory agencies for their records.

Once the diversions have been decommissioned, SCE would provide notification to the Water Board that the diversions are no longer in service and no longer necessary for project operations. SCE would request the water rights associated with the diversions be transferred or cancelled.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations consistent with the Settlement Agreement measure A1.6, Small Diversion Decommissioning Plan.

Our Analysis

Crater Creek

Crater Creek diversion dam is located about 1 mile west of Florence Lake at an elevation of 8,765 feet msl in the John Muir Wilderness. The diversion is currently in service. There is no MIF requirement for Crater Creek in the current license, but seepage from the diversion provides flow to the creek when the diversion is in operation.

Explosives and hand tools would be used to break up the concrete diversion and the rock mortar walls along the diversion channel and stream gage control structure. The diversion structure would be broken into small rock and mortar pieces that would be distributed on the ground surface in the immediate area around the former diversion, diversion channel, and stream gage. A helicopter may be used to remove the gage house materials and large sections of pipe (if the Forest Service determines that use of a helicopter is consistent with the results of a Minimum Tools Analysis [required for work in designated wilderness]). All airlifted materials would be transported as external loads, limiting the need for the helicopter to land at the diversion, and taken to SCE's Florence Work Camp where the material would be staged for transport and disposal at an appropriate facility. The smaller debris (e.g., pipe, metal associated with the diversion, tools, remaining trash) would be packed out by the crews.

Removing the diversion in the late summer-fall during low flow conditions with hand tools would minimize the potential for short-term turbidity or sedimentation related to the decommissioning. The proposed decommissioning would remove a structural fish passage barrier and restore natural instream flow and sediment transport to the Crater Creek bypassed reach, and would benefit the population of brook trout in this reach. Restoration of natural flow and sediment transport would help reduce cumulative effects related to flow and sediment deficit in the South Fork San Joaquin River bypassed reach.

Tombstone Creek

Tombstone Creek diversion dam and its associated water conveyance pipe are approximately 0.5 mile northeast of Florence Lake at an elevation of 7,673 feet msl in the John Muir Wilderness. The diversion is currently out of service.

Explosives and hand tools would be used to break up the rock mortar wall diversion and concrete support piers associated with the pipe into small pieces that would be distributed on the ground. Small debris would be packed out by the crews. The steel support poles used to elevate the pipe off the ground would be cut flush with ground surface. The supports, pipe, and other large debris may be airlifted out using a helicopter (if the Forest Service determines that its use is consistent with the results of a Minimum Tools Analysis). All airlifted materials would be transported to SCE's Florence Work Camp where it would be staged for transport to an appropriate disposal facility.

The exterior of the pipe is covered with an asbestos-bearing material. A California State Certified Industrial Hygienist with the appropriate asbestos certification would develop a work plan for the handling and disposal requirements of the pipe.

Removal of the diversions with hand tools in the late summer-fall during low flow conditions would minimize the potential for short-term turbidity or sedimentation related to the decommissioning activities. The proposed decommissioning would remove a structural fish passage barrier, restore sediment transport, and maintain the current instream flow in the Tombstone Creek bypassed reach. Restoration of natural sediment transport in Tombstone Creek would help reduce cumulative effects related to sediment deficit in the South Fork San Joaquin River bypassed reach.

North Slide Creek

The North Slide Creek diversion dam is located approximately 1.5 miles north of Florence Lake at an elevation of 7,501.5 feet msl, outside the Wilderness boundary. The diversion is currently out of service and has not been operational for 21 years.

Explosives and hand tools would be used to break up the rock and mortar wall diversion structure into small rock and mortar pieces that would be distributed on the ground surface in the immediate area around the former diversion. Ancillary features would be unbolted or torch cut into smaller manageable pieces that can be packed and transported from the area. All of the diversion piping is buried, and would be left in place. The first 5 feet of the pipe would be plugged using concrete. The diversion would be visually monitored once every 5 years to ensure that the pipe remains buried and sealed. The above-ground pipe and all debris (other than the rock and mortar wall debris) would be packed out by the crews.

North Slide Creek is naturally fishless, so the proposed decommissioning to maintain natural instream flow and restore sediment transport would not directly adversely affect or benefit fish in the bypassed reach. However, approximately 20 cubic yards of sediment are stored behind the diversion. SCE's intent, if approved by regulatory agencies, is to allow the sediment to be naturally redistributed by high flows. We expect that any increase in turbidity associated with sediment dispersal during high flows would be of relatively short duration. The restoration of sediment transport would help reduce cumulative effects related to sediment deficit in the South Fork San Joaquin River bypassed reach.

South Slide Creek

The South Slide Creek diversion dam is located approximately 1.5 miles southeast of Florence Lake at an elevation of 7,501.5 feet msl, outside of the Wilderness boundary. The diversion structure has been breached and the former mortar rock wall diversion structure has been degraded by extreme weather and high flow events. As a result, the diversion has not been operational for 21 years. The immediate area surrounding the diversion is overgrown with dense riparian vegetation.

The water conveyance system consists of a buried pipe that would be sealed with concrete and abandoned in place. The diversion would be visually monitored once every 5 years to ensure that the piping remains buried and sealed.

The diversion structure would be abandoned in place to prevent unnecessary disturbance to the stream channel and the riparian vegetation. Natural instream flow and sediment transport would be maintained.

The proposed decommissioning would maintain current instream flow and sediment transport in South Slide Creek. This creek is naturally fishless, so the abandoned diversion would not be a passage barrier, and the proposed decommissioning would not directly adversely affect or benefit fish.

Pitman Creek and Snow Slide Creek Domestic Diversions

The Pitman Creek and Snow Slide Creek domestic diversion dams are located approximately 1 mile east of the community of Big Creek. The diversion dams are concrete structures that historically provided domestic water to SCE personnel and facilities in the community, but have not been in operation for approximately 30 years. Associated with the diversions are water conveyance systems consisting of above and below ground steel pipes.

Decommissioning the Pitman and Snow Slide creek facilities would include removal of existing above ground structures (diversions and piping). Removal activities would be limited to those necessary to return the area to a natural condition without causing significant adverse effects. Both diversion dams would be removed by using explosives and hand tools. Buried ancillary facilities would require significant ground disturbance to remove; therefore, these underground facilities would remain in place.

Decommissioning would maintain current instream flow conditions in Pitman and Snow Slide creeks. Snow Slide Creek is naturally fishless so the proposed decommissioning (abandoning the buried diversion in place) would not directly adversely affect or benefit fish.

Pitman Creek, downstream of the domestic diversion has self-sustaining populations of rainbow, brown, and brook trout. Decommissioning the domestic diversion would maintain the current instream flow and natural sediment transport downstream to Pitman Creek diversion.

Bear Creek Large Wood Debris Management

The Bear Creek diversion dam blocks the transport of LWD from the upper watershed to the Bear Creek bypassed reach. Under Settlement Agreement measure A1.7, SCE would return large wood to Bear Creek by allowing LWD to pass over Bear Creek diversion dam spillway during spill. SCE would also collect LWD from the impoundment in the vicinity of the intake gates and dam for placement in the bypassed reach. For purposes of this measure, LWD is defined as dead or dying wood 10-feet or longer and at least 4-inches in diameter. SCE may cut large pieces of wood that otherwise would not be feasible to collect and move from the Bear Creek forebay as long as the minimum dimensions for LWD, as defined above, are maintained.

LWD would be placed downstream of the USGS gaging weir to ensure there is no obstruction of the flow recording equipment at the gage. Individual pieces of LWD would be placed so at least a portion lies within the channel to help ensure the wood is captured during spill events and transported and redistributed downstream. LWD should be distributed, as access allows, for approximately 100 to 200 feet downstream of the gaging weir.

SCE would describe the past year's LWD placement at annual consultation meetings. SCE and the resource agencies would decide if the amount of LWD is sufficient and the LWD procedures are adequate to transport downstream during spill events. Future placement and procedures for placing and distributing LWD in the Bear Creek channel may be modified based on the annual consultation.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations consistent with Settlement Agreement measure A1.7, Large Wood Debris Management.

Our Analysis

In the reference reach upstream of Bear Creek diversion, more than half of the habitat units had 1 to 15 pieces of LWD. Most habitat units in the bypassed reach did not have LWD; six habitat units had 1 to 5 pieces of LWD and one unit had 5 to 10 pieces (SCE, 2003b). The limiting factors analysis of the bypassed reach suggests that adult rearing and spawning habitat is heavily utilized by an abundant trout population, and the physical habitat may be approaching limiting values.

LWD contributes to productive aquatic ecosystems, and is an important component in the formation of complex aquatic habitat units and channel maintenance. The proposed LWD supplementation in the bypassed reach would increase the amount of available trout habitat by creating deep pools that provide thermal refugia and increasing habitat complexity. LWD creates high flow velocity breaks and provides cover from predators, including other trout. Snorkel surveys conducted by the Sierra National Forest indicate that the highest trout densities are associated with LWD. The velocity breaks created by LWD also retain and sort substrate to create gravel bars and spawning habitat by salmonids.

Increased LWD would provide more substrate for macroinvertebrates that are part of the trout prey base, and would trap drift insects and terrestrial organic material that would increase stream productivity and carrying capacity. LWD decay products also provide organic carbon and energy sources for the food web of the aquatic ecosystem.

Temperature Monitoring and Management

The Settlement Agreement provides for the release of increased MIFs to project bypassed reaches (measures A1.1.1.1-A1.1.1.25). Under measure A1.8, SCE would implement the Temperature Monitoring and Management Plan, included as Settlement Agreement appendix H, to document the effects of proposed MIFs on water temperatures and allow for adaptive management where needed.

Under the Temperature Monitoring and Management Plan, SCE would monitor water temperatures during at least the first three to five years that new MIFs are released, including at least one dry or critically dry water year. Water temperature monitoring would focus on the summer months (June 1 through September 30) in the designated bypassed reaches downstream of project diversions (Settlement Agreement appendix H, table 1). The temperature monitoring sites would be in the South Fork San Joaquin River, the San Joaquin River Mammoth reach, Big Creek, North Fork Stevenson Creek, San Joaquin River Stevenson reach, Camp 61 Creek, Mono Creek, and Florence Lake. Data would be collected by SCE to assist in (1) documenting consistency with water temperature Basin Plan targets for daily mean and maximum water temperatures under the new MIFs, and (2) obtaining information about potential project controllable factors.

In the higher elevation bypassed reaches and other bypassed reaches except those on the mainstem San Joaquin River, water temperatures are expected to be cool and monitoring would have a nominal duration of three years or until at least one dry or critically dry water year is monitored. If water temperatures targets are maintained in these locations, monitoring would be discontinued after three years. If target water temperatures are not maintained during extreme conditions in a reach, SCE and the resource agencies would consult to determine if monitoring should be extended for that reach. The Water Board and the Commission would decide when the water temperature monitoring has shown consistency with maintaining target water temperatures and if the monitoring of that stream reach can be terminated. In the lower elevation Mammoth and Stevenson reaches, water temperatures would be monitored for no less than five years, including at least one dry or critically dry water year. To understand the influence of extreme meteorological conditions on water temperatures, meteorological data would be collected by SCE in selected locations within the Upper San Joaquin River Basin.

Monthly water temperature profiles would be collected in Florence and Mammoth Pool reservoirs to characterize temperature stratification and the controllability of downstream water temperatures. Mammoth Pool reservoir mixes in the late summer/fall during dry water years so that increased water releases from the reservoir may not reduce downstream water temperatures, and water temperature may not be a controllable factor at such times. Real-time telemetry would be used to monitor summer water temperatures in the Mammoth and Stevenson reaches and in the South Fork San Joaquin River downstream of Lake Florence to identify when target temperatures are exceeded. Temperature profiles measured in Mammoth Pool reservoir and telemetry of water temperatures in Mammoth reach near the point of release would identify if the water available for release into the reach is sufficiently cool to attain target temperatures or to prevent warming of daily mean water temperatures over 20°C by more than 2.7°C.

If water temperatures in Mammoth reach exceed target temperatures when Mammoth Pool reservoir is thermally stratified, cool water would be released at Mammoth Pool dam to reduce water temperatures. If water temperatures in the Stevenson reach exceed target temperatures when cool water is present in the Dam 6 impoundment, cool water would be released at Dam 6 to reduce water temperatures. Water temperature conditions would be considered project controllable within the capacity of the flow release structures, when cool water is available.

A supplemental study that includes fish, water temperature, and DO data collection would be implemented in the first, third, and fifth years after implementation of the new MIF to evaluate the use and importance of Stevenson reach for transitional zone species including hardhead, Sacramento pikeminnow, and Sacramento sucker. Sampling would take place in the same locations and use the same techniques as were used in the SCE 2002 CAWG-7 Characterize Fish Populations report. If the supplemental study concludes that Stevenson reach is an important native fish transition zone, and the consensus recommendation of SCE and the resource agencies is to change the beneficial use designation of the reach or the lower portion of the reach (downstream of the Stevenson Creek confluence), SCE would propose an amendment of the coldwater habitat designation in the Basin Plan.

The combined monitoring results would be used by SCE to prepare a long-term water temperature control program that would be approved by the Water Board and the Commission, and would be added to the plan. SCE would also prepare an interim water temperature control program within 1 year after license issuance. The interim program would contain measures (e.g., increased flow releases) that may be feasibly implemented by SCE to maintain water temperatures below target temperatures, when water temperature is a project controllable factor. The interim program would also include feasible measures to reduce water temperature increases when water temperatures are above target levels and cannot be reduced below target levels, when water temperature increases are a project controllable factor.

Other Recommendations

Interior filed 10(a) recommendations for all four Big Creek ALP Projects that are consistent with Settlement Agreement measure A1.8, Temperature Monitoring and Management Plan. Interior's 10(a) recommendation would expand the program to include temperature monitoring of all of the projects' affected reservoirs and affected stream reaches.

Our Analysis

The proposed Temperature Monitoring and Management Plan was developed to verify whether the Basin Plan designated coldwater beneficial use would be maintained in project bypassed reaches under the new MIFs, as defined by daily mean water temperatures ≤20°C and daily maximum water temperatures ≤22°C. The proposed Temperature Monitoring and Management Plan would benefit fish by documenting how project operations affect water temperatures so that flows may be adjusted where temperature criteria are not being achieved. Through the interim program and adaptive management based on the monitoring results, water temperatures beneficial to coldwater fishes could be achieved. Once the long-term water temperature control program has been approved, water temperature targets would be met by SCE, when water temperatures are a project controllable factor.

The Temperature Monitoring and Management Plan includes measurement of water temperatures at 19 sites in 6 stream reaches[42] where daily mean water temperatures exceeded 20°C or daily maximum water temperatures exceeded 22°C in 2000 or 2001, based on criteria supplied by the Water Board to protect coldwater beneficial uses. We find these criteria to be consistent with available literature on the preferred temperature ranges for rainbow and brown trout, which indicate that the preferred water temperature range extends up to at least 20°C, with no indication that short-term increases to temperatures as high as 22°C would impair growth. Although a daily average temperature of 20°C is slightly outside of the preferred range of 14 to 19ºC given by Moyle (2002) for brook trout, this is not a native species in California and is considered to be invasive in many areas that it has colonized.

[42] Seven sites on the South Fork San Joaquin River and in two of its tributaries (Camp 61 and Mono creeks), at six sites in the Mammoth and Stevenson reaches of the San Joaquin River, at four sites in the middle and lower Big Creek reaches, and at two sites in North Fork Stevenson Creek.

Interior's 10(a) recommendation would expand the monitoring program to include eight additional bypassed stream reaches (Stevenson, Upper Balsam, Bear, Hooper, Pitman, Bolsillo, Chinquapin, and Camp 62 creeks) none of which exceeded a daily mean temperature of 20°C or a daily maximum water temperature of 22°C in 2000 or 2001. Short-term (3 year) water temperature monitoring is proposed for Mono Creek upstream of the San Joaquin River at RM 0.1 in the Temperature Monitoring and Management Plan due to thermal heating in the reach that exceeds the Basin Plan standard (>5ºF). Based on monitoring data collected in 2000 and 2001, these reaches currently support all beneficial uses, would continue to do so under the MIFs proposed in the Settlement Agreement, and the proposed Mono Creek MIF is expected to decrease thermal warming to meet Basin Plan standards. Therefore, it is unclear what environmental enhancements would be achieved by Interior's 10(a) recommendation.

The Temperature Monitoring and Management Plan also includes measurement of temperature profiles in two reservoirs (Mammoth Pool and Florence Lake) to assess the potential for using cold water in these reservoirs to reduce water temperatures downstream. Interior's 10(a) recommendation would expand the monitoring program to include all 15 affected reservoirs and impoundments. However, two project reservoirs (Shaver and Huntington) besides Mammoth Pool and Florence Lake have sufficient storage to suggest that they have the potential to be used to manage downstream water temperatures. Shaver Lake has a maximum storage of 135,568 acre-feet and likely could be used to manage water temperatures in the downstream reach of Stevenson Creek. SCE's temperature monitoring data from 2000 and 2001 indicate that the temperature in this reach already meets the objectives to support coldwater life, and would continue to do so under the increased flows proposed in the Settlement Agreement. Similarly, Huntington Lake has a substantial amount of usable storage capacity (89,166 acre-feet), but the Upper Big Creek reach downstream of the reservoir already meets the objectives to support coldwater life, and would also be expected to do so under the increased flows proposed in the Settlement Agreement.

Implementing the Temperature Monitoring and Management Plan would assist in meeting the Basin Plan objectives for coldwater beneficial uses and Interior's SROs for the project affected reaches through adaptive management based on monitoring results.

Fish Monitoring

Trout populations in a number of the bypassed reaches have low densities, fragmented distributions, and/or skewed age class distributions. In many cases, fish populations appear to be constrained by the effects of flow diversions and project structures on stream flows, water temperatures, fish passage, and the transport and supply of spawning gravel and LWD. The Settlement Agreement includes measures that are expected to enhance fish populations by addressing many of these project-related effects.

Under Settlement Agreement measure A1.9, SCE would implement the proposed Fish Monitoring Plan, included as Settlement Agreement appendix I. Fish monitoring would be implemented at years 3, 8, 18, 28 (and in year 38, if a 50-year license is granted) in nine stream reaches and in Mammoth Pool reservoir, Huntington Lake, Florence Lake and in Shaver Lake. Fish populations would be monitored in the following stream reaches: San Joaquin River downstream of Mammoth Pool and Dam 6, Big Creek downstream of Dams 4 and 5, South Fork San Joaquin River downstream of Florence dam, Mono Creek downstream of the Mono diversion, Bear Creek downstream of the diversion, North Fork Stevenson Creek, and Stevenson Creek downstream of Shaver Lake. The proposed Fish Monitoring Plan also calls for a minimal amount of night snorkeling in the Mammoth reach. Monitoring would not begin until the new MIFs have been implemented in each survey reach. If monitoring is scheduled for a wet water year it would be postponed until the next non-wet water year to prevent confounding the effect of high flows on fish recruitment and populations.

The Fish Monitoring Plan would evaluate the response of fish populations in selected reaches and major reservoirs to the instream flow and other enhancement measures (channel and riparian maintenance flows, LWD, and sediment) included in the new licenses. Species composition, relative abundance, size and age distribution, biomass, density, and condition factors would be monitored during the months of August and September. Population statistics for hatchery-origin and wild trout would be evaluated separately. Physical measurements and observations of stream and reservoir conditions would be made at each sampling site including water temperature, specific conductance, and DO.

In addition, fish and crayfish would be collected from Mammoth Pool reservoir and fish would be collected from Huntington Lake during the population sampling events for tissue analysis, to evaluate for the presence bioaccumulated silver. Ten wild fish would be collected from each reservoir, and an additional ten crayfish would be collected from Mammoth Pool reservoir. Samples would be analyzed for silver content in 1) fish muscle tissue; 2) fish livers; and 3) entire crayfish. None of the project surface water or reservoir water samples exceeded the secondary drinking water objective for silver (100 micrograms per liter [µg/L]) (SCE, 2003h). However, the CTR and NTR have established more stringent silver criteria for acute dissolved silver criteria that are hardness dependent and calculated on a sample-by-sample basis, for the protection of freshwater aquatic life. The dissolved silver criteria were exceeded at one station in Mono Creek (0.26 µg/L), and on one occasion in the San Joaquin River downstream of Stevenson Creek (0.34 µg/L). The source of silver at these locations is unknown but SCE reports that it is not project-related. Results of the reservoir tissue sampling and comparisons to appropriate criteria would be included in the monitoring report.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations for all four Big Creek ALP Projects that are consistent with Settlement Agreement measure A1.9, Fish Monitoring Plan.

Our Analysis

Project Bypassed Reaches

The Forest Service's fisheries management goals, objectives, and direction, and Interior's general resource objectives for project bypassed reaches include: (1) managing fish habitat to maintain viable populations of all resident or indigenous fish; (2) determining and recommending MIFs and habitat conditions that maintain, enhance, or restore all life stages of native aquatic species and fish passage; (3) providing hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic dependent species; and (4) managing habitat for Forest Service sensitive fish species in a manner that prevents any species from becoming a candidate for threatened or endangered status. Resource objectives developed by the Forest Service and Interior for specific reaches are presented in *General Streamflow Requirements*. These generally focused on (1) providing more adult trout habitat, (2) reducing water temperatures, (3) providing more trout spawning habitat, and (4) increasing fish passage during the spawning seasons.

Monitoring fish populations in these reaches would provide a means of assessing the effects of the new MIFs and other enhancement measures on fish populations and to apply adaptive management, as needed. Fish population monitoring also would help determine if the Forest Service, Interior, and Basin Plan objectives are being met in these reaches.

Project Reservoirs and Impoundments

Cal Fish & Game management objectives for the large project reservoirs are focused on maintaining adequate populations of coldwater game fish (rainbow trout, brown trout, and kokanee). Cal Fish & Game manages Mammoth Pool reservoir as a put-and-take fishery for catchable rainbow trout, and a stock-and-grow fishery for fingerling and sub-catchable rainbow trout. It manages Huntington and Shaver lakes as put-and-take fisheries for catchable rainbow trout and as stock-and-grow fisheries for fingerling and sub-catchable rainbow trout and kokanee. Shaver Lake also supports a warmwater fishery for smallmouth bass, bluegill, and crappie, and another Cal Fish & Game objective for Shaver Lake is to provide suitable habitat for warmwater sport fish. Florence Lake and its tributaries support a self-sustaining population of brown trout.

In the proposed reservoir monitoring studies, fish populations would be described by depth intervals along with corresponding measurements of physical habitat (temperature, specific conductance, and DO). Monitoring fish populations would provide a means of assessing the effects of the new MIFs on fish populations in the major reservoirs, including potential effects of earlier depletion of cool water in dry years on reservoir trout. This information would help determine if Cal Fish & Game's management objectives for these reservoirs are being met, and would guide adaptive management plans.

As part of reservoir sampling, fish and crayfish from Mammoth Pool reservoir and fish from Huntington Lake would be collected for tissue analysis to evaluate the presence of bioaccumulated silver. Elevated silver levels may be associated with application of silver iodide in the watershed by SCE to enhance rainfall in the Upper San Joaquin River Watershed as a means to increase water yields for project operations (letter from W.E. Loudermilk, Regional Manager, Cal Fish & Game, Fresno CA to J. McPheeters, Manager of Northern Hydro Region, SCE, Rosemond CA, dated October 17, 2005). The application of silver iodide in the San Joaquin Watershed to stimulate increased water supply for the projects in the Big Creek System represents a project-related activity. Although we have no means to identify whether silver that occurs in project waters and in the tissue of fish from project waters is from silver iodide applications or naturally occurring sources, the information on silver levels in fish tissue would help to determine the extent of silver bioaccumulation in aquatic biota.

Sediment Management

Accumulation of sediment behind project dams prevents the flow of sediment, spawning gravel, and other materials beneficial to fish and wildlife from continuing downstream through the project-affected stream reaches. Under Settlement Agreement measure A1.10, SCE would implement the sediment management measures described in Settlement Agreement appendix J. These include measures for passing accumulated sediment through project facilities followed by flushing flows to redistribute passed sediments, removing accumulated sediment from behind dams that may block low level outlets or intake structures if necessary for continued project operations and minimum flow releases, and monitoring turbidity or pool filling. Table 3-14 summarizes sediment and monitoring measures proposed in the Settlement Agreement for each reach. SCE commits to consult with the Forest Service, Cal Fish & Game, FWS, and other regulatory agencies regarding information needs and permitting requirements for sediment management activities. If additional information is needed to obtain necessary permits, SCE would provide that information. Turbidity monitoring results would be reported to the Forest Service, FWS, Cal Fish & Game, the Water Board, and other interested government agencies. SCE would consult with these agencies to determine if modifications to the sediment management measures are warranted.

Table 3-14. Summary of proposed sediment management measures. (Source: SCE 2007b, staff)

Dam	Sediment Pass-through	Sediment Removal	Flushing Flow	Monitoring	
				Pool-filling	Turbidity
Balsam Creek Bolsillo Creek Camp 62 Chinquapin Creek Hooper Creek Pitman Creek Ross Creek Rock Creek Ely Creek	yes	if needed	wet year spring runoff with no diversion	no	no
Dam 4	yes	no	600 cfs for 24 hrs	yes	yes
Dam 5	yes	if needed	600 cfs for 24 hrs	yes	yes
Dam 6	yes	if needed	3,000 cfs for 24 hrs	yes	yes
Mono Creek	no	if needed	Channel and riparian maintenance flow (450 or 800 cfs)	no	yes
Mammoth dam	yes	no	whitewater recreation pre-spill flows (350 to 850 cfs)	no	yes

Dam	Sediment Pass-through	Sediment Removal	Flushing Flow	Monitoring	
				Pool-filling	Turbidity
Portal dam	no	if needed	TBD	no	yes
Balsam Meadows dam	no	if needed	no[a]	no	yes

[a] In its comments on the draft EIS, SCE clarified that its intent was to commit to flushing flows, if needed, at Portal dam but not at Balsam Meadows dam.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations for all four Big Creek ALP Projects that are consistent with Settlement Agreement measure A1.10, Sediment Management Prescriptions.

Our Analysis

Sediment retention behind the project dams has resulted in depletion of spawning gravels in the bypassed reaches. The proposed sediment pass-through activities would restore sediment transport processes in the bypassed reaches by allowing sediments and gravels stored in project impoundments to be transported downstream. Likely benefits of restoring the passage of sediment into downstream reaches include: increasing the volume of spawning gravels, improving benthic macroinvertebrate production, creating greater quality and diversity of aquatic habitats to benefit native fishes, and creating point bar development to enhance riparian habitat.

The potential effects of sediment management measures proposed at specific locations are discussed individually below.

Balsam, Bolsillo, Camp 62, Chinquapin, Hooper, Pitman, Ross, Rock, and Ely Creek Diversions

The low level outlets in Balsam, Bolsillo, Camp 62, Chinquapin, Hooper, Pitman, Ross, Rock, and Ely creek diversions would be opened during each spring runoff period in wet years, when flow is not diverted, to facilitate the pass through of accumulated sediment. If necessary, physical removal of sediment from behind the diversions would be done by hand or equipment during the low flow period in the spring prior to runoff, or in the fall.

Spring sediment releases could potentially cause some short-term decreases in the quality of spawning gravels in areas where large amounts of fine sediments are deposited. However, implementing sediment pass-through activities in wet years would minimize the potential for deposition of fine sediments in spawning gravels. Furthermore, a long-term increase in the amount of gravel available in these reaches likely would improve the quantity and quality of available spawning habitat. Overall, pass-through releases would provide a relatively natural sediment cycle, prevent large volumes of sediment from accumulating, maintain the natural sediment budget, and facilitate sediment transport.

The sediment pass-through measures proposed for these creeks would also help address sediment deficits in the larger downstream reaches. Sediment pass-through measures proposed for Bolsillo, Camp 62, Chinquapin, and Hooper creeks would provide much needed sediment to the South Fork San Joaquin River bypassed reach. Pitman Creek (through the Dam 4 forebay), Balsam Creek, and Ely Creek would provide sediment to Middle Big Creek bypassed reach. Ross and Rock creeks would provide much needed sediment to Mammoth reach.

Big Creek Dams 4, 5, and 6

Sediment pass-through or sediment removal activities at Dams 4, 5, and 6 would be implemented within 5 years of approval of the sediment management measures and would be implemented at least every 5 years after the initial implementation. The proposed sediment pass-through activities would occur between January 1 and March 31, which may temporarily decrease the amount of suitable spawning gravel available to spring spawning rainbow trout. The earlier these activities are implemented within this timeframe, the less likely that spawning rainbow trout or eggs incubating in the gravel would be affected.

Big Creek Dam 4 Forebay – At Dam 4, the low level outlet valve would be opened and the water surface elevation repeatedly fluctuated between the elevation of the tunnel invert intake and the low level outlet to mobilize sediment from the banks of the forebay. A flow not less than the MIF would be maintained through the low level outlet. After sediment pass-through is completed and the low level outlet has been closed, a minimum of 600 cfs would be spilled over the dam for at least 24 hours to facilitate sediment transport.

Because Middle Big Creek bypassed reach is a high gradient reach (95 percent high gradient channel and 5 percent moderate), it has a high sediment transport capacity. As a result, we expect that the proposed 600 cfs flushing flow should be sufficient to facilitate sediment transport and reduce pool filling and sedimentation in the bypassed reach following the proposed sediment pass-through. Sediment transported through Middle Big Creek bypassed reach would be stored in Dam 5 forebay until passed through to Lower Big Creek bypassed reach.

Big Creek Dam 5 Forebay – Sediment pass-through would be conducted following the methods used at Dam 4. Equipment would be used to remove residual sediment if necessary and culverts would be installed in areas where heavy equipment must cross the forebay. The MIF would be maintained during sediment removal.

Under the current license, sedimentation of Lower Big Creek bypassed reach occurs every 7 years when the Dam 5 forebay is drained for tunnel inspections. The resulting sedimentation may cause pool filling and embed spawning gravels which may, in turn, adversely affect trout reproduction, until flows of sufficient magnitude and duration occur to move the sediment downstream into the San Joaquin River. Because Lower Big Creek bypassed reach is a high gradient channel with a natural capacity to transport sediment, we expect that the proposed 600 cfs flushing flow may be sufficient to facilitate sediment transport and stored sediment in the streambed and pools. The maximum discharge during the period of record between January and March was 972 to 3,540 cfs near the mouth of Big Creek (gage no. 11238500); minimum flows at this location were 1.2 to 1.4 cfs (see table 3-9). Sediment transported through Lower Big Creek bypassed reach would be stored behind Dam 6 until passed through the Dam 6 forebay to the Stevenson reach.

Big Creek Dam 6 Forebay – Sediment pass-through at Dam 6 would follow the same procedures used at Dams 4 and 5, with the following modifications. A flow not less than the MIF would be maintained through two low level outlets during sediment pass-through. During each forebay fluctuation, a different sequence of two of the four low level outlets will be opened. After the sediment pass-through is completed and the low level outlets have been closed, a minimum of 3,000 cfs would be spilled over the dam for at least 24 hours to facilitate sediment transport. Sediment removal, if required, would follow the same procedures proposed for Dam 5.

Sediment releases from Dam 6 would improve the diversity of habitat types that occur in the entrenched, gully type channel that comprises the entire length of the Stevenson reach downstream of Dam 6. Because the reach has a moderate gradient of 2 to 4 percent, the proposed spill flow of 3,000 cfs would likely be sufficient to transport sediments and sort gravels to provide quality spawning habitat. However, monitoring the quality of spawning gravels could be important to confirm whether the spill flow is sufficient to maintain and/or improve the quantity and quality of spawning habitat.

Mono Creek Diversion and Balsam Meadows and Portal Forebays

Sediment pass-through and sediment removal activities at Mono Creek diversion, Balsam Meadows forebay, and Portal forebay[43] would be implemented within 5 years of approval of the sediment management measures and then at least every 5 years after the initial implementation.

Mono Creek Diversion – Mono Creek diversion forebay sediment removal activities would occur in wet years prior to the implementation of channel and riparian maintenance flows. The forebay would be drawn down for no longer than two weeks between July 1 and August 31 to allow equipment to remove sediment. A trench would

[43] Portal forebay is part of the Portal Project, and changes in the proposed environmental measures for that project would be addressed in the license order for that proceeding.

be created in the forebay from the confluence of Mono Creek and the forebay to the low level outlet to transport the 25-cfs MIF or maximum flow through the outlet valve, whichever is less. There would be no sediment pass-through activities. Following sediment removal, the low level outlet would be closed and the Mono Creek channel and riparian maintenance flow would be spilled over the dam.

Mono Creek bypassed reach has large accumulations of sand that limit fish and macroinvertebrate populations (SCE, 2003b). Fine sediment in spawning substrate has been shown to significantly decrease salmonid embryo survival when it exceeds 20 percent (Bjornn and Reiser, 1991). The proposed Mono Creek diversion sediment management would not include any pass-through activities. Mechanical removal of accumulated sediment would be used to reduce further effects by sand and fine sediment. The proposed Mono Creek channel and riparian maintenance flow would transport accumulated sediment out of Mono Creek, including sediment introduced during sediment removal activities, downstream to the sediment deficit South Fork San Joaquin River bypassed reach (see *Channel and Riparian Maintenance Flows-Mono Creek*).

Balsam Meadows and Portal Forebays – If sediment removal is determined to be necessary in either forebay, it would be conducted in late fall to allow the use of mechanical equipment. The forebay would be drawn down to allow equipment to remove sediment, and a trench would be created in the forebay from the point of inflow to the low level outlet to transport the required MIF around the sediment removal area. No sediment pass-through activities are proposed.

Any sediment that is conveyed into Balsam and Camp 61 creeks during the proposed sediment removal activities has the potential to adversely affect spawning habitat. However, given that work would be conducted in the fall when flows would be low, the amount of sediment that would be transported to areas downstream of the forebays would likely be small. Any adverse effects on spawning conditions likely would be very minor and would affect only fall-spawning, non-native brook and brown trout. As a result, there would be no need to implement flushing flows downstream from Balsam Meadows or Portal forebays. The sediment management measure in the Settlement Agreement, however, includes a provision specifying that if a flushing flow is implemented in Camp 61 Creek downstream of the Portal forebay, the time frames and peak flow magnitudes of flushing flows would be determined in consultation with the Forest Service and other interested resource agencies, which would minimize the potential for any adverse effects.

Mammoth Pool

In wet water years, SCE would provide a continuous release between approximately 350 and 850 cfs for recreational purposes until such time as Mammoth Pool dam spills. This whitewater release is targeted to begin on April 15. If Mammoth Pool dam is already spilling on April 15, SCE would have no further responsibilities to provide whitewater recreational flows for the year. If SCE determines conditions are suitable to provide pre-spill flows prior to April 15, SCE may initiate pre-spill releases at an earlier date. Pre-spill release flows would be provided by operation of the Howell-Bunger valve at Mammoth Pool dam. Operation of the valve may allow sediment accumulated at the intake structure to pass downstream.

Mammoth Pool reservoir likely traps all but fine (suspended) sediments, and as a result, the Mammoth reach has a sediment deficit. Use of the Howell-Bunger valve to pass pre-spill releases would likely supply some sediment to the reach and improve the entrenched, gully type channel that comprises nearly half of bypassed reach. The proposed whitewater release flows would facilitate sediment transport, distribution, and sorting throughout the length of Mammoth reach.

Monitoring

The Settlement Agreement calls for monitoring pools downstream of Dams 4, 5, and 6 prior to and after implementation of sediment pass-through measures, to determine whether deposition of fine sediments has caused pools to fill with sediments and their volume reduced. The weighted mean value of the level of fine sediments in a representative set of five pools downstream of the diversion would be measured according to procedures defined by Hilton and Lisle (1993). Monitoring measurement locations would be approved by the Forest Service, Cal Fish & Game, Interior, the Water Board, and other interested resource agencies.

Monitoring pool depth at reaches downstream of Big Creek Dams 4, 5, and 6 would allow effects of sediment pass-through on pool habitat to be assessed and provide information that could be used to alter the implementation of sediment pass-through measures if excessive pool filling occurs. Excessive pool filling would adversely affect habitat availability and thermal refugia for adult trout. Given the relatively steep gradient and large drainage upstream of these dams, the volume of sediments retained in the reservoirs may be large, and the amount of sediment stored in these impoundments could be substantial. Also, given the relatively small size of the reservoirs, much of the sediment may be deposited relatively close to the dams, and may be accessible for release during the sediment pass-through operations.

The Settlement Agreement does not require monitoring of pool depths for the other dams where sediment pass-through measures would be implemented, including Mammoth Pool and the nine smaller headwater diversions listed in table 3-14. Because of the large size of the Mammoth Pool impoundment (approximately 8 miles in length), we would expect that most of the sediment retained in this reservoir would be deposited in the upstream portion of the reservoir. Furthermore, we expect that only small amounts of fine sediments would be released when pre-spill whitewater flows are released via the Howell-Bunger valve, and that these sediments would be easily transported downstream and pose little threat of pool-filling. The nine headwater diversions are on high gradient streams with very small impoundments, all of which have a surface area of less than 1 acre and a volume of less than 1 acre-foot. Given the small amount of sediment that could be retained in these impoundments and the high transport capacity of these headwater streams, we conclude there is little risk of pool-filling on these tributaries.

At all but nine small headwater diversions, SCE would also monitor turbidity prior to and during implementation of sediment management measures. In each year prior to implementation, SCE would monitor turbidity during two storm events at the same locations. Following submittal of the monitoring results, SCE would consult with the agencies to determine if modifications to sediment management measures are warranted. Monitoring would be discontinued in subsequent years, upon approval of the Forest Service, Interior, Cal Fish & Game, and the Water Board. Expansion of this monitoring component to include an assessment of the surficial deposition of fine sediment in representative potential spawning sites would allow potential adverse effects on spawning gravel to be evaluated and included in the evaluation of whether modifications to the sediment management measures are warranted.

Gravel Augmentation

Appendix B of the Settlement Agreement includes measures that the parties to the settlement do not propose as conditions in the new license because these measures were determined not to be related to project operations. We include an evaluation of one aquatic measure from appendix B of the Settlement Agreement in this section which we consider to be related to project operations and that has the potential to affect dam safety.

To address project effects on the recruitment of spawning gravels in Mammoth reach, SCE proposes to implement the Gravel Augmentation Plan described in Settlement Agreement measure B.1.2. The Forest Service reserved authority to add the gravel augmentation plan to its 4(e) conditions if the Settlement Agreement was not executed before a new license was issued.

Under the proposed plan, SCE would coordinate with the Forest Service, FWS, Cal Fish & Game, the Water Board, and other interested resource agencies to implement a feasibility assessment to determine if placing gravel in or near the spillway channel at Mammoth Pool dam is feasible and whether gravel placed at this location would be moved and redistributed by spill flows.

The assessment would determine whether gravel augmentation in or below the spillway channel would:

- impair the Mammoth Pool dam spillway function;
- result in erosion and undermining of the access road to Mammoth dam;
- result in dam instability or impair operation of the release structures; or
- hinder inspections to the dam and the release structures.

If the assessment concludes that the placement of gravel in or below the spillway channel would lead to any of these problems or would create other reliability or operational problems, then SCE would seek alternative locations for gravel placement.

SCE would evaluate various alternative locations to determine if other resources would be adversely influenced by gravel augmentation and if the augmentation would likely increase spawning gravel in Mammoth reach. The alternative locations would have sufficient physical space and access for placement of gravels and be comparable in cost to the placement of gravels in or below the spillway. These alternative locations would include, but would not be limited to, a location below the confluence of Rock Creek.

Gravel augmentation would begin after the first Mammoth reach fish monitoring following the initiation of the new flow regime. SCE would place 300 tons of gravel into the Mammoth reach immediately below Mammoth dam spillway, or at alternative feasible location(s). SCE would monitor gravel transport and distribution and evaluate whether the next two above normal or wet water year spill events with a peak flow of at least 5,000 cfs would be capable of moving the gravel from the emplacement site.

SCE would prepare a report following the completion of gravel monitoring after the second spill event for agency review and comment. SCE and the agencies would meet and decide whether to continue or modify the gravel augmentation program or implement a fish stocking program instead.

If the pilot project is successful, gravel augmentation would be implemented over the life of the license. If not, then a supplemental fish stocking program in the Mammoth reach would be implemented by Cal Fish & Game.

Our Analysis

Mammoth Pool dam is a barrier to downstream gravel movement and as a result, the Mammoth reach has a gravel deficit, and spawning habitat is limited. If feasible, based on results of the feasibility assessment, implementing a long-term gravel augmentation program would improve spawning habitat and trout recruitment in Mammoth. Increased gravel would also increase productivity by providing more habitat for benthic macroinvertebrates. Although the gravel augmentation program is proposed as a non-license measure, the feasibility assessment would be needed to determine the potential effect of this measure on project facilities, including the Mammoth Pool dam, spillway, and access road.

3.3.1.3 Cumulative Effects

Past and present cumulative effects on aquatic resources in the Upper San Joaquin River Basin result from hydropower development and operations, irrigation withdrawals, agricultural and rural development, recreational use and development, timber harvesting, mining, road building and maintenance, sport fisheries, and hatchery management.

These actions have caused adverse water quality and aquatic habitat effects, such as increased erosion and sedimentation, chemical and metals contamination, decreased floodplain connectivity, decreased riparian zones and LWD recruitment potential, altered peak and base flows, altered sediment transport, wetland and side-channel filling, rip-rapping to control channel migration, decreased aquatic habitat complexity, creation of migration barriers, loss of anadromous Chinook salmon and steelhead runs and productivity (i.e., loss of marine derived nutrients), introduction of non-native fishes and fish diseases.

Ongoing project-related cumulative effects on aquatic resources include interruption of sediment transport processes, alteration of water temperatures, and reduction of streamflows during the summer/fall low flow season.

The Settlement Agreement includes conservation measures that would reduce each of these cumulative effects and improve coldwater fish habitat and increase trout populations in project bypassed reaches. These measures have been previously discussed (see section 3.3.1.2), and would reduce the cumulative effects associated with operation of Big Creek facilities and would benefit all native and non-native coldwater trout by improving the quality of coldwater habitat in the bypassed reaches.

3.3.2 Terrestrial Resources

3.3.2.1 Affected Environment

Vegetation

SCE mapped vegetation communities within 0.25 miles of project facilities, roads, transmission lines, bypassed and flow-augmented reaches, and recreational facilities at the Big Creek ALP Projects in 2001, 2002, and 2003. SCE mapped 17 community types in the Big Creek Nos. 2A, 8, and Eastwood Project; 14 types at the Big Creek Nos. 1 and 2 Project; 13 types at the Mammoth Pool Project; and 5 types at the Big Creek No. 3 Project (table 3-15).

Table 3-15. Vegetation communities and wildlife habitats within 0.25 mile of the Big Creek ALP Project facilities. (Source: SCE, 2007a)

Vegetation Community/ Wildlife Habitat	Big Creek Nos. 2A, 8, and Eastwood	Big Creek Nos. 1 and 2	Mammoth Pool	Big Creek No. 3
Gray Pine-Chaparral Woodland/ Mixed Chaparral	X	X	X	X
Gray Pine-Chaparral Woodland with Rock Substrate/Mixed Chaparral with Rock Substrate	X	X	X	X
Westside Ponderosa Pine Forest/ Ponderosa Pine Forest			X	
Westside Ponderosa Pine Forest with Rock Substrate/Ponderosa Pine Forest with Rock Substrate				

Vegetation Community/ Wildlife Habitat	Big Creek Nos. 2A, 8, and Eastwood	Big Creek Nos. 1 and 2	Mammoth Pool	Big Creek No. 3
Sierran Mixed Coniferous Forest/Sierran Mixed Coniferous Forest	X	X	X	X
Sierran Mixed Coniferous Forest with Rock Substrate/Sierran Mixed Coniferous Forest with Rock Substrate	X	X	X	X
Jeffrey Pine Forest/Jeffrey Pine Forest	X			
Jeffrey Pine Forest with Rock Substrate/Jeffrey Pine Forest with Rock Substrate	X			
Jeffrey Pine-Fir Forest/Jeffrey Pine Forest	X	X		
Jeffrey Pine-Fir Forest with Rock Substrate/Jeffrey Pine Forest with Rock Substrate	X	X		
Lodgepole Pine Forest/ Lodgepole Pine Forest	X			
Blue Oak Woodland/Blue Oak Woodland		X	X	X
Oak Woodland/Montane Hardwood	X	X	X	X
Oak Woodland with Rock Substrate/Montane Hardwood with Rock Substrate	X	X	X	
Mixed Montane Chaparral/ Mixed Chaparral or Montane Chaparral	X	X	X	X
Mixed Montane Chaparral with Rock Substrate/Mixed Chaparral or Montane Chaparral with Rock Substrate	X	X	X	
Riparian/Montane, Valley, and	X	X	X	X

Vegetation Community/ Wildlife Habitat	Big Creek Nos. 2A, 8, and Eastwood	Big Creek Nos. 1 and 2	Mammoth Pool	Big Creek No. 3
Foothill Riparian				
Wet Montane Meadow/Wet Meadow	X	X	X	
Dry Montane Meadow/ Perennial Grassland	X			
Montane Freshwater Marsh/ Fresh Emergent Wetland				
Ruderal/Ruderal	X	X	X	
Open Ground/Open Ground	X	X	X	
Water/Water	X	X	X	X
Developed/ Developed	X	X	X	X

Noxious Weeds

In 2001, 2002, and 2003 SCE mapped noxious weeds adjacent to project facilities, roads, transmission lines, and recreational facilities at all the Big Creek ALP Projects.

SCE identified 10 noxious weeds and invasive ornamental plant species in the Big Creek Nos. 2A, 8, and Eastwood Project vicinity: black mustard (*Brassica nigra*), cheatgrass (*Bromus tectorum*), bull thistle (*Cirsium vulgare*), English ivy (*Hedera helix*), Klamathweed (*Hypericum perforatum*), perennial pepperweed (*Lepidium latifolium*), Himalayan blackberry (*Rubus discolor*), black locust (*Robinia pseudoacacia*), common tansy (*Tanacetum vulgare*), and woolly mullein (*Verbascum thapsus*). SCE identified eight noxious weeds and invasive ornamental plant species in the vicinity of the Big Creek Nos. 1 and 2 Project: cheatgrass, bull thistle, Scotch broom (*Cytisus scoparius*), Klamathweed, black locust, Himalayan blackberry, Spanish broom (*Spartium junceum*), and periwinkle (*Vinca major*). SCE identified four noxious weeds and invasive ornamental plant species in the vicinity of the Mammoth Pool Project, including: black mustard, cheatgrass, tocalote (*Centaurea melitensis*), and bull thistle. SCE identified six noxious weeds and invasive ornamental plant species in the vicinity of the Big Creek No. 3 Project: tree of heaven (*Ailanthus altissima*), black mustard, cheatgrass, Klamathweed, Himalayan blackberry, and Spanish broom.

Special-status Plant Species

SCE mapped special-status plant adjacent to project facilities, roads, transmission lines, and recreational facilities at the Big Creek ALP Projects in 2002 and 2003. SCE did not locate any state or federally listed plant species in any of the project areas. Based on the results of the surveys, SCE identified four special-status plant species in the vicinity of Big Creek Nos. 2A, 8, and Eastwood Project: Mono Hot Springs evening primrose (*Camissonia sierrae ssp. alticola*), short-leaved hulsea (*Hulsea brevifolia*), madera linanthus (*Leptosiphon serrulatus*), and flat-leaved bladderwort (*Utricularia intermedia*). SCE mapped two special-status plant species in the vicinity of the Big Creek Nos. 1 and 2 Project: subalpine fireweed (*Epilobium howellii*) and madera linanthus. SCE located three special-status plant species in the vicinity of Mammoth Pool Project, including: Mono Hot Springs evening primrose, flaming trumpet (*Collomia rawsoniana*), and Yosemite lewisia (*Lewisia disepala*). Several more special-status plant species have the potential to occur within these three Big Creek projects (see table 3-16). There are no known special-status plant species in the Big Creek No. 3 Project.

Riparian Vegetation

SCE mapped riparian vegetation along all of the Big Creek ALP Projects in 2002 and 2003. Significant riparian habitat occurs along approximately 47 river miles or 54 percent of the total river miles along streams associated with the projects (see table 3-17). Wet montane meadows comprise approximately 1.6 river miles or 3.4 percent of the mapped area along these streams. SCE found wide corridors of riparian vegetation to be relatively uncommon in the vicinity of the projects due to the geology, steep hillslopes, narrow valley bottoms, coarse substrate, and/or entrenched stream channels with limited soil development and sediment deposition sites. These factors result in only limited areas for riparian habitat to become established. In addition, many of the larger streams are deeply entrenched in bedrock-boulder channels with few locations for riparian vegetation establishment. Five riparian community types were identified in streams associated with the Big Creek ALP Projects, varying with elevation. The understory is composed of grasses and forbs, with few non-native species.

Table 3-16. Special-status plant species known or potentially occurring in the vicinity of the Big Creek ALP Projects. (Source: SCE, 2007a)

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Allium yosemitense Yosemite onion	–	FSS	CR, CNPS 1B.3	April–July	Broad-leaved upland forest, chaparral, cismontane woodland, lower montane coniferous forest; rocky, metamorphic substrate. 1,755–7,200 feet.	Unlikely	Not detected	Not detected	Unlikely
Botrychium crenulatum Scalloped moonwort	–	FSS	CNPS 2.2	Fertile June to July	Lower montane coniferous forests, oak woodlands, and chaparral, open rocky slopes. 4,900–10,765 feet.	Unlikely	Potential	Potential	Unlikely
Botrychium lineare Slender moonwort	FC	FSS	CNPS 1B.3	Unknown fertility period	Lower montane coniferous forests, oak woodlands, and chaparral, open rocky slopes to 8,530 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Bruchia bolanderi Bolander's candle moss	–	FSS	CNPS 2.2	N/A	Lower montane coniferous forest, meadows and seeps, upper montane coniferous forest: damp soil. 5,575–9,190 feet.	Unlikely	Potential	Potential	Unlikely
Calyptridium pulchellum Mariposa pussypaws	FT	–	CNPS 1B.1	April–August	Cismontane woodland in shallow granite soils on granitic domes, restricted to exposed sites. 1,300–3,600 feet.	Unlikely	Unlikely	Not detected	Not detected

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Camissonia sierrae ssp. *Alticola* Mono Hot Springs evening primrose	–	FSS	CNPS 1B.2	May–August	Lower montane coniferous forest, upper montane coniferous forest: granitic, gravel and sand pans. 4,500–8,500 feet.	Known	Not detected	Known	Unlikely
Carlquistia muirii Muir's tarplant	–	FSS	CNPS 1B.3	July–August	Chaparral (montane), lower montane coniferous forest, upper montane coniferous forest. 3,605–8,205 feet.	Unlikely	Not detected	Not detected	Unlikely
Carpenteria californica Tree-anemone	–	FSS	CT, CNPS 1B.2	May–July	Cismontane woodland, chaparral. Endemic to Fresno County. Very localized on well-drained granitic soils, mostly on north-facing ravines and drainages. 1,500–4,000 feet.	Not detected	Not detected	Not detected	Not detected
Castilleja campestris ssp. *succulenta* Succulent owl's-clover	FT	–	CE, CNPS 1B.2	April–May	Vernal pools. 1,640–2,460 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Clarkia biloba ssp. *australis* Mariposa clarkia	–	FSS	CNPS 1B.2	May–July	Chaparral, cismontane woodland. 980–3,100 feet.	Not detected	Not detected	Not detected	Not detected

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Clarkia lingulata Merced clarkia	–	FSS	CE, CNPS 1B.1	May–June	Chaparral, cismontane woodland. 1,312—1,492 feet.	Unlikely	Unlikely	Not detected	Not detected
Collomia rawsoniana Flaming trumpet	–	FSS	CNPS 1B.2	July–August	Riparian forest, lower montane coniferous forest on stabilized alluvium in riparian zones, at mid elevations along perennial streams north of the San Joaquin River. 2,500–7,200 feet.	Known	Not detected	Not detected	Not detected
Cypripedium montanum Mountain lady's slipper	–	FSS	CNPS 4.2	March–August	Broad-leaved upland and lower montane coniferous forests, moist or dry shaded slopes. 700–7,200 feet.	Not detected	Not detected	Not detected	Not detected
Delphinium inopinum Unexpected larkspur	–	FSS	CNPS 4.3	May–July	Alpine boulder and rock fields at high elevations in rocky soil at the extreme southern boundary of the SNF. 7,200–9,200 feet.	Unlikely	Not detected	Not detected	Unlikely
Dicentra nevadensis Tulare County bleeding heart	–	FSS	CNPS 4.3	June–October	Subalpine coniferous forest in gravelly openings. 7,200–10,000 feet.	Unlikely	Not detected	Not detected	Unlikely
Epilobium howellii Subalpine fireweed	–	FSS	CNPS 1B.3	July–August	Meadows, subalpine coniferous forest, wet meadows, mossy seeps. 6,500–9,000 feet.	Unlikely	Known	Not detected	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Erigeron aequifolius Hall's daisy	–	FSS	CNPS 1B.3	July–August	Broad-leaved upland forest, lower and upper montane coniferous forest, pinyon-juniper woodland, rocky soils. 4,900–8,000 feet.	Unlikely	Not detected	Not detected	Unlikely
Eriogonum nudum var. *regirivum* King's River buckwheat	–	FSS	CNPS 1B.2	August–November	Cismontane woodland; carbonate, rocky substrate. 490–985 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Eriogonum prattenianum var. *avium* Kettle Dome buckwheat	–	FSS	CNPS 4.2	June–August	Upper montane coniferous forest on granitic soils. 3,900--8,500 feet.	Unlikely	Not detected	Not detected	Unlikely
Eriophyllum congdonii Congdon's woolly sunflower	–	FSS	CR,CNPS 1B.2	May–June	Chaparral, cismontane woodland, lower montane coniferous forest: on metamorphic soils. 1,600–6,200 feet.	Not detected	Not detected	Not detected	Not detected
Erythronium pluriflorum Shuteye Peak fawn lily	–	FSS	CNPS 1B.2	May–July	Upper montane coniferous forest, meadows, subalpine coniferous forest, rocky granitic outcrops and slopes. 6,758–8,366 feet.	Unlikely	Not detected	Not detected	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Heterotheca monarchensis Monarch golden-aster	–	FSS	CNPS 1B.3	May–October	Cismontane woodland; carbonate substrate. 3,590–6,070 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Hulsea brevifolia Short-leaved hulsea	–	FSS	CNPS 1B.2	May–August	Granitic or volcanic soils in openings and under canopy in mixed conifer and red fir forest. 4,900–8,900 feet.	Unlikely	Not detected	Known	Unlikely
Hydrothyria venosa Veined water lichen	–	FSS	–	N/A	Cold, clear, unpolluted streams in mixed conifer forests. 4,000–8,000 feet.	Unlikely	Potential	Potential	Unlikely
Lewisia congdonii Congdon's lewisia	–	FSS	CR,CNPS 1B.3	April–June	Chaparral, cismontane woodland, lower montane coniferous forest, upper montane coniferous forest, granitic, moist places on metamorphic soils. 1,600–9,200 feet	Unlikely	Unlikely	Unlikely	Unlikely
Lewisia disepala Yosemite lewisia	–	FSS	CNPS 1B.2	April–June	Lower montane coniferous forest, pinyon juniper woodland upper montane coniferous forest, fine gravel on rock outcrops or domes. 4,250–11,000 feet.	Known	Not detected	Not detected	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Leptosiphon serrulatus Madera linanthus	–	–	CNPS 1B.2	April–May	Cismontane woodland, lower montane coniferous forest, open areas, chaparral. 1,000–4,000 feet.	Not detected	Known	Known	Not detected
Lupinus citrinus var. *citrinus* Orange lupine	–	FSS	CNPS 1B.2	April–July	Chaparral, cismontane woodland, lower montane coniferous forest, rocky granitic outcrops, usually in open areas (i.e. forest openings), on flat to rolling terrain. 2,000–5,000 feet.	Not detected	Unlikely	Not detected	Not detected
Meesia triquetra Three-ranked hump moss	–	FSS	CNPS 2.2	N/A	In bogs and wet woods. 6,000–8,000 feet.	Unlikely	Potential	Potential	Unlikely
Meesia uliginosa Broad-nerved hump moss	–	FSS	CNPS 2.2	N/A	In bogs and rock fissures, usually in alpine or arctic regions, sometimes in the lowlands. 7,500–9,000 feet.	Unlikely	Potential	Potential	Unlikely
Mimulus filicaulis Slender-stemmed monkeyflower	–	FSS	CNPS 1B.2	April–August	Cismontane woodland, lower montane coniferous forest, meadows and seeps, upper montane coniferous forest; vernally mesic environments. 2,950–5,745 feet.	Not detected	Not detected	Not detected	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Mimulus gracilipes Slender-stalked monkeyflower	–	FSS	CNPS 1B.2	April–June	Lower and upper montane coniferous forest, pinyon-juniper woodlands; granitic sand substrate. 1,600–4,300 feet.	Not detected	Not detected	Not detected	Not detected
Mimulus pulchellus Pansy monkeyflower	–	FSS	CNPS 1B.2	May–July	Lower montane coniferous forest, meadows and seeps; vernally mesic environments. 1,965–6,565 feet.	Not detected	Not detected	Not detected	Unlikely
Orcuttia inaequalis San Joaquin Valley Orcutt grass	FT	–	CE, CNPS 1B.1	April–September	Vernal pools. 100–2,477 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Sidalcea keckii Keck's checkerbloom	FE	–	CNPS 1B.1	April–May	Cismontane woodland, valley and foothill grassland; serpentine and clay substrate. 393–1,394 feet.	Unlikely	Unlikely	Unlikely	Not detected
Streptanthus fenestratus Tehipite Valley jewel-flower	–	FSS	CNPS 1B.3	April–July	Lower montane coniferous forest, upper montane coniferous forest. 3,490–5,745 feet.	Unlikely	Not detected	Not detected	Unlikely
Trifolium bolanderi Bolander's clover	–	FSS	CNPS 1B.2	June–August	Lower montane coniferous forest, meadows and seeps, upper montane coniferous forest; mesic environments. 7,900–8,530 feet.	Unlikely	Unlikely	Not detected	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Utricularia intermedia Flat-leaved bladderwort	–	–	CNPS 2.2	June–August	Bogs, fens, meadows, seeps, marshes and lake margins. 3,950–8,850 feet.	Unlikely	Potential	Known	Unlikely
Viola pinetorum ssp. *Grisea* Grey-leaved violet	–	FSS	CNPS 1B.3	April–July	Dry peaks and slopes in subalpine conifer forest and upper montane conifer forest. 4,875–11,050 feet.	Unlikely	Not detected	Not detected	Unlikely

State Status
CR = California Rare
CT = California Threatened
CE = California Endangered

CNPS = California Native Plant Society
1B = Rare, threatened or endangered in California and elsewhere
2 = Rare in California but more common elsewhere
3 = Need more information
4 = Plants of limited distribution; a watch list

_.1 = Seriously endangered in California (over 80% of occurrences threatened / high degree and immediacy of threat)
_.2 = Fairly endangered in California (20–80% occurrences threatened)
_.3 = Not very endangered in California (<20% of occurrences threatened or no current threats known)

Federal Status
FC = Candidate Species
FE = Federal Endangered
FPE = Federally proposed for listing as endangered
FT = Federal Threatened
FSS = Forest Service Sensitive

Known: Species identified either through literature review (Forest Service, CNDDB, CNPS) or during focused surveys completed in the vicinity of the Big Creek ALP Projects.
Potential: Surveys were completed only in representative habitat potentially supporting the species. Species could potentially occur in potential habitat in the vicinity of the Big Creek Projects that were not surveyed.
Not Detected: Species were not found during surveys completed in the vicinity of the Big Creek ALP Projects.
Unlikely: Regulatory agencies identified species as potentially occurring in the vicinity of the Big Creek ALP Projects. Upon further review, it was determined that the projects were outside the species known elevation range or that no appropriate habitat is present.

Table 3-17. Linear miles of riparian vegetation by project within the Big Creek ALP Project area. (Source: SCE, 2007a)

Project	Riparian community type	Dominant species	Total Linear Miles	Patchy Riparian (miles)	Discontinuous Corridor (miles)	Continuous Corridor (miles)
Big Creek Nos. 2, 8, and Eastwood Project			34.92	0.2	16.1	17.2
	Aspen Riparian Forest	*Populus Tremuloides*	3.73	0.00	1.11	2.61
	Montane Riparian Scrub	*Alnus incana* ssp. *tenuifolia*, and *Salix* spp.	6.38	0.00	1.01	5.37
	White Alder Riparian Scrub	*Alnus rhombifolia* and *Salix* spp.	4.49	0.12	1.92	2.34
	White Alder Riparian Scrub/Montane Riparian Scrub	*Alnus incana* ssp. *tenuifolia*, *Alnus rhombifolia*, and *Salix* spp.	18.96	0.04	12.08	6.85
	Montane Black Cottonwood Riparian Forest	*Populus balsamifera* spp. *trichocarpa*	0.08	0.00	0.00	0.00
	Wet Meadow		1.27	0.00	0.00	0.00

Project	Riparian community type	Dominant species	Total Linear Miles	Patchy Riparian (miles)	Discontinuous Corridor (miles)	Continuous Corridor (miles)
Big Creek Nos. 1 and 2 Project			8.91	0.0	4.7	1.6
	Montane Riparian Scrub	*Alnus incana* ssp. *tenuifolia,* and *Salix* spp.	1.37	0.00	0.00	1.37
	White Alder Riparian Scrub	*Alnus rhombifolia* and *Salix* spp.	4.89	0.00	4.63	0.26
	White Alder Riparian Scrub/Montane Riparian Scrub	*Alnus incana* ssp. *tenuifolia, Alnus rhombifolia*, and *Salix* spp.	2.35	0.01	0.10	0.00
	Wet Meadow		0.31	0.00	0.00	0.00

Project	Riparian community type	Dominant species	Total Linear Miles	Patchy Riparian (miles)	Discontinuous Corridor (miles)	Continuous Corridor (miles)
Mammoth Pool Project			1.55	0.07	1.48	0.00
	White Alder Riparian Scrub	*Alnus rhombifolia* and *Salix* spp.	1.55	0.07	1.48	0.00
Big Creek No. 3 Project			1.08	0.01	1.07	0.00
	White Alder Riparian Scrub	*Alnus rhombifolia* and *Salix* spp.	1.08	0.01	1.07	0.00

Wildlife

Game Species

Mule deer are a Sierra National Forest-Management Indicator Species. In the central Sierra, the San Joaquin deer herd ranges from about 2,000 feet along the San Joaquin River up to about 12,000 feet along the crest of the Sierra. The herd inhabits winter ranges at elevations up to 3,600 feet from early October through mid-May. The herd remains at its winter range until mid-May (depending on snow pack) and then begins a gradual upward migration. During the summer, mule deer may be found from 6,000 to 10,000 feet in elevation from late May to early November. They are most commonly found from 6,500 to 8,000 feet, where optimum habitat occurs. A large number of deer using the summer range in Fresno County winter on the north side of the San Joaquin River in Madera County, and thus must cross the river when migrating between summer and winter ranges.

The North Kings mule deer herd is known to occur in and migrate through the Big Creek Nos. 2A, 8, and Eastwood Project near Shaver Lake. Both summer and winter range and several migration corridors occur or cross the project vicinity. The San Joaquin deer herd—including the Huntington herd, which is part of the larger San Joaquin herd—is known to occur in the vicinity of the Big Creek ALP Projects. The Huntington Lake area is within mule deer summer and winter range and several migration corridors occur in the Big Creek Nos. 1 and 2 Project vicinity. The area around Mammoth Pool reservoir has been identified as a mule deer holding area and mule deer are known to migrate through the Mammoth Pool Project vicinity. Deer have been observed swimming the reservoir, as well as crossing the road on the dam. The Huntington mule deer herd also occurs in the vicinity of the Big Creek No. 3 Project.

Special Status Wildlife

SCE conducted numerous studies and surveys for special-status wildlife species. Table 3-18 identifies all special-status wildlife species known to occur or potentially occur in the vicinity of the Big Creek ALP Projects. Special-status species that are known to occur include bald eagle (*Haliaeetus leucocephalus*), American peregrine falcon (*Falco peregrinus anatum*), mountain yellow-legged frog (MYLF) (*Rana muscosa*), Yosemite toad (*Bufo canorus*), western pond turtle (*Actinemys marmorata*), Townsend's western big-eared bat (*Corynorhinus townsendii*), pallid bat (*Antrozous pallidus*), and western red bat (*Lasiurus blossevilli*). Additionally, potential habitat for the foothill yellow-legged frog (FYLF) (*Rana boylii*) occurs.

Table 3-18. Special-status wildlife species known or potentially occurring in the vicinity of the Big Creek ALP Projects. (Source: SCE, 2007a)

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Desmocerus californicus dimorphus Valley elderberry longhorn beetle	FT, FPD	–	–	Elderberry shrubs throughout the Central Valley and foothills below 3,000 feet elevation.	Known	Not detected	Potential	Known
Ambystoma californiense California tiger salamander	FT (Central California), FE (Sonoma and Santa Barbara Cos. only)	–	CSC	Vernal pools, annual grassland, and the grassy understory of valley-foothill oak woodland habitats below 4,500 feet. Requires seasonal wetlands or slow moving stream courses for reproduction.	Unlikely	Unlikely	Unlikely	Unlikely
Batrachoseps relictus Relictual slender salamander	–	FSS	CSC	Habitat requirements are poorly understood. Have been found under rocks, bark, and downed woody debris. Known from the SNF at elevations ranging from 600 to 8,000 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Hydromantes brunus Limestone salamander	–	FSS	CT, CFP	Associated with limestone outcroppings in foothill woodland and chaparral habitats of Merced Canyon in Mariposa County from 836–2,624 feet.	Unlikely	Unlikely	Unlikely	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Rana aurora draytonii California red-legged frog	FT	–	CSC	Breeds in quiet streams and permanent, deep, cool ponds with overhanging and emergent vegetation below 4,000 feet elevation. Known to occur adjacent to breeding habitats in riparian areas and heavily vegetated streamside shorelines, and non-native grasslands. Sierran streams historically supported populations of red-legged frog; however, these populations have been eliminated.	Unlikely	Unlikely	Unlikely	Unlikely
Rana boylii Foothill yellow-legged frog	–	FSS	CSC	Breeds in rocky streams with cool, clear water in a variety of habitats, including valley and foothill oak woodland, riparian forest, ponderosa pine, mixed conifer, coastal scrub, mixed chaparral, and wet meadows; occurs at elevations ranging from 0 to 4,500 feet.	Potential	Potential	Potential	Potential
Rana muscosa Mountain yellow-legged frog	FC (Sierra Nevada), FE (San Gabriel, San Jacinto, and San Bernardino Mts. Only)	FSS	CSC	Occurs in the Sierras at elevations ranging from 4,500 to 12,000 feet; associated with streams, lakes, and ponds in montane riparian, lodgepole pine, subalpine conifer, and wet meadow habitats; breeds in shallow water in low gradient perennial streams and lakes. Known from the high elevations of the SNF.	Unlikely	Known	Potential	Unlikely
Bufo canorus Yosemite toad	FC	FSS	CSC	Occurs in montane meadows and forest borders; breeds in shallow pools, at lake margins, or in pools of quiet streams at elevations ranging 6,400 to 11,300 feet. Known from the SNF.	Unlikely	Known	Known	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Actinemys marmorata Western pond turtle	–	FSS	CSC	Perennial wetlands and slow moving creeks and ponds with overhanging vegetation up to 6,000 feet; suitable basking sites such as logs and rocks above the waterline.	Known	Potential	Known	Known
Gambelia silus Blunt-nosed leopard lizard	FE	–	CE, CFP	Scarce resident of sparsely vegetated alkali and desert scrub habitats in the San Joaquin Valley and adjacent foothills up to 3,000 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Pandion haliaetus Osprey	–	–	SNF MIS, CSC	Breeds in northern California, associated strictly with large fish-bearing waters, primarily in ponderosa pine and mixed conifer habitats.	Known	Known	Known	Known
Haliaeetus leucocephalus Bald eagle	Former FT	FSS	SNF MIS, CE, CFP	Local winter migrant to various California lakes. Most of the breeding population is restricted to more northern counties. Regular winter migrants to the region. Usually not found at high elevations in the Sierra.	Known	Known	Known	Known
Accipiter cooperi Cooper's hawk			CSC (nesting)	Breeding resident throughout most of the wooded portion of the state. Breeds in Sierra Nevada foothills, New York Mountains, Owens Valley, and other local areas in southern California. Dense stands of oak and riparian woodland for nesting and grassland for foraging up to 9,000 feet.	Potential	Potential	Known	Known
Accipiter gentilis Northern goshawk	–	FSS	SNF MIS, CSC (nesting)	Prefers middle to high elevation, mature, dense conifer forests for foraging and nesting. Casual in foothills during winter, northern deserts in pinyon-juniper woodland, and low elevation riparian habitats.	Known	Known	Known	Known

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Buteo swainsoni Swainson's hawk	–	FSS	CT (nesting)	Uncommon breeding resident and migrant in the Central Valley, Klamath Basin, Northeastern Plateau, Lassen County, and Mojave Desert. Riparian woodlands, juniper-sage flats, and oak woodlands for nesting. Grasslands and agricultural areas for foraging.	Unlikely	Unlikely	Unlikely	Unlikely
Falco peregrinus anatum American peregrine falcon	Former FE	FSS	SNF MIS, CE, CFP	Very uncommon breeding resident and uncommon as a migrant. Breeds in woodlands, forests, coastal habitats, and riparian areas near wetlands, lakes, rivers, or other water on high cliffs, banks, dunes, or mounds. Active nesting sites are known along the coast, in the Sierra Nevada, and in the mountains of northern California. Migrants occur along the coast and the western Sierra Nevada in spring and fall.	Potential	Known	Known	Known
Strix nebulosa Great gray owl	–	FSS	CE (nesting)	Nests in old-growth coniferous forests and forages in montane meadows. Distribution includes high elevations of the Sierra Nevada and Cascade Ranges from 4,500 to 7,500 feet.	Unlikely	Known	Known	Unlikely
Strix occidentalis occidentalis California spotted owl	–	FSS	SNF MIS, CSC	Resides in dense, old growth, multi-layered mixed conifer, redwood, Douglas fir, and oak woodland habitats, from sea level up to approximately 7,600 feet. Known from the SNF.	Known	Known	Known	Known
Empidonax traillii brewsteri Willow flycatcher	–	FSS	SNF MIS, CE (nesting)	Wet meadow and montane riparian habitats from 2,000 to 8,000 feet. Most often occurs in broad, open river valleys or large mountain meadows with lush growth of shrubby willows. Known from the SNF.	Potential	Potential	Known	Known

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Vireo bellii pusillus Least Bell's vireo	FE	–	CE (nesting)	Summer resident below 2,000 feet in Santa Barbara, Ventura, San Bernardino, Riverside, San Diego, Imperial, and Inyo counties. Prefers willows and other low, dense valley-foothill riparian habitat in the lower portion of canyons for breeding.	Unlikely	Unlikely	Unlikely	Unlikely
Dendroica petechia brewsteri Yellow warbler			CSC (nesting)	Breeds in riparian woodlands from coastal and desert lowlands up to 8,000 feet in the Sierra Nevada. Also breeds in montane chaparral, open ponderosa pine, and mixed conifer habitats with substantial amounts of brush.	Potential	Potential	Known	Potential
Lasiurus blossevilli Western red bat	–	FSS	–	Occurs from British Columbia to South America. In California, occurs from Shasta County to the Mexican border west of the Sierra crest. Roosts solitarily in foliage in forests and woodlands from sea level up through mixed coniferous forest. In California known to roost in cottonwood and willow.	Not detected	Known	Not detected	Not detected
Corynorhinus townsendii Townsend's western big-eared bat	–	FSS	CSC	Found in all but alpine and subalpine habitats; most abundant in mesic habitats. Requires caves, mines, tunnels, buildings, or other man-made structures for roosting. This species is extremely sensitive to disturbance and may abandon a roost if disturbed. Known from the SNF.	Not detected	Not detected	Known	Known
Antrozous pallidus Pallid bat	–	FSS	CSC	Inhabits grasslands, shrublands, woodlands, and forests from sea level up through mixed conifer forests. Typically roosts in caves, crevices, or mines. Requires open habitat for foraging.	Not detected	Not detected	Known	Known

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Aplodontia rufa Sierra Nevada mountain beaver	–	–	SNF MIS, CSC	Occurs in dense riparian and open brushy stages of most forest types. Deep, friable soils are required for burrowing along cool, moist microclimates. Line in burrows located in or near deep soils near streams and springs. Typical habitat in the Sierra is montane riparian.	Potential	Potential	Known	Potential
Dipodomys nitratoides exilis Fresno kangaroo rat	FE	–	CE	Alkali desert scrub habitat and herbaceous habitat with scattered shrubs. Found in the San Joaquin Valley up to 1,800 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Vulpes vulpes necator Sierra Nevada red fox	–	FSS	CT	Occurs throughout the Sierra Nevada at elevations above 7,000 feet in forests interspersed with meadows or alpine forests. Open areas are used for hunting, forested habitats for cover and reproduction. Known from the higher elevations of the SNF.	Unlikely	Known	Known	Unlikely
Martes americana American (pine) marten	–	FSS		Within the SNF, martens are known from the high elevation forested plant communities. Optimal habitats are various mixed evergreen forests with more than 40% crown closure and large trees and snags for den sites. Most commonly found in red fir and lodgepole pine forests between 4,000 and 10,600 feet elevation.	Unlikely	Known	Known	Unlikely
Martes pennanti pacifica Pacific fisher	FC	FSS	CSC, SNF MIS	Suitable habitat consists of large areas of mature, dense forest red fir, lodgepole pine, ponderosa pine, mixed conifer, and Jeffery pine forests with snags and greater than 50% canopy closure. Known from 4,000 to 8,000 feet elevations in the SNF.	Potential	Known	Known	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Gulo gulo luteus California wolverine	–	FSS	CT, CFP	Mixed conifer, red fir, and lodgepole habitats, and probably sub-alpine conifer, alpine dwarf shrub, wet meadow, and montane riparian habitats. Occurs in Sierra Nevada from 4,300 to 10,800 feet. Majority of recorded sightings are found above 8,000 feet elevation.	Unlikely	Known	Known	Unlikely
Ovis canadensis californiana Sierra Nevada (California) bighorn sheep	FE	FSS	CE, CFP	Southern Sierra Nevada from Fresno and Mono counties and south. Alpine dwarf–shrub, low sage, sagebrush, bitterbrush, pinyon-juniper, palm oasis, desert riparian, desert succulent shrub, desert scrub, subalpine conifer, perennial grassland, montane chaparral, and montane riparian habitats.	Unlikely	Unlikely	Unlikely	Unlikely

State Status
CFP = California Fully Protected
CSC = California Species of Special Concern
CE = California Endangered
CT = California Threatened

Federal Status:
FC = Candidate Species
FE = Federal Endangered
FPE = Federally proposed for listing as endangered
FT = Federal Threatened
FSS = Forest Service Sensitive
SNF MIS = Sierra National Forest Management Indicator Species

Known: Species identified either through literature review (USFS, CNDDB, CNPS) or during focused surveys completed in vicinity of the four Big Creek Projects.
Potential: Surveys were completed only in representative habitat potentially supporting the species. Species could potentially occur in other potential habitat in the vicinity of the four Big Creek Projects that were not surveyed. For birds, the potential for occurrence refers to the potential for the species to nest in the Project area.
Not Detected: Species were not found during surveys completed in the vicinity of the four Big Creek Projects.
Unlikely: Regulatory agencies identified species as potentially occurring in the vicinity of the four Big Creek Projects. Upon further review, it was determined that the projects were outside the species known elevation range or that no appropriate habitat is present.

Bald Eagle—Bald eagles were federally delisted from the ESA on June 28, 2007; they continue to be federally protected by both the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The breeding range of bald eagles formerly included most of the North American continent, but bald eagles now nest mainly in Alaska, Canada, the Pacific Northwest, the Great Lakes states, Florida, and Chesapeake Bay. The winter range of the bald eagle is similar to the breeding range, but extends mainly from southern Alaska and southern Canada southward. Bald eagles are permanent residents and uncommon winter migrants throughout the state of California. They breed primarily in Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties. The breeding range is primarily in mountainous habitats next to reservoirs, in the Central Coast Range, and on Santa Catalina Island. About half of the wintering population is found in the Klamath Basin. Bald eagles forage near large aquatic ecosystems such as lakes, reservoirs, or free flowing rivers. Bald eagle nests are usually located in uneven-aged stands with old-growth components. Nesting usually occurs in large trees along shorelines in relatively remote areas. Breeding occurs from February through July, with peak activity occurring between the months of March through June. Average clutch size is two eggs. Incubation lasts approximately 35 days and fledging takes place at 11 to 12 weeks of age. Parental care may extend to 11 weeks after fledging. Bald eagles become sexually mature at 4 to 5 years of age.

Within the Big Creek Nos. 2A, 8, and Eastwood Project area, SCE identified one active nest located just outside the project boundary about 0.1 mile from the shoreline of Shaver Lake (SCE, 2007d). In 2000, two chicks were reported, but both died. In 2001, two chicks successfully fledged. The nest was unsuccessful in 2002, but produced three young in 2003. In 2005, one chick fledged successfully and in 2006 the pair attempted to nest but was unsuccessful. At the Big Creek Nos. 1 and 2 Project, bald eagles are known to winter and forage at Huntington Lake. A bald eagle nest was identified at Huntington Lake in 2003 about 400-feet from the shoreline, just outside the project boundary (SCE, 2007d). In 2004, the nest produced one fledgling. In 2005, the nest produced two fledglings. One juvenile was observed on the nest in 2006, but it is not known if this bird fledged successfully. Bald eagles are known to winter at the Mammoth Pool and Big Creek No. 3 projects.

American Peregrine Falcon—In 1999, FWS removed the peregrine falcon in North America from the federal endangered species list. The American peregrine falcon breeds in woodlands, forests, coastal habitats, and riparian areas near wetlands, lakes, rivers, or other water bodies, situated near high cliffs, banks, dunes, or mounds. It is a very uncommon breeding resident and migrant in California, with active nesting areas along the coast north of Santa Barbara, in the Sierra Nevada, and in other mountains of northern California. Migrants occur along the coast and in the western Sierra Nevada in spring and fall. The nest is a scrape on a depression or ledge in an open area, on human-made structures, and occasionally in a tree or snag cavity or old nest of other raptors. Riparian areas and coastal and inland wetlands are important habitats yearlong, especially in non-breeding seasons. It feeds on a variety of birds and occasionally takes mammals, insects, and fish. Breeding occurs from early March to late August with a clutch size of three to seven eggs. Incubation is approximately 32 days. No peregrine falcon nests are known to occur in the Big Creek Nos. 2A, 8, and Eastwood, Mammoth Pool, and Big Creek No. 3 Project areas; however, potential habitat occurs. One pair of peregrine falcons is known to nest in the Big Creek Nos. 1 and 2 Project area, previously nesting on Powerhouse 1 and on Sunset Point.

Mountain Yellow-legged Frog—The MYLF is endemic to the Sierra Nevada and Transverse ranges in California. This species is highly aquatic and is closely associated with low-gradient streams, meadows, ponds, and lakes from 4,500 to 12,000 feet in elevation in the Sierra Nevada. Adults are most active during the day and often bask in open areas. The MYLF is most often found in lakes and streams with gently sloping banks that are moderately rocky and interspersed with sedges, grasses, and low clumps of willows. The MYLF is a pond-breeding species that associates primarily with lakes and ponds throughout its southern range and with streams throughout its northern range. Because of harsh winters and high spring run-off in the higher elevations of the MYLF's range, only large pools and ponds that maintain the low velocities required during metamorphosis are used for breeding. Tadpoles may transform after their second summer, thus the tadpoles require still, deep water with fine sediments for overwintering. Adults are commonly observed basking at the edge of pools and along shallow sloped stream margins. Like other pond-breeding frogs and toads, the MYLF is not well adapted to swift flowing water. However, individuals have been noted basking on open, sunny cobbles adjacent to gently flowing riffles during dispersal season.

There are no known occurrences of MYLF within the vicinity of the Big Creek Nos. 2A, 8, and Eastwood Project. However, potential MYLF habitat (i.e., that rated as good or moderate in survey results) was identified along Tombstone, Crater, Chinquapin, Camp 62, Bolsillo, Bear, Mono, Pitman, Stevenson, and Balsam creeks; the South Fork San Joaquin River, Florence Lake to Mammoth Pool, North Fork Stevenson Creek, Florence Lake dam arches, Bear diversion pool, Mono diversion pool, and Dam 5 forebay. Meadows associated with these stream reaches also represent potential habitat.

There are known occurrences of MYLF in the vicinity of the Big Creek Nos. 1 and 2 Project, at Huntington Lake. Potential MYLF habitat (i.e., that rated as good or moderate in habitat survey results) was also identified in the vicinity of the Big Creek Nos. 1 and 2 Project in the following areas: Big Creek to Huntington Lake and adjustable channel reach; Big Creek to Dam 4; Big Creek Dam 4 to Dam 5; and Dam 4 forebay. MYLF habitat does not occur within the Mammoth Pool or Big Creek No. 3 Project areas.

Yosemite Toad—The Yosemite toad associates with montane meadows, streams, ponds, and lakes in lodgepole pine forests in the Sierra Nevada from 6,400 to 11,300 feet. Along the western slope of the Sierra Nevada, the northernmost limit of this species is Heather Lake in El Dorado County, and the southernmost limit is approximately 5 miles south of Kaiser Pass in Fresno County. The preferred habitat of the Yosemite toad is high elevation montane meadows, although individuals do associate with slow flowing, low-gradient stream habitats, such as pools and flatwater, near or adjacent to meadows. Individuals are rarely, if ever, seen in swiftly flowing stream habitats like cascades or exposed habitats like bedrock sheets. The substrate in streams that meander through montane meadows is predominantly composed of fines occasionally interspersed with sand. Coarse material is rare and probably holds little value for the Yosemite toad, which breeds in shallow pools in meadows during spring and primarily uses stream habitats during the drier portions of the year. Because the toads have a high association with low gradient streams adjacent to meadows, cover types more typical to those habitats are considered to have higher importance in providing refuge sites. Specifically, aquatic and terrestrial vegetation, woody debris, and undercut banks would be more common in meadow-stream complexes and would provide crucial protection from predators. There are known populations of Yosemite toad in the vicinity of the Big Creek Nos. 2A, 8, and Eastwood Project. SCE identified potential Yosemite Toad habitat (i.e., that rated as good or moderate in survey results), at Tombstone Creek, and the South Fork San Joaquin River. There are known occurrences of Yosemite toad in the vicinity of the Big Creek Nos. 1 and 2 Project at Huntington Lake. Yosemite toad habitat does not occur within the Mammoth Pool or Big Creek No. 3 Project areas.

Foothill Yellow-legged Frog—The FYLF is a stream-dwelling frog native to California and Oregon. As a stream obligate species, adult and juvenile FYLF primarily associate with pool and riffle habitats with gently to moderately flowing water. Tadpoles are often found in shallow near-shore habitats such as eddies, backwaters, and other low velocity areas. In eastern California it ranges from the Sierra Nevada foothills to approximately 4,500 feet (SCE, 2007c). The FYLF is not known to occur in any of the Big Creek ALP Projects; however, SCE identified potential habitat in reaches at all four projects.

Western Pond Turtle—The western pond turtle ranges from Baja, California to Washington and inland into western Nevada. In the Sierra Nevada, it historically occurred in most of the major drainages along the western slope. Its elevational distribution is from sea level to approximately 6,000 feet, but most populations occur below 4,000 feet. Populations found between 4,500 and 6,000 are expected to be transplants. This turtle occurs in marshes, perennial and intermittent streams, rivers, canals, ponds, vernal pools, and reservoirs, but also can be found nesting or overwintering in adjacent upland habitats (SCE, 2007c). At the Big Creek Nos. 2A, 8, and Eastwood Project the western pond turtle is known to occur at Shaver Lake, Camp 62 Creek, Stevenson Creek, North Fork Stevenson Creek, Dam 5 forebay, and Dam 6 forebay. At the Big Creek Nos. 1 and 2 Project, the western pond turtle is not known to occur; however, potential habitat occurs. At the Mammoth Pool Project, the western pond turtle is known to occur in two stretches of Rock Creek, from the diversion to the San Joaquin River and along Ross Creek. There are known occurrences of western pond turtle in the vicinity of the Big Creek No. 3 Project at Adit 2, Tunnel 3 at Powerhouse 3, and at FS Road No. 8S05 (Canyon Road).

Townsend's Western Big-eared Bat—Townsend's big-eared bat is a year-round resident in California, occurring from low desert to mid-elevation montane habitats. It is found primarily in rural settings, from inland deserts to coastal redwoods, oak woodland of the inner Coast Ranges and Sierra Nevada foothills, and low to mid-elevation mixed coniferous-deciduous forests. It typically roosts during the day in caves and mines, but can roost in buildings that offer suitable conditions. Night roosts are in more open settings and include bridges. It hibernates in mixed sex aggregations of a few to several hundred individuals. Hibernation occurs for prolonged periods in colder areas and intermittently in non-freezing areas. Townsend's big-eared bat arouses periodically and moves to alternative roosts, and actively forages and drinks throughout the winter (SCE, 2007c). There are known occurrences of Townsend's western big-eared bat in the vicinity of the Big Creek Nos. 2A, 8, and Eastwood Project at Tombstone Creek diversion piping. There are known roosts at the 102-inch valve house at Powerhouse 2A and at the Eastwood School site.

Pallid Bat—This year-round California resident is found in arid desert areas, grasslands and oak savanna, coastal forested areas, and coniferous forests of the mountain regions of California. Roost sites are typically rock outcroppings, caves, hollow trees, mines, buildings, and bridges. Pallid bats make use of similar structures for night roosting and will use more open sites such as eaves, awnings, and open areas under bridges for feeding roosts. Pallid bats are largely inactive in the winter months, and there is evidence for both hibernation and migration. Hibernation aggregations tend to be much smaller than summer aggregations. There are known occurrences of pallid bat in the vicinity of the Big Creek Nos. 2A, 8, and Eastwood Project at Powerhouse 8; Tunnel 7, at the Huntington-Pitman-siphon water conveyance system; Florence and Shaver lakes; Bear diversion pool; and Dam 5 forebay. There are known occurrences of pallid bat in the vicinity of the Big Creek No. 3 Project, at the angler access stairway at Mammoth powerhouse, and the parking area near Mammoth powerhouse gate. There are pallid bat roosts at Tunnel 3, Adits 1, 2 and 3, and at Powerhouse 3.

Western Red Bat—The western red bat is a solitary, foliage-roosting bat. These bats are adapted for exposed roosting behavior. In California, this species is known to roost in cottonwood trees and willows, but is commonly detected in a variety of habitats, including chaparral. Roost heights range from 10 to 50 feet. The range of the western red bat is from British Columbia to Central and South America. Migration occurs throughout its range and bats of Canada move into the coastal lowlands of California, and the California population is thought to winter in Central America. There are known occurrences of western red bat in the vicinity of the Big Creek Nos. 1 and 2 Project at Huntington Lake.

3.3.2.2 Environmental Effects

Vegetation and Integrated Pest Management Plan

Vegetation management, including trimming of vegetation by hand or equipment and the use of herbicides, occurs at several locations within the Big Creek ALP Projects. This regularly occurring management could have both beneficial and adverse effects on special-status plants and wildlife and the proliferation of noxious weeds.

SCE proposes, in measure 5.6 of the Settlement Agreement, to implement a Vegetation and Integrated Pest Management Plan. As part of the plan, SCE proposes avoidance and protection measures including: (1) regulated pesticide use; (2) special-status plant protection; (3) VELB (*Desmocerus californicus dimorphus*) protection; (4) peregrine falcon protection; (5) osprey protection; (6) cultural resources protection; (7) measures to prevent the spread of noxious weeds; (8) treatment of new and established infestations; (9) prevention of the spread of invasive ornamental plants; (10) revegetation of disturbed sites; and (11) weed-free erosion control methods. Measures related to the VELB, a federally threatened species, are discussed in section 3.3.3.2, *Threatened and Endangered Species*.

In addition to the above avoidance and protection measures, SCE has also established several programs to train personnel on the recognition and avoidance of special-status species. SCE proposes to continue the following programs: (1) Endangered Species Alert Program which annually trains personnel in the identification and potential locations of legally protected plant and animal species within the project location; (2) Northern Hydro Special-Status Species Information Program which provides SCE with a means of identifying when they may be working within an area that could support a Forest Service sensitive species; (3) Avian Protection Program which includes training information for SCE personnel on raptor and avian protocols; (4) Cultural Resources Environmental Awareness Program, in conjunction with the Endangered Species Alert Program, which includes procedures for implementation of the HPMP and awareness of Native American traditional cultural values, including biological resources with Native American cultural significance ; (5) Environmental Training Program which includes SCE employees regularly attending training sessions including a review of background material, permit conditions, and instructions on how to avoid effects on biological resources; (6) Noxious Weed Training program which trains SCE personnel on noxious weed control; (7) Compliance Program which includes a process that SCE must follow prior to implementing specific operations and maintenance activities to track the activities and guide personnel in implementation of these activities in compliance with established avoidance and protection measures; (8) Northern Hydroelectric Environmental Compliance Database which SCE would integrate into its existing databases and would include tracking the training records of SCE personnel, operation and maintenance activities that SCE has planned and completed, and noxious weed populations that have been identified and treated; (9) Geographic Information System Database which would include the results of all the project studies, data obtained from the Forest Service Special-status Species Database, the California Natural Diversity Database, other biological studies, and annual updates with any new data.

In addition, SCE proposes as part of the plan, to mitigate for adverse effects on the VELB (discussed in section 3.3.3.2, *Threatened and Endangered Species*) and to monitor the effectiveness of the avoidance and protection measures on special-status plants, VELB, cultural resources (discussed in section 3.3.5.2, *Cultural Resources*), noxious weeds and invasive ornamentals, and erosion control and revegetation areas. SCE also would continue to consult annually with the Forest Service to inform it of proposed vegetation management activities and would review the plan every 5 years.

SCE also proposes in measure 5.3 of the Settlement Agreement to prepare a biological evaluation to describe the potential effect of the action on the species or its habitat prior to construction of new project features on Forest Service land that may affect Forest Service special-status species and their habitat (i.e., Forest Service sensitive and/or management indicator species). For state or federally listed species, federal candidate species, California species of special concern, and California fully protected species, SCE proposes to prepare a biological assessment or other required document and obtain any necessary permits or approvals.

Forest Service 4(e) condition 16 is consistent with proposed measure 5.6 with the addition of requiring SCE to provide the Forest Service with survey data and completion reports at the annual consultation meeting. Interior 10(j) recommendation 11 (Project No. 67), 8 (Project Nos. 120 and 2175), and 9 (Project No. 2085) also are consistent with the proposed measure.

Forest Service 4(e) condition 14 is consistent with proposed measure 5.3, with additional specific guidance regarding the contents of a biological evaluation. Interior 10(j) recommendations 8, 5, and 6 (for Project Nos. 67, 120, and 2175, and 2085, respectively) are consistent with proposed measure 5.3 as well.

Our Analysis

The Big Creek ALP Projects contain populations of both noxious weeds and special-status plants and wildlife. Several species of special-status upland plant species (federal species of special concern, Forest Service sensitive and watch list species, and California Native Plant Society listed species) occur in proximity to project facilities at the Big Creek Nos. 2A, 8, and Eastwood, the Big Creek Nos. 1 and 2, and the Mammoth Pool projects. Populations of aquatic, wetland, and riparian special-status species occur close to project facilities at the Big Creek Nos. 2A, 8, and Eastwood Project. Vegetation maintenance, in the form of hand and mechanical trimming and herbicide application occurring at all four Big Creek ALP Projects near project facilities, recreational facilities, roads, and trails, could affect populations of special-status plants occurring in areas where vegetation is maintained. The proposed Vegetation and Integrated Pest Management Project would protect special-status plants by implementing herbicide controls, marking special-status plant locations prior to management activities, and maintaining 5-foot buffers around populations where SCE would not allow mechanized trimming and herbicide use. SCE's proposed measure would further benefit special-status plant populations by controlling the spread and proliferation of noxious weeds, which can outcompete native species and eliminate special-status plant populations.

According to the Vegetation and Integrated Pest Management Plan, two peregrine falcon nests and two osprey nests are located in areas potentially disturbed by vegetation management. The two osprey nests are located along two access roads to Shaver dam in the Big Creek Nos. 2A, 8, and Eastwood Project. The two peregrine falcon nests are located near Big Creek Nos. 1 and 2 Project roads. Mechanized vegetation management close to these nests during nesting season (March through September and February 15 through August 31 for osprey and peregrine falcons, respectively) could disturb nesting birds and reduce nesting success. Implementing the measures in the Vegetation and Integrated Pest Management Plan would limit the duration of mechanized vegetation clearing during osprey nesting and either prohibit or limit the duration of mechanized vegetation management within one quarter mile of active peregrine falcon nests. Limiting the extent and duration of mechanized clearing during nesting season would minimize disturbance of these special-status birds.

Monitoring the effectiveness of the proposed avoidance and protection measures for special-status plants and wildlife, noxious weed locations and treatment areas, and erosion control and revegetation areas would allow SCE to ensure that its proposed measures are working. If monitoring determines that noxious weed treatments and revegetation are not successful, SCE would consult with the Forest Service to identify alternative or additional treatment, ultimately increasing the likelihood that noxious weed control would be successful. In addition, SCE proposes to conduct periodic surveys for special-status plants, peregrine falcons, osprey, and noxious weeds. As such, SCE would be able to update its training programs to include newly identified populations and would be able to implement its avoidance and protection measures in the newly identified areas as well. Providing the Forest Service with the results of these surveys at the annual coordination meetings, as specified by the Forest Service, would allow the Forest Service to more accurately provide guidance during annual consultation. Additionally, preparing a biological evaluation and assessment, as appropriate, prior to constructing any new project facilities would maintain or enhance the protection of special-status plants and wildlife within the Big Creek ALP Projects during the course of any new licenses.

Riparian Monitoring

Quantitative and qualitative riparian studies completed for the Big Creek ALP Projects identified potential riparian or meadow resource issues along certain bypassed streams. Under Settlement Agreement measure A1.11, SCE would implement the Riparian Monitoring Plan included as appendix K in the Settlement Agreement to determine the effectiveness of channel and riparian maintenance flows for maintaining channels and riparian and meadow ecosystems (see section 3.3.1.2, *Channel and Riparian Maintenance Flows*).

The Riparian Monitoring Plan would be designed to monitor the status and trends of the riparian resources along Mono Creek, South Fork San Joaquin River, and Camp 61 Creek bypassed reaches in response to the channel and riparian maintenance flows and MIFs required under the new licenses. The specific objectives for the monitoring include the following:

- Monitor riparian and meadow vegetation composition in selected reaches.
- Monitor riparian vegetation age class structure, including regeneration, in selected reaches.
- Monitor trends in riparian and meadow health in selected reaches over the length of the new license.

Riparian resources would be evaluated the first year after license issuance, 5 years following channel and riparian maintenance flow releases made in the first wet water year for Mono Creek and Camp 61 Creek and the second wet water year for the South Fork San Joaquin River, and at 10-year intervals for the remainder of the license term.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations for all four Big Creek ALP Projects that are consistent with Settlement Agreement measure A1.11, Riparian Monitoring Plan.

Our Analysis

The riparian issues in Mono Creek bypassed reach and Mono Meadow are: (1) channel encroachment and reduced regeneration success (age class structure); (2) change in community composition; (3) reduced floodplain connectivity and bar inundation along adjustable reaches; (4) bank erosion due to livestock grazing; and (5) altered frequency and timing of peak flows.

The riparian issues in the South Fork San Joaquin River bypassed reach, specifically the Jackass Meadow complex, are: (1) decreased flow and floodplain connectivity; (2) change in community composition; (3) upland species encroachment (lodgepole pine); and (4) stressed herbaceous vegetation and willows caused in part by grazing and recreation. The Forest Service also expressed an interest in the regeneration of sedge beds in certain locations along the meadow.

The monitoring data, including regeneration success, species coverage, species presence/absence, distribution of stem size classes, and percent decadence of species present, would provide information to determine whether or not the proposed channel and riparian maintenance flows and MIFs promote healthy riparian and meadow communities; result in successful establishment of native species' on alluvial surfaces in reaches with identified age class resource issues; support native riparian or meadow species; and discourage the establishment of mature woody vegetation and upland species on lower surfaces within the channel causing channel encroachment.

Adaptive management would be implemented based on pool monitoring (see section 3.3.1.2, *Channel and Riparian Maintenance Flows*) and riparian monitoring results to ensure the channel and riparian management goals are met in Mono, Camp 61, and the South Fork San Joaquin River bypassed reaches.

Special-Status Wildlife Species

Numerous special-status wildlife species, such as bald eagles, western red bat, Townsend's western big-eared bat, and pallid bat, occur at the Big Creek ALP Projects. Project operations, maintenance, and recreation all have the potential to disturb bald eagles and special-status bats, decreasing their productivity or reducing the quality of their habitat. Additionally, electrocution or collisions with project transmission lines could injure or kill bald eagles.

SCE proposes, in measure 5.1 of the Settlement Agreement, to consult with Cal Fish & Game, the Forest Service, and FWS prior to conducting any non-routine maintenance activities that could result in harm to special-status bat species or their habitat, in structures that are known to support maternal or roosting bat species (including but not limited to, reconstruction and painting), as identified in table 5.1-1 of the Settlement Agreement. Based on the consultation, SCE would implement appropriate avoidance and protection measures if necessary to minimize disturbance of special-status bat species or their habitat.

SCE proposes, in measure 5.4 of the Settlement Agreement, to implement its Bald Eagle Management Plan. The Bald Eagle Management Plan contains avoidance and protection measures including implementing the Avian Protection Plan to minimize the potential for bald eagles to be electrocuted on project transmission lines, protecting active and inactive bald eagle nests, implementing the SCE training programs described above under the Vegetation and Integrated Pest Management Plan, monitoring known nests and surveying for new nests annually or every 5 years as needed, and surveying wintering eagles and for winter roost sites every 5 years. SCE would report on the results of the surveys and provide the reports to Cal Fish & Game, the Forest Service, and FWS.

Forest Service 4(e) condition 15 and Interior conditions 7 and 9 (for Project No. 67) and 4 and 6 (for Project Nos. 120 and 2175), and 7 (for Project No. 2085) are consistent with the measures proposed in the Settlement Agreement. In addition, Forest Service 4(e) condition 15 specifies that SCE notify the Forest Service of project related bald eagle mortality.

Our Analysis

Bald Eagle—There are two known bald eagle nests located within the Big Creek ALP Projects area: one about 400-feet from Huntington Lake just outside of the Big Creek Nos. 1 and 2 Project boundary and about 0.1 mile from Shaver Lake just outside of the Big Creek Nos. 2A, 8, and Eastwood Project boundary. Wintering bald eagles are known to occur at all Big Creek ALP Projects. Although bald eagles were federally delisted from the ESA on June 28, 2007, they continue to be federally protected by both the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Bald eagles are sensitive to a variety of human activities, especially during the nesting season. If bald eagles are disturbed during nesting or foraging, they have to expend additional energy and time being flushed from their nest or locating a different foraging area. If the disturbance is great enough, bald eagles may abandon their nests, reducing the productivity of that nest territory. Project activities that could disturb bald eagles include helicopter flights for inspection and maintenance and project recreation, such as boating, fishing, hiking, and camping. Each nesting bald eagle pair has a different sensitivity to disturbance, based on such factors as acclimation and nest tree screening.

In its November 27, 2007 response to a Commission AIR, SCE identified project-related activities that could disturb nesting bald eagles that occur within a 660-foot buffer surrounding the nests and assessed the activities' consistency with FWS National Bald Eagle Management Guidelines (FWS, 2007). SCE does not conduct operation and maintenance activities within the 660-foot buffer around either known nest site. Water-based recreation activities (boating, kayaking, angling, water skiing, etc.) occur on both lakes; however, there are no recreational facilities within the buffer at Shaver Lake and only a portion of the Rancheria Campground (owned and operated by the Forest Service) is within the buffer at Huntington Lake. These activities do not occur within 330 feet of the two known bald eagle nests and recreational activity is not expected to increase significantly as a result of any new project licenses. Because the existing bald eagle nests are accustomed to the current recreational use, project-related recreation is consistent with management guidelines. SCE uses helicopters in both the Big Creek Nos. 1 and 2 and Big Creek Nos. 2A, 8, and Eastwood projects; however, no landing sites are located in close proximity to the known nest locations. SCE occasionally flies helicopters close to the nests during nesting season; however, the known bald eagle nests appear to tolerate the occasional helicopter activity.

SCE proposes to rehabilitate the Rancheria Campground within 5 years of any new license for the Big Creek Nos. 1 and 2 Project, likely between May and October because of severe winter weather conditions. The portion of the campground that overlaps the 660-foot buffer around the bald eagle nest adjacent to Huntington Lake contains a small section of road that SCE would resurface and several campsites which SCE may regrade. Rehabilitation would replace or repair roads and trails in-kind, so SCE would not cut any trees and major grading would not be necessary. The capacity and type of recreational activities at this site are not expected to increase as a result of this rehabilitation. SCE states in its November 27, 2007 response to a Commission AIR that it would consult with and coordinate construction activities with the Forest Service. Overall, any adverse effect on the Huntington Lake bald eagle nest would be short-term in nature and would not affect the long-term productivity of this nesting pair.

Electrocution and/or collision with project transmission lines also can adversely affect bald eagles. SCE analyzed project power lines at the Big Creek ALP Projects to determine if they meet the guidelines contained in *Suggested Practices for Raptor*

Protection on Power Lines: The State of the Art in 1996 (APLIC, 1996) and determined that three transmission lines do not met the design and siting standards for avoidance or minimization of bird electrocutions and collisions: (1) the EPS-BC1 220 kV line at the Big Creek Nos. 2A, 8, and Eastwood Project; (2) the Musick 7 kV powerline at the Big Creek Nos. 1 and 2 Project; and (3) the MPPH-BC3 220 kV transmission line at the Mammoth Pool Project (SCE, 2007c). The risk of bird electrocution increases when transmission lines do not have adequate spacing between conductors or the lines and the ground. This is especially true for highly susceptible raptors with large wing spans, like the bald eagle. Bald eagles are at risk for collision with transmission lines with overhead groundwires because the small size of the wires makes them less visible to birds.

The proposed Bald Eagle Management Plan, including the Avian Protection Plan, would report any bald eagle mortality to SCE specialists and would provide FWS and Cal Fish & Game with annual bald eagle mortality reports in years where there is a project-related mortality. This reporting, including sending the mortality reports to the Forest Service as specified in 4(e) condition 15, would enable the agencies to monitor the hazard of these non-guideline compliant power lines and suggest any follow-up measures that SCE may need to implement to protect bald eagles and other raptors from electrocution. If SCE uses the most recent version of the APLIC guidelines, such as the 2006 update to the 1996 version, SCE would ensure that the most up-to-date guidance is met. In addition, the management plan specifies that SCE would conduct bald eagle nest surveys to locate any new nests and monitor the productivity of existing nests and bald eagle wintering surveys, which would enable SCE and the agencies to implement the measures in the management plan for any new nests and identify any activities that may be affecting bald eagles in the project areas.

Special Status Bats—The special-status western red bat, Townsend's big-eared bat, and pallid bat occur in the Big Creek Nos. 2A, 8, and Eastwood, Big Creek Nos. 1 and 2, and Big Creek No. 3 Project areas. Often bats use man-made structures in which to roost, including the Townsend's western big-eared bat roosting in a valve house at Powerhouse 2A and at the Eastwood School site and pallid bats roosting at Powerhouse 3 and at Adits 1, 2, and 3 at Tunnel 3 at the Big Creek No. 3 Project. Maintenance activities at project facilities housing special-status bat roosting or maternal colonies could disturb the bats or degrade their habitat. Regular maintenance is on-going and would not create any new disturbances; however, non-routine maintenance activities would potentially create new disturbance. Implementing the proposed measure would protect special-status bats located in project facilities listed in the proposed measure because SCE's consultation with the agencies would identify the need for any avoidance or protection measures prior to any work.

Mule Deer

The San Joaquin mule deer herd must cross the San Joaquin River, particularly Mammoth Pool reservoir, as they migrate from their winter habitat at 1,200 to 3,600 feet in elevation to their breeding grounds at 6,000 to 10,000 feet in elevation. Deer could be injured or killed attempting to swim or cross project facilities because of high currents, build up of debris, or because they get trapped. Recreational use could increase this mortality when users spook deer, forcing them to jump into dangerous areas to escape. Mule deer also migrate through the Eastwood project area around Shaver Lake. Recreational use around the lake could also affect migrating deer. SCE has implemented several mule deer protection measures at the Mammoth Pool project; however, the potential for mule deer mortality remains.

SCE proposes, in measure 5.2 of the Settlement Agreement to maintain: (1) fences around the Mammoth Pool dam spillway; (2) the Daulton Creek bridge; and (3) a device to discourage deer from crossing the reservoir near the spillway; such as the barrel line that is present across the spillway. If at any time during the term of the license, one or more of these facilities requires repair or replacement, SCE proposes to maintain the facility as needed. Prior to replacement/repair of the facility, SCE would contact Forest Service, Cal Fish & Game, and FWS to inform them of the proposed work and provide a replacement/repair plan and schedule. The Forest Service, Cal Fish & Game, and FWS would approve any replacement/repair plan and schedule prior to implementation.

SCE also proposes, as part of this measure to ensure sand is present on the Mammoth Pool dam road to encourage deer to use the dam road to cross during the peak migration period (May 1 through June 15) and would close the road during the peak migration period to reduce any adverse effects from recreation.

Additionally, SCE proposes to provide annual photo documentation to Cal Fish & Game, the Forest Service, and FWS of the area at the floating boom above the Mammoth Pool spillway. SCE would also provide an estimate of the extent of any debris present to ensure that the presence of debris that may impede deer migration across Mammoth Pool reservoir is monitored and that any build up of debris is removed in a timely manner. If Cal Fish & Game and/or the Forest Service and/or FWS determines, based on review of the photographs and the estimate of the aerial extent of debris buildup, that the debris would impede deer migration, SCE proposes to remove sufficient levels of debris to allow deer to migrate without impediment.

At the Big Creek Nos. 2A, 8, and Eastwood Project, SCE proposes, in condition 5.2 of the Settlement Agreement, to implement road closures to prevent the disturbance of mule deer and other wildlife. Table 3-19 shows the roads proposed to be closed.

Table 3-19. Roads and road closure requirements. (Source: SCE, 2007b)

Forest Service Road No.	Road Description	Gate (Closure Period)
FS Road No. 9S58	FS Road No. 9S58 from gate to NF Stevenson gage	Gate A1 (*nights only*) Gates A2 & B (*all year*)
FS Road No. 9S32	FS Road No. 9S32 from gate near Highway 168 to EPH transmission line	Gates J & M (*all year*)
FS Road No. 9S32A	FS Road No. 9S32A, spur from 9S32 to east side of Balsam forebay	Gate L (*all year*)
FS Road No. 9S312	Access to Eastwood substation from Highway 168	Gate G (*all year*)
FS Road No. 9S24	From Highway 168 to NF Stevenson Creek gate 2 (Tunnel 7)	Gate H (*all year*)

Forest Service 4(e) condition 15 for the Mammoth Pool Project and 15 for the Big Creek Nos. 2A, 8, and Eastwood Project and Interior 10(j) recommendation 5 for the Mammoth Pool Project and 12 for the Big Creek Nos. 2A, 8, and Eastwood Project are consistent with the measures proposed in the Settlement Agreement.

Our Analysis

Cal Fish & Game, the Forest Service, and SCE monitored deer migration from 1958 to 1975 to document deer losses, problems, and behavior associated with the construction of the Mammoth Pool Project (SCE, 2003i). Substantial losses occurred at the diversion tunnel during construction and at the spillway after project construction during the spring when deer were migrating through the area. Deer mortality was also caused by the Daulton Creek diversion (steep-sided and hazardous during high-flows), trash buildup at points where deer were trying to swim the reservoir, and harassment from recreational activities on the reservoir (SCE, 2003i).

In response to these noted effects, SCE implemented several deer protection measures. SCE and the Forest Service close the road to Mammoth Pool dam and close the reservoir to boating during peak migration season (May 1 to June 15) and installed fencing along the west side of the Mammoth Pool spillway to keep deer from being frightened by cars or people and jumping into the spillway. SCE also placed 3 inches of sand on the bridge over the spillway to promote deer use. SCE maintains this fencing and sand placement. SCE maintains fencing blocking the migration trail west of the spillway and a barrel line across the spillway intake, in order to prevent deer from being pulled into the spillway when the reservoir is spilling. SCE built a bridge across Daulton Creek to aid in deer migration, and SCE places sand on the bridge to make it more appealing for deer use. A 2003 SCE study (2003i) assessed the effectiveness of these protection measures and found no signs of deer struggles or mortality. The mule deer protection measures appear to be effective and deer continue to use the bridges. SCE does not currently remove debris from the Mammoth Pool reservoir. Deer drowning is known to have occurred (SCE, 2003i), especially around the spillway when deer get trapped in debris.

SCE's proposal would ensure that SCE would continue to maintain the existing mule deer protection measures at Mammoth Pool that are currently effective in limiting deer mortality. Maintaining the fences and barrel line and closing the Mammoth Pool reservoir and dam road to recreation would encourage mule deer to cross the reservoir safely along the road instead of entering the hazardous spillway. Similarly, maintaining the Daulton Creek bridge encourages mule deer to use the bridge to cross the creek instead of getting trapped in the high flows and steep sides of the creek. Because mule deer are known to die after becoming trapped in debris and trash that build up in the area of the floating boom above the Mammoth Pool spillway while trying to swim across the reservoir, photographing and estimating the amount of debris in this location annually allows the agencies to monitor the hazardousness of the condition. This would allow SCE to remove the trash buildup when it reaches a hazardous level, without having to remove it annually.

Similar to the Mammoth Pool Project, migrating deer around the Eastwood Project can be spooked by cars and recreationalists using project roads. Closing the roads identified in SCE's proposal would allow mule deer migration pathways with minimal disturbance. Reducing disturbance would be beneficial to the health of the herd, along with other wildlife in the area.

Bear/Human Interaction

Black bears potentially occur in the vicinity of the Big Creek ALP Projects. Human activities could lure bears into close proximity to project facilities and recreational areas. In measure 5.7 of the Settlement Agreement, SCE proposes to install and maintain bear-proof dumpsters at the Big Creek No. 1 administrative offices and company housing, and other project facilities where people may dispose of or store food waste. SCE also proposes to implement a program to educate SCE personnel about proper food storage and garbage disposal.

Forest Service 4(e) condition 14 and Interior 10(j) recommendation 9 are consistent with SCE's proposed measure.

Our Analysis

Bears are often drawn into potentially dangerous proximity to humans by garbage or food that is left in places bears can access. Installing and maintaining bear-proof dumpsters at Big Creek No. 1 Project facilities would discourage bears from coming into areas used frequently by humans. Educating SCE personnel would further ensure that people do not leave food and garbage in places that could lure bears into close proximity to project facilities.

Effects of Proposed Operations

As discussed in section 3.3.1.2, *Aquatic Resources*, SCE proposes increased MIF requirements in many of the Big Creek ALP Project reaches, channel and riparian maintenance flow for several reaches in the Big Creek Nos. 2A, 8, and Eastwood Project, and sediment management activities for the Big Creek ALP Projects. These proposed measures are designed to improve the existing condition of the aquatic and riparian habitat for the benefit of fish. Several special-status amphibian and reptile species, including the federal candidate and Forest Service sensitive species MYLF and Yosemite toad, and Forest Service sensitive species western pond turtle and FYLF occur within various reaches in the Big Creek ALP Project areas. Additionally, riparian habitat could support special-status plants and wildlife at all four Big Creek ALP Projects. Altering project operations could potentially affect habitat for these species.

Our Analysis

The Big Creek Nos. 2A, 8, and Eastwood Project supports populations of Yosemite toad and western pond turtle, as well as several riparian special-status species such as flat-leaved bladderwort, willow flycatcher, and yellow warbler. Additionally, the project contains potential habitat for the MYLF and FYLF. Implementing the proposed project operation measures would enhance aquatic habitat, water quality, and riparian habitat, thereby maintaining or enhancing project conditions for these species. Improving fish habitat, however, could increase fish populations, which are often predators for special-status amphibians and reptiles. Although habitat conditions for these species may improve, increasing the predator population could keep amphibian and western pond turtle populations from increasing or becoming established in new areas.

SCE proposes to decommission the North and South Slide Creek, Crater Creek, and Tombstone Creek diversions. Permanently returning these reaches to free-flowing conditions would likely benefit habitat for Yosemite toad, which is known to occur near Tombstone Creek, and MYLF.

The Big Creek Nos. 1 and 2 Project supports populations of MYLF, Yosemite toad, and supports potential habitat for FYLF, western pond turtle, several special-status riparian plant species, and willow flycatcher and yellow warbler. Implementing the proposed project operation measures would enhance aquatic habitat, water quality, and potentially riparian habitat, thereby maintaining or enhancing project conditions for these species. Improving fish habitat could increase fish populations, which are often predators for special-status amphibians and reptiles. Although habitat conditions for these species may improve, increasing the predator population could keep amphibian and western pond turtle populations from increasing or becoming established in new areas.

The Mammoth Pool Project supports populations of western pond turtle and supports potential habitat for FYLF, several special-status riparian plant species, and willow flycatcher. Implementing the proposed project operation measures would enhance aquatic habitat, water quality, and potentially riparian habitat, thereby maintaining or enhancing project conditions for these species. Improving fish habitat, however, could increase fish populations, which are often predators for special-status amphibians and reptiles. Although habitat conditions for these species may improve, increasing the predator population could keep amphibian and western pond turtle populations from increasing or becoming established in new areas.

The Big Creek No. 3 Project supports populations of western pond turtle and supports potential habitat for FYLF and willow flycatcher. Implementing the proposed project operation measures would enhance aquatic habitat, water quality, and potentially riparian habitat, thereby maintaining or enhancing project conditions for these species. Improving fish habitat, however, could increase fish populations, which are often predators for special-status amphibians and reptiles. Although habitat conditions for these species may improve, increasing the predator population could keep amphibian and western pond turtle populations from increasing or becoming established in new areas.

3.3.2.3 Cumulative Effects

Construction and operation of the Big Creek ALP Projects, along with numerous other hydroelectric projects in the San Joaquin River Basin, has likely affected habitat for a number of native aquatic amphibians, and in particular, for the MYLF, FYLF, and Yosemite Toad. Existing operation of the Big Creek ALP Projects and proposed operation of the projects under the Settlement Agreement would result in continued cumulative effects on the amount and quality of aquatic amphibian habitat from flow diversion and reservoir inundation. Project operation would continue to alter the natural hydrograph, which may have ongoing adverse effects by impairing breeding, rearing, dispersal, and overwintering. The historic introduction of non-native salmonids is thought to have resulted in the extirpation of native amphibians from many sites in the Sierra Nevada. Ongoing stocking of trout in the basin by SCE and Cal Fish & Game is expected to occur and could continue to suppress FYLF and MYLF populations.

Cumulatively, implementation of the measures related to increased flow releases (both MIF and channel and riparian maintenance flow); control of herbicide and pesticide use, decommissioning of small backcountry diversion, grazing exclusion, and sediment and LWD management either required or proposed for the seven Big Creek Projects would improve aquatic and riparian habitat conditions in bypassed streams in the basin. The improved habitat conditions would likely result in higher fish and amphibian populations. Although the quality of potential habitat for special-status amphibians would increase in the basin in the future, higher fish populations may suppress any increase in amphibian populations in reaches where both are present.

3.3.3 Threatened and Endangered Species

3.3.3.1 Affected Environment

Valley Elderberry Longhorn Beetle

The federally threatened VELB (*Desmocerus californicus dimorphus*) is dependent upon its host species plant, the elderberry. The VELB occurs below 3,000 feet in elevation, generally along waterways and in floodplains that support riparian vegetation including various species of elderberry.

SCE conducted VELB surveys at the Big Creek ALP Projects during the spring and summer of 2002, 2003, and 2004. SCE mapped VELB habitat (i.e., elderberry shrubs located below 3,000 feet in elevation) within the project boundaries on 7.5-minute USGS quadrangles and incorporated the results into a geographic information system (GIS) database in conjunction with the special-status plant species surveys. Where accessible, SCE inspected elderberry shrubs for beetle exit holes. The survey area included all land within a 150-foot perimeter around the following project facilities: dams, reservoirs, moderate diversions, gaging stations, forebays, powerhouses, transmission lines, and recreational facilities in the study area. SCE surveyed all land within a 100-foot perimeter around small diversions, roads, and trails. Following initial elderberry shrub identification in 2002, SCE conducted a protocol-level survey according to FWS' *Conservation Guidelines for Valley Elderberry Longhorn Beetle* (FWS, 1999) on all 567 shrubs identified in the study area in 2002. The protocol-level survey included examining elderberry shrubs within the study area for beetle exit holes and counting the number of stems greater than or equal to 1 inch in diameter and less than or equal to 3 inches (≥1 and ≤ 3), stems greater than 3 and less than 5 inches in diameter (>3 and <5), and stems greater than or equal to 5 inches (≤ 5) in diameter (FWS, 1999). VELB occupancy was assumed, based upon the presence of exit holes (external evidence of prior beetle presence). No additional shrubs were detected in the study area in 2003. Five additional shrubs were identified in the study area in 2004.

Survey results identified the following potential VELB occurrences and habitat (SCE, 2007c):

- Big Creek Nos. 2A, 8, and Eastwood: a total of 15 elderberry shrubs occur in the vicinity of the Big Creek Nos. 2A, 8 and Eastwood Project, none of which showed signs of VELB occupancy. These shrubs are located near Powerhouse 8, Tunnel 8 and FS Road No. 8S03A (an access road to Powerhouse 8 from FS Road No. 8S03 [#166]).
- Big Creek Nos. 1 and 2: No potential VELB habitat occurs in the project area.
- Mammoth Pool: a total of 42 elderberry shrubs in the vicinity of the Mammoth Pool Project, of which 2 showed signs of beetle occupancy. The elderberry shrubs are located adjacent to FS Road No. 9S42, the Mammoth Pool powerhouse transmission line access road from gate near County Road 225, Italian Bar Road to FS Road No. 8S44.
- Big Creek No. 3: a total of 515 elderberry shrubs occur in the vicinity of the Big Creek No. 3 Project, 8 of which showed signs of beetle occupancy. The elderberry shrubs are located near: (1) Powerhouse 3 near the penstocks, rock/sand traps and surge chamber; (2) FS Road No. 8S05, Canyon Road (from junction with FS Road No. 8S03 to junction with Italian Bar Road); (3) FS Road No. 9S89 from Italian Bar Road east to Powerhouse 3 and administrative building; and, (4) miscellaneous Powerhouse 3 roads (i.e., water tank access road and shop).

California Red-Legged Frog

The California red-legged frog (CRLF) (*Rana aurora draytonii*) is federally threatened and occurs in aquatic and upland areas where suitable breeding and non-breeding habitat is interspersed and connected. CRLF historically occurred in aquatic, riparian, and upland habitats throughout much of California and northern Baja, California. It currently ranges from sea level to approximately 3,500 feet, although historical sightings have been reported as high as 4,900 feet in the Sierra Nevada (Entrix, 2003). The primary constituent elements for CRLF include an area with two (or more) suitable breeding locations, a permanent water source, and associated uplands surrounding these water bodies up to 300 feet from the water's edge. All these elements must be within 1.25 miles of one another and connected by barrier-free dispersal habitat that is at least 300 feet wide. There is no critical habitat for this species in the vicinity of the Big Creek ALP Projects.

The Big Creek ALP Projects are within the historic range, but not within the current known range, of the CRLF. The project vicinities occur within the Sierra Nevada Foothills and Central Valley Recovery Unit for CRLF (FWS, 2002a). This unit includes the western foothills and Sierra Nevada foothills, to approximately 5,000 feet elevation in the Central Valley hydrographic basin. However, the four project vicinities are not within a core area (SCE, 2007c). A site assessment was prepared for the Big Creek ALP Projects (Entrix, 2003). Historical records documenting CRLF presence nearest to the vicinity of the four projects are 30 miles to the south, near Minkler, and 15 miles to the northwest in Willow Creek near O'Neals. The Minkler record dates back to 1916 and CRLF are presumed extirpated at this site. The O'Neals records date back to 1951 with CRLF seen as late as 1968. They are currently presumed extirpated. The nearest known extant population of CRLF to the vicinity of the Big Creek ALP Projects is in Mine Creek (near Mercey Hot Springs), about 90 miles to the west in the Coast Range foothills in Fresno County.

The CRLF site assessment assessed 35 potential aquatic habitat sites for potential CRLF habitat (Entrix, 2003). With the exception of small sections in Jose and Chiquito creeks, the site assessment concluded that the project areas are unsuitable for CRLF. Jose and Chiquito creeks are not project reaches (i.e., bypass, flow-augmented, or flow-modified). The site assessment concluded that CRLF is not expected to occupy the Big Creek ALP Project areas due to a lack of suitable habitat and because the projects are outside of the species' current known range (Entrix, 2003).

Because CRLF is not expected to occupy the Big Creek ALP Project areas due to the lack of suitable habitat and the projects are outside of the species' current known range, the Big Creek ALP Projects would have no effect on the CRLF and are not discussed further.

3.3.3.2 Environmental Effects

Valley Elderberry Longhorn Beetle

SCE uses a combination of manual, mechanical, and chemical methods to control vegetation in the vicinity of the Big Creek ALP Projects. SCE also conducts regular road maintenance on project roads, including grading, graveling, and paving. These project management activities could result in adverse effects on the VELB by trimming or pruning elderberry bushes that provide potential habitat.

SCE proposes to implement the VELB Management Plan included in section 5.5 of the Settlement Agreement. The VELB Management Plan includes the following avoidance and protection measures at Big Creek Nos. 2A and 8, Eastwood, Mammoth Pool, and Big Creek No. 3 projects:

- Prior to implementation of management activities, flag each elderberry shrub, or group of shrubs, potentially affected by project operation or maintenance activities, with 1 or more stems measuring 1 inch in diameter or greater (>1) at ground level.
- Install signage in areas where elderberry shrubs are known to occur.

- Do not remove any elderberry shrub with 1 or more stems >1 inch in diameter at ground level.
- Do not trim any elderberry shrub stems or branches >1 inch in diameter.
- Only conduct annual and biannual vegetation control in July through April in areas within 100 feet of elderberry shrubs.
- Do not use any flail-type mower within an elderberry shrub dripline with 1 or more stems measuring >1 inch in diameter at ground level.
- Use basal bark or foliar techniques when herbicide application must occur within 100 feet of the dripline of an elderberry shrub with 1 or more stems measuring >1 in diameter or greater at ground level. Basal application techniques include cutting of a non-elderberry shrub and applying an oil-based herbicide directly to the stump. Foliar application techniques include hand spraying of an herbicide, with a deposition/retention additive, to control overspray. A certified pesticide applicator would complete or supervise the application of herbicides. Herbicide application would occur from July through April on an as-needed basis.
- Conduct non-emergency road grading July through April and restrict the use of a grader to the road surface and adjacent berms to remove any eroded material and to maintain roadside berms.

In addition to the above avoidance and protection measures, SCE also established several programs to train personnel on the recognition and avoidance of special-status species, as described in section 3.3.2.2, *Terrestrial Resources*.

SCE proposes to include several new roads as project roads that have not yet been surveyed for VELBs. In the VELB Management Plan, SCE proposes to survey the roads that are at or below 3,000 feet in elevation to determine the location of potential VELB habitat within 1 year of Commission approval of the VELB Management Plan. SCE also proposes to evaluate any elderberry shrubs identified during these surveys to determine potential project effects from vegetation management and road maintenance.

SCE proposes, as part of the VELB Management Plan, to provide mitigation for adverse effects on VELB, in accordance with FWS' 1999 Conservation Guidelines (FWS, 1999). SCE proposes to plant a total of eight elderberry seedlings on Forest Service property in the project vicinity adjacent to other elderberry shrubs, in a location agreed upon by SCE, FWS, and the Forest Service. SCE proposes to monitor the mitigation site following planting to assess the general condition of the site and the condition of the elderberry plantings. SCE also proposes to monitor the shrubs, and the 12 adjacent shrubs that SCE would trim during vegetation maintenance. SCE would monitor 7 times over a 15-year period, in years 1, 2, 3, 5, 7, 10, and 15, but would not monitor for VELB occupancy. SCE would prepare monitoring reports. SCE proposes that if a minimum elderberry survival rate of at least 60 percent is not maintained throughout the monitoring period, that it would replace, within 1 year, the failed plantings. If SCE determines that the success criteria cannot be met for reasons beyond its control, SCE would provide FWS with a letter report summarizing the reasons. FWS indicates that SCE already has established an FWS-approved VELB conservation area and planted a total of 30 elderberry seedlings (rather than the originally proposed eight seedlings) to compensate for current, potential, and limited future effects, not yet identified on the VELB and its habitat (letter from C.C. Goude, Acting Field Supervisor, FWS, Sacramento, CA to the Commission, dated December 16, 2008).

Forest Service 4(e) condition 16 for all Big Creek ALP Projects and Interior 10(j) recommendation 10 (Project No. 67), 7 (Project Nos. 120 and 2175), and 8 (Project No. 2085) are the same as the proposed VELB Management Plan with the addition of the Forest Service specifying that SCE provide survey data and completion reports to the Forest Service at the annual consultation meeting specified in 4(e) condition 1.

Our Analysis

At the Big Creek ALP Projects, SCE conducts vegetation management and road maintenance on a regular basis to reduce fire hazard, improve visibility, and provide for worker/public health and safety. Vegetation management includes trimming of vegetation by hand or equipment and the use of herbicides. In general these activities occur in the spring and summer and in areas within 150 feet of project facilities and within 10 feet on either side of roads. Vegetation trimming by hand and mechanical means occurs on an as-needed basis. Following trimming, SCE may apply herbicides using basal or foliar application methods. SCE uses basal application on shrubs including applying an oil-based herbicide directly to the cut shrub-stump. Foliar application includes hand spraying an herbicide with an additive to control overspray. Vegetation maintenance around roads typically occurs one or more times in a 5 year period, whereas maintenance of the actual roads occurs more infrequently, less than once every 5 years.

Both the vegetation and road maintenance occur in areas that support potential VELB habitat. As such, implementing these regular maintenance methods within areas of potential VELB habitat could adversely affect VELB. Implementing the VELB Management Plan, including the protection of elderberry shrubs by signage and flagging, and restrictions on vegetation management practices within proximity to elderberry shrubs would minimize the loss of potential VELB habitat and any VELB inhabiting these shrubs. Additionally, continuing vegetation maintenance in areas surrounding potential VELB habitat reduces the chance of a brush fire causing widespread loss of habitat. SCE also proposes to include new roads within the project boundaries which have not been surveyed for VELB. SCE's proposed measure to survey these roads within 1 year of license issuance and subsequently implementing the proposed VELB Management Plan measures in these locations would minimize the loss of any potential VELB habitat in these areas from maintenance associated with these roads.

Although implementing the proposed VELB Management Plan would reduce adverse effects on VELB habitat, some vegetation and road maintenance must continue to occur in VELB habitat adjacent to roads for safety reasons. As a result, some VELB habitat would continue to be affected under the proposed measures. The VELB Management Plan assessed the likelihood of continued vegetation and road management affecting the 572 elderberry shrubs known to occur within the Big Creek ALP Project boundaries, based on the type of management activities, the distance of the shrub from the facility, the presence of elderberry stems greater than or equal to 1 inch in diameter, and the ability to implement the previously identified protection and avoidance measures in that location. This assessment determined that SCE should not remove any elderberry shrubs over the term of the license at any of the Big Creek ALP Projects; however, trimming would occur on 18 of the 572 shrubs. This includes trimming 5 shrubs at the Big Creek Nos. 2A, 8, and Eastwood Project, and 13 shrubs in the Big Creek No. 3 Project. None of these shrubs showed evidence of VELB occupancy. Within these shrubs, during the course of any new project licenses, SCE would trim a total of 7 stems greater than 1 inch in diameter but less than 3 inches in diameter, 27 branches less than 1 inch in diameter, and 1 branch greater than 1 inch in diameter but less than 3 inches in diameter. As such, project vegetation and road maintenance would affect VELB habitat at Big Creek Nos. 2A, 8, and Eastwood and Big Creek No. 3; however, SCE would only trim approximately 1 percent of the total number of shrubs. Additionally, SCE's proposed employee training and sensitive species database programs would ensure that the proposed protection and avoidance measures are enforced and no unnecessary elderberry trimming or herbicide application would occur.

As a result of the necessary trimming of some elderberry shrub stems, SCE proposes mitigation based on the FWS Conservation Guidelines (FWS, 1999), with modifications developed cooperatively with FWS. SCE would plant eight elderberry seedlings and monitor the plantings to determine if a minimal 60 percent survival rate is met. SCE's proposed mitigation would meet FWS guidelines for VELB, and SCE would monitor the mitigation areas. The VELB Management Plan, however, does not specify that the mitigation sites occur within the project boundaries. If mitigation sites occur outside of project lands, the Commission would not be able to enforce the proposed monitoring and subsequent success criteria requirements. Locating any mitigation sites on project lands, at a location agreed upon by SCE, FWS, and the Forest Service would ensure that mitigation requirements are met. As previously noted, FWS indicates that SCE already has established a VELB conservation area, but the location of this site has not been provided to the Commission. Providing the Forest Service with the results of VELB surveys and monitoring results would increase the Forest Service's database and contribute to regional protection of VELB.

3.3.4 Recreational Resources

3.3.4.1 Affected Environment

Regional Recreational Resources

The Big Creek ALP Projects are all located within the 1.3 million-acre Sierra National Forest. The Sierra National Forest is bordered by the Stanislaus National Forest and Yosemite National Park to the north, the Inyo National Forest to the east, the Sequoia National Forest and Kings Canyon National Park to the south, and by private lands to the west. The Sierra National Forest provides year-round recreational opportunities and designated Wilderness areas; 60 campgrounds; more than 1,000 miles of hiking trails; snow recreation areas; resort areas; 11 major reservoirs and more than 470 smaller lakes offering flatwater recreational opportunities; 1,800 miles of streams and rivers providing canoeing, kayaking, and rafting; and 13 designated off-highway vehicle routes.

The San Joaquin River Trail is a public multi-use trail that runs through the San Joaquin River Canyon from Millerton Lake to the crest of the Sierra Nevada Mountains. The San Joaquin River Trail is co-aligned with the Mammoth Pool transmission line road for about 9 miles. The San Joaquin River Trail also crosses two other project roads: FS Road No. 8S03 (Mammoth Pool Powerhouse Road) and FS Road No. 7S47 (Rock Creek diversion access road). Within the region there are 14 trails that have trailheads within or near the Big Creek ALP Projects. Table 3-20 summarizes the trailhead and the closest reservoir/forebay.

Table 3-20. Regional trails. (Source: SCE, 2003a)

Project	Trailhead	Closest Reservoir/Forebay
Big Creek Nos. 2A, 8, and Eastwood Project	Dutch/Crater Trailhead	Florence Lake
	Bear Creek Trailhead at Kaiser Pass Road	Mono Creek forebay
	Bear Creek Trailhead at Forebay	Bear forebay
	Balsam Meadows Trailhead	Balsam forebay
Big Creek Nos. 1 and 2	Billy Creek Trailhead	Huntington Lake
	College Rock Trailhead	Huntington Lake

Project	Trailhead	Closest Reservoir/Forebay
	Rancheria Creek Trailhead	Huntington Lake
	Inspiration Point/ Sunset Point Trailhead	Huntington Lake
Portal	Margaret Lakes Trailhead	Lake Thomas A Edison
	Mono Creek Trailhead	Lake Thomas A. Edison
	Mono Crossing Trailhead	Portal forebay
	Rattlesnake Crossing Trailhead	Portal forebay
	Bear Ridge Trailhead	Lake Thomas A. Edison
Mammoth Pool	Logan Meadow Trailhead	Mammoth Pool reservoir

Big Creek Nos. 2A, 8 and Eastwood Project

The Big Creek Nos. 2A, 8, and Eastwood Project encompasses areas surrounding Florence Lake and the Mono Creek diversion (Upper Basin) and Shaver Lake and the Big Creek Canyon at Powerhouse 8 (Lower Basin). Developed public recreational facilities within this project include two boat launch areas, seven day-use picnic areas, four campgrounds, and one trailhead parking area. These facilities occur near Florence Lake and Mono Creek in the Upper Basin and near Shaver Lake and Balsam forebay in the Lower Basin. Dispersed recreational activities occur along the bypassed reaches, near the South Fork San Joaquin River, Mono Creek, Bear Creek and several small creeks in the Upper Basin and near North Fork Stevenson Creek in the Lower Basin.

Recreational Facilities

Figures 3-7 (Upper Basin) and 3-8 (Lower Basin) show the location and table 3-21 summarizes developed public recreational facilities at the Big Creek Nos. 2A, 8, and Eastwood Project.

Florence Lake—Florence Lake is located in a remote setting with a relatively low level of facility development. It has about 9.3 miles of shoreline. The lake is accessed from Florence Lake Road, which intersects Kaiser Pass Road east of Kaiser Pass. Kaiser Pass Road is typically open from late May through mid-November. The developed recreational facilities typically do not open until Kaiser Pass Road is opened and typically close around the beginning of October. The Forest Service closes Kaiser Pass Road to vehicular traffic in the winter and the road is used as a snowmobile trail. Except for areas where project- related facilities and dam structures are located, the entire shoreline is open to non-motorized public access. Visitors can access the headwaters of the South Fork San Joaquin River and the John Muir Wilderness area from Florence Lake.

Developed recreational facilities include Florence Lake boat ramp, Florence Lake day-use area, Jackass Meadow Campground, and the Dutch/Crater Trailhead. Florence Lake day-use area has 16 picnic sites and is located adjacent to the boat launch at the western end of the lake. Jackass Meadow Campground has 50 campsites and is located a short distance downstream of Florence Lake dam along South Fork San Joaquin River. The Dutch/Crater Trailhead is located at the northern end of Florence Lake near the day-use area. All of the developed recreational facilities, except for portions of the Lower Florence Lake boat ramp parking area and the entire upper parking area, are located within the existing project boundary.

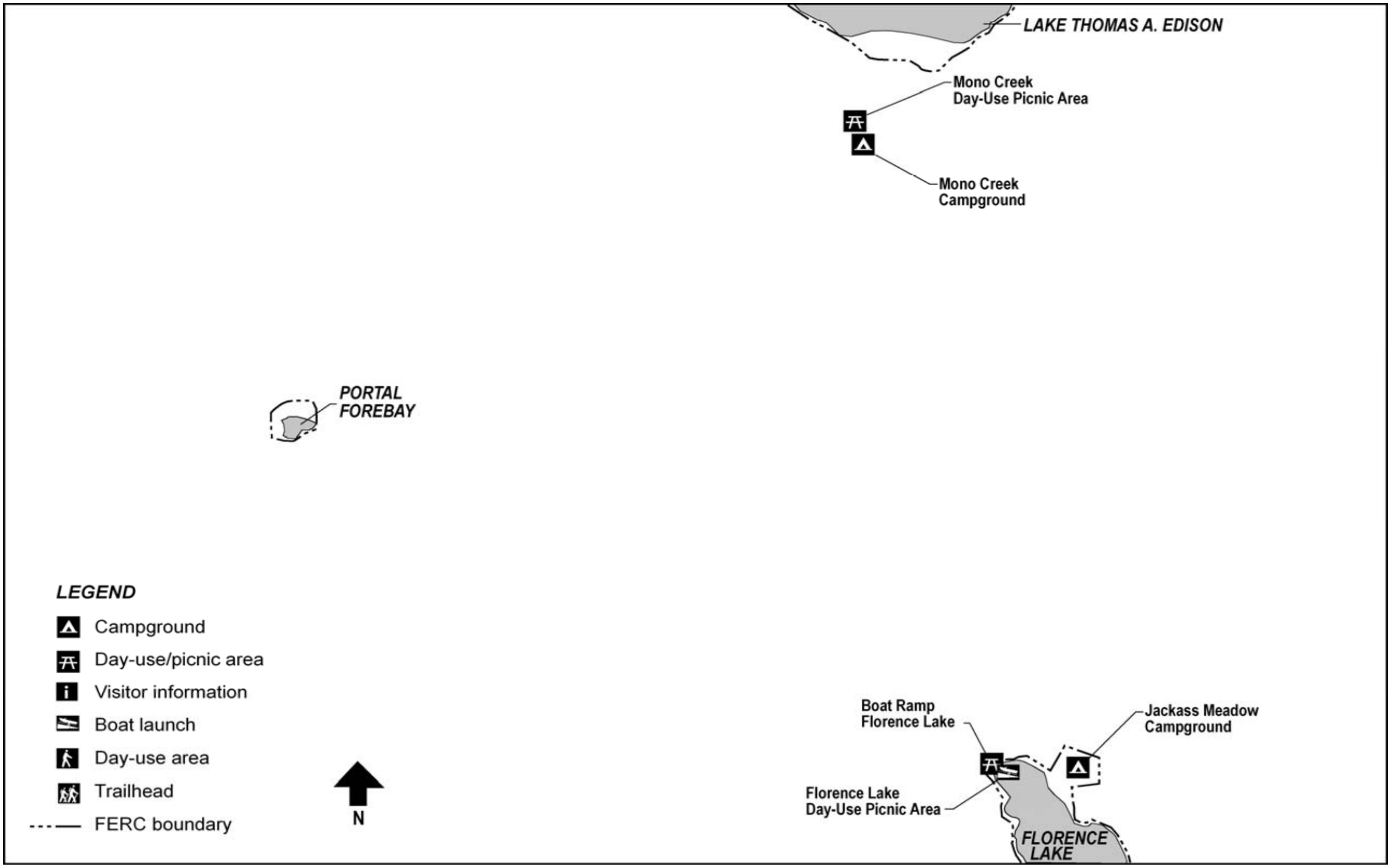

Figure 3-7. Location of the developed public recreational areas at the Big Creek Nos. 2A, 8 and Eastwood Project – Upper Basin. (Source: 2007a, as modified by staff)

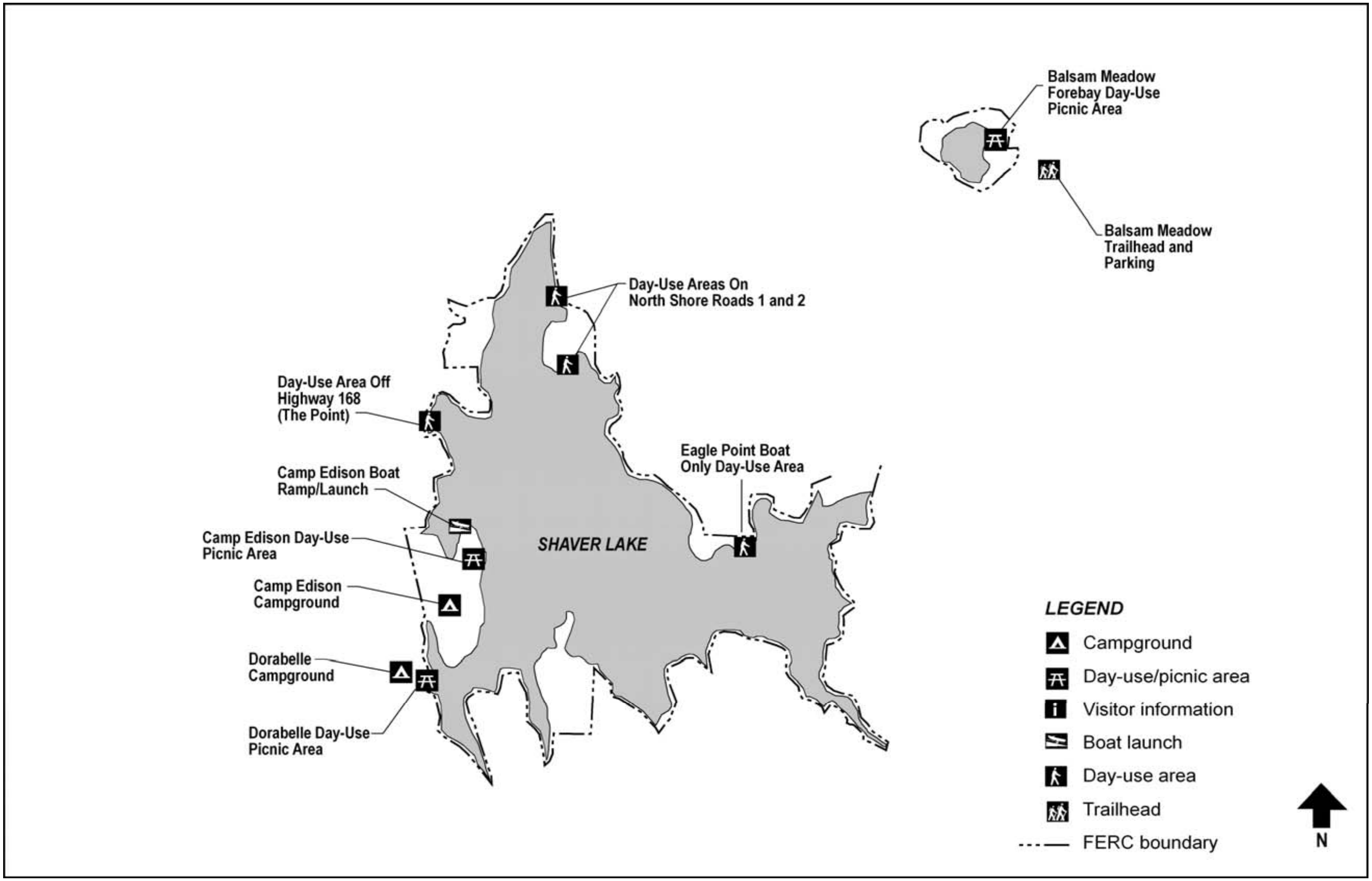

Figure 3-8. Location of the developed public recreational areas at the Big Creek Nos. 2A, 8 and Eastwood Project – Lower Basin. (Source: SCE, 2007a, as modified by staff)

Table 3-21. Big Creek Nos. 2A, 8, and Eastwood Project developed public recreational facilities. (Source: SCE, 2002b and 2007a)

Location	Site	Boat Ramps	Picnic Tables	Camp sites	Trails	Rest-rooms	Bear Boxes	Trash Facilities	Signage	Parking
Florence Lake	Florence Lake boat ramp and Parking Areas	1	-	-	X	-	-	-	-	X
	Florence Lake day-use picnic area	-	16	-	X	1	-	X	-	X
	Jackass Meadow Campground	-	50	50	-	2	50	X	X	-
Mono Creek Forebay	Mono Creek day-use picnic area	-	6	-	-	1	6	-	-	-
	Mono Creek Campground	-	16	14	-	2	16	-	X	X
Shaver Lake	Camp Edison Campground	-	290	252	-	13	252	X	X	X
	Camp Edison Boat Launch	1	-	-	-	-	-	X	X	X
	Dorabelle Campground	-	70	70	-	16	-	X	X	X

Location	Site	Boat Ramps	Picnic Tables	Camp sites	Trails	Rest-rooms	Bear Boxes	Trash Facilities	Signage	Parking
	Dorabelle day-use picnic area	-	22	-	-	2	-	X	X	X
	Day-use picnic areas on North Shore Roads 1 and 2	-	40	-	-	3	-	X	-	X
	Day-use picnic area off of Hwy 168 (The Point)	-	-	-	-	1	-	X	X	X
	Eagle Point boat-in day-use picnic area	-	7	-	-	1	-	X	-	-
Balsam Forebay	Balsam Meadows forebay day-use picnic area	-	2	-	X	1	-	X	X	-
	Balsam Meadows trailhead and parking	-	-	-	X	1	-	X	X	-
Huntington Lake Area	Eastwood Overlook and parking	-	-	-	-	1	-	X	X	X
	Eastwood Overflow Campground	-	-	-	-	-	-	-	-	-

The Florence Lake boat ramp is designed to provide access from full pool (7,330 feet elevation/64,406 acre-feet storage) to the end of the paved 25-foot ramp at 7,326 feet elevation (62,967 acre-feet storage); although boaters can access the reservoir at lower elevations by driving down the reservoir bank. From 1981 to 2001, Florence Lake was maintained on average between elevations 7,286 to 7,320 feet during the recreational season (Memorial Day to Labor Day) (see figure 3-2); however, during this period, boaters accessed the reservoir during the entire summer recreational season. The Florence Lake Ferry Service, operated by the Florence Lake Store, is located at the north end of the lake near the boat ramp. The Florence Lake Ferry Service transports hikers across Florence Lake to access the John Muir Wilderness Area bordering the southern portion of the lake. A floating dock is used for the ferry and is functional from elevation 7,327 feet (64,406 acre-feet storage) to 7,261 feet (12,237 acre-feet storage). SCE operates the reservoir to maintain relatively high elevation during the peak recreational season with the highest levels between May to August (see figure 3-2). In a visitor survey during summer 2002 to evaluate current uses and future demands at project-area recreational facilities, 93 percent of the respondents rated boat ramp availability at Florence Lake as acceptable (with 32 percent rating it moderately acceptable and 61 percent rating it highly acceptable).

Mono Creek Forebay—The Mono Creek forebay is located south of Thomas A. Edison Lake (Thomas A. Edison Lake is part of the Vermilion Valley Project) in the Upper Basin. Developed recreational facilities in this area include the Mono Creek day-use picnic area and Mono Creek Campground at the southeastern end of the Mono Creek forebay. The majority of the day-use area is located within the existing project boundary and the majority of the campground is located outside of the existing project boundary.

Shaver Lake—Shaver Lake, with about 22 miles of shoreline, is less remote than Florence Lake and has multiple developed user access points and developed recreational facilities. Developed public recreational facilities include one public boat launch area, four day-use picnic areas, and two campgrounds. In addition to the public facilities, private facilities include boat docks, winter boat storage, gas pumps, and concessions. Gold Arrow Island operates a summer waterskiing camp. Sierra Marina, Shaver Lake Marina, and the Fresno Fishing Club provide private recreational facilities.

Public day-use areas at Shaver Lake include Dorabelle day-use picnic area, day-use areas on North Shore Roads 1 and 2, day-use area off of Highway 168 (The Point), and Eagle Point boat-in day-use picnic area. Eagle Point boat-in day-use area is located on the east side of Shaver Lake. SCE maintains an access road to the boat-in day-use area which branches off FS Road No. 9S58. The access road to the boat-in day-use area is closed to public vehicular traffic. SCE uses this road exclusively to access the facility.

Campgrounds at Shaver Lake include Dorabelle Campground and Camp Edison Campground, both along the southwestern shoreline. Dorabelle Campground has 70 campsites, flush toilet restrooms, picnic tables, fires rings, and bear boxes. Camp Edison has 252 campsites with full hook-up RV sites, flush toilets, showers, fish-cleaning stations, an interpretive display, cable television connections, and an amphitheatre.

There is one public and one private boat launch area that provide boating access to Shaver Lake: Camp Edison boat ramp (public) and the Fresno County boat ramp at Sierra Marina (private with public access). The Camp Edison boat ramp is designed provide access to the lake from full pool (5,370 elevation/135,568 acre-feet) to elevation 5,348 feet (90,000 acre-feet). Beyond this point, potential users launching boats are required to leave the pavement and drive onto the reservoir bed to reach the water. The minimum reservoir elevation at which boats can access the water is 5,296 feet. The Fresno County boat ramp is designed to provide access to the lake from full pool (5,370 elevation/135,568 acre-feet) to elevation 5,333 feet (66,000 acre-feet). It is possible to launch boats from the reservoir bed (at elevation 5,300 feet). For the recreational seasons between 1983 and 2002, boaters accessed the lake from the Camp Edison boat ramp for the entire season during wet, above normal, and dry years, and 98 percent of the time during critically dry years. For the Fresno County boat ramp, during the same time period, boaters accessed the lake for the entire season during wet and above normal water years; 93 percent of the time during the dry water years; and 36 percent of the time in critically dry water years. SCE operates the reservoir to maintain a relatively high water elevation throughout the peak recreational season from May through October (see figure 3-3). In a visitor survey conducted during summer 2002 to evaluate current uses and future demands at project area recreational facilities, 90 percent of the respondents rated their satisfaction with boat ramp availability at Shaver Lake to be acceptable (29 percent moderately acceptable and 61 percent highly acceptable).

All of the recreational facilities, except for the Dorabelle Campground and portions of the Dorabelle day-use area and day-use area on North Shore Road 1 are located within the existing project boundary.

Balsam Forebay—Developed recreational facilities include the Balsam Meadows forebay day-use picnic area and the Balsam Meadows trailhead and parking area. Both facilities are located within the existing project boundary.

Huntington Lake Area—The Eastwood Overlook and the Eastwood Overflow Campground are currently within the existing project boundary of the Big Creek Nos. 2A, 8, and Eastwood Project. The Eastwood Overlook is located near the Portal Powerhouse at the north end of Huntington Lake. The Overlook provides an interpretive display containing signs, maps, and project area information. There is a Forest Service Visitor Center in this vicinity that is opened Memorial Day weekend through the end of September. The Eastwood Overflow Campground is a designated Forest Service dispersed camping area located just north of the Eastwood Overlook that is used when the developed campgrounds at nearby Huntington Lake are full.

River Corridors—In the Upper Basin, dispersed recreational use occurs along South Fork San Joaquin River near Mono Hot Springs, along South Fork San Joaquin

River below Florence Lake, along Mono Creek above and below the Mono diversion and along Bear Creek. In the Lower Basin, dispersed recreational use occurs along the North Fork Stevenson Creek upstream of Shaver Lake, and Stevenson Creek below Shaver Lake. There are no developed recreational facilities in these river corridor areas; however, there is a trailhead located at the Bear Creek forebay area.

Recreational Use

Upper Basin—In the Upper Basin, Florence Lake provides flatwater boating, hiking, angling, camping, and day-use recreational opportunities. Boat angling is the primary day-use activity, and hiking is popular due to the access to the John Muir Wilderness Area. The peak recreational season in the Upper Basin is primarily from late May/early June to early October. There are no developed facilities or services provided during the winter season; however, snowmobiling activities are popular within the Florence and Edison lakes area. The primary snowmobiling route extends along Kaiser Pass Road from Huntington Lake to Florence and Edison lakes. SCE, on rare occasions, removes snow along Kaiser Pass Road after consultation with the Forest Service.

About 77 percent of the recreational use in the Upper Basin is associated with overnight visitation; the remaining 23 percent is day-use visitation. In 2006, annual overnight visitation to the Upper Basin was 18,062 recreation days with an estimated 5,392 day-use visitation for a total estimated visitation of 23,534 recreation days. During 2006, the average weekend and weekday campsite occupancy was 26 and 17 percent, respectively, for Jackass Meadow Campground and 37 and 24 percent, respectively, at Mono Creek Campground. Future recreational use within the Upper Basin area is projected to increase by 8.2 percent between 2006 and 2040.

River corridor recreation in the Upper Basin occurs primarily along South Fork San Joaquin River near Mono Hot Springs and South Fork San Joaquin River below Florence Lake, along Mono Creek above and below the Mono diversion and along Bear Creek. The primary recreational activities include hiking, walking, fishing, swimming/wading, viewing wildlife/scenery, and relaxing. Cal Fish & Game conducts fish stocking (trout) in the Upper Basin in South Fork San Joaquin River, Mono Creek, and Florence Lake to support angling opportunities. Details on fish stocking efforts are described in section 3.3.1, *Aquatic Resources*.

Whitewater boating opportunities occur along the 6.5-mile-long reach of South Fork San Joaquin River from Florence Lake dam to Mono Crossing. Current whitewater boating use is low and there are no commercial whitewater boating operators on this reach. This reach, the "Florence Run" whitewater boating run, is classified as Class IV+ to V difficulty which is advanced to expert skill levels.[44]

In 2003, SCE conducted a single flow study of the "Florence Run" at a flow of 750 cfs. The study team of whitewater boaters estimated the minimum acceptable flow for the run to be between 350 and 700 cfs for kayaks and between 400 and 700 cfs for rafts; optimal flow was estimated between 650 to 1,000 cfs for kayaks and between 650 to 750 cfs for rafts; and the maximum acceptable flow was estimated to be between 800 and 2,000 cfs for kayaks and between 750 to 1,200 cfs for rafts. This resulted in the estimated boatable flow range for this reach to be between 350 to 2,000 cfs for kayaks and between 400 and 1,200 cfs for rafts.

SCE conducted an evaluation of historical boating opportunities from 1983 to 2002 under the existing hydrology. This assessment indicated that boating opportunity days within the boatable flow range on the "Florence Run" occurred in wet water year types between May through August, ranging from 0.5 to 14.5 boating opportunity days (average) per month, with no boating opportunity days occurring during September through April on average. During above normal water years, typically no boating opportunity days occurred.

Lower Basin—The primary recreational season for the Lower Basin is from mid to late May, with the opening of the developed public recreational facilities, to October. Primary recreational season activities at Shaver Lake include flatwater recreational activities (such as power boating, house boating, fishing, swimming, water skiing, jet-skiing) camping, sunbathing, picnicking, hiking mountain biking, motor biking, off-highway vehicle use, and horseback riding. Shaver Lake also serves as a vacation community for downhill and cross country skiers who use the Sierra Summit Ski Resort and other winter recreational facilities in the region. In addition, Shaver Lake serves as a vacation community with rental cabins. The Balsam forebay area provides day-use recreational and angling opportunities. Cal Fish & Game stocks Shaver Lake (trout and kokanee) to support angling opportunities (see section 3.3.1, *Aquatic Resources*).

Shoulder season (spring and fall) recreational activities are similar to peak season activities but use levels are lower and depend on the opening and closing of the recreational facilities, road access, and weather conditions. Winter recreational activities include snow play, cross country skiing, and snow shoeing. Highway 168 is plowed for

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[44] Classification of rapids is based on the International Whitewater Classification System (AWA, 1998): Class IV, Advanced: Intense, powerful, but predictable rapids requiring precise boat handling in turbulent water; Class V, Expert: Extremely long, obstructed, or very violent rapids that expose a paddler to above average endangerment; Class VI, Extreme and exploratory: These runs have almost never been attempted and often exemplify the extremes of difficulty, unpredictability, and danger.

snow removal and is accessible year round. SCE operates Camp Edison year-round and maintains about 9 miles of cross-country ski trails.

In the Lower Basin, about 76 percent of the recreational use is associated with overnight visitation and the remaining 24 percent with day-use. For 2006, visitation to the Shaver Lake vicinity was estimated at a total of 51,701 recreation days. During 2006, the average weekend campground occupancy for Camp Edison was 83 percent, with weekday average occupancy of 73 percent. For Dorabelle Campground the average weekend campsite occupancy was 63 percent and the average weekday campsite occupancy was 43 percent. Camp Edison has the highest weekend and weekday campsite occupancies of any campground facility within the Big Creek ALP Projects. Future recreational use within the Shaver Lake vicinity is estimated to increase by 3.6 percent between 2006 and 2040.

River corridor recreational use occurs along the North Fork Stevenson Creek upstream of Shaver Lake for dispersed recreation day-use activities, such as hiking, fishing, swimming/wading, and wildlife/scenery viewing. Stevenson Creek below Shaver Lake is relatively inaccessible due to the steep channel and waterfalls.

Big Creek Nos. 1 and 2 Project

Recreational opportunities at the Big Creek Nos. 1 and 2 Project include developed recreational facilities around Huntington Lake and more informal recreational opportunities along Big Creek below Huntington Lake and Big Creek between Dam 4 and Dam 5.

Recreational Facilities

Figure 3-9 shows the location and table 3-22 summarizes the facilities of the developed public recreational areas at the Big Creek Nos. 1 and 2 Project. Developed public recreational facilities at Huntington Lake include two boat ramps, five day-use areas, seven campgrounds, and one overlook/parking area. In addition, there is an undeveloped area at the west end of the lake near Dam 3, which is used to access the lake for angling and other dispersed day-use recreational activities.

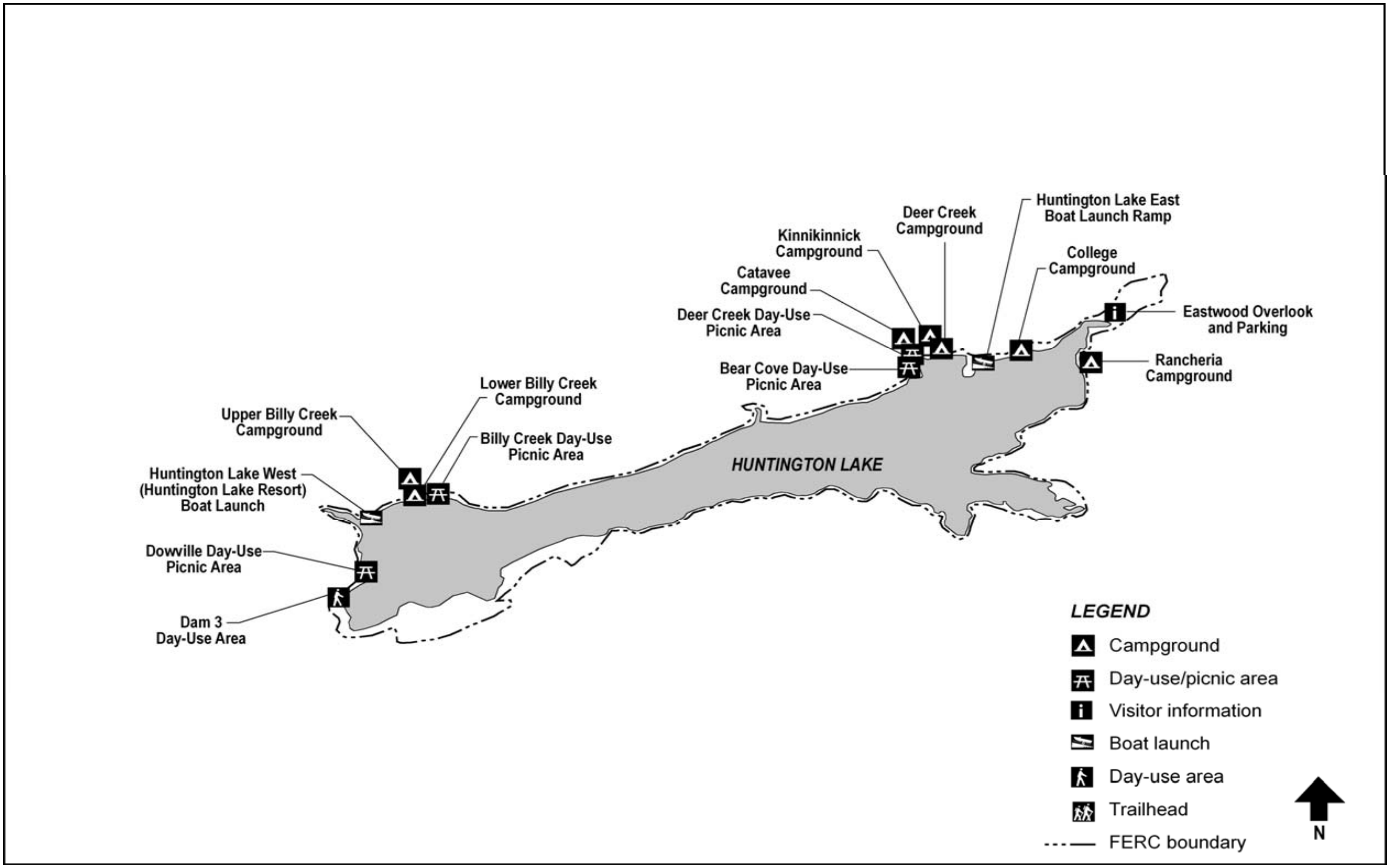

Figure 3-9. Location of the developed public recreational areas at the Big Creek Nos. 1 and 2 Project. (Source: SCE, 2007a, as modified by staff)

Table 3-22. Big Creek Nos. 1 and 2 Project developed public recreational facilities (Huntington Lake). (Source: SCE, 2002b; 2007a)

Site	Boat Ramps	Picnic Tables	Camp-sites	Trails	Rest-rooms	Bear Boxes	Trash Facilities	Signage	Parking
Boat Launch/Parking Huntington Lake East	1	-	-	-	2	-	X	X	X
Boat Ramp Huntington Lake West (Huntington Lake Resort)	1	-	-	-	-	-	-	-	X
Bear Cove day-use picnic area	-	30	-	-	1	-	X	X	X
Upper Billy Creek Campground	-	44	44	-	7	-	X	X	-
Lower Billy Creek Campground	-	13	13	-	1	-	X	X	-
Catavee Campground	-	24	24	-	1	-	X	X	X
College Campground	-	11	11	-	2	-	X	X	-
Deer Creek Campground	-	28	28	-	1	-	X	X	-
Kinnikinnick Campground	-	27	27	-	1	-	X	X	X
Rancheria Campground	-	161	161	-	18	-	X	X	X
Billy Creek day-use picnic area	-	7	-		-	-	-	X	X
Deer Creek day-use picnic area	-	5	-		1	-	X	X	X
Dowville day-use picnic area	-	5	-	-	1	-	X	X	X

The Huntington Lake West Boat Launch is located along the northern shoreline of the western end of the lake at the Huntington Lake Resort. The boat ramp extends to elevation 6,945 feet; however, the slope and surface of the reservoir bed beyond the paved ramp allow boaters to access the water to elevation 6,928 feet. Between 1983 and 2000, boaters accessed the lake from the boat launch during the entire recreational season in above normal and dry water years. During wet and critically dry water years, the lake was accessible from the ramp 90 and 99 percent of the recreational season, respectively.

The Huntington Lake East Boat Launch, located along the northern shoreline at the eastern end of the lake, extends to elevation 6,936 feet. The reservoir bed is too uneven and flat to extend the use of the boat ramp beyond the designed use. Between 1983 and 2000, boaters accessed the lake from the ramp during the entire recreational season of above normal and critically dry water years, and 93 percent of this time period during wet water years.

Under the existing license SCE is required to make every reasonable effort to maintain the water surface of Huntington Lake as high as possible and with as little fluctuation as possible from May 1 to September 10. Historically, other than the refill of the reservoir in May and June, water levels have remained stable from July through early September (see figure 3-4, in section 3.3.1, *Aquatic Resources*). When the lake elevations drop 3 to 5 feet below full pool elevation (6,950 feet), water depths are too shallow for launching deep-keeled sailboats at the boat launches. Other watercrafts, such as personal watercrafts, small sailboats, or angling boats are not as constrained by the lower water elevations. In a summer 2002 visitor survey to evaluate the current uses and future demands at project-area recreational facilities, 92 percent of the respondents rated their satisfaction with boat ramp availability at Huntington Lake to be acceptable (26 percent moderately acceptable and 66 percent highly acceptable).

The day-use areas include: Bear Cove, Billy Creek, Deer Creek, Dam 3 and Dowville day-use areas. The facilities provide 47 picnic sites and fire rings, restrooms, and trash dumpsters. The campgrounds include: Upper Billy Creek, Lower Billy Creek, Catavee, College, Deer Creek, Kinnikinnick, and Rancheria campgrounds. In total, the campgrounds provide 308 campsites and include picnic tables, fire rings, bear boxes (food storage), restrooms, and trash disposal facilities. Rancheria Campground also has an amphitheatre.

There is one established trail, the Huntington Shore Trail, which is about 2 miles long and extends from the Billy Creek Picnic Area to the Bear Cove Picnic Area along the northern shoreline of Huntington Lake. In addition, there are numerous informal trails that extend from the boat ramps, picnic areas, and campgrounds.

There are two private marinas at Huntington Lake: Rancheria Marina at the eastern end of the lake and Huntington Lake Resort Marina at the western end of the lake. Both marinas provide boat rental and docks with mooring slips. There are five private Boy Scout Camps around Lake Huntington, including on the south shore: Camp Kern;

Camp Olijato; Camp Mirimichi and Camp Gold Arrow; and on the north shore is Camp Silver Fir.

A private developed downhill ski area (Sierra Summit) is located along Highway 168 at the eastern side of the lake. During the winter months, the East Boat Launch and the Eastwood Visitor Center parking areas located near the eastern end of Huntington Lake are plowed to establish two snow-parks that provide parking and staging areas for winter recreational activities.

Developed public recreational facilities located within the existing project boundary include the Dowville day-use picnic area. Developed public recreational facilities located partially within the project boundary include: Huntington Lake Boat Launch (at Huntington Lake Resort) (ramp is within, parking area is outside), Lower Billy Creek Campground, Billy Creek day-use picnic area, Bear Cove day-use picnic area, Deer Creek day-use picnic area, Deer Creek Campground, Huntington Lake East boat ramp (ramp is within, parking area is outside), College Campground, and Rancheria Campground. Developed public recreational facilities located outside of the existing project boundary include: Upper Billy Creek Campground, Catavee Campground, Kinnikinnick Campground, and Eastwood Overlook and Parking Area.

Dispersed recreation occurs along Big Creek below Huntington Lake and Big Creek between Dam 4 and Dam 5. There are no developed recreational facilities in these river corridor areas.

Recreational Use

Recreational use in the vicinity of Huntington Lake includes motor boating, pontoon boating, sailing, canoeing/kayaking, personal watercraft use, windsurfing, swimming and angling, camping, picnicking, hiking, horseback riding and winter recreational activities, including snowmobiling and cross-country and downhill skiing. The Huntington Lake area provides year-round recreational opportunities. The peak recreational season begins in mid to late May, with the opening of developed recreational facilities, and continues through September to October when the facilities typically close. Shoulder season recreational activities are similar to peak season activities but at a lower use level and with angling being the primary recreational use activity. The level of use for winter activities is typically dependent on vehicular access to the project area. In the winter, Highway 168 is the only plowed road that provides access to the project area.

Cal Fish & Game conducts fish stocking at Huntington Lake (trout and kokanee) to support angling opportunities (see section 3.3.1, *Aquatic Resources*).

About 85 percent of the recreational use in the Huntington Lake vicinity is associated with overnight visitation with the remaining 15 percent being day-use visitation. In 2006, the estimated annual overnight visitation was 35,882 recreation days and day-use visitation was 6,332 for a total estimated visitation of 42,214 recreation days. For the campgrounds within the Big Creek Nos. 1 and 2 Project, the average weekend campsite occupancy in 2006 ranged from a low of 28 percent at Rancheria Campground to a high of 77 percent at Deer Creek Campground. The average weekday campsite occupancy during 2006 at these campgrounds ranged from a low of 18 percent at Rancheria Campground to a high of 66 percent at Deer Creek Campground. Future recreational use within the Big Creek Nos. 1 and 2 Project is projected to increase by 5.8 percent between 2006 and 2040.

Big Creek below Huntington Lake is readily accessible and is a popular area for dispersed recreation. Big Creek below Dam 4 and Dam 5 lies in a steep and narrow canyon and is primarily accessible by a foot trail on the southern side of the canyon. Dispersed recreational activities in these areas include hiking, walking, fishing, swimming/wading, viewing wildlife/scenery, and general relaxing.

Mammoth Pool Project

Opportunities at the Mammoth Pool Project include developed recreational facilities around Mammoth Pool reservoir and more informal recreational opportunities along the San Joaquin River between Mammoth Pool dam and Dam 6 forebay.

Recreational Facilities

Figure 3-10 denotes the location and table 3-23 summarizes facilities associated with the developed public recreational areas located at the Mammoth Pool Project. Mammoth Pool reservoir is located in a remote setting and is accessed through Mammoth Pool Road, off Minarets Road. The reservoir is closed to public vehicular access from May 1 to June 15 to avoid interference with the annual deer migration. Developed public recreational facilities at the Mammoth Pool Project include two boat launches, one picnic area, one trailhead/trail, and two campgrounds.

Mammoth Boat Launch is located along the southwestern corner of the reservoir and extends to elevation 3,262 feet. The boat ramp does not function well beyond the end of the paved section due to large rock hazards at the end of the paved ramp and a steep reservoir bed. However, when this boat ramp is not available, visitors can access the reservoir at the Windy Point boat ramp, which has no lower limit in terms of access. Between 1983 and 2000, the boaters accessed the water from Mammoth Boat Launch during 99 percent of the summer season during wet water years, 90 percent during above normal water years, 93 percent during dry water years, and 66 percent during critically dry water years.

Windy Point Boat Launch is an undeveloped ramp that was originally designed as an access road during reservoir construction and is now used as a boat launch when reservoir levels are low. While there is no lower limit to the use of this ramp, the launch is not suitable for most ski boats and larger fishing boats. Between 1983 and 2002, the water was accessible from Windy Point Boat Ramp during the entire summer recreational season. Windy Point Picnic Area has dispersed picnic sites with no picnic tables or restroom facilities.

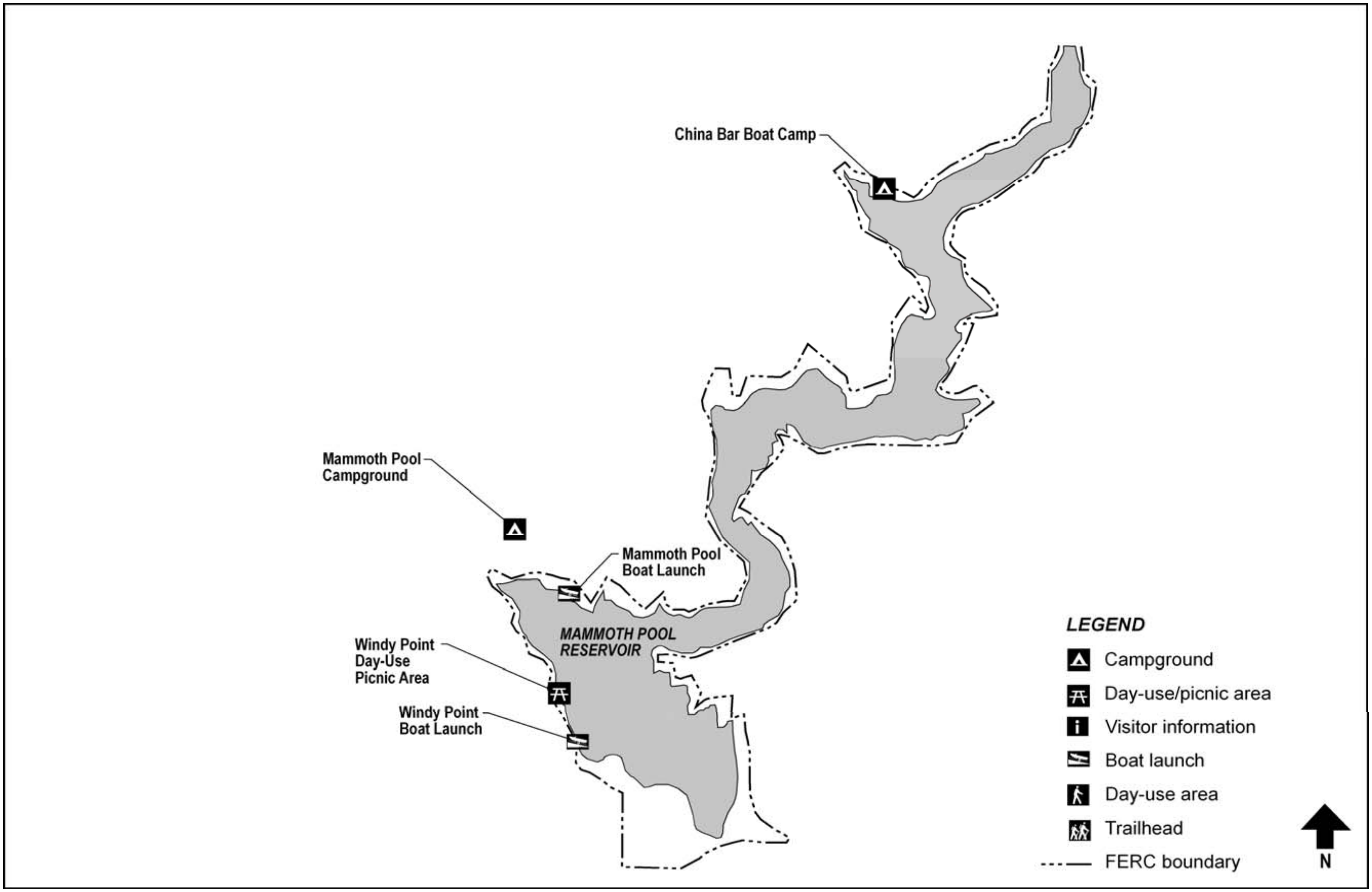

Figure 3-10. Location of the developed public recreational areas at the Mammoth Pool Project. (Source: SCE, 2007a, as modified by staff)

Table 3-23. Mammoth Pool Project developed public recreational facilities. (Source: SCE, 2002b and 2007a)

Site	Boat Ramps	Picnic Tables	Campsites	Trails	Restrooms	Bear Boxes	Trash Facilities	Signage	Parking
Windy Point Picnic Area	-	-	-	-	1	-	-	-	-
Mammoth Boat Launch	1	-	-	-	1	-	X	X	X
Windy Point Boat Launch	1	-	-	-	-	-	-	-	-
China Bar Boat Camp	-	-	6	-	2	-	X	X	-
Mammoth Pool Campground	-	-	47	-	8	-	X	X	-

For Mammoth Pool reservoir, historical average elevations range from about elevation 3,257 feet to 3,321 feet during the recreational season (see figure 3-5). The existing license requires SCE make every effort to maintain the water surface elevation at the maximum level, with a minimum amount of fluctuation from June 1 to September 1. According to historical records, the average decrease in water levels during the last half of the summer is between 1 and 1.5 feet per day. In a summer 2002 visitor survey to evaluate the current uses and future demands at project area recreational facilities, 92 percent of the respondents rated their satisfaction with boat ramp availability at Mammoth Pool reservoir to be acceptable (34 percent moderately acceptable and 58 percent highly acceptable).

Mammoth Pool Campground is located outside of the project boundary near Mammoth Pool Boat Launch and includes 47 campsites with tables, fire-rings, and restroom facilities. Logan Meadow Trailhead is located near the Mammoth Pool Campground and provides access to French Trail which runs to the northwest of the reservoir. China Bar Boat Camp is located about 2 miles upstream from the project dam along the northern shoreline and is a boat-in only campground. China Bar Boat Campground has six campsites, picnic tables, and restroom facilities.

Mammoth Boat Launch, Windy Point day-use picnic area, Windy Point Boat Launch, and China Bar Boat Camp are located within the existing project boundary. The parking area for Mammoth Boat Launch and Mammoth Pool Campground are located outside of the project boundary. The San Joaquin River Trail is a 75-mile long trail that runs through the vicinity of the Mammoth Pool Project and shares alignment with the Mammoth Pool Powerhouse-Big Creek No. 3 Transmission Line Road (FS Roads Nos. 9S42 and 8S44Y) within the Project.

Recreational Use

The primary recreational season is from June 16 to Labor Day when the vehicular access road is open. The recreational activities in the primary recreational season include: boating (waterskiing, jet-skiing, etc.), boat angling, camping, picnicking, and swimming. Following Labor Day weekend, recreational use decreases substantially and consists primarily of angling with some limited boating use. The Mammoth Pool Project area is not typically used for winter recreational activities because the primary access road, Minarets Road, is not plowed during the winter.

About 87 percent of the recreational use in the vicinity of Mammoth Pool Project is associated with overnight visitation with the remaining 13 percent being day-use visitation. In 2004, estimated annual overnight visitation was 3,009 recreation days and day-use visitation was 446 recreation days for a total estimated visitation of 3,455 recreation days. At Mammoth Pool Campground, the average weekend campsite occupancy in 2004 was 27 percent and the average weekday campsite occupancy was 17 percent. Future recreational use within Mammoth Pool Project area is projected to increase by 20 percent between 2004 and 2040.

Cal Fish & Game conducts fish stocking at the Mammoth Pool Reservoir (trout and kokanee) to support angling opportunities (see 3.3.1, *Aquatic Resources*).

Angling and whitewater boating use occurs along the 8.5-mile reach of the San Joaquin River between Mammoth Pool dam and Dam 6 forebay. Angling use is limited because of the steep topography of the river canyon in this reach. Whitewater boating along this reach, known as the "Tied-For-First" whitewater boating run, is classified as Class IV+ to V difficulty (advanced to expert skill level). Current whitewater boating use is low and there are no commercial whitewater boating operators on this reach.

In 2003, SCE conducted a single flow study of the "Tied-For-First" run at a flow of 862 cfs. The study team of whitewater boaters estimated the minimum acceptable flow for the run to be between 700 and 800 cfs; the optimal flow to be between 1,000 to 1,200 cfs; and the maximum acceptable flow to be between 1,400 and 2,000 cfs. The study team determined that the boatable flow range for this reach is between 700 and 2,000 cfs.

SCE conducted an evaluation of historical boating opportunities from 1983 to 2002 under the existing hydrology, which indicated that on the Tied-for-First run boating opportunity days within the boatable flow range occurred in wet and above normal water year types. During wet water years, boating opportunity days occurred between May through August, ranging from 1.9 to 3.9 boating opportunity days (average) per month, during January through April from 1.9 to 5.6 (average) per month. During September through December typical flows did not support boating. In above normal water years, boating opportunity days occurred in May and June, ranging from 4.7 to 8.7 boating opportunity days (average) per month, with typically no boating opportunity days during the remaining months.

Big Creek No. 3 Project

There are no developed overnight or day-use recreational facilities associated with the Big Creek No. 3 Project other than the angler access stairways and parking area near the Mammoth Pool Powerhouse. Recreational opportunities include angling and hiking along the Dam 6 forebay area and whitewater boating in the bypassed reach. This stretch of river has a steep incised river channel which severely limits stream access throughout the bypassed reach.

Angling use occurs along the Dam 6 forebay. An angler access stairway located near the Mammoth Pool Powerhouse provides access to the north shore at the upstream end of the forebay. A parking area is located near the stairs for use by anglers and hikers. Anglers and hikers can access the south side of the forebay on foot by crossing the bridge over the San Joaquin River, which ties into Canyon Road.

Whitewater boating opportunities occur along a stretch of about 8.3 miles of the San Joaquin River from the bottom of Dam 6 to the Italian Bar Bridge crossing at the head of Redinger reservoir. This reach is identified as the "Chawanakee Gorge Run" and is considered class V to V+ level of difficulty (expert only). In 2003, SCE conducted a single flow study of his reach at a flow of 662 cfs. The study team estimated the minimum acceptable flow for the run to be between 350 and 550 cfs; the optimal flow to be 600 cfs; and the maximum acceptable flow to be between 700 and 1,000 cfs for whitewater boating opportunities. The study team estimated that the boatable flow range is between 350 and 1,000 cfs.

SCE conducted an evaluation of historical boating opportunities from 1983 to 2002 under the existing hydrology, which indicated that for the "Chawanakee Gorge Run" boating opportunity days within the boatable flow range normally occurred in wet and above normal water years, and occasionally in a dry water year. During wet water years, boating opportunity days occurred between May through August, ranging from 1.3 to 4.0 boating opportunity days (average) per month, during January through April from 0.5 to 14.3 boating opportunity days (average) per month, and from 0 to 0.8 boating opportunity days (average) per month during the remaining months. In above normal years, boating opportunity days occurred in May and June, ranging from 3.3 to 7.0 boating opportunity days (average) per month, with typically no days in the other months.

3.3.2.2 Environmental Effects

Recreation Management Plan

As part of the Settlement Agreement, SCE proposes to implement the Recreation Management Plan for the Big Creek ALP Projects, included as appendix O in the Settlement Agreement. The Recreation Management Plan was developed in consultation with stakeholders and agencies as part of the ALP.

Forest Service final 4(e) condition 18 (Project No. 67) and condition 17 (Projects No. 120, 2175 and 2085) specify that SCE implement the Recreation Management Plan included as appendix O in the Settlement Agreement. Interior, as 10(a) recommendation 4 (Projects Nos. 67, 120, 2175 and 2085), recommends the same. Interior supports the Recreation Management Plan and states that the plan has been designed to minimize potential adverse effects of project-related recreation and its management on fish and wildlife resources.

The Recreation Management Plan provides measures for: annual coordination meetings; periodic review and reporting; recreational facility annual operational maintenance responsibilities, major rehabilitation, and capital improvements; interpretive displays; reservoir water surface elevations; reservoir water surface elevation information; stream flow information dissemination; whitewater boating flow releases; fish stocking; San Joaquin River Trail maintenance; and winter snow plowing. The following sections describe the proposed components of the Recreation Management Plan and our assessment of the potential effects of the plan on the Big Creek ALP Projects' recreational resources.

Annual Coordination Meeting

SCE proposes to meet with the Forest Service each year during the term of the new license to discuss measures needed to ensure protection and use of the recreational facilities at the Big Creek ALP Projects (sites listed in table 3-24). These annual meetings would allow SCE and the Forest Service to review the long-term planning and implementation schedule for the rehabilitation measures at existing recreational facilities and new capital improvements proposed by SCE, identify any revisions, and make adjustments to the plan or schedule if needed. SCE would coordinate with the Forest Service regarding proposed work at recreational facilities during the upcoming year, including permitting requirements and key resources that would need to be protected from potential adverse effects associated with the implementation of scheduled recreational projects. Any substantive revisions to the Recreation Management Plan would be distributed to signatories of the Settlement Agreement for review and comment prior to submittal to the Commission for review and approval. Within 60 days following the consultation meeting, SCE would file with the Commission a summary of the meeting and any agreements or revisions to the Recreation Management Plan that were reached by SCE and the Forest Service.

Our Analysis

Given the location of the Big Creek ALP Projects within the Sierra National Forest, many of the recreational facilities are Forest Service facilities and are affiliated with Forest Service lands. The Recreation Management Plan includes measures associated with recreational facilities which are located within the Sierra National Forest and within, outside, or partially within and outside of the existing project boundaries of the Big Creek ALP Projects. The proposed annual coordination meeting and associated coordination measures between the Forest Service and SCE would provide the means to manage the recreational resources in a coordinated and comprehensive manner over the term of new license. These annual meetings would also provide the means for interim review and assessment of the status of the implementation of measures incorporated in the Recreation Management Plan; thereby providing the means to ensure that these proposed measures are appropriately implemented. We expect that by reviewing specific proposed projects for the upcoming year, including permitting requirements and resources to be protected, best management practices would be effectively incorporated into specific plans, as appropriate. In addition, the proposed provisions for substantive revisions to the Recreation Management Plan would ensure that stakeholders would have the opportunity to provide input and provide the means for Commission review and approval of any substantive revisions to the Plan. The Recreation Management Plan and annual coordination meeting would, therefore, ensure that project-related recreational opportunities are maintained over the term of any new license that may be issued for the Big Creek ALP Projects.

Table 3-24. Summary of recreation management and rehabilitation for the Big Creek ALP Projects. (Source: SCE, 2007a and 2007e; Forest Service, 2008a, b, and c; as modified by staff)

Vicinity	Existing Recreation Facility	Within or Outside the Existing Project Boundary	Ownership and Annual Operation and Maintenance Responsibility	Year Rehabilitation Activity Would Begin Post-Settlement Agreement
Big Creek Nos. 2A, 8, and Eastwood Project				
Florence Lake Area	Boat Ramp – Florence Lake	Ramp – Within Parking – Partially	Forest Service	10
	Jackass Meadow Campground	Within	Forest Service	8
	Florence Lake day-use picnic area	Within	Forest Service	10
Mono Creek Forebay	Mono Creek Campground	Partially	Forest Service	17
	Mono Creek day-use picnic area	Partially	Forest Service	17
Shaver Lake Area	Camp Edison Campground	Within	SCE	[a]
	Camp Edison boat ramp/Launch	Within	SCE	[a]
	Dorabelle Campground	Outside	Forest Service	3
	Dorabelle day-use picnic area	Partially	Forest Service	3
	Day-use picnic areas on North Shore Roads 1 and 2	No. 1 - Partially No. 2 - Within	SCE	[a]

Vicinity	Existing Recreation Facility	Within or Outside the Existing Project Boundary	Ownership and Annual Operation and Maintenance Responsibility	Year Rehabilitation Activity Would Begin Post-Settlement Agreement
	Day-use picnic area off of Hwy 168 (The Point)	Within	SCE	[a]
	Eagle Point boat-in day-use picnic area	Within	SCE	[a]
Balsam Meadows Forebay	Balsam Meadows forebay day-use picnic area	Within	SCE	[a]
	Balsam Meadows Trailhead and Parking	Within	SCE	[a]
Big Creek Nos. 1 and 2 Project				
	Boat Ramp/Parking Huntington Lake East	Ramp - Within Parking - Partially	Forest Service	21
	Boat Ramp Huntington Lake West	Partially	Forest Service	5
	Bear Cove day-use picnic area	Partially	Forest Service	4
	Upper Billy Creek Campground	Outside	Forest Service	4
	Lower Billy Creek Campground	Partially	Forest Service	4
	Catavee Campground	Outside	Forest Service	22
	College Campground	Partially	Forest Service	2

Vicinity	Existing Recreation Facility	Within or Outside the Existing Project Boundary	Ownership and Annual Operation and Maintenance Responsibility	Year Rehabilitation Activity Would Begin Post-Settlement Agreement
	Deer Creek Campground	Partially	Forest Service	23
	Kinnikinnick Campground	Outside	Forest Service	23
	Rancheria Campground	Partially	Forest Service	1
	Billy Creek day-use picnic area	Partially	Forest Service	4
	Deer Creek day-use picnic area	Partially	Forest Service	23
	Dowville day-use picnic area	Within	Forest Service	3
	Eastwood Overlook and parking	Within	SCE	6
Mammoth Pool Project				
	Mammoth Pool Boat Launch	Partially	Forest Service	12
	China Bar Boat Camp	Within	Forest Service	16
	Mammoth Pool Campground	Outside	Forest Service	11
	Windy Point day-use picnic area	Within	Forest Service	14

Vicinity	Existing Recreation Facility	Within or Outside the Existing Project Boundary	Ownership and Annual Operation and Maintenance Responsibility	Year Rehabilitation Activity Would Begin Post-Settlement Agreement
	Windy Point Boat Launch	Within	Forest Service	14
Big Creek No. 3 Project				
	Angler Access Stairway at Mammoth Pool Powerhouse	Within	Forest Service	11
	Parking Area near Mammoth Pool Powerhouse Gate	Within	Forest Service	11

[a] These facilities are maintained by SCE and the rehabilitation of these facilities is conducted on an ongoing basis during the term of the license as part of the routine maintenance and repair activities.

Periodic Review and Reporting

SCE proposes to at least once every 6 years complete a recreational use and facilities condition survey of the recreational facilities at the Big Creek ALP Projects (sites listed in table 3-24). The survey would be designed to determine trends of use, the number of days parking capacity is met or exceeded, and whether resource damage is occurring. SCE would use Forest Service data when available. When the data indicate a need for increased campground facilities, SCE and the Forest Service would address the need through this periodic plan review process.

SCE proposes to prepare a Recreation Report every 6 years after license issuance, and file this report along with the Form 80 Licensed Hydropower Development Recreation Report that is required by the Commission. The Recreation Report would include the following information: the recreational use and facilities condition survey information, graphs and exceedance tables summarizing water surface elevations between May 1 and September 10 at Huntington Lake, dates when Kaiser Pass Road was opened to provide public vehicular traffic access into the backcountry for non-winter recreational use, annual number of whitewater boating opportunity days provided by SCE through pre-spill release flows below Mammoth Pool reservoir (Tied-for- First Reach) and channel and riparian maintenance flow releases below Florence Lake (Florence Run), and the number of days that Kaiser Pass Road was open concurrent with the channel and riparian maintenance flow releases. Boating opportunity days were defined as: for Florence Run – days when flow in this reach is between 350 to 2,000 cfs for kayaks and between 400 and 1,200 cfs for rafts; for the Tied-For-First Run – days when the flow is between 700 and 2,000 cfs.

Our Analysis

The condition of recreational facilities and recreational demand at the Big Creek ALP Projects may change over the term of a new license. Measures to monitor the recreational use and condition of the facilities at the projects would provide the means to periodically assess whether recreational opportunities are being adequately provided. The proposed recreational use and facilities condition report survey would provide information related to recreational use trends and conditions of the recreational facilities within the Big Creek ALP Projects. The inclusion of visitor use trends and capacity information, including both parking and campsite capacity at the project facilities, would help assess changes in recreational use and capacity at these facilities. The proposed Recreation Report would provide the means to summarize and assess the survey information and monitor other recreational management provisions, such as the whitewater boating releases and water surface elevation management (during May 1 and September 10 at Huntington Lake), and provision of public vehicular access (at Kaiser Pass Road) to the Big Creek ALP Projects. Conducting the surveys and Recreation Report every 6 years in coordination with the filing of the FERC Form 80 Report would help provide a systematic means of monitoring the recreational use, trends, and facility conditions over the term of new license at the Big Creek ALP Projects.

Recreational Facility Annual Operational Maintenance

SCE proposes to continue to operate and maintain its existing facilities at the Big Creek Nos. 2A, 8, and Eastwood Project, including: Camp Edison Campground, Camp Edison Boat Launch, day-use areas on North Shore Roads 1 and 2, day-use area off Highway 168 (The Point), Eagle Point boat-in day-use area, Balsam Meadows forebay day-use area, the Balsam Meadows trailhead and parking area, the Eastwood Overlook; and the angler access stairway at Big Creek No. 3. The Forest Service would be responsible for the maintenance of the remaining recreational facilities that it currently operates in the vicinity of the Big Creek ALP Projects.

Our Analysis

The Recreation Facility Annual Operational Maintenance provisions incorporated into the Recreation Management Plan provide the means to define the entities (SCE or Forest Service) who would be responsible for the annual operation and maintenance measures at the recreational facilities within and adjacent to the Big Creek ALP Projects. These provisions for the continued operation and maintenance of these facilities would help to ensure that these facilities and associated recreational opportunities are provided at the projects. The licensee is ultimately responsible for all recreational project-related facilities in the project boundary, including those operated by the Forest Service.

Recreational Facility Major Rehabilitation

SCE proposes to be responsible for the full cost for major rehabilitation of existing developed recreational facilities at the Big Creek ALP Projects listed in table 3-24. SCE proposes to do this by providing necessary personnel, equipment, materials, and management and to be responsible for replacing/rehabilitating recreational features currently existing at the developed recreational facilities.

The specific rehabilitation measures to be completed at each facility would be determined in consultation with the Forest Service during the planning process. SCE proposes to conduct rehabilitation measures on recreational facilities that are located within, outside, or partially within the existing project boundaries of the Big Creek ALP Projects (see table 3-24). SCE (2007d) provides a summary of the anticipated rehabilitation measures at each site, which we summarize below.

Facilities within the Existing Project Boundary

Big Creek Nos. 2A, 8, and Eastwood Project

- Jackass Meadow Campground: rehabilitate 50 campsites, install two single standing toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.
- Florence Lake day-use picnic area: rehabilitate 16 picnic sites; install one single standing toilet; regrade and resurface parking area; reconstruct trash disposal facilities; and replace informational and directional signage.
- Camp Edison Campground: rehabilitate 250 campsites; install 13 single standing vault toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.
- Camp Edison Boat Launch: resurface boat ramp; replace docks; regrade and resurface parking area; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.
- Day-use area No. 2 on North Shore: rehabilitate 40 picnic sites; install 3 single standing toilets; regrade and resurface parking area; reconstruct trash disposal facilities; and replace informational and directional signage.
- Day-use area off Hwy 168 (The Point): regrade the parking area; install one single standing toilet; reconstruct trash disposal facilities; and replace informational and directional signage.

- Eagle Point boat-in day-use area: rehabilitate 7 picnic sites; reconstruct 2 trash disposal facilities; and replace informational and directional signage.
- Balsam Meadows forebay day-use picnic area and trailhead: install one single standing toilet; regrade and resurface parking area; and replace informational and directional signage.

Big Creek Nos. 1 and 2 Project

- Dowville day-use picnic area: rehabilitate 5 picnic sites; install one single standing vault toilet; regrade and resurface parking area; reconstruct trash disposal facilities; and replace informational and directional signage.
- Eastwood Overlook and Parking[45]: replace the interpretive displays at Eastwood Powerhouse Overlook; regrade and resurface the parking and access pathways; and replace informational and directional signage.

Mammoth Pool Project

- China Bar Boat Camp: rehabilitate 6 campsites; install 2 single standing vault toilets; and replace informational and directional signage.
- Windy Point day-use picnic area: install one single vault toilet.
- Windy Point Boat Launch: resurface the boat launch ramp.

Big Creek No. 3 Project

- Angler Access Stairway at Mammoth Pool Powerhouse: replace the stairway providing water-edge access.
- Parking Area near Mammoth Pool Powerhouse Gate: regrade and resurface parking area.

Facilities Partially within the Existing Project Boundary

Big Creek Nos. 2A, 8, and Eastwood Project

- Florence Lake Boat Launch: resurface boat ramp; replace docks; install one single standing toilet; regrade and resurface parking area; replace vehicle control structures (i.e., gates); reconstruct trash disposal facilities; replace informational and directional signage; and construct an accessible boat loading platform.

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[45] This facility would be removed from the Big Creek Nos. 2A, 8, and Eastwood Project and included within the Big Creek Nos. 1 and 2 Projects.

- Mono Creek Campground: rehabilitate 14 campsites; install 2 single standing vault toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.
- Mono Creek day-use picnic area: rehabilitate 6 picnic sites; install one single standing toilet; regrade and resurface parking area; reconstruct trash disposal facilities; and replace informational and directional signage.
- Day-use area No. 1 on North Shore Road: rehabilitate 40 picnic sites; install 3 single standing toilets; regrade and resurface parking area; reconstruct trash disposal facilities; and replace informational and directional signage.
- Dorabelle day-use picnic area: rehabilitate 22 picnic sites; install 2 single standing toilets; regrade and resurface parking area; reconstruct trash disposal facilities; and replace informational and directional signage.

Big Creek Nos. 1 and 2 Project

- Huntington Lake East Boat Ramp: resurface the boat launch ramp; replace docks; install 3 single standing vault toilets; regrade and resurface parking area; replace informational and directional signage; replace vehicle control and barrier structures; reconstruct trash disposal facilities; refurbish the internal trail system and upgrade to current accessibility standards; and construct an accessible boat-loading platform.
- Huntington Lake West Boat Ramp: resurface the boat launch ramp; replace docks; regrade and resurface parking area; replace informational and directional signage; replace vehicle control and barrier structures; reconstruct trash disposal facilities; refurbish the internal trail system and upgrade to current accessibility standards; and construct an accessible boat-loading platform.
- Bear Cove day-use picnic area: rehabilitate 30 picnic sites; install one single standing vault toilet; regrade and resurface parking area; replace vehicle control structures; reconstruct trash disposal facilities; replace informational and directional signage; and rehabilitate internal trail system.
- Lower Billy Creek Campground: rehabilitate 13 campsites; install one single standing vault toilet; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.
- College Campground: rehabilitate 11 campsites; install 2 single standing vault toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal

facilities; replace informational and directional signage; and rehabilitate internal trail system.

- Deer Creek Campground: rehabilitate 28 campsites; install one single standing vault toilet; resurface the interior road system, all campsite parking spurs, and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; replace informational and directional signage; and rehabilitate internal trail system.
- Rancheria Campground: rehabilitate 161 campsites; install 18 single standing vault toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; replace informational and directional signage; and refurbish the amphitheater and rehabilitate the adjacent trail.
- Billy Creek day-use picnic area: rehabilitate 7 picnic sites; regrade and resurface parking area; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.
- Deer Creek day-use picnic area: rehabilitate 5 picnic sites; install one single standing vault toilet; regrade and resurface parking area; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.

Mammoth Pool Project

- Mammoth Pool Boat Launch: resurface boat ramp; replace docks; install one single standing toilet; regrade and resurface parking area; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.

Facilities Located Outside of the Existing Project Boundary

Big Creek Nos. 2A, 8, and Eastwood Project

- Dorabelle Campground: rehabilitate 70 campsites; install 16 single standing vault toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.

Big Creek Nos. 1 and 2 Project

- Upper Billy Creek Campground: rehabilitate 44 campsites; install 7 single standing vault toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.

- Catavee Campground: rehabilitate 24 campsites; install one single standing vault toilet; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; replace informational and directional signage; and rehabilitate internal trail system.
- Kinnikinnick Campground: rehabilitate 27 campsites; install one single standing vault toilet; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.

Mammoth Pool Project

- Mammoth Pool Campground: rehabilitate 47 campsites; install 8 single standing vault toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.

In all rehabilitation measures, an emphasis would be placed on minimizing ground-disturbing activities, or other measures that might affect cultural or biological resources. If facilities need to be removed to prevent ongoing or possible future resource damage, the area would be restored to a natural appearance, including re-vegetation, using species native to the area. The following list describes general rehabilitation guidelines that would be used in implementing the above specific measures:

- Relocate and reconstruct campsites, picnic sites, parking spurs, and restroom structures, if located in environmentally or culturally sensitive areas.
- Rehabilitate and stabilize erosive areas and inoperative water drainage facilities (culverts). At locations where ongoing resource damage occurs, the ground surface would be re-graded and re-vegetated with native materials to stabilize the area and prevent further resource damage. This may include the removal and replacement of drainage culverts that are deemed ineffective.
- Clear overgrown vegetation, if necessary. Thinning of trees and removal of overgrown brush may be conducted to improve accessibility and safety at campgrounds and day-use areas.
- Develop universally accessible facilities. The number of assets at each developed recreational facility that would need to be upgraded would be determined and reviewed with the Forest Service. Universally accessible facilities would be located where the topography is relatively flat and near other developed facilities, such as restrooms.

The proposed schedule for the rehabilitation of recreational facilities (provided in the Recreation Plan) spans a 25-year time period. Table 3-24 provides a summary of the year the proposed rehabilitation would begin at each facility. SCE proposes that it could revise the rehabilitation schedule after consultation with the Forest Service and submittal to and approval by the Commission. The rehabilitation schedule identifies for each of the recreational facilities a 5-year time frame in which SCE would complete the planning, design, contracting, and rehabilitation construction activities. This 5-year planning and implementation timeframe would include (1) preparation of a Design Narrative and Conceptual Plan; (2) completion of any necessary additional NEPA environmental review; (3) preparation of a Site Development Plan and Construction Plan; (4) contracting, reconstruction; and (5) acceptance of completion. Any required additional NEPA environmental review would be initiated by the Forest Service following its approval of the Design Narrative and Conceptual Plan.

In addition to these proposed rehabilitation measures, SCE proposes to remove the Florence Lake day-use area from the existing project boundary. SCE also proposes to remove the Eastwood Overflow Camping Area and the Eastwood Overlook from the existing project boundary of the Big Creek Nos. 2A, 8, and Eastwood Project and to include these two facilities within the Big Creek Nos. 1 and 2 Project. We discuss SCE's proposal for project boundary modifications in more detail in section 3.3.6, *Land Use and Aesthetic Resources*.

Our Analysis

SCE's proposed major facility rehabilitation measures, as provided for in the Recreation Management Plan, would provide the means for future rehabilitation and replacement (as needed) of existing recreational facilities within and adjacent to the Big Creek ALP Projects. The facility rehabilitation measures would help ensure that these access sites would continue to provide adequate facilities to meet recreational demand at the projects. Some of the proposed rehabilitation measures would include providing or enhancing recreational facilities to meet accessibility guidelines and would, therefore, increase the number and type of facilities that provide access for disabled individuals to the projects. Improving access for the disabled at the Big Creek ALP Projects would be consistent with the Commission's policy on recreational facilities[46] at licensed projects under which licensees are expected to consider the needs of the disabled in the design and construction of such facilities.

Facilities Located Within the Existing Project Boundary

The facilities owned and operated by SCE (with the exception of a portion of the day-use area on North Shore Road 1 at Big Creek Nos. 2A, 8, and Eastwood Project) are located within the existing project boundaries. SCE proposes to maintain its facilities

[46] See 18 CFR §2.7.

over the term of a new license as part of the ongoing measures associated with maintenance and repair activities at the Big Creek ALP Projects and, therefore, does not provide specific timeframes for major facility rehabilitation. SCE facilities and the facilities operated by the Forest Service located within the existing project boundary would be reviewed as part of the periodic review and reporting measures in the Recreation Plan. SCE's proposed rehabilitation measures and ongoing monitoring efforts would enhance these recreational facilities and ensure that these facilities are maintained over the term of a new license. If, during the term of a new license, the Forest Service would no longer operate facilities located within the project boundary, the licensee would ultimately be responsible for the provision of these project-related recreational facilities to maintain public recreational use and access to the project resources. Therefore, these measures, in addition to the provision that they are located within the project boundaries, would ensure that they are adequately maintained for public use and access over the term of any new license.

SCE's proposal to remove the Florence Lake day-use area from the project boundary would remove an existing facility that provides public use and access to the project. SCE proposes to remove this facility because it is used for public recreation and not for project operations. SCE has not demonstrated that these facilities and lands are no longer required for project purposes and that there is no nexus of these lands and facilities to the project and public recreational access to project resources.

The Florence Lake day-use area provides recreational day-use facilities associated with the project and is located adjacent to the Florence Lake boat ramp, which provides public access to project waters. Maintaining the Florence Lake day-use area within the project boundary would provide the Commission authority to ensure long-term public use and access at these facilities.

Facilities Located Partially Outside the Existing Project Boundary

For those facilities that are located partially outside of the project boundary, the long-term management of these facilities would not be clear over the term of a new license. These facilities are currently associated with the project and provide public access to project lands and waters. The proposed provisions in the Recreation Management Plan for future rehabilitation, and ongoing maintenance and operation measures associated with recreational facilities provides some means for long-term management of these facilities. However, for those portions of facilities that are located outside of the project, the Commission would have no authority under the license to ensure that these facilities are maintained or that the public could access project lands and waters over the term of new licenses unless these portions of the facilities are also included within the project boundary of the individual project.

The Commission can require the licensee to include recreational facilities within the project boundary in order to ensure public access to project facilities and waters (18 CFR § 2.7 (a)). Therefore, revisions to the existing project boundaries of the individual

Big Creek ALP Projects to include those facilities located partially outside the project boundary would provide the Commission authority to ensure long-term public use and access at these facilities. In that event, SCE would be required to provide the Commission a revised Exhibit G that includes the incorporation of these entire facilities within the revised project boundary.

Facilities Located Outside of the Existing Project Boundary

For the five Forest Service campgrounds located outside of the existing project boundaries of the Big Creek ALP Projects—Dorabelle, Upper Billy Creek, Catavee, Kinnikinnick, and Mammoth Pool—SCE's proposed rehabilitation measures under the Settlement Agreement would occur at one time for each facility.

At Shaver Lake, where the Dorabelle Campground is located, SCE currently meets camping needs and provides public access to project lands and waters by the use of its Camp Edison Campground, which also has a day-use area and boat launch. SCE also provides public access to Shaver Lake at four additional day-use areas along the shoreline and proposes to provide support of a fifth day-use area along the Shaver Lake shoreline.

At Huntington Lake, where Upper Billy Creek, Catavee, and Kinnikinnick Campgrounds are, SCE operates and maintains its Eastwood Overlook and Parking Area and proposes to provide support to the Forest Service for operation, maintenance, and rehabilitation of boat launches on the east and west sides of the lake, four day-use areas, and four campgrounds

At Mammoth Pool reservoir, the location of Mammoth Pool Campground, SCE proposes to provide public access to project lands and waters by supporting the Forest Service operation, maintenance, and rehabilitation of two boat launches, a day-use area overlooking the reservoir, and a small campground on the reservoir accessible only by boat. In addition to these facilities, existing camping needs are met by Sweetwater Campground, about 2 miles from the reservoir, and Placer Campground, about 3 miles from the reservoir. Two additional campgrounds, Rock Creek and Fish Creek, are located along Minarets Road, the primary access road to the reservoir.

Recreational Facility Capital Improvements

SCE proposes to develop four new recreational facility capital improvements: two at the Big Creek Nos. 2A, 8, and Eastwood Project and two at the Big Creek Nos. 1 and 2 Project. These proposed facility improvements are summarized below:

Big Creek Nos. 2A, 8 and Eastwood Project

- Develop an accessible fishing platform on the South Fork San Joaquin River near Jackass Meadows Campground. SCE proposes to consult with the Forest Service to select a location for the construction of this facility.
- Develop an accessible boat loading facility at the Florence Lake boat ramp.

Big Creek Nos. 1 and 2 Project

- Develop a day-use area adjacent to Dam 3 at Huntington Lake, including a parking area, trail from the parking area to Dam 3, toilet, three picnic tables, a new gate to prevent parking on Dam 3, and two designated disabled parking spots at the north end of the dam.
- Develop an accessible fishing platform at Huntington Lake. SCE proposes to consult with the Forest Service to select a location for this facility.

SCE would be responsible for the full cost of the capital improvements and for scheduling or performing all needed construction activities, including the provision of necessary personnel, equipment requirements, materials purchase, and management oversight. The proposed capital improvements would be designed in consultation with the Forest Service and designed and constructed according to applicable Forest Service specifications and standards and conform to current applicable accessibility and health and safety requirements. The Forest Service would be responsible for the operation and maintenance of these facilities.

Our Analysis

SCE's proposed recreational capital improvements would enhance recreational access and opportunities associated with angling and boating use at the Big Creek Nos. 2A, 8, and Eastwood Project and the Big Creek Nos. 1 and 2 Project. The implementation of the proposed accessible fishing platform and boat loading facilities at the Big Creek Nos. 2A, 8, and Eastwood Project would enhance recreational opportunities for disabled individuals by providing boating access at Florence Lake and fishing access along South Fork San Joaquin River near Jackass Meadows Campground.

At the Big Creek Nos. 1 and 2 Project, the proposed new day-use area adjacent to Dam 3 would provide developed recreational facilities in a location where dispersed day-use recreational activities currently occur. Input from stakeholders indicated that additional facilities were needed to meet demand at the Dam 3 area along Huntington Lake. Specifically, parking at this location was identified as a potential safety hazard on busy summer days and weekends when demand is high. Providing developed recreational facilities would enhance the recreational experience in this area and control recreational use and associated effects by providing support facilities, including parking, trail, and toilet facilities. In addition, the gate at Dam 3 would control parking on Dam 3 which would enhance public safety in this area. The proposed fishing platform would provide additional accessible fishing opportunities and would therefore enhance recreational opportunities in the vicinity of the Big Creek Nos. 1 and 2 Project.

At the Big Creek Nos. 2A, 8, and Eastwood Project, the Florence Lake boat ramp is located within the project boundary and therefore, the boat loading facility which would be placed at the Florence Lake boat ramp area would also be located within the existing project boundary. The location of the fishing access platform on the South Fork San Joaquin River would be determined in consultation with the Forest Service and portions of the facilities may be within the existing project boundary. At the Big Creek Nos. 1 and 2 Project, the location of the proposed day-use area within the vicinity of Dam 3 would be located outside of the existing project boundary (as illustrated on Figure 5.2.9-7 of the amended PDEA). The location of the accessible fishing platform at Huntington Lake would be determined in consultation with the Forest Service and portions of the facilities may be within the existing project boundary.

As discussed previously (under *Recreational Facility Major Rehabilitation*), the Commission would have no authority to ensure that these facilities are maintained over the term of new licenses unless these facilities are included within the project boundary. Therefore, revisions to the existing project boundaries, as needed, of the individual Big Creek ALP Projects to include these facilities, would provide the Commission authority to ensure long-term public use and access at these facilities.

Interpretive Displays

SCE proposes to design and install up to 13 interpretative display exhibits (kiosks) at various locations in the vicinity of the Big Creek ALP Projects. The kiosks would contain two display panels to educate the public on cultural, historical, pre-historic, biological and recreational resources in the Big Creek area. SCE would consult with the Forest Service and the Big Creek Heritage Advisory Committee (as defined in the HPMP) regarding the design, content, and placement of the interpretative display panels/kiosks. The final design would be submitted to the Commission for approval. The schedule for the design and installation of the interpretive display exhibits would be coordinated with the proposed rehabilitation of the recreational facilities where the kiosks are to be installed. The proposed locations of the kiosks include:

- Big Creek Nos. 2A, 8, and Eastwood Project area - Florence Lake Store, Jackass Meadows Campground, Mono Campground, and Whitebark Vista;
- Big Creek Nos. 1 and 2 Project area - Bear Cove day-use picnic area, Dam 3 parking area, Dowville day-use picnic area, and Eastwood Visitor Center; and
- Mammoth Pool Project area - Mammoth Pool vicinity and Redinger reservoir Overlook.

Our Analysis

The proposed interpretive displays would provide information regarding cultural, historical, pre-historic, biological and recreational resources within the region. They would enhance the recreational experience within the vicinity of the Big Creek ALP Projects by conveying this information to the public.

Reservoir Water Surface Elevations

SCE proposes to make a good faith effort to support reservoir-based recreation through the maintenance of reservoir water surface elevations, while meeting the primary purpose of the reservoirs. These proposed measures include the following:

- Florence Lake (FERC Project No. 67) - SCE proposes to maintain a minimum reservoir storage of 21,000 acre-feet level (elevation 7,276 feet) at Florence Lake during the period from July 1 through August 31, and a minimum reservoir storage of 1,000 acre-feet (elevation 7,231 feet) level during the remainder of the year.
- Shaver Lake (FERC Project No. 67) - SCE proposes to make every effort to maintain the water surface at the maximum elevation practical for water storage, with minimum noticeable fluctuation, from Memorial Day to September 10. (This is a change from current operations, which are detailed in table 3-5).
- Huntington Lake (FERC Project No. 2175) - SCE proposes to make every reasonable effort to maintain the water surface at as high an elevation and with as little fluctuation as feasible during the period between May 1 to September 10 of each water year as is consistent with the primary purpose of the reservoir, existing water rights, and contracts.
- Mammoth Pool Reservoir (FERC Project No. 2085) - SCE proposes to make every effort to maintain the water surface at the maximum elevation practical for water storage, with minimum noticeable fluctuation, from June 1 to September 1 of each year.

Reservoir elevations needed to support recreation would not be maintained when reduced water storage is necessary to (1) allow necessary repairs to the dam(s) or associated equipment; (2) provide water supplies during drought periods to downstream water users or for environmental purposes; (3) operate generating facilities to address power shortages in California due to unscheduled power outages of other power generation facilities, state-declared energy emergencies, or orders from a state agency with authority to dispatch power generated by the Big Creek ALP Projects; (4) reduce downstream flooding risks; (5) meet the terms of the Mammoth Pool Operating Agreement or other obligations to downstream water rights holders; or (6) meet other project license water release requirements. In addition, under the proposed action, SCE would not be required to reduce power generation to maintain reservoir elevations if the releases from the reservoir are required to meet license conditions, and/or generation is ordered by the Independent System Operator or another authority.

Our Analysis

Low water surface elevations at the reservoirs could reduce recreational opportunities and diminish recreational experiences as a result of limited boating access at the reservoir boat ramps. In addition, lower water surface elevations may result in more exposed shoreline areas and have an adverse effect on shoreline recreational use and access.

SCE's proposed measures to maintain the water surface elevations at Huntington Lake and Mammoth Pool reservoir during the primary recreational season would be the same as existing conditions and access to the water would remain similar to existing conditions. At Florence Lake, where minimum water surface elevations during July and August are specified, our review of the water surface elevations over a 26-year period (see figure 3-2) indicates that the proposed measure would have resulted in higher water surface elevations during the primary recreational season in 5 years. For Shaver Lake, SCE's proposal would have the potential to provide more stable elevations during the recreational season.

Reservoir Water Surface Elevation Information

SCE proposes to provide reservoir surface elevation information to the public through the Internet or other appropriate technology. Where feasible, SCE proposes to provide year-round midnight reservoir surface elevations at Florence Lake and Shaver Lake (Project No. 67), Huntington Lake (Project No. 2175), and Mammoth Pool reservoir (Project No. 2085). SCE would also post the functional operating ranges of the boat launch ramps at the reservoirs.

SCE proposes to annually notify the Forest Service, the Huntington Lake Resort, Lakeshore Resort, Rancheria Enterprises, Sierra Marina, Shaver Lake Marina, and post at the Sierra National Forest boat ramp and via a website or other similar method, its monthly storage targets for Florence Lake and Shaver Lake (Project No. 67), Huntington Lake (Project No. 2175), Mammoth Pool reservoir (Project No. 2085), and Thomas A. Edison reservoir (Vermilion Valley Project, No. 2086) for the recreational season (May through September). SCE proposes to make a good faith effort to notify these parties and post via website or other method, at least 2 weeks before it plans to substantially reduce the reservoir elevation for dam maintenance or annual drawdown unless SCE must reduce the reservoir elevation for emergency purposes or other circumstances that preclude the issuance of a notification. In such cases, SCE proposes to make a good faith effort to inform the above listed entities of the circumstances and expected reservoir elevation and fluctuations as soon as possible.

SCE proposes to install a staff gage and post the annual water plan for Huntington Lake (Project No. 2175) at the Forest Service boat ramp. The annual water plan for the lake would provide estimates of projected reservoir water surface elevations during the recreational season. SCE proposes to provide the annual report on Huntington Lake water surface elevations (including an exceedance table of water surface elevations) from the previous year to the Forest Service, the Huntington Lake Association, and interested parties. Upon request of the Huntington Lake Association, SCE would attend the

Association's annual meeting or meet with the Association's Board in lieu of the annual meeting to discuss the annual water plan.

Our Analysis

SCE's proposed staff gages, distribution of the annual water plans and dissemination of reservoir surface elevation information would provide the means for the public to gain information regarding reservoir surface elevations for the specified reservoirs within the Big Creek ALP Projects. This information could then be used to determine if recreational opportunities and desired surface water elevations for boating access and other recreational activities would be available. This would allow the public to take better advantage of opportunities for public recreational use of Florence, Shaver, and Huntington lakes, and Mammoth Pool reservoir.

Stream Flow Information Dissemination

SCE proposes to provide real-time streamflow information that shows the most recent 7 days of flow information to the public via the Internet or other appropriate publicly accessible technology. SCE would provide year-round hourly flow data for the following stream reaches:

- South Fork San Joaquin River below Florence dam;
- San Joaquin River below Mammoth Pool reservoir;
- San Joaquin River below Dam 6;
- Stevenson Creek below Shaver dam; and
- Mono Creek between Vermilion Valley dam and Mono diversion.

Under the proposed action, SCE could decline to post this information if it determines that the information has market value that could adversely affect SCE's power purchase bidding activities and power or ancillary service prices; or would be considered by a regulatory agency to be inappropriate or unlawful. If SCE decides to discontinue or modify the provision or method of providing flow data, it would post notice of the discontinuation or modification on the Internet at least 2 days prior to the suspension of data. Within 30 days of the suspension or modification, SCE would notify the Commission, and request approval to suspend posting of this data.

In addition to posted streamflow data, SCE proposes to install and maintain staff gages from which streamflow in cfs or reservoir elevation could be determined. Staff gages would be installed in the South Fork San Joaquin River below Florence dam, at the Forest Service Rancheria boat ramp at Huntington Lake, and in the San Joaquin River below Mammoth Pool dam. SCE proposes to make a good faith attempt to locate the gages near angling access and whitewater boating put-in locations, so they are viewable by the public.

By April 10 each year, SCE proposes to make the forecast of the water year type in the same fashion as the streamflow information available on the Internet, and the forecast of the probability of spill and/or supplemental flows at Florence Lake and Mammoth Pool dams, if available. SCE also proposes to make a good faith effort to provide notice of the anticipated date of the beginning of spill at these dams during years when spill is likely to occur.

Our Analysis

SCE's proposed staff gages and dissemination of streamflow information would provide the means for the public to gain information regarding streamflow for specified stream reaches. This information could then be used to determine if recreational opportunities and desired flow ranges for angling, whitewater boating, and other recreational activities would be available. This would allow the public to take better advantage of opportunities for public recreational use of these stream reaches.

Whitewater Boating Flow Releases

SCE proposes to provide pre-spill whitewater flow releases below Mammoth Pool and Florence reservoir dams in wet and above normal years. The presence of wet years and above normal years would be determined by CDWR in its April 1 forecast for the projected water runoff for the San Joaquin River Basin. Upon request of the American Whitewater or regional whitewater boating representatives after March 15, SCE would discuss the anticipated water runoff conditions in relation to pre-spill releases, as described below. If the water year type is determined to be a wet or above normal water year, the timing and flow magnitudes of the pre-spill releases would be proposed.

Channel and riparian maintenance flow at Florence Lake Dam - SCE proposes to provide channel and riparian maintenance flow in the South Fork San Joaquin River below Florence Lake in wet and above normal water years for riparian habitat enhancements (see section 3.3.2, *Terrestrial Resources*). SCE proposes to attempt to provide flows sufficient in timing and magnitude for whitewater boating opportunities during the descending portion of the channel and riparian maintenance flow release to the extent it is within SCE's control and consistent with the requirements of the channel and riparian maintenance flow schedule at Florence dam.

Wet Year Releases at Mammoth Pool Dam - In wet years, as defined by the CDWR forecast, SCE would provide a continuous release of between approximately 350 and 850 cfs until such time as Mammoth Pool dam spills. This pre-spill whitewater release would be targeted to begin on April 15. If, on April 15, Mammoth Pool dam is spilling, SCE would have no further responsibilities to provide whitewater recreational flows for the year. If, SCE determines conditions are suitable to provide pre-spill flows prior to April 15, SCE could initiate pre-spill releases at an earlier date. Pre-spill release flows would be provided by operation of the Howell Bunger valve at Mammoth Pool dam. Operation of the valve would be consistent with the requirements of the Sediment Management Prescriptions.

Above Normal Year Releases at Mammoth Pool Dam - To provide whitewater boating opportunities during above normal water years, SCE would provide pre-spill whitewater releases below Mammoth Pool dam of between approximately 350 and 850 cfs for 2 consecutive weekend days. At a minimum, the whitewater flows would be provided between the hours of 10 AM to 4 PM over one weekend. These pre-spill whitewater releases would be made after April 15. If by April 15, Mammoth Pool dam is spilling, SCE would have no further responsibilities to provide whitewater releases for that year. Upon the request of regional whitewater boating representatives and if SCE determines conditions are suitable, SCE could initiate pre-spill releases at an earlier date. Pre-spill release flows would be provided by operation of the Howell-Bunger valve at Mammoth Pool dam. Operation of the valve would be consistent with the requirements of the Sediment Management Prescriptions.

Pre-spill releases have the potential to affect flood control and water supply operations downstream of the Mammoth Pool reservoir. Prior to making pre-spill releases, SCE would consult with the U.S. Bureau of Reclamation (or the then current operator of Friant dam). If the U.S. Bureau of Reclamation determines that a pre-spill release would adversely affect its flood control or water supply operations, SCE would not make the planned pre-spill release. In that situation, SCE would make a good faith effort to identify another time acceptable to the U.S. Bureau of Reclamation when pre-spill releases may be made.

Our Analysis

Currently whitewater boating opportunities occur downstream of the Florence Lake dam on the 6.5 mile long reach of the South Fork San Joaquin River from Florence Lake dam to the Mono crossing (Florence Run) and downstream of the Mammoth Pool dam on the San Joaquin River along an 8.5 mile reach from the Mammoth Pool dam to Dam 6 (Tied-for-First Run) and along an 8.3 mile reach from bottom of Dam 6 forebay to the head of Redinger reservoir (Chawanakee Gorge Run).

Under the existing hydrology (for the period 1993 through 2002), estimated boating opportunity days at the boatable flows for these reaches occur on the Florence Run. During wet water years there were no boating opportunity days during April and for May there were an average of 0.5 days. During above normal years, on average, there were no boating opportunity days during April and May.

On the Tied-for-First Run during the wet water years, in April and May there were an average of 3.7 and 3.9 boating opportunity days per month, respectively, and during the above normal water years there were no boating opportunity days during April and May. For the Chawanakee Run, during wet water years, in April and May there were an average of 14.3 and 4.0 boating opportunity days per month, respectively, and during the above normal water years there were an average of 0.3 and 3.3 boating opportunity days per month, respectively, during April and May.

SCE's proposal of additional whitewater boating flows below the Florence Lake dam would provide an increased number of boating opportunity days by providing the channel and riparian maintenance flows, when possible, in a manner of timing and magnitude that would provide boatable flows in the Florence Run reach. SCE's proposed whitewater boating flow releases below the Mammoth Pool dam would provide increased opportunities for whitewater boating through the provision of boatable flows during a period when flows, particularly in above normal water years, are somewhat limited.

Fish Stocking

SCE proposes to match equally the Cal Fish & Game stocking of the Big Creek ALP Project reservoirs and bypassed stream reaches below the projects' diversions and upstream of Redinger reservoir, up to the following amounts:

- Rainbow Trout: Fingerlings – up to 20,000 per year; Catchables – up to 60,000 per year; and Subcatchables – up to 40,000 per year
- Kokanee: Fingerlings – up to 30,000 per year

SCE would consult with Cal Fish & Game annually to obtain fish stocking targets and verify the completion of the previous years stocking efforts. At SCE's option, it would either acquire the fish directly through available sources or reimburse Cal Fish & Game for the cost of fish production.

Our Analysis

SCE's proposed assistance to Cal Fish & Game to annually contribute to fish stocking activities within Big Creek ALP Projects reservoirs and stream reaches would help to maintain fish stocking activities within the project region. These fish stocking provisions enhance angling opportunities on Big Creek reservoirs and stream reaches within the vicinity of the projects.

San Joaquin River Trail Maintenance

SCE proposes to maintain the section of the San Joaquin River Trail that is co-aligned with the Mammoth Pool transmission line project road located within the Mammoth Pool Project. The Mammoth Pool transmission line project road would be maintained in accordance with, and to Forest Service road standards for a Maintenance Level 2 road. In addition, SCE proposes to maintain the two project road crossings of the trail with a surface material that accommodates multiple use of the San Joaquin River Trail.

Our Analysis

The San Joaquin River Trail is co-aligned with the Mammoth Pool transmission line project road for about 9 miles. The San Joaquin River Trail has Trail Class 3 designation under the Forest Service National Trail Management Class System. A Class 3 trail is defined as a developed/improved trail that is obvious and continuous; the width accommodates unhindered one-lane travel with occasional allowances constructed for passing, and typically has native materials (Forest Service, 2006).

The Mammoth Pool transmission line project road has a Level 2 maintenance designation. Road Maintenance Level 2 is defined in the Forest Service Transportation System Maintenance Handbook (FSH 7709.58,10,12.3) and described in the Forest Service Guidelines for Road Maintenance Levels (Forest Service, 2005) as: "Assigned to roads open for use by high-clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level. Appropriate traffic management strategies are either to (1) discourage or prohibit passenger cars or (2) accept or discourage high-clearance vehicles."

SCE's proposed maintenance of the Mammoth Pool transmission line project road in accordance with Level 2 road maintenance prescriptions would help maintain the portion of the San Joaquin River Trail that coaligns the road with the trail's prescribed management Class 3 trail designation. This routine maintenance would help ensure that the trail would remain functional, minimize the need for additional trail reconstruction activities along this portion of trail, and help ensure that the trail would remain accessible to the public for recreational opportunities.

Winter Snow Plowing

To protect winter recreational use and opportunities in the vicinity of Big Creek Nos. 1 and 2 Project and Big Creek Nos. 2A, 8, and Eastwood Project, SCE proposes to plow Kaiser Pass Road (5S80) and Florence Lake Road (7S01) (in the event it needs to plow for emergency access to project facilities) as follows:

- Unless required for larger equipment, SCE would plow one lane only on the Eastwood/Badger Flat segment of road 5S80 and the other lane would be maintained and reserved for winter sports use. SCE would avoid placement of blown snow on the reserved lane.
- Provide a uniform travel surface of a maximum one tractor blade width on snow adjacent to the cleared roadway, where practical.

Our Analysis

Kaiser Pass Road (5S80) and Florence Lake Road (7S01) provide snowmobiling and cross-country skiing opportunities during the winter recreational season (the season varies dependent on snow conditions). The Forest Service maintains the snowmobile trail along these roads by grooming the trail following each winter storm. On occasion, SCE may need to gain emergency access to project facilities and plow portions of Kaiser Pass Road to provide vehicular access. The plowing of these roads could lead to the disruption of the snowmobile and cross-country skiing recreational opportunities. SCE's proposed methods for plowing would help to maintain a portion of the road so that these recreational activities could continue without being adversely affected.

3.3.4.3 Cumulative Effects

Ongoing project effects associated with recreational resources would result in continued recreational access and associated public use of the project waters and lands. Public use and recreational access would potentially result in cumulative effects on project lands and waters, including the potential adverse effects of boating use, noise related to power boats and jet skis, and associated wave-related erosion on project reservoirs, and soil compaction and erosion as a result of recreational use along the reservoir shoreline areas. Beneficial cumulative effects from the provision of recreational facilities and access to project lands and waters over the term of any new license would also occur by focusing recreational activities at specific sites designed to handle public use in a manner that is minimally disruptive to the environment.

Implementation of SCE's proposed environmental measures, specifically the Recreation Management Plan and associated recreational rehabilitation and capital improvement measures at the Big Creek ALP Projects, would likely enhance recreational opportunities within the vicinity of the projects. Proposed recreational measures would generally not increase the capacity of existing recreational facilities and thus would not draw additional recreational visitors to the project areas. Additional recreational use in sensitive areas could have adverse effects on natural and cultural resources. Proposed new recreational facilities would better enable persons with disabilities to enjoy recreational experiences and, in the case of the proposed day-use area at Huntington Lake, would formalize existing informal and dispersed recreational use that currently occurs at this location, which creates unsafe conditions for the public. In addition, the proposed recreational facility rehabilitation measures and enhancements would likely complement the management objectives of the Forest Service's management objectives for the Sierra National Forest. The provisions included in the Recreation Management Plan for the recreational facilities within the vicinity of the Big Creek ALP Projects would provide the means for these recreational facilities to be managed in a coordinated and comprehensive manner between the Forest Service and SCE. In addition, the proposed Recreation Management Plan would provide the means for adaptive management of these facilities over the term of any new license for the Big Creek ALP Projects through the annual coordination meetings and periodic review and update. Therefore, the proposed recreational enhancements and rehabilitation measures at the Big Creek ALP Projects would likely result in a cumulative beneficial effect on regional recreational resources.

3.3.5 Cultural Resources

3.3.5.1 Affected Environment

Definition of Cultural Resources, Historic Properties, Effects, and Area of Potential Effects

Historic properties are cultural resources listed or eligible for listing in the National Register. Historic properties can be buildings, structures, objects, districts (a term that includes historic and cultural landscapes), or sites (archaeological sites or locations of important events). Historic properties also may be resources of traditional religious and cultural importance to any living community, such as an Indian tribe or a local ethnic group, that meet the National Register criteria; these properties are known as traditional cultural properties. Cultural resources must possess sufficient physical and contextual integrity to be considered historic properties. For example, dilapidated structures or heavily disturbed archaeological sites, although they may retain certain historical or cultural values, may not have enough integrity to be considered eligible.

Section 106 of the National Historic Preservation Act requires federal agencies including the Commission to consider the effects of their undertakings on historic properties. An undertaking means a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including, among other things, processes requiring a federal permit, license, or approval. Advisory Council on Historic Preservation (Advisory Council) regulations implementing section 106 define effects on historic properties as those that change characteristics that qualify those properties for inclusion in the National Register. In this case, the undertaking is the proposed issuance of new licenses for continued operation of the Big Creek ALP Projects. Potential effects of licensing may result from construction of project facilities, day-to-day operation and maintenance of the project, or other actions required by the license, such as those associated with land or natural resource management or recreation.

Determination of effects on historic properties first requires identification of historic properties in the APE. The Advisory Council's regulations define the APE as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. For the Big Creek ALP Projects, the APE includes lands within the projects' licensed boundaries, plus any locations outside the licensed boundaries where project operation or project-related activities (e.g., those required under the terms of a license) may affect the character or use of historic properties.

Advisory Council regulations also require the Commission to seek concurrence from the State Historic Preservation Officer (SHPO) on any finding involving effects or no effects on historic properties, and allow the Advisory Council an opportunity to comment on any finding of adverse effects. In addition, regulations require the Commission to consult with interested Native American tribes that might attach religious or cultural significance to historic properties within the APE.

Cultural History Overview

The archaeological record documents at least 7,000 years of human activity in the southern Sierra Nevada. Archaeological sites are physical evidence of Native American use of regional uplands for settlement, food, and other resource procurement, trade, and travel. Historical records describe traditional use of the Big Creek ALP Projects area by Mono and Paiute people, although other Native American groups (e.g., Miwok and Yokuts) may have used the area as well, especially on trading ventures.

Earliest encounters between Native Americans and Europeans in the project area probably date to the late 1700s when incidental Spanish exploration of the region began. By the 1820s contact between Mono, Yokuts, and other indigenous groups and Spanish expeditions intensified, and Native American groups came under military attack. Soon thereafter (if not before) introduced European diseases devastated susceptible Native American populations. In the 1830s, American trappers began exploring the region, but it was the Gold Rush of the late 1840s and early 1850s that brought the greatest influx of Americans and others. While the southern Sierra was not the focus of Gold Rush activities, disappointed would-be miners and others recognized the abundant timber and grazing potential of this region and began timbering, livestock grazing, and homesteading with some limited mining. These activities further disrupted traditional Native American ways of life as Euro-Americans displaced Mono and other groups from their traditional lands, confined them to reservations and rancherias, denied them access to subsistence and other resources, and assimilated them into cash-based economies. Throughout the 20th century and to the present, the local economy has focused on timbering, grazing, hydropower development and production, and recreation.

The construction of the Big Creek System was a major factor in the development of the project area. The first components of this system were the Huntington dam and reservoir, which were built between 1911 and 1913. Additional dams, reservoirs, and associated facilities were erected over the next 40 years. Completed in 1987, the Balsam Meadows development (Balsam Meadows forebay and Eastwood power station) is the youngest component of the Big Creek System. Over the decades, the reservoirs have served as catalysts for recreational development on National Forest lands around and in the vicinity of these water bodies.

Cultural Resources Investigations

Many components of the Big Creek System dating from 1911 to 1929 have been determined eligible for the National Register as a result of initial work by Shoup et al. (1988). Since that time, additional components contributing to the significance of the Big Creek Hydroelectric System Historic District (BCHSHD) have been identified; however, there has been to date no formal documentation of the entire inventory of contributing and non-contributing system elements. A second potential historic district, known as the Huntington Lake Historic Recreation District, has been identified as a result of various studies by the Sierra National Forest over the last two decades. As the name suggests, this potential district focuses on resources related to recreational development in the Huntington Lake Basin between 1913 and 1960. The Sierra National Forest is working with NPS to complete evaluations of recreational residence tracts, with an eye toward completion of a multiple-property document and National Register nomination forms for historic properties in the Huntington Lake Basin.

Cultural resources investigations for the Big Creek ALP Projects incorporated information from previous studies, such as those cited above, plus results of an archaeological survey for prehistoric and historic resources commissioned by SCE. SCE contracted with Pacific Legacy, Inc. (Legacy) to conduct this survey, which was completed between spring 2002 and winter 2004. Cultural resources consultants also conducted interviews and multiple site visits with tribal members to obtain information about locations and resources of cultural or historical value to Native Americans. This information was incorporated into Legacy's final cultural resources report. The SHPO has not yet reviewed nor commented on Legacy's report and recommendations regarding National Register eligibility. Based upon the information provided in Legacy's report, we find that the resources identified in that report warrant consideration regarding their eligibility for inclusion in the National Register.

Known Cultural Resources

Within the Big Creek Nos. 1 and 2 Project are 15 prehistoric archaeological sites, 11 historic archaeological sites, portions of one historic railroad grade, and portions of two historic districts (BCHSHD and Huntington Lake Historic Recreation District). Legacy recommended one of the 15 prehistoric sites as eligible for the National Register. Five archaeological sites, as yet unevaluated, are being managed by SCE as eligible for the National Register until they can be evaluated. Additional cultural resources that Legacy has recommended as eligible for the National Register are historically documented Native American trail routes and river crossings in the general area of Huntington Lake; though no physical evidence of the trails was found in the APE during Legacy's survey.

Big Creek Nos. 2A, 8, and Eastwood contain 28 prehistoric archaeological sites, 14 historic archaeological sites, 17 archaeological sites with prehistoric and historic material, and portions of one historic district (BCHSHD). Nine of the archaeological sites, identified prior to the Legacy surveys, have been determined eligible for the National Register by the SHPO. Legacy recommended two archaeological sites, or components of sites, as eligible for the National Register. SCE is managing six unevaluated archaeological sites as eligible for the National Register until they can be evaluated. Additional cultural resources that Legacy recommended as eligible for the National Register are historically documented Native American trail routes and river crossings in the general area of Florence Lake, Shaver Lake, and the Mono Creek diversion dam, although Legacy has found no physical evidence of the trails in the APE.

Big Creek No. 3 contains eight historic archaeological sites, two prehistoric archaeological sites, one historic road (Million Dollar Mile Road), and portions of one historic district (BCHSHD). Legacy recommended one of the archaeological sites as eligible for the National Register.

Mammoth Pool contains 25 prehistoric sites, portions of one potential archaeological district (Chawanakee Flats), and one potential traditional cultural property (Mammoth Pool Cultural Use Area). The Mammoth Pool Cultural Use Area, recommended by Legacy as eligible for the National Register, comprises locations where Native Americans traditionally hunted, fished, and gathered plants; gathering places; medicine places; archaeological sites; river crossings; and trail routes. The Chawanakee Flats Archaeological District is located in an area of the Sierra National Forest that has been identified in ethnographic studies as an important Mono settlement location. All but two of the known prehistoric and ethnographic sites that compose the Chawanakee Flats Archaeological District are located on Forest Service land outside of the project boundaries of the Big Creek ALP Projects. Preferring that sites remain untested unless absolutely necessary, the Forest Service asked SCE to limit testing and evaluation of Chawanakee Flats sites to the two lying within project boundaries. Neither of these two sites was recommended by Legacy as eligible for the National Register.

Legacy recommended 17 archaeological sites in the Mammoth Pool Project as eligible for the National Register. SCE is managing seven unevaluated archaeological sites as eligible for the National Register until they can be evaluated. Legacy also has recommended historically documented Native American trail routes and river crossings in the general area of Mammoth Pool as eligible for the National Register, although no physical evidence of the trails has been found to date in the APE.

3.3.5.2 Environmental Effects

Effects on cultural resources within the APE can result from project-related activities such as reservoir operations, modifications to project facilities, or project-related ground-disturbing activities. Effects also can result from other forces such as wind and water erosion, recreational use (project and non-project related), vandalism, and private and commercial development. The type and level of effects on cultural resources can vary widely, depending upon the setting, size, and visibility of the resource, as well as whether there is public knowledge about the location of the resources.

SCE proposes to complete its HPMP for the Big Creek ALP Projects (a draft of which was filed with the Commission in November 2005), in consultation with the Commission, the parties to the Settlement Agreement (including the Forest Service and Interior), and the Tribes, and would implement the finalized HPMP upon execution of the PA. A draft PA was sent to the consulting parties on September 23, 2008. No comments on it have been received as of the date of the preparation of this final EIS. We anticipate circulating a final PA for signature in April 2009.

The HPMP would enumerate measures both general and site-specific for management and protection of historic properties and of "important cultural resources" (defined in the HPMP as plant species of importance to Native Americans and archaeological sites associated with Native American occupation and/or recreational use of the area that do not meet National Register criteria). The HPMP also provides for establishment of a Big Creek Advisory Committee, open to the Tribes and organizations that participated in the Cultural Resources Working Group during the Big Creek ALP. Throughout license terms, SCE would consult with the Advisory Committee on the development and implementation of management and monitoring plans for cultural resources, review and evaluation of cultural resources data, and development and implementation of cultural resources protection measures.

SCE proposes that the finalized HPMP would specify coordination of the plan with other plans to be implemented over the license terms, including but not limited to the vegetation management, recreational management, and riparian monitoring plans. It would specify Forest Service representation on the Big Creek Heritage Advisory Committee. SCE would also provide the Forest Service with GIS-compatible electronic data so that archaeological survey coverage and site locations could be entered into the Forest Service database.

Forest Service preliminary 4(e) condition 20 and 21 are the same as those contained in the Settlement Agreement. Interior's recommendations regarding cultural resources in the Big Creek ALP Projects also mirror the specifications of the Settlement Agreement and the Forest Service conditions.

By letters of February 25, 2005, to the Commission, the Tribes recommend that SCE provide funding for the following measures:

- development of a tribal-specific communications protocol for future use in negotiations between SCE and the Tribes;
- recovery of expenses incurred by the Tribes during their participation in the Big Creek ALP;
- retention of a third-party facilitator to facilitate negotiations between the Tribes and SCE;
- capital and subsequent staffing and operating costs for a Native American center, to be located at Shaver Lake on land donated by SCE to the Tribes;
- comprehensive ethnographic studies and evaluation of traditional cultural properties within the Big Creek ALP Project areas;
- a solar powered infrastructure and delivery program for the Tribes;
- Native American interpretive and signage programs; and
- a Native American historical monument.

In letters to the Commission dated January 20, 2006, and April 22, 2008, the North Fork Mono Tribe expressed concerns regarding treatment of archaeological sites threatened by erosion on reservoir shorelines.

Our Analysis

SCE's finalization of its HPMP in accordance with the provisions of the Settlement Agreement would provide for management and protection of historic properties and important cultural resources throughout the Big Creek ALP Projects APE over the license terms. In addition, it would address Forest Service concerns (expressed in its preliminary 4(e) conditions) regarding participation in the management and protection of cultural resources in those portions of the APE lying in or adjacent to the Sierra National Forest.

Organization and operation of the Big Creek Advisory Committee, as specified in the finalized HPMP, would afford the Tribes ongoing opportunity to make their views and concerns regarding cultural resources known through a forum whose protocols and procedures will be established by its members. Regarding the use of a third-party facilitator, SCE stated in the HPMP that it would employ a facilitator from an organization outside the Advisory Committee membership in the event that a majority of the membership so chooses.

The HPMP also includes provisions for educating the public about Native American heritage and historical values of the Big Creek ALP area through permanent display boards, printed matter, and other media. These educational materials would be developed in consultation with the Advisory Committee, thereby affording the Tribes opportunity to comment on and contribute to the design, content, and placement of cultural and heritage informational materials. Educational/interpretive signage at pertinent locations would provide an effective vehicle for memorializing the past, present, and future value of the Big Creek area to Native Americans. Signage and other informational/interpretive media would effectively educate the public and foster public appreciation of the area's heritage values within the context of new licenses for the Big Creek ALP Projects. Such measures would have a closer nexus to the projects and resources than would SCE's building a cultural center as the Tribes recommend.

The cultural resources technical report submitted as part of SCE's license application adequately summarizes existing ethnographic information about the Big Creek ALP Project area. Additionally, SCE and its cultural resources consultants conducted interviews and multiple site visits with tribal members to identify and obtain information about locations and resources of cultural or historical value to Native Americans. This information, incorporated into the cultural resources report and the draft HPMP, provides a reasonable basis for management of these locations and resources over the license term. Participation in the Big Creek Advisory Committee would afford the Tribes opportunities over the license term to contribute additional ethnographic information as they may choose.

Development and implementation of alternative sources of electrical power (specifically solar generation) is an issue of increasing importance throughout the United States today. However, there appears to be no nexus between the purpose and operation of the Big Creek ALP Projects (which is to generate electricity from water power) and the Tribes' request for funding for solar power generation.

In its draft HPMP, SCE proposes an initial 5-year monitoring program for certain eligible archaeological sites and several important cultural resources that are or may be affected by project operations, chiefly but not limited to, shoreline erosion. All such sites would be monitored at least twice during the 5-year period; however, SCE proposes to monitor sites "where archaeological data recovery is a consideration" more frequently. The draft HPMP also specifies that the Big Creek Advisory Committee would visit each of the monitored resources twice during the 5-year period and provide SCE with recommendations regarding the monitoring or possible alternative treatments. At the end of the initial 5-year period, the Advisory Committee would advise SCE regarding whether, and how frequently, monitoring should continue for each designated site. Implementation of these measures under a finalized HPMP would ensure appropriate management and treatment of resource conditions under the new license.

In anticipation of license issuance, the Commission would execute the PA with the SHPO, and would include SCE, the Tribes, and Forest Service as consulting parties. The PA would include a stipulation for finalization of the HPMP in consultation with the SHPO, Tribes, and Forest Service.

3.3.6 Land Use and Aesthetic Resources

3.3.6.1 Affected Environment

Land Use

Land Management Plans and Policies

Lands in the vicinity of the Big Creek ALP Projects are generally rural forest and foothills in character, and the existing land uses include: small communities of private residences or seasonal homes, hydroelectric power generation, rangeland, timber production, mining, research areas, wilderness areas, and recreation. The private land holdings in the vicinity of the project include small private in-holdings and lands owned by SCE. Depending on the ownership status, the land use and management is governed by federal or local plans and regulations. Lands within and adjacent to the project boundaries are administered by the Sierra National Forest, under the Forest Service. Long-term land management direction is provided by the Sierra National Forest Land and Resource Management Plan (Forest Service, 1991). This plan follows the framework guidance of the Sierra Nevada Forest Plan, which was amended in 2001 (Forest Service, 2001). In response to growing concern about fuels and fire management, the *Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement* further modified this framework guidance and Record of Decision dated January 21, 2004. The standards and guidelines presented in that final EIS would be made part of a future amendment to the Sierra National Forest Plan.

County Plans

Project lands located in Fresno and Madera counties are subject to the Fresno County General Plan (2000) or the Madera County General Plan (1995). Big Creek Nos.1 and 2 and Big Creek Nos. 2A, 8, and Eastwood projects are located within Fresno County. Big Creek No. 3 and Mammoth Pool projects are located in Fresno and Madera counties. The Fresno County General Plan covers issues of land use, transportation, and environmental resource management. The plan identifies the project vicinity lands as being within the Sierra-North Regional Plan Area and designates its land use as Public Lands and Open Space. This designation is applied to land or water areas that are unimproved and planned to remain open in character. The designation provides for preservation of natural resources; managed production of resources, parks and recreation; and the protection of the community from natural and manmade hazards. Although project lands are within Fresno County boundaries, the Fresno County General Plan does not refer specifically to the Big Creek ALP Projects' areas because they are managed by the Sierra National Forest, whose jurisdiction supersedes that of Fresno County.

The Madera County General Plan directs land use in the northeastern portion of the area in which the Big Creek ALP Projects are located, from the middle of the San Joaquin River, Dam 6 forebay, and Mammoth Pool reservoir northward. The plan designates the lands in the vicinity of the projects as Open Space with some smaller parcels of land designated as Agriculture Exclusive. The Open Space designation provides for land uses that include: low intensity agricultural uses, irrigation canals, grazing, forestry, recreation and equestrian, transmission lines, and areas under public control. The Agricultural Exclusive designation provides for agricultural uses, limited agricultural support service uses, agriculturally-oriented services, timber production, mineral extraction, public and quasi-public uses, and similar uses. Although project areas are within Madera County boundaries, the Madera County General Plan does not specifically refer to the Big Creek ALP Projects.

Big Creek Nos. 2A, 8, and Eastwood Project

The Big Creek Nos. 2A, 8 and Eastwood Hydroelectric Project is located in Fresno County, California, near the town of Shaver Lake within the South Fork San Joaquin River, Big Creek, and Stevenson Creek watersheds. As currently licensed, the Big Creek Nos. 2 A, 8, and Eastwood Project occupies 2,389.54 acres of land in an unincorporated portion of Fresno County, California. The project area lies within the

Sierra National Forest, Pineridge Ranger District, and occupies 2,388.8 acres[47] of federal lands. No state or county owned lands fall within the project boundary. SCE owns land within the project boundary near Shaver Lake and Balsam Meadows forebay that it uses for hydroelectric generation, recreation, timber harvesting, and wildlife management.

The project boundary encompasses three geographic areas:

- The Upper Basin area (includes Florence Lake located on the South Fork San Joaquin River);
- Shaver Lake (located on Stevenson Creek) and Balsam Meadows forebay area; and
- The Lower Big Creek Canyon (includes Big Creek Nos. 2A, 8, and Eastwood powerhouses).

The Upper Basin area contains eight small diversion dams on small tributary streams which flow to the South Fork San Joaquin River (see figure 3-6). Two of the small diversions, Crater Creek and Tombstone Creek diversions, are located within the John Muir Wilderness Area, which surrounds the Florence Lake area. Another two small diversions, North and South Slide Creek diversions, are located within 200 feet of the wilderness area boundary. These four small diversions were constructed in 1945 before the designation of the wilderness area in 1964. Non-industrial land uses within the project boundary in the Upper Basin area are mainly recreation-oriented and are described in section 3.3.4, *Recreational Resources*. Non-industrial land uses adjacent to the project boundary at Florence Lake include recreation and wildlife resource management.

Non-industrial land uses within the project boundary near Shaver Lake also are mainly recreation-oriented. Detailed descriptions of the recreational facilities are included in section 3.3.4, *Recreational Resources*. Adjacent land use in the vicinity of Shaver Lake includes private residential and commercial in-holdings in the community of Shaver Lake, timber harvest and wildlife management on SCE owned lands, and recreational use at the Dorabelle Campground and day-use area managed by the Sierra National Forest. The land uses adjacent to the project boundary in the vicinity of Balsam Meadows forebay include timber harvest and wildlife management on SCE owned lands, and natural resource management on adjacent Sierra National Forest lands. In addition, portions of SCE's private lands in the project boundary on the western and southwestern shore of Shaver Lake are designated as "Public Facilities" in the *Fresno County Shaver Lake Community Plan* amended in 1986.

The Sierra National Forest Land and Resource Management Plan (Forest Service, 1991) divides the forest into management and analysis areas. The Big Creek Nos. 2A, 8,

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[47] See 124 FERC ¶62,068, Order Approving Revised Exhibit K Drawings and Revising Annual Charges (July, 25, 2008).

and Eastwood Project is within Management Area 1 and Analysis Areas 45 (Florence Lake) and 36 (Shaver Lake). In these areas, developed recreational opportunities such as public campgrounds, day-use areas, visitor information centers, resorts, and recreational residences are emphasized. Lands adjacent to the Powerhouse 2A project boundary are managed by the Sierra National Forest for natural resource management use.

Facilities in the Upper Basin area are accessed via Kaiser Pass Road (FS Road No. 5S80) and Florence Lake Road (FS Road No. 7S01). Both roads are maintained by the Forest Service and are open to vehicular travel from approximately the end of May until the first snow fall in late October or early November. Kaiser Pass Road begins at the east end of Huntington Lake. At approximately 3 miles northeast of Huntington Lake, Kaiser Pass Road changes from a two-lane to a single-lane road. Kaiser Pass Road climbs over Kaiser Pass and provides access to the Upper Basin back-country area terminating at Lake Thomas A. Edison (a component of the Vermilion Valley Hydroelectric Project [Project No. 2086]). At Camp 62 in the back-country, Kaiser Pass Road intersects with Florence Lake Road. Florence Lake Road is also a single-lane road that continues for 7 miles to Florence Lake. SCE vehicles use Kaiser Pass Road and Florence Road during the summer months and SCE estimates its vehicle use on Kaiser Pass Road accounts for approximately 1.4 percent of the total vehicle traffic on the road. SCE also uses FS Road No. 7S65 to access facilities on Hooper Creek in the Florence Lake area, and FS Road No. 6S83 (a 4-wheel drive route) to access the Bear diversion facilities. Both of these roads are maintained by the Sierra National Forest. SCE maintains a number of spur roads and foot trails to access facilities associated with the Florence Work Camp and the small diversions in the Upper Basin area.

Project facilities in the vicinity of Shaver Lake and Balsam Meadows forebay are accessed via State Highway 168 and Huntington Lake Road. SCE maintains and controls access along a number of secondary roads and associated spur roads on SCE owned lands to access project facilities, including a road along the northeast side of Shaver Lake (FS Road No. 9S58), and a road to Balsam Meadows forebay (FS Road No. 9S32).

Project facilities in the Big Creek Canyon area associated with Powerhouses 2A and 8 are accessed via the Canyon Road (FS Road No. 8S05) and a few spur roads. The Canyon Road is closed to public vehicle access and is maintained by SCE.

Big Creek Nos. 1 and 2 Project

As currently licensed the Big Creek Nos. 1 and 2 Project, owned and operated by SCE, occupies 2,078.51 acres in an unincorporated portion of Fresno County. The project area lies within the Sierra National Forest, Pineridge Ranger District, and occupies 2,017.78 acres[48] of federal land. No state or county owned lands are within the project boundary. SCE owns some land parcels located at Huntington Lake and near

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[48] See 123 FERC ¶ 62,209, Order Approving Revised Exhibit K Drawings and Revising Annual Charges (June 9, 2008).

Powerhouse 2. The project boundary includes: Dam 4, Huntington Lake reservoir, a water conveyance system, two powerhouses, and roads and trails that are maintained by SCE and needed for the operation and maintenance of the project.

Non-industrial land uses within the project boundary are recreation-oriented. Section 3.3.4, *Recreational Resources* describes the recreational facilities. Land uses adjacent to the project boundary are Sierra National Forest lands and are primarily natural resource conservation or recreation-based. Pursuant to the Sierra National Forest Land and Resource Management Plan, the Big Creek Nos. 1 and 2 Project is within Management Area 1 and Analysis Area 47 (Huntington Lake) (Forest Service, 1991). In this area, developed recreational opportunities such as public campgrounds, day-use areas, visitor information centers, resorts, and recreational residences are emphasized.

The recreation-based lands include seven developed Forest Service campgrounds and four day-use areas that are located around the northern perimeter of Huntington Lake. Immediately north of Huntington Lake is the Kaiser Wilderness Area (designated as a wilderness area in 1976). Other existing land uses include small communities of private residences and vacation homes, private Boy Scout camps, and several commercial business facilities (store, restaurant and marina).

The system of roads and trails needed for project operation and maintenance provide access to two geographic areas: Huntington Lake and the Big Creek Canyon. Huntington Lake facilities are accessed via State Highway 168 and Huntington Lake Road (M2710, a Fresno County maintained road). Both roads provide access to Huntington Lake from Shaver Lake. State Highway 168 climbs up and crosses Tamarack Ridge and provides access to the east end of Huntington Lake. Huntington Lake Road begins at State Highway 168 at Shaver Lake and drops into the Big Creek Canyon, to the community of Big Creek, and continues along the north shore of Huntington Lake. In the Huntington Lake area, SCE maintains a number of roads (FS Road No. 8S66 and associated spurs) that provide access to Dams 1, 2, 3 and 3A and associated facilities located at the southwestern end of the Huntington Lake.

The community of Big Creek, Powerhouse 1, and Powerhouse 2 are located within the Big Creek Canyon. SCE maintains a number of roads in the community of Big Creek that provide access to Powerhouse 1, Northern Hydro offices, and other various project support facilities. Access to project facilities located downstream in Big Creek Canyon is provided via the Canyon Road (FS Road No. 8S05) which is located off Huntington Lake Road. SCE maintains Canyon Road which is gated; public vehicular access is restricted. Canyon Road provides access to Powerhouse 2 and associated facilities. SCE also maintains a number of secondary roads off Canyon Road which provides access to ancillary facilities associated with the project.

Mammoth Pool Project

As currently licensed, the Mammoth Pool Project occupies approximately 2,035.84 acres in unincorporated portions of Madera and Fresno counties. The project area straddles the Sierra National Forest Pineridge Ranger District in Fresno County and the Bass Lake Ranger District in Madera County. The project occupies 2,029.68 acres[49] of federal lands administered by the Sierra National Forest. No state or county owned lands are within the project boundary. Privately owned land within the project boundary is located in the Kinsman Flat area where the Mammoth Pool powerhouse-Big Creek 3 transmission line alignment crosses a private land parcel.

Non-industrial land uses within the project boundary are recreation-oriented. These include: a boat-in campground, boat launch, and picnic area at the Mammoth Pool reservoir. The lands adjacent to the project area are Forest Service lands and the land uses are primarily natural resource conservation or recreation based. Pursuant to the Sierra National Forest Land and Resource Management Plan, the Mammoth Pool Project is within Management Area 1 and Analysis Area 28 (Mammoth Pool) (Forest Service, 1991). This is an area where developed recreational opportunities such as public campgrounds, day-use areas, visitor information centers, resorts, and recreational residences are emphasized.

The recreation-related facilities in the vicinity of the Big Creek ALP Projects include the Mammoth Pool Campground (located adjacent to the northern upstream extent of the reservoir along the San Joaquin River) and the Ansel Adams Wilderness, which was designated in 1964.

Roads and trails needed for the operation and maintenance of the project provide access to four geographic areas: (1) Mammoth Pool dam and reservoir; (2) Shakeflat helicopter landing site, trail and stream gage; (3) Mammoth Pool powerhouse; and (4) Mammoth Pool powerhouse-Big Creek 3 transmission line.

The Mammoth Pool reservoir is accessed via Minarets Road (FS Road No. 4S81), a Madera County road, and FS Road Nos. 6S25 (Mammoth Pool Road) and 6S76. Mammoth Pool Road provides access to the Mammoth Pool dam and spillway, and is maintained by the Forest Service from Minarets Road to the project boundary at the dam and spillway. Mammoth Pool boat ramp is accessed via FS Road No. 6S76 which is maintained by the Forest Service. In cooperation with the Cal Fish & Game, the Forest Service closes Mammoth Pool Road to vehicular traffic each year between May 1 and June 15, to protect mule deer during the spring migration season.

Mammoth Pool powerhouse is accessed via FS Road No. 8S03. This road is maintained by the Forest Service and is open to public access from Minarets Road (FS Road No. 4S81) to the San Joaquin River. At the San Joaquin River crossing, public vehicular access is restricted by a SCE-controlled gate. SCE maintains the road beyond the locked gate.

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[49] See 99 FERC ¶62,191, Order Amending License, Approving Revised Exhibits and Revising Annual Charges (June 14, 2002).

SCE maintains a number of roads along the Mammoth Pool powerhouse-Big Creek 3 transmission line corridor and public vehicle access to these roads is restricted and controlled by SCE locked gates. These roads include FS Road Nos. 8S44 and 9S42, and a number of spur roads.

Big Creek No. 3 Project

As currently licensed, the Big Creek No. 3 Project facilities, owned and operated by SCE, occupy 508.14 acres of land in unincorporated Fresno County. The project area is located in the San Joaquin River canyon of the Sierra National Forest, Pineridge Ranger District. Total federal land occupied by the project is 508.14 acres.[50] No state or county owned lands are within the project boundary. Private lands within the project boundary, owned and managed by SCE, are located near Powerhouse 3.

The community of Big Creek 3, located adjacent to Powerhouse 3, includes administrative offices, maintenance shops, and facilities that support the hydroelectric operations in the lower canyon area. The community also includes three employee housing structures. The lands associated with these support facilities and employee housing are located within the project boundary.

Non-industrial land uses in the project boundary are open space-oriented. Lands in the project boundary adjacent to Powerhouse 3 forebay are Sierra National Forest lands and are managed primarily for open space and natural resources.

Project facilities are accessed through a system of project roads and trails associated with the operation and maintenance of the project which provide access to two geographic areas:

- Dam 6 forebay and
- Powerhouse 3.

Dam 6 facilities are accessed via Canyon Road (FS Road No. 8S05) which is gated and closed to public vehicle access and maintained by SCE. There are three ways to access Dam 6 forebay: (1) from the Northern Hydro offices area by taking Huntington Lake Road and then Canyon Road along Big Creek to the San Joaquin River; (2) from the Powerhouse 3 area, by traveling north on Canyon Road along the San Joaquin River; or (3) from the Mammoth Pool powerhouse area by traveling south on FS Road No. 8S03, along the San Joaquin River.

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[50] By Order Approving Revised Exhibit K Drawings (122 FERC ¶ 62,241, March 20, 2008), the Commission authorized SCE to take a distribution line, telephone line, and other miscellaneous structures out of the project once it obtains the appropriate Forest Service permits. Removing these project features will reduce the federal lands from 508.14 to 421.33 acres.

Powerhouse 3 and the Big Creek No. 3 community are accessed via Jose Basin Road (a Fresno County maintained road) from the Northern Hydro offices through the community of Auberry, or by Canyon Road (FS Road No. 8S05) from Dam 6 forebay. SCE also uses and maintains a number of spur roads in the Big Creek No. 3 area.

Aesthetic Resources

SCE, in consultation with resource agencies and stakeholders, conducted a visual quality assessment to evaluate the visual compatibility of project facilities with the surrounding landscapes. The aesthetic character and visual effects of the four Big Creek ALP Projects was evaluated using the Forest Service's Visual Management System. This consultation and subsequent analysis was conducted in support of the Big Creek ALP (SCE, 2003j; 2004).

Big Creek Nos. 2A, 8, and Eastwood Project

The Upper Basin consists of an upper high alpine plateau of Jeffrey pine and white fir/lodgepole pine forest. It is in a predominantly granite landscape that abuts the rugged peaks of the high Sierra Mountains to the east. The South Fork San Joaquin River Canyon is also a dominant feature in the Upper Basin area. The project features in this landscape setting include: Florence dam, Bear Creek and Mono Creek diversions and forebays; eight small diversion facilities that are located on small tributaries to the South Fork San Joaquin River; and the Mono-Bear siphon control flow line.

Florence Lake is a large, high elevation alpine lake located in a glacial valley surrounded by large granite domes and mountains. The area around the dam and lake is surrounded by Jeffrey pine and white fir/lodgepole pine forests. It is interspersed with mixed Montane chaparral along the lake shoreline. Vehicular access to the reservoir is limited to locations on its northwestern shore near the dam and boat launch. The upstream shores of the reservoir are only accessible by boat or on foot. Florence Lake is managed by SCE to reach peak storage in the summer, and then is reduced in the fall to its lowest level during the winter to avoid water freezing on the dam face. During summer, when reservoir levels are high, there is relatively little exposed shoreline. However, in the fall and winter with reduced water surface elevation, the shoreline becomes exposed. The Forest Service designates the area around Florence Lake as a visual "Retention" area under its Visual Quality Objective (VQO) criteria. Retention areas imply a high degree of scenic integrity where the landscape appears to be intact.

The Mono-Bear siphon control flow line is visible at its crossing over the South Fork San Joaquin River. It is adjacent to a portion of Kaiser Pass Road immediately north of the South Fork San Joaquin River. The area is dominated by granitic boulder outcrops interspersed with areas of mixed Montane chaparral. The designated VQO around the flow line is "Retention."

The Bear Creek diversion and forebay is a moderate-sized dam and water body located in an area of granitic outcrops amongst Jeffrey pine and white fir/lodgepole pine forests. Access to the dam and forebay is by a 4-wheel drive road (FS Road No. 6S83). Views of the dam and forebay are limited to visitors who travel specifically to the site. This facility is not visible from other locations in the Big Creek Basin. The designated VQO in the area around Bear Creek diversion and forebay is "Retention."

The Shaver Lake Basin area of the project consists mostly of steep mountains with dense Sierran mixed conifer forest and mixed Montane chaparral shrubs. The project features in this setting include Shaver Lake and dam, Balsam forebay and dam, Pitman Creek diversion, Balsam Creek diversion, and the 220 kV Eastwood to Big Creek No. 1 transmission line.

Shaver Lake is surrounded by a dense forest of mixed conifer forests and Montane chaparral shrubs interspersed with granite outcrops. It is surrounded by mountains along the west, north, and east. Shaver Lake is the largest lake in the Big Creek System. It has housing developments, recreational facilities, and commercial marina facilities along its western shore. Public road access to Shaver Lake is limited to the western shore. Road access is limited to the Forest Service, Cal Fish & Game, and SCE on the northern shore. The designated VQO around Shaver Lake is "Retention."

Balsam forebay is surrounded by chaparral and conifer forests. It is located on the ridge of granite peaks northeast of Shaver Lake. A foot trail provides public access to and around the forebay and vehicular access to Balsam forebay is from the southeast shore. Road access to the forebay is limited to SCE, Cal Fish & Game, and Forest Service vehicles. The designated VQO around Balsam forebay is "Retention."

The Lower Big Creek Canyon area consists mostly of a steep, narrow river canyon, characterized by a bare, rocky riverbank in a dry setting of chaparral and oak woodland. The project facilities viewed in this vicinity include Dam 5 and impoundment and Powerhouses 2A and 8. Access to these facilities is along Canyon Road; public vehicles are restricted. The designated VQO in the area around Dam 5 and forebay is "Retention." In the area of Big Creek 8 Powerhouse it is "Retention/Partial Retention." Partial retention refers to landscapes where the valued landscape characters appear slightly altered.

One key observation point, the Mono-Bear siphon control flow line over the South Fork San Joaquin River, was identified in consultation with the Forest Service as a project feature that can be viewed from Kaiser Pass Road.

Big Creek Nos. 1 and 2 Project

The Big Creek Nos. 1 and 2 Project occupies terrain which includes Huntington Lake, dense Sierran mixed conifer forest, the surrounding peaks of resistant sedimentary roof pendants, granitic outcrops to the north, and remnant volcanic peaks to the southeast. Lower in elevation below Huntington Lake is Big Creek Canyon; a steep narrow canyon characterized by mixed conifer forest transitioning to oak woodland with interspersed granitic outcrops. Kerckhoff Dome, a large granite dome, is a dominant feature in the landscape and is located in the background of the Big Creek community.

Huntington Lake is located in a valley surrounded by mountains to the south, east and north. Huntington Lake is a large, man-made, high mountain reservoir that supports developed recreational use. The area is vegetated with Sierran mixed conifer forest and mixed Montane chaparral shrubs. Project features viewed in the vicinity of Huntington Lake include the reservoir and Dams 1, 2, 3, and 3A, located at the southwest end of the lake. Views of the dams are generally limited to motorists along Huntington Lake Road and to visitors in the immediate vicinity of the dams.

Public access to Huntington Lake is from the southeast via Highway 168, and from the southwest from the town of Big Creek via Huntington Lake Road, which provides public access to the lake along its northern shore. A number of private cabins are located along the northern shores of Huntington Lake. There are seven developed campgrounds around the lake, mostly located along the northern shore. The water surface elevation of the lake is managed by SCE to include spill prevention and keeping the lake at near maximum capacity to support recreational uses from Memorial Day through Labor Day. To protect the dam structures during the winter season, and to prepare for spring run-off, the water surface elevation of the lake is reduced in the fall, after the peak recreational season. This reduction typically exposes an observable shoreline ring.

The project features viewed in the Big Creek Canyon area include: SCE's administrative buildings and company housing; Dam 4 and forebay; and Powerhouse 1 penstocks and switchyard. Powerhouse 2 is not readily viewed by the public as it is located down Big Creek Canyon along Canyon Road, which is not open to public vehicular access. The Northern Hydro administrative facilities and company housing, Powerhouse 1 penstocks switchyard, and Dam 4 forebay are all located in a mixed conifer forest setting. Views of the community, powerhouse, dam, and forebay are limited by the steep narrow river canyon and forest vegetative growth bordering the road. However, from Huntington Lake Road, motorists can view the penstocks for Powerhouse 1 adjacent to Kerckhoff Dome and the Big Creek No. 1 switchyard next to the powerhouse. The designated VQO in this vicinity is "Retention."

Two key observation points were identified along Huntington Lake Road. From these key observation points along Huntington Lake Road the general public can easily view the Big Creek No. 1 penstocks and the switchyard. These key observation points were identified in consultation with the Forest Service.

Mammoth Pool Project

The dam and reservoir occupy terrain which consists of steep sided granite mountains in a mixed conifer and oak woodland transition zone forest. The reservoir shoreline consists of exposed granite outcrops interspersed with areas that are vegetated with shrubs and trees. Access to the reservoir is limited to locations on its south shore near the dam, boat launch, and developed campground. The northwest and southeast shores of the reservoir are only accessible by boat or on foot. The reservoir is managed by SCE to maintain a relatively stable water surface elevation during the recreational season. During the fall and late winter the reservoir water surface elevation is reduced in preparation for the capture of spring run-off, exposing a ring of barren shoreline around the perimeter of the reservoir. The designated VQO in the area around Mammoth Pool reservoir is "Retention."

The area around Mammoth Pool powerhouse consists of a steep, narrow river canyon characterized by a bare, rocky riverbank in a dry setting of chaparral and oak woodland. The project facilities viewed in this landscape include the Mammoth Pool powerhouse and penstocks. Public access to the location is via FS Road No. 8S03 from Minarets Road located on the ridge to the west of the powerhouse and canyon. The designated VQO in the area of Mammoth Pool powerhouse and penstocks is "Partial Retention/Modification."

One key observation point along FS Road No. 8S03 was identified in consultation with the Forest Service where the general public can easily view the Mammoth Pool powerhouse and penstock when looking in a southeasterly direction.

Big Creek No. 3 Project

The significant landscape feature in the vicinity of the Big Creek No. 3 Project is the San Joaquin River Canyon. It is characterized by a steep, narrow river canyon, commonly referred to as Chawanakee Gorge. This reach of the river is interspersed with sections where the canyon is deeply incised as the river cuts through large granitic domes, exposing dramatic views of sheer granite walls along the edge of the canyon. Project features within this landscape include Dam 6 at the upper reach of the project, the Powerhouse 3 and penstocks, and Big Creek No. 3 administrative facilities.

Dam 6 and its forebay are located at the confluence of Big Creek and the San Joaquin River. The landscape is of a steep, narrow river canyon in a dry oak woodland and chaparral setting. The forebay is confined in the narrow canyon, and is subject to limited fluctuation of water surface elevation. Public vehicle access is only available at the upstream northern extent of the forebay. This location is accessible by FS Road No. 8S03 from Minarets Road, located on the ridge to the west of the forebay. At the river crossing of FS Road No. 8S03, there is a public parking area and a locked gate that restricts public vehicle access along the eastern shore of the forebay. The view of Dam 6 is limited, due to the narrow canyon and public vehicular access is restricted by a SCE-controlled gate. The designated VQO in the vicinity of Dam 6 is "Partial Retention."

Powerhouse 3 and its associated penstocks are located on the San Joaquin River at the upstream end of Redinger reservoir. The topography opens up into a small basin area, commonly referred to as Jose Basin. This small basin is an area of rolling hills in dry oak woodland and grassland setting that is surrounded by steep mountains. Access into the basin is provided by Italian Bar Road from the west and Jose Basin Road from the south. Public vehicular access upstream along the San Joaquin River is restricted and controlled by a locked gate.

Powerhouse 3 and penstocks are located against the steep granite mountain located at the mouth of Chawanakee Gorge. The views of these facilities from Italian Bar Road or Jose Basin Road are limited by the narrow steep topography. However, the powerhouse and penstocks are easily viewed by boaters on the upstream end of Redinger reservoir. The designated VQO in the vicinity of Powerhouse 3 and penstock is "Partial Retention."

The Big Creek No. 3 administrative facilities consist of a number of administrative support buildings in an area of rolling hills in an oak woodland and grassland setting. Views of project facilities are generally limited to motorists traveling along Jose Basin Road. The designated VQO in the vicinity of Big Creek No. 3 administrative facilities is "Partial Retention."

One key observation point was identified from Redinger reservoir and Italian Bar Road in consultation with the Forest Service where the general public can easily view the Big Creek No. 3 penstocks.

3.3.6.2 Environmental Effects

Project Boundary Revisions

Big Creek Nos. 2A, 8, and Eastwood Project

SCE proposes to remove eight parcels from the Big Creek Nos. 2A, 8, and Eastwood Project boundary. SCE states that the parcels proposed to be removed are lands that are not needed for access to, or for the safe and efficient operation and maintenance of, the Big Creek Nos. 2A, 8, and Eastwood Project. The eight parcels include: lands located southwest of powerhouses 2 and 2A and along the southern side of Rancheria Creek; Eastwood Overflow Campground; Eastwood Overlook; two Forest Service roads (FS Road No. 5580H, the access road to Bolsillo Creek diversion from FS Road No. 5S80 and FS Road No. 9S311 from Highway 168 to the Eastwood power station switchyard); Chinquapin diversion piping; and the Florence Lake day-use area. SCE proposes to add 27 parcels to the project boundary which include: 11 project roads; 4 foot trails leading to project facilities; 3 gaging stations; and 9 helicopter landing sites. SCE states that the parcels proposed to be added are lands necessary for the maintenance and safe and efficient operation of the project.

Areas proposed for inclusion in the project boundary include:

- FS Road No. 8S08A, the access road to the upper penstock valves for Tunnel 5 from FS Road No. 8S08 (Railroad Grade Road);
- Bolsillo Creek diversion and Stream Gage Trail
- Chinquapin Creek diversion and Stream Gage Trail;
- FS Road No. 9S17 access road to Eastwood power station – Big Creek 1 transmission line tower M0 T3;

- FS Road No. 9S312, access road to Eastwood power station switchyard;
- Gaging station on the South Fork San Joaquin River above Hooper Creek confluence (SCE gage no. 128S);
- FS Road No. 8S83 from the current project boundary for Big Creek Nos. 1 and 2 Project to the Huntington-Pitman-Shaver siphon;
- FS Road No. 8S94, Pitman Creek diversion access road;
- FS Road No. 9S32C, access road to the Eastwood power station-Big Creek No. 1 transmission line;
- FS Road No. 8S47, access road to the Eastwood power station-Big Creek 1 transmission line;
- FS Road Nos. 8S02 and 8S02B, access road to the Huntington-Pitman-Shaver tunnel adit;
- FS Road No. 9S58, access road to Eastwood power station and the North Fork Stevenson Creek gage;
- FS Road No. 9S58K, access road to Eastwood power station entrance tunnel;
- Access road to Eagle Point boat-in day-use area;
- Trail to Big Creek stream gage below Dam 5;
- Bear Creek Stream Gage Trail;
- Gaging station on South Fork San Joaquin River below Hooper Creek confluence (SCE gage no. 129);
- Land surrounding the gaging station on Hooper Creek below Hooper Creek diversion (SCE gage no. 114) and the Hooper Creek diversion helicopter landing site; and
- Helicopter landing sites at South Fork San Joaquin River at Florence spill station; Summit at Shaver Hill; Tiffany Pines at Camp Edison; Bear Creek diversion; South Fork San Joaquin River below Hooper Creek; Mount Givens telecom site; Florence Lake dam; Mono Creek diversion; and Mono Creek below Lake Edison.

Our Analysis

According to 18 CFR 4.51(h), land included within a project's boundary must enclose those lands necessary for operation and maintenance of the project and for other project purposes such as recreation, shoreline control, or protection of environmental resources. The Big Creek Nos. 2A, 8, and Eastwood Project covers the largest geographical area of all seven projects in the Big Creek System. Pursuant to SCE's request to include the three gaging stations, access is important to SCE's ability to monitor flows within the project's water conveyance system at remote sites.

The nine helicopter landings, eleven roads, and four foot trails proposed to be added to the project boundary would all be used frequently by SCE for project purposes to gain access to project facilities, the transmission line, and stream gages located in remote areas during all types of weather.

Eastwood Overflow Campground is used as a designated Forest Service dispersed camping area when developed campgrounds at nearby Huntington Lake are full. The Forest Service allows camping here for a maximum of 24 hours. The Eastwood Overlook is located on 2 acres of land near Portal powerhouse at the north end of Huntington Lake. The overlook provides an interpretive display containing signs, maps, and project area information. The facility features several informational signs about the Big Creek System. SCE states the Eastwood Overflow Campground is more strongly associated with recreational use at Huntington Lake, a primary feature of Big Creek Nos. 1 and 2 Project, than it is with the Big Creek Nos. 2A, 8, and Eastwood Project. SCE recommends the campground and overlook be removed from the Big Creek Nos. 2A, 8, and Eastwood Project boundary and included in the Big Creek Nos. 1 and 2 Project. Commission staff analyzed this issue during the relicensing of the Portal Project (Project No. 2174) and agreed that the removal of these facilities from the Big Creek Nos. 2A, 8, and Eastwood and Portal projects and their incorporation into the Big Creek Nos. 1 and 2 Project would ensure the three project boundaries no longer overlap and the two facilities would be managed under one project's management strategy. This action would not affect the Forest Service's management capabilities of the Eastwood Overflow Campground or uses of these parcels.

The Florence Lake day-use area is located near the Florence Lake boat ramp by the Crater Creek diversion channel that flows into the northwestern corner of Florence Lake. The day-use area consists of 16 picnic sites, a toilet, and dumpster and is operated and maintained by the Forest Service. SCE's proposal to remove the Florence Lake day-use area from the project boundary would remove an existing facility that provides public use and access to the project. SCE has not demonstrated that these facilities and lands are no longer required for project purposes and that there is no nexus of these lands and facilities to the project and public recreational access to project resources. By maintaining the Florence Lake day-use area within the project boundary, the Commission would retain the authority to ensure that SCE provides long-term public use and access at these facilities.

The Florence Lake boat ramp would remain within the project boundary and would help ensure that long-term public access to the project's reservoir for recreational opportunities over the term of a new license.

Approximately 16.48 acres located southwest of Powerhouses 2 and 2A are proposed to be removed from the project boundary. Land use for this area has changed since the project was first licensed. Formerly, this land was occupied by SCE company housing. The structures have been removed and the land has been restored after consultation with the Forest Service. In addition, 12.53 acres located along the southern side of Rancheria Creek from approximately 500 feet upstream of Portal powerhouse downstream to Huntington Lake is proposed to be removed from the project boundary. These lands are not used by SCE and SCE states it does not require any access to these lands for the operation of the project. A review of the record for this proceeding does not indicate any formal recreational facilities or shoreline issues on these lands.

FS Road No. 5580H (access road to Bolsillo Creek diversion, from FS Road No. 5S80) and the access road to the Bolsillo Creek diversion are proposed to be removed from the project boundary. FS Road No. 5S80 is open to public access and provides access to the Forest Service's Bolsillo Campground, a Forest Service horse corral, and the Corbett Lake trailhead. This road is not used by SCE for project purposes and would not affect the Forest Service's management capabilities.

The Chinquapin diversion piping and co-aligned segment of FS Road No. 7S01 is also proposed to be removed from the project boundary. The Chinquapin diversion was relocated in 2002 and the associated steel diversion piping alongside of the road was removed at that time. The change in land use associated with these lands no longer requires SCE to access them and their removal from the project boundary would not affect the operation of the project or the Forest Service's management capabilities.

FS Road No. 9S311 from Highway 168 to the Eastwood power station switchyard is also proposed to be removed from the project boundary. SCE employees use FS Road No. 9S312 to gain access to the switchyard which is a feature of the transmission grid and not associated with the hydroelectric project. Therefore, removal of this road would not affect project operations or the Forest Service's management capabilities.

Big Creek Nos. 1 and 2

SCE proposes ten modifications to the Big Creek Nos. 1 and 2 Project boundary. Six modifications include the removal of lands from the project boundary. SCE states that the parcels proposed to be removed are lands that are not needed for access to, or for the safe and efficient operation and maintenance of, the Big Creek Nos. 1 and 2 Project. These modifications include: a portion of Rancheria Creek; a portion of a road right-of-way along a Forest Service road; a communication line right-of-way; former company housing areas; a Forest Service road; and excess lands near Powerhouses 2 and 2A. Four modifications include the addition of lands within the project boundary. These modifications include: the Eastwood Overflow Campground; the Eastwood Overlook; and two Forest Service roads. SCE states in its application that all these parcels proposed to be added are lands necessary for the maintenance and safe and efficient operation of the project. The Forest Service concurs with the project boundary changes SCE is proposing at the project.

Our Analysis

SCE proposes to add the access road beginning from the gate located at the terminus of Fresno County Road 3380 (Huntington Lodge Road) to the west end of Dam 2 (FS Road No. 8S66) and the segment of FS Road No. 8S83 from the junction with FS Road No. 8S83A to the current project boundary to the project boundary. SCE uses both of these roads to access project facilities in the vicinity of Dams 1 and 2.

SCE proposes to take out of the project boundary the area surrounding Rancheria Creek from Portal powerhouse to the high water line of Huntington Lake (Portal tailrace). This reach is primarily affected by flow through the Ward Tunnel and is currently included in the project boundaries of two other FERC licensed projects (Big Creek Nos. 2A, 8, and Eastwood, Project No. 67; and Portal Project, Project No. 2174). Commission staff analyzed this issue during the relicensing of the Portal Project and concurred with SCE's recommendation that this reach be removed from the Portal Project (FERC, 2006) boundary. Removal of this reach from the Big Creek Nos. 1 and 2 Project would be consistent with the action proposed for the Portal Project. Since this reach is the primary water conveyance from the back-country diversions, which are largely part of Project No. 67, protection of this reach under the Big Creek Nos. 2A, 8, and Eastwood Project would ensure the project's continued operation.

The right-of-way along the access road to the gaging station located on Big Creek below Huntington Lake (FS Road Nos. 8S66 and 8S66A) is proposed to be reduced from 100 ft to 50 ft. The project boundary is proposed to be modified to align with two road segments as follows: (1) FS Road No. 8S66 from near the east end of Dam 2 to the intersection with FS Road No. 8S66A; and (2) FS Road No. 8S66A from FS Road No. 8S66 to the gaging station. Aligning the project boundary with project roads would allow for easier administrative management of project lands. Removal of these lands would not change the Forest Service's management capabilities or change SCE's responsibilities under the Transportation System Management Plan, discussed later in this section.

Two parcels of land that have been used in the past for company housing areas are proposed to be removed from the project boundary. The land use for both parcels has changed since the project was first licensed. The structures have been removed and the land has been restored after consultation with the Forest Service. SCE does not need continued access to these lands; therefore, they are not necessary for project purposes. A review of the record for this proceeding indicates no formal recreational facilities or shoreline issues within the 36.19 acres proposed for removal from the project boundary.

The segment of FS Road No. 8S13 between the gate near the top of the penstocks for Powerhouses 2 and 2A and FS Road No. 8S08 (Railroad Grade Road) is proposed to be removed. SCE uses Canyon Road (FS Road No. 8S05) as its primary access to project facilities in this area. SCE does not use this road, and it not needed for project purposes.

The communication line right of way from the dispatcher's office near Powerhouse 3 to Powerhouse 2 and the Northern Hydro offices near Powerhouse 1 is proposed to be removed. The land use for this area has changed and the communication line and associated equipment have been removed, after consultation with the Forest Service. Communication between the project facilities is currently conducted via microwave transmission or by fiber optic cable. SCE does not need access to this area any more and the land is not needed for any project purpose.

Mammoth Pool Project

SCE proposes two project boundary modifications to include a helicopter landing site adjacent to the San Joaquin River above Shakeflat Creek and trail along Shakeflat Creek that would provide access leading to the stream gage (SCE gage no. 157) located on the San Joaquin River. The net change in project area would be an increase of 3.6 acres, revising the total federal land acreage within the project to 2,033.28. The Forest Service concurs with these project boundary changes.

Our Analysis

SCE's request to include the trail and helicopter landing in the project boundary in order to access SCE gage no. 157 is important to SCE's ability to monitor flows within the project's water conveyance system at remote sites. The helicopter landing is needed to access the trail and maintain the stream gage. The helicopter landing and foot trail would be used frequently by SCE for project purposes to gain access to the project stream gage, located in a remote area of the project, during all types of weather.

Big Creek No. 3 Project

SCE proposes to remove 44.17 acres of federal land above the high water line around Dam 6 forebay. SCE states the land is not needed for access to the forebay or for the operation and maintenance of the project. The net change in project area would be a reduction of 44.17 acres, ultimately revising the total federal land acreage to 377.16 acres. The Forest Service concurs with the project boundary changes SCE is proposing at the project.

Our Analysis

A review of the record for this proceeding does not indicate any formal recreational facilities or shoreline issues on the 44.17 acres proposed for removal. The area does is not needed for project operations or maintenance needs; therefore, SCE does not need access to these lands for project purposes.

Land Management Plans

Transportation System Management Plan

The Transportation System Management Plan was developed for all four Big Creek ALP Projects subject to this environmental analysis. SCE proposes to implement the Transportation System Management Plan filed as appendix N in the Settlement

Agreement. The plan's objective is to address transportation system management issues in a comprehensive manner and put all requirements of the license in one plan that would cover the Big Creek System. The plan addresses road and trail issues related to access, maintenance activities, rehabilitation needs, road use, and traffic control measures. The plan describes measures that SCE would implement to repair, minimize, or eliminate effects associated with the maintenance and operation of SCE's Big Creek ALP Projects. The plan addresses only those project roads and trails that are located within the project boundaries or used by SCE for the operation and maintenance of the project.

The plan states that SCE would maintain roads and trails outside license boundaries where the primary purpose is to provide access for SCE to operate its facilities. These roads would be authorized by a Road Use Permit and SCE would be responsible for maintenance at a rate commensurate with its use. The Forest Service would calculate commensurate share responsibilities based on SCE access to SCE facilities. Estimates may be based on traffic surveillance, recreational use reports, or estimates derived through observation. SCE may perform maintenance of these roads and/or provide the Forest Service with deposits for maintenance activities at the Forest Service's discretion.

The plan states SCE would have full responsibility and would take appropriate measures to rehabilitate unsafe conditions or resource damage on project roads and trails. SCE would consult with the Sierra National Forest annually to identify road rehabilitation and maintenance projects and other activities that would be performed each year.

Big Creek Nos. 2A, 8, and Eastwood Project

Forest Service specifies in condition 19, implementation of the Transportation System Management Plan included as appendix N in the Settlement Agreement. The condition is generally consistent with the Settlement Agreement. SCE responded to Forest Service condition 19 and made 12 corrections in the Forest Service's table 1. These corrections included changes in road length and SCE operation and maintenance activities conducted on specific roads.[51] In addition, SCE states that condition 19 included non-project roads that would be regulated by the Forest Service, not by SCE. SCE states the manner in which non-project roads will be addressed does not belong in a 4(e) condition.

Big Creek Nos. 1 and 2, Mammoth Pool, and Big Creek No. 3 Projects

Forest Service condition 18 specifies implementation of the Transportation System Management Plan included as appendix N in the Settlement Agreement. For the

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[51] In its draft EIS comments, the Forest Service indicated that it would provide copies of the tables that should have been included as agreed to in the Settlement Agreement with its revised final section 4(e) conditions (letter from E. Cole, Forest Supervisor, Sierra National Forest, Clovis, CA to the Commission, October 29, 2008.

Mammoth Pool Project, the Forest Service also states that SCE would continue to maintain the graded natural road surface on portions of the road that have a shared alignment, and also at those locations where the San Joaquin River Trail crosses a project road. The condition is generally consistent with the Settlement Agreement.

SCE's response to Forest Service condition 18 for the Big Creek Nos. 1 and 2 Project included 3 corrections to the Forest Service's Table 1 Project Roads and 20 corrections for Big Creek Project No. 3. These corrections included changes in road length and SCE operation and maintenance activities conducted on specific roads.[52] In addition, SCE states that non-project roads and how those roads would be regulated by the Forest Service does not belong in a 4(e) condition.

Our Analysis

The Transportation System Management Plan helps to clarify SCE use of Forest Service roads and trails and establish a forum for coordination of road maintenance activities between SCE and the Forest Service. This plan delineates SCE's responsibilities for maintaining project roads and trails used for project operations and maintenance and ensures that safety and environmental measures associated with these roads are addressed in the proper manner.

The establishment of the cost-sharing agreement for non-project roads based on use classification helps provide an equitable basis for funding the maintenance of project related roads among users. Roads and trails located outside of the project boundary are not subject to Commission jurisdiction or the terms and conditions of the license, therefore, outside of the scope of 4(e) conditions.

Land Resource Plans

The Forest Service specifies in its conditions that SCE would develop and file with the Commission, in consultation with the Forest Service, Land Resource Plans that are approved by the Forest Service, as they relate to resource management on the National Forest. The plans would include a Fire Management and Response Plan and a Visual Resources Plan.

Fire Management and Response Plan

SCE states that fire management responsibility in the Big Creek ALP Projects' vicinity falls to the Forest Service and local fire districts. SCE states that mutual aid agreements are in place for the fire responders to assist each other. SCE maintains a basin-wide fire plan that is developed and reviewed annually in consultation with the Forest Service. The plan outlines responsibilities for fire prevention and suppression during planned field activities for the duration of each declared fire season, or when ground litter and vegetation would sustain combustion, causing the spread of fire. The

[52] See footnote 51.

plan also includes initial attack and reporting procedures that would be followed in the event of a fire in the vicinity of the projects, or resulting from any SCE operations on federal lands.

Forest Service conditions specify that SCE, within 1 year of license issuance, file with the Commission a fire prevention and response plan that is approved by the Forest Service, and developed in consultation with appropriate state and local fire agencies. The plan would set forth in detail SCE's responsibility for the prevention (excluding vegetation treatment as described in Forest Service condition 16), reporting, control, and extinguishing of fires in the vicinity of the Big Creek ALP Projects resulting from project operations. At a minimum the plan would address the following categories: (1) fuels treatment/vegetation management; (2) prevention; (3) emergency response preparedness; (4) reporting; and (5) fire control/extinguishing. Forest Service conditions further describe the cooperative relationship that would be maintained during investigations of fires on project lands.

Our Analysis

The development of a fire management response plan would inform Forest Service staff of potential threats to natural resources and project facilities from project induced fires, and how to protect project facilities from natural wildfires. The fire management response plan would enable the Forest Service to prepare or train staff to assist in preventing or controlling fires on or adjacent to project facilities for the protection of the project or natural resources. The plan would identify the cooperative roles and responsibilities of SCE and the Forest Service in fire investigation on project lands.

Visual Resources Plan

The Visual Resources Plan was developed for all four Big Creek ALP Projects subject to this environmental analysis. SCE proposes implementing the Visual Resources Plan included as appendix M of the Settlement Agreement. The plan includes an evaluation of existing visual resources in the projects' vicinity, mitigation measures for facilities that have been identified as currently having a visual effect on the landscape character, and a discussion for the selection of colors for future painting of project facilities to minimize potential visual effects on aesthetic resources.

The Visual Resources Plan states SCE would consult with the Forest Service for the selection of three test colors to be used in test patches that blend best with the surrounding environment. SCE would paint three 10 foot by 10 foot or other readily visible and appropriately sized test panels on the penstock and conduit using the agreed upon test colors. These test patches would be observed for a 1-year period to determine which color best blends with the natural environment. The 1-year period would allow for seasonal color contrast comparisons. SCE would select the final color in consultation with the Forest Service. SCE would repaint project facilities using the agreed upon color during the normal painting schedule for that facility.

The Visual Resources Plan states that a number of project facilities associated with the four Big Creek ALP Projects are proposed contributing elements of the National Register of Historic Places-eligible BCHSHD and are proposed key components of the historic landscape. Upon determination by the State Historic Preservation Officer (SHPO) of the Big Creek Historic District Designation and concurrence that the penstocks and flow line conduit are contributing elements of the BCHSHD, SCE would seek guidance from the SHPO regarding the selection of paint colors that would preserve the historic character of the BCHSHD. Upon approval by SHPO, SCE would seek approval from the Forest Service and the Commission. These facilities would be repainted using a color that retains the historic character of the BCHSHD.

According to the Forest Service, the following project facilities with a VQO of Partial Retention are noticeable deviations from the landscape character and are inconsistent with a Partial Retention VQO.

- for the Big Creek Nos. 2A, 8, and Eastwood Project: the Mono-Bear siphon control flow line conduit over the San Joaquin River from Kaiser Pass Road;
- for the Big Creek Nos. 1 and 2 Project: the Big Creek No. 1 penstocks from Huntington Lake Road;
- for the Mammoth Pool Project: the penstock area; and
- for the Big Creek No. 3 Project, the penstocks from Redinger reservoir.

In addition, according to the Forest Service the Big Creek No. 1 switchyard deviates from the landscape character and is inconsistent with a Retention VQO when viewed from Huntington Lake Road.

Forest Service conditions require that SCE implement the Visual Resources Plan, included in the Settlement Agreement, appendix M. The conditions are consistent with the Settlement Agreement.

Our Analysis

The landscape views of the project penstocks and Mono-Bear siphon control flow line over the San Joaquin River from Kaiser Pass Road have a VQO of Partial Retention. The facilities are deviations from the landscape character and are inconsistent with Partial Retention VQO. The project facilities are not compatible with the current Forest Service VQOs for the area. SCE's implementation of the Visual Resources Plan, specifically the selection of neutral paint color schemes that blend in with the surrounding landscapes, would reduce visual effects to the aesthetic resources at the project.

The landscape view of the Big Creek No. 1 switchyard can be viewed from one location along Huntington Lake Road when looking across Big Creek Canyon. The facilities are deviations from the landscape character and are inconsistent with Partial Retention VQO. The project facilities are not compatible with the current Forest Service VQOs for these areas. SCE's implementation of the Visual Resources Plan, specifically the selecting of neutral paint color schemes that blend in with the surrounding landscapes and the screening of the Big Creek No. 1 switchyard would reduce visual effects to the aesthetic resources at the project.

Sign Plan

Forest Service condition 20 (Project No. 67) and 19 (Project Nos. 120, 2175, and 2085) specify that SCE prepare a Sign Plan (as a component of the Land Resource Plans) in consultation with the Forest Service, California Department of Transportation, Fresno County, and other interested parties, within 1 year of license issuance. The plan would conform to the Manual of Uniform Traffic Control Devices, Forest Service sign handbook, and other applicable standards. The Forest Service specifies that the Sign Plan should at a minimum include the measures for sign format/consistency and the location, design, size, color, and message for the following types of signs: information and education, fire prevention, regulatory and warning, project license, road, recreational, directional (to assist non-local visitors), and safety.

The Forest Service also specifies that the Sign Plan address maintenance standards so that all signs are maintained in a neat and presentable condition and that signs which are to be placed on National Forest System lands be approved by the Forest Service. The Forest Service specifies that SCE would not be required to consult or obtain the prior approval of the Forest Service for signs on SCE-owned land that are not visible from National Forest System lands. The Forest Service specifies that SCE implement the Sign Plan upon Commission approval of the plan.

Our Analysis

Development and implementation of a Sign Plan and associated measures for the Big Creek ALP Projects would provide the means for coordinated and systematic development of signage associated with the projects. The Sign Plan, as specified by the Forest Service, would also provide the means to ensure that signage within the Big Creek ALP Projects conforms to applicable standards and are maintained and conform to Forest Service standards on lands that are visible from National Forest Service lands. Review and approval of the Sign Plan by the Commission would ensure that the recommended components of the Sign Plan conform to Commission regulations for licensed hydropower projects.

3.3.7 Air Quality

3.3.7.1 Affected Environment

The California Air Resources Board (CARB), as part of the California Department of Environmental Protection, is responsible for protecting public health and the environment from the harmful effects of air pollution. Pollutants associated with air emissions, such as ozone, particulate matter, and nitrogen dioxide, are associated with respiratory illness. Carbon monoxide, another air pollutant, can be absorbed through the lungs into the bloodstream and reduce the ability of blood to carry oxygen. Sources of air emissions include commercial facility operations, fugitive dust, on-road vehicles and trucks, aircraft, boats, trains, and natural sources such as biogenic and geogenic hydrocarbons and wildfires.

The topography and meteorology of the western slope of the Sierras are the important factors in the environmental effects of air quality emissions. Dispersion of high pollutant concentrations in downwind areas is hindered by the mountainous topography. Frequent inversions, in which warm air overlays cool air, trap pollutants close to the ground. In summer, long days, stagnant air, and high temperatures facilitate photochemical production of ozone from precursor air pollutants such as volatile organic compounds and oxides of nitrogen. Although the San Joaquin Valley is influenced by pollutants transported from other air basins, the effect declines from north to south. Most of the air pollution caused from ozone in the valley is a result of local emissions from agricultural operations, motor vehicle emissions, and larger industrial sources such as oil production and refining in the southern portion of the San Joaquin Valley (CARB, 2001). CARB has designated Fresno and Madera counties, which are located in the eastern portion of San Joaquin Valley Air Basin, as a severe impact zone for ozone measured over a 1-hour period (CARB, undated).

The central portion of the San Joaquin Valley, which includes the city of Fresno, has a rapidly growing population. Recently, the Fresno area has experienced the highest ozone concentrations in the valley, consistently violating the state ozone standard. These violations are predominantly caused by local emissions (CARB, 2001). From the San Joaquin Valley, winds carry pollution eastward up the canyons of the western Sierra Nevada during the day, as far as the crest of the mountains. This conduit includes the area in which the Big Creek ALP Projects are located. From there, pollutants flow east via gaps in the crest, contributing to ozone violations in the Mammoth Lakes area on the eastern slope of the Sierra Nevada (CARB, 2001).

To reduce harmful exposure to air pollutants, the federal Clean Air Act requires EPA to set outdoor air quality standards for the nation with the option for states to adopt additional or more protective standards if needed. CARB has adopted ambient (outdoor) air quality standards that are more protective than federal standards and has implemented standards for some pollutants not addressed by federal standards. An ambient air quality standard establishes the concentration above which the pollutant is known to cause adverse health effects to sensitive groups within the population such as children and the elderly. The goal is for localized project effects not to cause or contribute to an exceedance of the standards. Criteria pollutants for which ambient air quality standards have been established are ozone, carbon monoxide, lead, nitrogen dioxide, particulate matter, sulfur dioxide, sulfates, hydrogen sulfide, and vinyl chloride. California and federal ambient air quality standards for criteria pollutants are presented in table 3-25.

Table 3-25. California and federal ambient air quality standards. (Source: CARB, 2008)

Pollutant	Averaging Time	California Standards	Federal Standards	
			Primary	Secondary
Ozone (O_3)	1 hour	0.09 ppm (180 $\mu g/m^3$)	-	Same as primary standard
	8 hour	0.07 ppm (137 $\mu g/m^3$)	0.08 ppm (157$\mu g/m^3$)	
Respirable Particulates (PM_{10})	24 hour	50 $\mu g/m^3$	150$\mu g/m^3$	Same as primary standard
	Annual mean	20 $\mu g/m^3$	--	
Fine Particulates ($PM_{2.5}$)	24 hour	No standard	35 $\mu g/m^3$	Same as primary standard
	Annual mean	12 $\mu g/m^3$	15 $\mu g/m^3$	
Visibility Reducing Particulates	8 hour	Extinction coefficient of 0.23 per km; visibility of 10 miles or more	--	--
Carbon Monoxide (CO)	1 hour	20 ppm (23 $\mu g/m^3$)	35 ppm (40 $\mu g/m^3$)	None
	8 hour	9.0 ppm (10 $\mu g/m^3$)	9 ppm (10 $\mu g/m^3$)	
Nitrogen Dioxide (NO_2)	1 hour	--	--	Same as primary standard
	Annual mean	0.25 ppm (470 $\mu g/m^3$)	0.053 ppm (100 $\mu g/m^3$)	
Sulfur Dioxide (SO_2)	1 hour	0.25 ppm (655 $\mu g/m^3$)	--	--
	3 hour	--	--	0.5 ppm (1300 $\mu g/m^3$)
	24 hour	0.04 ppm (105 $\mu g/m^3$)	0.14 ppm (365 $\mu g/m^3$)	_
	Annual mean	--	0.03 ppm (80 $\mu g/m^3$)	--

Pollutant	Averaging Time	California Standards	Federal Standards	
			Primary	Secondary
Lead	30 day average	1.5 $\mu g/m^3$	--	--
	Calendar quarter	--	1.5 $\mu g/m^3$	Same as primary standard
	Rolling 3-month average	--	0.15 $\mu g/m^3$	
Sulfates	24 hour	25 $\mu g/m^3$	--	--
Hydrogen Sulfide	1 hour	0.03 ppm (42 $\mu g/m^3$)	--	--
Vinyl Chloride	24 hour	0.01 ppm (26 $\mu g/m^3$)	--	--

Existing Air Quality

To manage air quality problems, California is divided into 15 air basins, each of which is associated with an Air Quality Management District. The Big Creek ALP Project study area is located in Fresno and Madera counties, which are within the San Joaquin Valley Air Basin.

Both the California and federal governments use ambient air monitoring data to classify areas according to their attainment status with respect to criteria pollutants. These designations are used to identify areas with air quality problems and help determine whether project emissions would be considered significant under the NEPA and CEQA assessments. The three basic designation categories are:

- Attainment—indicates that ambient air quality is not in violation of the established standard for the specific criteria pollutant.
- Non-attainment—indicates that the ambient air quality violates the established standard for the specific criteria pollutant.
- Unclassified—indicates that there is currently insufficient data for determining attainment or non-attainment.

Fresno and Madera counties are currently in attainment for state standards for carbon monoxide, nitrogen dioxide, sulfur dioxide, sulfates, and lead, non-attainment for ozone and particulate matters ($PM_{2.5}$ and PM_{10}), and unclassified for hydrogen sulfide and visibility reducing particles. Both counties are also in attainment for national standards for carbon monoxide, nitrogen dioxide, and sulfur dioxide, and non-attainment for ozone and $PM_{2.5}$. On September 25, 2008, EPA reclassified the San Joaquin Valley as attainment for the PM_{10} national air quality standard (San Joaquin Valley Air Pollution Control District, 2008a).

During the years 2003 through 2005, the San Joaquin Valley recorded an average of 105 exceedance days per year for the national ozone standard. The 1990 amendments to the Clean Air Act require federal agencies to conform to applicable State Implementation Plans for non-attainment areas. State Implementation Plans are state air quality regulations that provide for the implementation, maintenance, and enforcement of the national ambient air quality standards and include emissions limitations and control measures to attain and maintain the standards. The San Joaquin Valley Air Pollution Control District developed the 2007 Ozone Plan as the State Implementation Plan for ozone non-attainment (San Joaquin Valley Air Pollution Control District, 2007a). From 1990 through 2005, valley-wide emissions of two ozone precursors, oxides of nitrogen and volatile organic compounds, have decreased by 42 percent and 37, respectively and ozone values measured at every monitoring site in the San Joaquin Valley were lower in 2005 than in 2003 (San Joaquin Valley Air Pollution Control District, 2007a).

The San Joaquin Valley Air Pollution Control District submitted a request for redesignation of the valley to attainment for PM_{10}, and a maintenance plan documenting steps that would be taken to ensure continued attainment of the national air quality standard (San Joaquin Valley Air Pollution Control District, 2007b). As previously noted, EPA designated the valley as attainment for PM_{10} in September 2008. According to Rule 8011, developed by the San Joaquin Valley Air Pollution Control District pursuant to guidance from EPA for serious PM_{10} non-attainment areas, activities conducted at an elevation of 3,000 feet or higher above msl are exempt from the required actions to prevent or reduce fugitive dust emissions (San Joaquin Valley Air Pollution Control District, 2004). According to the District, this exemption was enacted because studies within the District have indicated that mountainous areas do not significantly contribute to PM_{10} non-attainment in the District (personnel communication, H. Guerra, Senior Air Quality Planner, San Joaquin Valley Air Pollution Control District, as cited in SCE, 2004b). SCE determined that there are 13 project-related road segments below elevation 3,000 feet that provide access to Dams 5 and 6 and the Mammoth Pool and Big Creek No. 3 powerhouses. SCE's analysis of PM_{10} emissions from these roads indicates that under existing conditions, fugitive dust is less than half of *de minimis* levels identified by the San Joaquin Valley Air Pollution Control District (SCE, 2004b). All but one of the 13 road segments are paved, providing the highest level of dust reduction.

The San Joaquin Valley Air Pollution Control District (2008b) also developed a proposed $PM_{2.5}$ State Implementation Plan. This plan documents that $PM_{2.5}$ levels have been decreasing in the valley since monitoring began in 1999 and that oxides of nitrogen are the dominant contributor to current $PM_{2.5}$ levels, although direct reductions in $PM_{2.5}$ and SO_2 would contribute to reductions in the overall $PM_{2.5}$ levels. Mobile sources (i.e., trucks, passenger vehicles, farm equipment, and off-road equipment) contribute 80 percent of the San Joaquin Valley's oxides of nitrogen emissions (San Joaquin Valley Air Pollution Control District, 2008b).

SCE holds seven air permits for emergency generators, transportable air compressors, and snow blowing equipment, and four permits for above ground fuel storage tanks (SCE, 2004b). Compliance with the permit conditions is ensured by the San Joaquin Valley Air Pollution Control District, which inspects the permitted facilities on an annual basis.

3.3.7.2 Environmental Effects

Relicensing of the Big Creek ALP Projects in accordance with the provisions of the Settlement Agreement would entail construction to implement some of the environmental measures. As such, there is potential for air quality effects, depending on the nature of the construction.

Operation of the Big Creek ALP Projects under the flow regimes specified in the Settlement Agreement would reduce the ability of each project to generate electricity. SCE would need to replace this lost energy from an alternative source because it does not have any deactivated or retired plants that could be restarted to address the generation shortfall. The needed energy would be purchased by SCE on the open market. The most likely source of this replacement energy would be from a natural gas-fired combined cycle generating station. Therefore, relicensing the Big Creek ALP Projects could have an indirect effect on air emissions associated with the generation of replacement energy. No entity has made any recommendations pertaining to air emissions.

Effects of Construction

The no-action alternative would not involve construction of any kind beyond what might be required for maintenance of project facilities and thus would not have air emissions effects related to construction activities. Some activities related to construction associated with proposed environmental measures and to diversion dam decommissioning could have the potential to contribute limited , short-term air emissions. We list those activities in table 3-26.

Table 3-26. Activities under the proposed project that entail construction or use of equipment to remove or replace existing project features. (Source: SCE, 2007a, modified by staff)

Environmental measure	Year(s) from license issuance when measure would be implemented
Big Creek Nos. 2A, 8, and Eastwood Project	
Decommission Crater Creek diversion	2
Decommission Tombstone Creek diversion	3
Decommission North Slide Creek diversion	4
Decommission South Slide Creek diversion	4
Rehabilitation of existing recreational facilities	1-10,13-17
New recreational facilities (accessible fishing platform at Jackass Meadows and accessible boat loading platform at Florence Lake)	1-5
Big Creek Nos. 1 & 2 Project	
Decommission Pitman Creek domestic diversion	5
Decommission Snow Slide Creek domestic diversion	5
Rehabilitation of existing recreational facilities	1-6, 17-23
New recreational facilities (Dam 3 day-use area and accessible fishing platform)	1-5
Mammoth Pool Project	
Rehabilitation of existing recreational facilities	7-16
Big Creek No. 3 Project	
Rehabilitation of existing recreational facilities	7-11

Our Analysis

The proposed decommissioning of five of the six diversion dams will be accomplished with hand tools and explosives. In most cases, non-rock and mortar debris will be cut into manageable pieces and transported from the demolition site. The Crater Creek and Tombstone Creek diversion dams are in a designated wilderness area that is not accessible by road. If determined by the Forest Service to be consistent with the management of the wilderness area, SCE may remove larger sections of pipe and other debris via helicopter. We estimate that no more than two helicopter flights would be needed to remove large debris from these two sites. The South Slide Creek diversion dam is already breached and what remains of the dam would be left in place. The ends of the buried piping at this site would be sealed with concrete and no further demolition would occur. We estimate that decommissioning activities at each site would be accomplished in less than a month. Given the minor construction activity involved in removing the diversion dams, we do not see any potential for diversion dam decommissioning to adversely influence air quality.

SCE proposes to be responsible for rehabilitation of recreational facilities at all four Big Creek ALP Projects. As indicated in table 3-24, some of these facilities are currently owned and operated by SCE, but many are operated, maintained, and managed by the Forest Service. As indicated in footnote "a" of table 3-24, SCE considers rehabilitation of facilities that it owns to be part of routine maintenance and repair activities. Consequently, if SCE did not fund this rehabilitation, either the Forest Service would need to fund this work or the facilities would fall into disrepair and eventually become unusable by the public. Thus, any construction-related air emissions associated with the rehabilitation of recreational facilities would likely occur under either the no-action alternative or the proposed action alternative.

As indicated in table 3-26, the rehabilitation work would be spread over a 23-year period, thus keeping air emissions from this work at any one time to a minimum. Specific rehabilitation work would typically entail transporting items that are pre-fabricated off-site (e.g., vault-type toilets, bear-proof trash receptacles, and picnic tables) or materials to repair or rebuild existing facilities (e.g., lumber, bricks, mortar, cement) to the site via truck; using equipment to unload this material at the designated recreational facility; and primarily using hand tools to install, repair, or rebuild the facilities. Additional equipment would be needed where regrading of roads, parking areas, campsites, and eroded areas may be needed and where resurfacing of existing areas is proposed. Rehabilitation work at any one recreation site would be short-term; we expect most rehabilitation projects at specific sites would take a month or less to complete. Therefore, any air quality effects from recreational facility rehabilitation would be minor, short-term, and local in nature.

Proposed new recreational facilities include accessible fishing platforms, an accessible boat loading platform, and a new day-use area. The fishing platforms and boat loading platform likely would need to be removed during the winter to prevent ice damage. As such, most of the components of these new facilities could be pre-fabricated off-site and moved to the proposed site for installation. Similarly, most of the components of the day-use area (e.g., picnic tables and toilets) could be pre-fabricated off-site. On-site work for the four proposed new recreational facilities would be limited to installation of facility components, and grading and surfacing needed for access and parking. This on-site work likely could be completed in a month or less. As with proposed recreational facility rehabilitation, we expect any air quality effects associated with construction of new recreation facilities to be minor, short-term, and local.

EPA has developed two conformity regulations for transportation and non-transportation projects. Transportation projects are governed by the "transportation conformity" regulations (40 CFR Parts 51 and 93). Non-transportation projects are governed by the "general conformity" regulations (40 CFR Parts 6, 51, and 93) described in the final rule for Determining Conformity of General Federal Actions to State or Federal Implementation plans. Since the Big Creek ALP Projects are not related to transportation, only the general conformity rule applies.

The general conformity rule applies to federal actions occurring in air quality regions designated as being in non-attainment for the national ambient air quality standards or attainment areas subject to maintenance plans (maintenance areas). Federal actions occurring in attainment areas are not subject to the conformity rules. The proposed projects are in an air basin currently designated as serious non-attainment for 8-hour ozone, non-attainment for $PM_{2.5}$, and as PM_{10} maintenance (previously nonattainment) areas.

Because of the minor, short-term and local construction associated with the proposed Big Creek ALP Project environmental measures, we conclude these actions would have de minimis effect on basin air quality. In reaching our finding on the air quality effects of the proposed Big Creek ALP Project environmental measures, we compared construction activities at the Big Creek ALP Projects with two recently completed Commission air quality analyses of hydroelectric projects that involve substantially more extensive construction but were found to have de minimis effects on air quality. The first project is the Upper American River Project (FERC No. 2101), located in El Dorado County, to the north of the Big Creek ALP Projects. The second is the proposed Lake Elsinore Advanced Pumped Storage Project (FERC No. 11858) located primarily in Riverside County, to the south of the Big Creek ALP Projects.

Effects of Operations

The existing Big Creek ALP Projects produce 3,366,594 MWh of renewable energy by utilizing the water cycle. The implementation of SCE's proposed flow regime at each of the four projects in accordance with the Settlement Agreement would reduce this energy production by 189,404 MWh, as shown in table 3-27.

Table 3-27. Annual energy generation at the Big Creek ALP Projects. (Source: SCE, 2007a, as modified by staff)

Project	No-Action (MWh)	Proposed Action (MWh)	Difference (MWh)
Big Creek Nos. 2A, 8, and Eastwood	1,173,296	1,125,429	47,867
Big Creek Nos. 1 and 2	765,483	657,072	108,411
Mammoth Pool	603,734	592,449	11,285

Project	No-Action (MWh)	Proposed Action (MWh)	Difference (MWh)
Big Creek No. 3	824,081	802,240	21,841
Total	3,366,594	3,177,190	189,404

Conventional hydroelectric generation is a reliable, efficient, economical, and less polluting source of energy resulting in zero air emissions. In section 1.2.2, *Need for Power*, we conclude that there is a need for the energy produced by these four hydroelectric projects. Reducing the energy produced by the Big Creek ALP Projects would require an equivalent amount of energy to be generated from an alternative source. SCE conducted an analysis of air emissions offsets from hydroelectric generation and developed values for equivalent emissions per MWh. The values derived by SCE are shown in table 3-28. SCE assumed that the offsets would be derived from natural gas-fired combined-cycle stations operating with the current Best Available Control Technology emission controls that would be required in the South Coast Air Quality Management District (SCE, 2004b). We consider this a reasonable assumption.

Table 3-28. Air Emission offsets of hydroelectric generation; equivalent emissions from fossil-fuel generation per MWh. (Source: SCE, 2004b)

Unit emissions	Oxides of nitrogen	CO	Reactive organic compounds[a]	PM_{10}	Oxides of sulfur	Ammonia
Pounds/MWh	0.053	0.033	0.019	0.048	0.004	**0.049**
Tons/MW-year	**0.234**	**0.143**	**0.082**	**0.210**	**0.019**	**0.216**

[a] Reactive organic compounds are emissions defined by CARB that are essentially the same as what EPA defines as volatile organic compounds.

Our Analysis

Operation of the existing Big Creek ALP Projects would not contribute meaningfully to air emissions. It may offset the need to generate electricity from sources that would contribute to air emissions under both the no-action and proposed project alternatives. We estimate the annual emissions offsets of these alternatives in table 3-29 using the annual generation values presented in table 3-27 and SCE's unit emission estimates presented in table 3-28.

Table 3-29. Annual air emission offsets from operation of the Big Creek ALP Projects. (Source: Staff)

		Annual Offset Emissions (tons/year)					
Alternative	**Project**	**Oxides of nitrogen**	**CO**	**Reactive organic compounds**	**PM_{10}**	**Oxides of sulfur**	**Ammonia**
No-action	Big Creek Nos. 2A, 8, and Eastwood	274,551	167,781	96,210	246,392	22,292	253,432
	Big Creek Nos. 1 and 2	179,123	109,464	62,770	160,751	14,544	165,344
	Mammoth Pool	141,274	86,334	49,506	126,784	11,471	130,407
	Big Creek No. 3	192,835	117,844	67,575	173,057	15,658	178,001
	Total	**787,783**	**481,423**	**276,061**	**706,985**	**63,965**	**727,184**
Proposed	Big Creek Nos. 2A, 8, and Eastwood	263,350	160,936	92,285	236,340	21,383	243,093
	Big Creek Nos. 1 and 2	153,755	93,961	53,880	137,985	12,484	141,928
	Mammoth Pool	138,633	84,720	48,581	124,414	11,257	127,969
	Big Creek No. 3	187,724	114,720	65,784	168,470	15,243	173,284
	Total	**743,462**	**454,338**	**260,530**	**667,210**	**60,367**	**686,273**
Net increase in air emissions from Proposed Alternative	Big Creek Nos. 2A, 8, and Eastwood	11,201	6,845	3,925	10,052	909	10,339
	Big Creek Nos. 1 and 2	25,368	15,503	8,890	22,766	2,060	23,417
	Mammoth Pool	2,641	1,614	925	2,370	214	2,438
	Big Creek No. 3	5,111	3,123	1,791	4,587	415	4,718
	Total	**44,321**	**27,085**	**15,531**	**39,775**	**3,599**	**40,911**

We note that the potential net increase in air emissions associated with the proposed Big Creek ALP Projects is an indirect effect. Although SCE assumes that the source of replacement energy would be from a gas-fired generation plant located in the South Coast Air Quality Management District, the actual source of electricity that SCE would need to purchase on the open energy market to meet its customers' demands could come from elsewhere in California or from sources outside of California. The owner of the source generation facility would be responsible for complying with applicable state and federal regulations that would apply to the specific geographic area in which the generation facility is located. Therefore, precise quantification of the environmental effects of operating the proposed projects is difficult. However, our analysis illustrates that although the flow regimes proposed in the Settlement Agreement would represent environmental enhancements to the aquatic and riparian habitat in the project areas, it would not be without environmental consequences elsewhere.

3.3.8 Noise

3.3.8.1 Affected Environment

Noise is defined as unwanted sound. It is emitted from many sources including airplanes, factories, railroads, power generation plants, and highway vehicles. The magnitude of noise is described by its sound pressure. Because the range of sound pressure varies greatly, a logarithmic scale is used to relate sound pressures to some common reference level, the decibel. Sound pressures described in decibels are called sound pressure levels.

Sound levels measured using an A-weighted decibel scale are expressed as dBA. Throughout this analysis, all noise levels are expressed in dBA. Several examples of noise pressure levels in dBA are listed in table 3-30.

The degree of disturbance or annoyance of unwanted sound depends essentially on three things:

- the amount and nature of the intruding noise;
- the relationship between the background noise and the intruding noise; and
- the type of activity occurring where the noise is heard.

In considering the first of these factors, it is important to note that individuals have different sensitivities to noise. Loud noises bother some individuals more than others, and some patterns of noise also enter into an individual's judgment of whether or not a noise is offensive.

With regard to the second factor, individuals tend to judge the annoyance of an unwanted noise in terms of its relationship to noise from other sources (background noise). The blowing of a car horn at night when background noise levels are approximately 45 dBA generally would be more objectionable than the blowing of a car horn in the afternoon when background noises might be 55 dBA.

Table 3-30. A-weighted (dBA) sound levels of typical noise environments. (Source: FICON, 1992, as modified by staff)

A-Weighted	Overall Level	Noise Environment
120	Uncomfortably Loud (32 times as loud as 70 dBA)	Military jet takeoff at 50 feet
100	Very loud (8 times as loud as 70 dBA)	Jet flyover at 1,000 feet
80	Loud (2 times as loud as 70 dBA)	Propeller plane flyover at 1,000 feet; diesel truck 40 mph at 50 feet
70	Moderately loud	Freeway at 50 feet from pavement edge; vacuum cleaner (indoor)
60	Relatively quiet (1/2 as loud as 70 dBA)	Air condition unit at 10 feet; dishwasher at 10 feet (indoor)
50	Quiet (1/4 as loud as 70 dBA)	Large transformers; small private office (indoor)
40	Very quiet (1/8 as loud as 70 dBA)	Bird calls; lowest limit of urban ambient sound
10	Extremely quiet (1/64 as loud as 70 dBA)	Just audible
0	Threshold of hearing	

Note: dBA – A-weighted decibel scale

The third factor is related to the interference of noise with activities of individuals. In a 60-dBA environment, normal work activities requiring high levels of concentration may be interrupted by loud noises, while activities requiring manual effort may not be interrupted to the same degree.

Time-averaged descriptors are utilized to provide a better assessment of time-varying sound levels. The three most common noise descriptors used in community noise surveys are the equivalent sound level (L_{eq}), percentile distributions of sound levels ($L_{\%}$), and the day-night average sound level (L_{dn}).

The L_{eq} is an energy-averaged sound level that includes both steady background sounds and transient short-term sounds. The L_{eq} is equivalent in energy to the fluctuating sound level over the measurement period. The L_{eq} is commonly used to describe traffic noise levels, which tend to be characterized by fluctuating sound levels.

The $L_{\%}$ indicates the sound level exceeded for a percentage of the measurement period. For example, the L_{90} is the sound level exceeded for 90 percent of the measurement period and is commonly used to represent background sound levels. The L_{10} is the sound level exceeded for 10 percent of the measurement period and represents the peak sound levels present in the environment.

The L_{dn} is another descriptor used to evaluate community noise levels. The L_{dn} is a 24-hour average sound level, which includes a 10 dBA penalty added to nighttime sound levels (10:00 p.m. to 7:00 a.m.) because people tend to be more sensitive to noise during the nighttime. The day-night average sound level is commonly used to describe aircraft and train noise levels.

For the state of California, noise intensity is also discussed in terms of Community Noise Equivalent Level, which presents a weighted average noise level that increases the relative significance of evening and nighttime noise. The Community Noise Equivalent Level descriptor is used to evaluate community noise levels, which includes a 5 and 10 dBA penalty added to evening (7:00 p.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) sound levels, respectively, in consideration of people's increased sensitivity to noise during these times.

Existing Noise Environment

The Big Creek ALP Projects' features are generally located in remote and forested areas within the Sierra National Forest. Clusters of residences and recreational facilities are located near project reservoirs, particularly Shaver and Huntington lakes and to a lesser degree, Mammoth Pool reservoir and Florence Lake. Fresno County community noise surveys indicate that most communities in unincorporated portions of the county, which would include much of the area of the Big Creek ALP Projects, have light levels of activity and are relatively quiet (Fresno County, 2000). Measured day-time noise levels range between the high 30s dBA to mid-50s dBA L_{eq}. Noise was not identified as a project-related issue during the ALP. The only indirect conflicts that referenced noise were identified in recreational surveys conducted at Huntington Lake; survey participants complained about noise associated with motorboats and jet skis disrupting their recreational experiences (2007a).

Noise Standards

The Fresno County General Plan Policy HS-G-7 states that where existing noise levels are less than 60 dBL_{dn} at outdoor activity areas of noise-sensitive sites, a $5dBL_{dn}$ increase in noise levels will be considered significant (Fresno County, 2000). Noise sensitive sites include residences, schools, hospitals, churches, and libraries. The Fresno County Noise Control Ordinance (Fresno County Code Chapter 8.40) states that at sensitive sites, sources that cause exterior noise levels to exceed 50 dBA daytime L_{50} or 45 dBA nighttime L_{50} are prohibited (Fresno County, 2000). Non-emergency construction in sensitive areas is limited to daytime hours.

Madera County General Noise Regulations (Chapter 9.58.020) have no numeric standards, but list a number of factors that are considered when determining whether a violation of the regulations has occurred, including the level, origin, duration, recurrence interval, and time of day of the noise; level of background noise; and density of inhabitants near the source (Madera County, undated). The objective of the regulation is to protect residences, schools, courts, churches, hospitals, and libraries from excessive noise levels.

3.3.8.2 Environmental Effects

Activities associated with granting new licenses to the Big Creek ALP Projects that have the potential to generate noise are those that entail construction or use of equipment to remove or replace existing project features. We list those activities in table 3-26 and describe them in our analysis of Air Quality in section 3.3.7.2.

Our Analysis

The diversion dams proposed for removal are between 0.25 (Pitman Creek and Snow Slide Creek domestic diversions) and over a mile (North Slide and Crater creek diversions) from the nearest residence or recreational facility. Consequently, the public would be unlikely to hear any noise associated with the hand tools associated with decommissioning activities. If explosives or helicopters are used to remove the dams or transport debris from the diversion dam sites, there would be short-term noise that could be audible to persons in the area. Any such noise would not rise to levels considered a public nuisance.

Noise associated with rehabilitation of recreational facilities currently managed by the Forest Service would likely occur regardless of the outcome of this proceeding (rehabilitation would still be implemented by either the Forest Service or SCE). Activities that could generate noise include trucks delivering supplies for rehabilitation work; trucks and machinery used to resurface boat launches, day-use areas, and campgrounds; and hand tools such as hammers and electric saws and drills. It is probable that major rehabilitation work would be scheduled to occur outside the peak recreational season (i.e., before Memorial Day or after Labor Day), thus reducing the number of people who would hear noises associated with rehabilitation work.

Construction of two of the proposed four new recreational facilities (accessible fishing platform and Jackass Meadows and an accessible boat loading platform at Florence Lake) likely would entail using largely pre-fabricated components. Thus on-site construction would be relatively brief and minimally disruptive to nearby recreational visitors from a noise perspective. Scheduling on-site work to avoid peak recreational periods would further reduce the effects of noise on recreational visitors. Constructing the proposed Dam 3 day-use area and an accessible fishing platform at Huntington Lake could involve some minor increase in noise to nearby residences and recreational users of the lake. However, we expect most of the on-site work to be short-term, entailing trucks to deliver prefabricated items such as picnic tables, vault toilets, and platforms, and equipment to prepare and surface access routes and parking areas. Any noise generated from these construction activities would be minor and short-term in nature.

SCE compliance with applicable Fresno and Madera county noise ordinances should minimize the effects on noise level levels during construction and rehabilitation work. We expect no noise effects from continued operation of the Big Creek ALP Projects beyond those associated with dam decommissioning and construction and rehabilitation of recreational facilities.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative (baseline condition), the Big Creek ALP Projects would continue to operate as they have in the past. None of SCE's proposed measures specified in the Settlement Agreement would be implemented by SCE. The continued operation of existing Big Creek ALP Projects would not result in any atmospheric emission of criteria pollutants or other hazardous material that can affect air quality. The continued operation of the existing facilities under the no-action alternative would, on average, result in the annual generation of 3,366,590 MWh of clean energy.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we analyze the Big Creek ALP Projects' use of the water resources of the San Joaquin River Basin to generate power, estimate the economic benefits of the SCE facilities, and estimate the cost of various environmental measures and the effects of these measures on project operations.

4.1 POWER AND ECONOMIC BENEFITS OF THE PROJECTS

4.1.1 Economic Assumptions

Under its approach to evaluating the economics of hydropower projects, as articulated in Mead Corporation, Publishing Paper Division (72 FERC ¶61,027, July 13, 1995), the Commission employs an analysis that uses current costs to compare the costs of the project and likely alternative power with no consideration for potential future inflation, escalation, or deflation beyond the license issuance date. The Commission's economic analysis provides a general estimate of the potential power benefits and costs of a project and reasonable alternatives to project-generated power. The estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license.

For our economic analysis of the project alternatives, we used the assumptions, values and sources shown in table 4-1.

Table 4-1. Staff assumptions for economic analysis of SCE's Big Creek ALP Projects. (Source: Staff)

Assumption	Value	Source
Base year for costs and benefits	2008	Staff
Energy value (mills/kWh)[a]	$52.40	SCE
Dependable capacity value ($/kW-yr)[b]	$73.93	SCE
Period of analysis[c]	30 years	Staff
Term of financing	20 years	Staff
Federal and state tax rate	35%	Staff
Local tax rate[d]	1.08%	SCE

Assumption	Value	Source
Insurance rate	0.25%	Staff
Discount rate[e]	10.0%	SCE

[a] SCE provided an energy rate for 2009 in exhibit D, table D-3, of the license applications for Big Creek Projects Nos. 67, 120, and 2175. The application for Mammoth Pool was filed earlier and used older energy rate forecast information.

[b] SCE provided dependable capacity rates for 2009 in exhibit D, table D-3, of the license applications for Big Creek Projects Nos. 67, 120, and 2175. The application for Mammoth Pool was filed earlier and used older capacity rate forecast information.

[c] Although our period of financial analysis is 30 years, SCE provided costs in its comments on the draft EIS for 44 years, reflecting a potential 50-year license. We have recognized the expenditures beyond year 30 by computing the present value of the expenditures over 44 years and then computing the annualized cost over 30 years.

[d] We derived the local tax rate by dividing the local taxes paid by the net investment values as provided by SCE. The rate for each project was very similar, so we used a simple average of the rates for all four Big Creek ALP Projects.

[e] We used cost of capital provided by SCE in table 7.0-1 of the amended PDEA.

4.1.2 Current Annual Costs and Future Capital Costs for the Big Creek ALP Projects under the No-action Alternative

Total annualized costs for the no-action alternative for the Big Creek Nos. 2A, 8, and Eastwood Project amount to $37,317,930 (table 4-2).

Table 4-2. Summary of current annual costs and future costs for SCE's Big Creek Nos. 2A, 8, and Eastwood Project under the no-action alternative. (Source: SCE, 2007a)

Cost	Capital and One-Time Costs	Annual Costs, Including O&M	Total Annualized Costs (2009$)
Original net investment[a]	$219,234,230 (12/31/06)		
Relicensing cost[a]	$14,884,000 (12/31/06)		
Total net investment	$234,118,230 (12/31/06)		$24,721,510

Cost	Capital and One-Time Costs	Annual Costs, Including O&M	Total Annualized Costs (2009$)
Plant operation and maintenance[b]		$12,012,890 (12/31/06)	$12,596,420
Total			$37,317,930

[a] The values shown above were presented by SCE in the license application. We have updated these values to current year dollars by depreciating using a 150 percent declining balance over 20 years, which is the federal tax method cited in table 7.0-1 of the amended PDEA.

[b] The values shown above were presented by SCE in the license application. We have updated these values to 2009 dollars by escalating them at a rate of 2.4 percent per year.

Total annualized costs for the no-action alternative for the Big Creek Nos. 1 and 2 Project amount to $12,973,290 (table 4-3).

Table 4-3. Summary of current annual costs and future costs for Big Creek Nos. 1 and 2 Project under the no-action alternative. (Source: SCE, 2007a)

Cost	Capital and One-Time Costs	Annual Costs, Including O&M	Total Annualized Costs (2009$)
Original net investment[a]	$39,594,900 (12/31/05)		
Relicensing cost[a]	$10,741,000 (12/31/06)		
Total net investment	$47,366,280 (12/31/06)		$5,001,600
Plant operation and maintenance[b]		$7,602,400 (12/31/06)	$7,971,690
Total			$12,973,290

[a] The values shown above were presented by SCE in the license application. We have updated these values to current year dollars by depreciating using a 150 percent declining balance over 20 years, which is the federal tax method cited in table 7.0-1 of the amended PDEA.

[b] Values shown above were presented by SCE in the license application. We have updated them to 2009 dollars by escalating them at a rate of 2.4 percent per year.

Total annualized costs for the no-action alternative for the Mammoth Pool Project amount to $8,520,220 (table 4-4).

Table 4-4. Summary of current annual costs and future costs for the Mammoth Pool Project under the no-action alternative. (Source: SCE, 2007a)

Cost	Capital and One-Time Costs	Annual Costs, Including O&M	Total Annualized Costs (2009$)
Original net investment[a]	$27,172,070 (12/31/04)		
Relicensing cost[a]	$4,944,470 (12/31/06)		
Total net investment	$28,193,570		$2,977,070
Plant operation and maintenance[b]		$5,286,360 (12/31/06)	$5,543,150
Total			$8,520,220

[a] The values shown above were presented by SCE in the license application. We have updated these values to current year dollars by depreciating using a 150 percent declining balance over 20 years, which is the federal tax method cited in table 7.0-1 of the amended PDEA.

[b] Values shown above were presented by SCE in the license application. We have updated them to 2009 dollars by escalating them at a rate of 2.4 percent per year.

Total annualized costs for the no-action alternative for the Big Creek No. 3 Project amount to $11,757,710 (table 4-5).

Table 4-5. Summary of current annual costs and future costs for SCE's Big Creek No. 3 Project under the no-action alternative. (Source: SCE, 2007a)

Cost	Capital and One-Time Costs	Annual Costs, Including O&M	Total Annualized Costs (2009$)
Original net investment[a]	$37,174,160 (12/31/05)		
Relicensing cost[a]	$5,310,000 (12/31/06)		
Total net investment	$39,696,100 (12/31/06)		$4,191,670
Plant operation and maintenance[b]		$7,215,534 (12/31/06)	$7,566,040
Total			$11,757,710

[a] The values shown above were presented by SCE in the license application. We have updated these values to current year dollars by depreciating using a 150% declining balance over 20 years, which is the Federal tax method cited in table 7.0-1 of the amended PDEA.

[b] Values shown above were presented by SCE in the license application. We have updated them to 2009 dollars by escalating them at a rate of 2.4 percent per year.

4.2 COST OF ENVIRONMENTAL MEASURES

As proposed under the Settlement Agreement and as recommended by staff, the environmental measures for the Big Creek ALP Projects would both reduce generation and increase annual O&M costs and capital costs. SCE does not anticipate the environmental measures would affect the dependable capacity of the project, which we find reasonable.

4.2.1 Cost of Environmental Measures for the Big Creek ALP Projects

SCE provided updated costs for environmental measures in 2009 dollars. Although our period of financial analysis is 30 years, SCE provided costs in its comments on the draft EIS for 44 years, reflecting a potential 50-year license. We have recognized the expenditures beyond year 30 by computing the present value of the expenditures over 44 years and then computing the annualized cost over 30 years.

Tables 4-6 through 4-9 summarize the costs by major resource area for both the proposed action and the proposed action with staff modifications for the Big Creek ALP Projects. In its comments on the draft EIS, SCE indicated that they support the staff alternative. We interpret this to mean that SCE's proposed project is now the same as the staff alternative. For details of the costs of specific measures included in each resource category in tables 4-6 through 4-9, see appendix B, *Capital and Annual Costs of Measures for the Big Creek ALP Projects and the Portal Project*.

Table 4-6. Summary of annualized costs for measures included in the proposed action and proposed action with staff modifications for the Big Creek Nos. 2A, 8, and Eastwood Project. (Source: Staff)

	Proposed Action and Proposed Action with Staff Modifications		
Resource Area	**Capital Cost**	**Annualized O&M Cost**	**Total Annualized Cost**
Aquatic resources	$4,880,050	$2,933,710	$3,535,940
Terrestrial resources	$25,350	$104,530	$107,660
Recreation, land use, and aesthetics	$3,162,330	$628,630	$1,021,180
Cultural resources	$228,120	$35,980	$64,130
Total	$8,295,850	$3,702,850	$4,728,910

Table 4-7. Summary of annualized costs for measures included in the proposed action and proposed action with staff modifications for the Big Creek Nos.1 and 2 Project. (Source: Staff)

	Proposed Action and Proposed Action with Staff Modifications		
Resource Area	**Capital Cost**	**Annualized O&M Cost**	**Total Annualized Cost**
Aquatic resources	$2,915,130	$5,882,810	$6,212,560
Terrestrial resources	$25,350	$72,360	$75,490
Recreation, land use, and aesthetics	$12,225,270	$488,120	$1,996,860
Cultural resources	$36,820	$5,900	$10,440
Total	$15,202,520	$6,449,190	$8,295,350

Table 4-8. Summary of annualized costs for measures included in the proposed action and proposed action with staff modifications for the Mammoth Pool Project. (Source: Staff)

	Proposed Action and Proposed Action with Staff Modification		
Resource Area	**Capital Cost**	**Annualized O&M Cost**	**Total Annualized Cost**
Aquatic resources	$27,035,610	$770,850	$4,107,370
Terrestrial resources	$27,270	$87,210	$90,570
Recreation, land use, and aesthetics	$731,020	$465,170	$555,390
Cultural resources	$41,610	$6,280	$11,420
Total	$27,835,510	$1,329,510	$4,764,750

Table 4-9. Summary of annualized costs for measures included in the proposed action and proposed action with staff modifications for the Big Creek No. 3 Project. (Source: Staff)

	Proposed Action and Proposed Action with Staff Modifications		
Resource Area	**Capital Cost**	**Annualized O&M Cost**	**Total Annualized Cost**
Aquatic resources	$1,956,370	$1,230,860	$1,471,820
Terrestrial resources	$25,390	$52,930	$56,080
Recreation, land use, and aesthetics	$106,390	$422,530	$435,660
Cultural resources	$38,490	$6,280	$11,030
Total	$2,126,640	$1,712,600	$1,974,590

4.2.2 Effect of Proposed Operations on the Big Creek ALP Projects

Several measures affect energy generation. Energy estimates were provided by SCE for the proposed minimum flows and proposed channel and riparian maintenance flows (see section 3.3.1, *Aquatic Resources*). Staff notes that a reduction of 47,867 MWh would result from flows needed for environmental requirements at the Big Creek Nos. 2A, 8, and Eastwood Project as detailed in appendix B. A reduction of 108,411 MWh would result from flows needed for environmental requirements at the Big Creek Nos. 1 and 2 Project as and detailed in appendix B.

A reduction of 11,285 MWh would result from flows needed for environmental requirements at the Mammoth Pool Project as detailed in appendix B and a reduction of 19,841 MWh would result from flows needed for environmental requirements at the Big Creek No. 3 Project detailed in appendix B.

4.3 COMPARISON OF ALTERNATIVES

Table 4-10 compares the power value, annual costs, and net benefits of the no-action alternative, proposed action, and the proposed action with staff modifications for the Big Creek Nos. 2A, 8, and Eastwood. In section 5.2, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the proposed action with staff modifications, and explain why we conclude the environmental benefits are worth these costs.

Table 4-10. Summary of annual net benefits for the no-action, proposed action, and proposed action with staff modifications for the Big Creek Nos. 2A, 8, and Eastwood Project. (Source: Staff)

	No Action	**Proposed Action**	**Proposed Action with Staff Modifications**
Dependable capacity (MW)[a]	370	370	370
Value of dependable capacity ($)	$27,354,100	$27,354,100	$27,354,100
Generation (MWh)[b]	1,173,296	1,125,429	1,125,429
Value of generation ($)	$61,480,710	$58,972,480	$58,972,480
Annual power value ($)	$88,834,810	$86,326,580	$86,326,580
Annual power value ($/MWh)	75.71	76.71	76.71

	No Action	Proposed Action	Proposed Action with Staff Modifications
Annualized cost of operations and current environmental measures ($)	$37,317,930	$37,317,930	$37,317,930
Annualized cost of new environmental measures ($)	$0	$2,216,540	$2,216,540
Annual cost ($)	$37,317,930	$39,534,470	$39,534,470
Annual cost ($/MWh)	31.81	35.13	35.13
Annual net benefit ($)	$51,516,880	$46,792,110	$46,792,110
Annual net benefit ($/MWh)	43.90	41.58	41.58

[a] The dependable capacity for each project was provided in the license applications.

[b] The average annual generation was provided in table 7.1-6 of the amended PDEA.

Table 4-11 compares the power value, annual costs, and net benefits of the no-action alternative, proposed action, and the proposed action with staff modifications for the Big Creek Nos. 1 and 2 Project. In section 5.2, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the proposed action with staff modifications, and explain why we conclude the environmental benefits are worth these costs.

Table 4-11. Summary of annual net benefits for the no-action, proposed action, and proposed action with staff modifications for the Big Creek Nos. 1and 2 Project. (Source: Staff)

	No Action	Proposed Action	Proposed Action with Staff Modifications
Dependable capacity (MW)[a]	150	150	150
Value of dependable capacity ($)	$11,089,500	$11,089,500	$11,089,500
Generation (MWh)[b]	765,483	657,072	657,072
Value of generation ($)	$40,111,310	$34,430,570	$34,430,570
Annual power value ($)	$51,200,810	$45,520,070	$45,520,070
Annual power value ($/MWh)	66.89	69.28	69.28

	No Action	Proposed Action	Proposed Action with Staff Modifications
Annualized cost of operations and current environmental measures ($)	$12,973,290	$12,973,290	$12,973,290
Annualized cost of new environmental measures ($)	$0	$2,614,620	$2,614,620
Annual cost ($)	$12,973,290	$15,617,910	$15,617,910
Annual cost ($/MWh)	16.95	23.76	23.76
Annual net benefit ($)	$38,227,520	$29,902,160	$29,902,160
Annual net benefit ($/MWh)	49.94	45.52	45.52

[a] The dependable capacity for each project was provided in the license applications.

[b] The average annual generation was provided in table 7.1-6 of the amended PDEA.

Table 4-12 compares the power value, annual costs, and net benefits of the no-action alternative, proposed action, and the proposed action with staff modifications for the Mammoth Pool Project. In section 5.2, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the proposed action with staff modifications, and explain why we conclude the environmental benefits are worth these costs.

Table 4-12. Summary of annual net benefits for the no-action, proposed action, and proposed action with staff modifications for the Mammoth Pool Project. (Source: Staff)

	No Action	Proposed Action	Proposed Action with Staff Modifications
Dependable capacity (MW)[a]	187	187	187
Value of dependable capacity ($)	$13,824,910	$13,824,910	$13,824,910
Generation (MWh)[b]	603,734	592,449	592,449
Value of generation ($)	$31,635,660	$31,044,330	$31,044,330
Annual power value ($)	$45,460,570	$44,869,240	$44,869,240

	No Action	Proposed Action	Proposed Action with Staff Modifications
Annual power value ($/MWh)	75.30	75.74	75.74
Annualized cost of operations and current environmental measures ($)	$8,520,220	$8,520,220	$8,520,220
Annualized cost of new environmental measures ($)	$0	$4,173,430	$4,173,430
Annual cost ($)	$8,520,220	$12,693,640	$12,693,640
Annual cost ($/MWh)	14.11	21.43	21.43
Annual net benefit ($)	$36,940,350	$32,175,600	$32,175,600
Annual net benefit ($/MWh)	61.19	54.31	54.31

[a] The dependable capacity for each project was provided in the license applications.

[b] The average annual generation was provided in table 7.1-6 of the amended PDEA.

Table 4-13 compares the power value, annual costs, and net benefits of the no-action alternative, proposed action, and the proposed action with staff modifications for the Big Creek No. 3 Project. In section 5.2, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the proposed action with staff modifications, and explain why we conclude the environmental benefits are worth these costs.

Table 4-13. Summary of annual net benefits for the no-action, proposed action, and proposed action with staff modifications for the Big Creek No. 3 Project. (Source: Staff)

	No Action	Proposed Action	Proposed Action with Staff Modifications
Dependable capacity (MW)[a]	181.9	181.9	181.9
Value of dependable capacity ($)	$13,447,870	$13,447,870	$13,447,870
Generation (MWh)	824,081	804,240	804,240
Value of generation ($)[b]	$43,181,840	$42,142,170	$42,142,170
Annual power value ($)	$56,629,710	$55,590,040	$55,590,040

	No Action	Proposed Action	Proposed Action with Staff Modifications
Annual power value ($/MWh)	68.72	69.12	69.12
Annualized cost of current operations and environmental measures ($)	$11,757,710	$11,757,710	$11,757,710
Annualized cost of new environmental measures ($)	$0	$934,930	$934,930
Annual cost ($)	$11,757,710	$12,692,640	$12,692,640
Annual cost ($/MWh)	14.27	15.78	15.78
Annual net benefit ($)	$44,872,000	$42,897,400	$42,897,400
Annual net benefit ($/MWh)	54.45	53.34	53.34

[a] The dependable capacity for each project was provided in the license applications.

[b] The average annual generation was provided in table 7.1-6 of the amended PDEA.

4.4 OTHER ECONOMIC CONSIDERATIONS

In addition to the costs evaluated in sections 4.2, 4.3, and 4.4, SCE would incur costs associated with measures that are not part of a potential Commission license. Because the measures are not part of our recommended action, we do not account for them here.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPARISON OF EFFECTS OF PROPOSED ACTION AND ALTERNATIVES

In this section, we compare the developmental and non-developmental effects of SCE's proposal, SCE's proposal as modified by staff, and the no-action alternative. We summarize the environmental effects of the different alternatives in the following section.

Aquatic Resources—Under SCE's and the staff alternatives: (1) habitat for trout and other aquatic biota would be enhanced by increased flows; (2) trout spawning and riparian habitat downstream of seven dams associated with the Big Creek Nos. 2A, 8, and Eastwood Project would be exposed to seasonal high flows that would flush sediment from gravel, thus enhancing potential for spawning success, and enhanced wildlife habitat from increased riparian vegetation regeneration; (3) the potential for inadvertent flow-related adverse affects on aquatic habitat from releases of inappropriate flows would be minimized by upgraded streamflow measurement capabilities; (4) habitat diversity and the amount of spawning gravel would be increased by provisions to pass sediment downstream of project dams; (5) project diversions would be decommissioned, and the affected stream reaches returned to essentially natural flow and sediment transport conditions; and (6) aquatic habitat downstream of the Bear Creek diversion would be enhanced by passing LWD previously blocked by the diversion dam.

Terrestrial Resources—Under SCE's and the staff alternatives: (1) wildlife habitat would be enhanced; (2) bald eagle, mule deer, bats, and special status species of wildlife and their habitat would be protected; and (3) vegetation would be managed and the spread of noxious weeds controlled in accordance with a defined plan.

Threatened and Endangered Species—Under SCE's and the staff alternatives VELB habitat and mature elderberry shrubs would be protected and potential widespread loss of VELB habitat from brush fires would be reduced by vegetation maintenance adjacent to elderberry shrubs.

Recreation—Under SCE's and the staff alternatives: (1) operation, maintenance, and rehabilitation of existing recreation facilities would enhance the recreational experience of the public; (2) new recreational opportunities for the general public and people with disabilities would be created by the construction of new facilities, including accessible fishing platforms and boat loading platforms, and a day use area; (3) angling opportunities would be enhanced by stocking fish in project reservoirs and stream reaches; and (4) more water dependent recreational use at project reaches would likely occur because of whitewater boating releases and improved dissemination of flow information to the public.

Cultural Resources—Under SCE's and the staff alternatives, cultural resources would be protected under provisions specified in the finalized HPMP. There would also be increased awareness of cultural resources by the general public with the implementation of proposed environmental programs.

Land Use and Aesthetics Resources—Under SCE's and the staff alternatives: (1) project-related roads would remain functional and safe by clearly defining maintenance, monitoring, and rehabilitation responsibilities; (2) the experience of visitors to the area would be enhanced by the installation of interpretive signs at selected locations; and (3) certain project features would be less noticeable to the public by use of painting strategies defined in a Visual Resources Plan.

Under the no-action alternative, environmental conditions would remain the same, and there would not be any enhancement of environmental resources.

5.2 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. This section contains the basis for and a summary of our recommendations to the Commission for relicensing the Big Creek ALP Projects. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on the Big Creek ALP Projects and our review of the environmental and economic effects of the proposed projects and their alternatives, we selected the staff alternative as the preferred alternative. This alternative includes elements of the applicant's proposal, section 4(e) conditions, resource agency recommendations, and some additional measures. We recommend this alternative because (1) issuance of a new hydropower license by the Commission would allow SCE to operate the Big Creek ALP Projects as economically beneficial and dependable sources of electrical energy for its customers; (2) the 865-MW projects may eliminate the need for an equivalent amount of fossil-fuel derived energy and capacity, which helps conserve these nonrenewable resources and reduce atmospheric emissions; (3) the public benefits of this alternative would exceed those of the no-action alternative; and (4) the recommended measures would protect and enhance fish and wildlife resources and would provide improved recreational opportunities at the Big Creek ALP Projects.

We recommend approving most of the Settlement Agreement terms with some minor modifications and making these terms conditions of the license to be issued for the Big Creek ALP Projects. However, we recommend modifications and finalization of some of the plans as proposed in the Settlement Agreement. Any such modified or finalized plans would be filed with the Commission for approval. This would allow Commission staff to monitor compliance with the conditions of the license and review the results of many of the proposed studies and measures.

We evaluate numerous recommendations in the resource sections of this final EIS and, given the environmental benefits, we recommend including the following measures that SCE proposes in any license issued by the Commission for the Big Creek ALP Projects. Our recommended modifications to SCE's originally proposed measures are *italicized*. In its comments on the draft EIS, SCE states that it supports our modifications to its originally proposed projects.

5.2.1 All Big Creek ALP Projects

- Implement the streamflow requirements including new MIF releases in the bypassed reaches of Rock Creek, Ross Creek, Lower Stevenson Creek, Balsam Creek (forebay to diversion), Upper Balsam Creek (diversion to Big Creek), Lower Big Creek (Dam 5 to San Joaquin River), Middle Big Creek (Dam 4 to Dam 5), Upper Big Creek (Huntington Lake to Dam 4), Ely Creek, North Fork Stevenson Creek, Pitman Creek, Bear Creek, Mono Creek, Bolsillo Creek, Camp 62 Creek, Chinquapin Creek, and Hooper Creek; the San Joaquin River, including Dam 6 to Redinger -"Stevenson reach" and Mammoth Pool dam to Dam 6; and the South Fork San Joaquin River. (The Settlement Agreement also specifies proposed MIF releases for Camp 61 Creek, which is part of the Portal Project [No. 2174] and not a Big Creek ALP Project; we recommend the proposed MIFs be included in a license for the Portal Project).
- Implement the Temperature Monitoring and Management Plan in the San Joaquin River (Mammoth and Stevenson reaches), South Fork San Joaquin River, Big Creek, Florence Lake, Mammoth Pool reservoir, Mono Creek, and North Fork Stevenson Creek. (The Settlement Agreement also includes Camp 61 Creek in the Temperature Monitoring and Management Plan; we recommend this measure be included in a license for the Portal Project).
- Implement the Flow Monitoring and Reservoir Level Measurement Plan in the bypassed reaches of Rock, Ross, Stevenson, Balsam, Big, Ely, North Fork Stevenson, Pitman, Bear, Mono, Bolsillo, Camp 62, Chinquapin, and Hooper creeks; the San Joaquin River; the South Fork San Joaquin River; Mammoth Pool reservoir; and Huntington, Florence, and Shaver lakes and, as appropriate, adjust the MIFs, many of which are based on water year types, based on the April 1 and May 1 water year forecasts if it is revised from the March 1 forecast. (The Settlement Agreement also includes Camp 61 Creek in the Flow Monitoring and Reservoir Level Measurement Plan; we recommend this measure be included in a license for the Portal Project).

- Implement the Fish Monitoring Plan in the bypassed reaches of Big Creek downstream of Dams 4 and 5, Mono Creek, Bear Creek, North Fork Stevenson Creek, and Stevenson Creek; the San Joaquin River downstream of Mammoth Pool and downstream of Dam 6; South Fork San Joaquin River downstream of Florence dam; Mammoth Pool reservoir; and Huntington, Florence, and Shaver lakes at years 3, 8, 18, 28, and 38, if a 50-year license is granted.
- Attend annual consultation meeting for water and aquatic resources.
- Implement wildlife habitat enhancements.
- Implement the Bald Eagle Management Plan *but modify the plan to ensure that when investigating any raptor mortality that may be associated with a project transmission line, the most recent APLIC guidelines be used to assess potential corrective actions*.
- Implement the Vegetation and Integrated Pest Management Plan.
- Implement environmental programs for environmental training, avian protection, noxious weeds, environmental compliance, the Endangered Species Alert Program, and the Northern Hydro Special-Status Species Information Program.
- Attend annual consultation meeting for terrestrial resources.
- Prepare a report on recreational resources, *including information on reservoir elevations, boat ramp accessibility, and parking and campsite capacity*.
- Attend annual consultation meeting for recreational resources.
- Implement the proposed project boundary changes detailed in section 2.2.5, *Proposed Project Boundary*, and analyzed in section 3.3.6.2, *Project Boundary Revisions, with the exception of maintaining the Florence Lake day-use area within the project boundary and including portions of the recreational facilities that are partially outside of the existing project boundary inside the revised project boundary.*
- Implement the Transportation System Plan.
- *Develop a Sign Plan*.
- *Develop a Fire Management Plan*.
- *Develop a Spill Prevention and Countermeasure Plan*.
- Attend annual meeting for land management resources.
- Provide transportation system plan labor and equipment.
- Finalize and implement one HPMP for the Big Creek ALP Projects.
- Implement environmental programs for cultural resources awareness.

- Attend annual consultation meeting for cultural resources.

5.2.2 Big Creek Nos. 2A, 8, and Eastwood Project

- Implement the Channel Riparian Maintenance Flow Plan in South Fork San Joaquin River and in Bear, Bolsillo, Camp 62, Chinquapin, and Mono creeks. (The Settlement Agreement also includes Camp 61 Creek in the Channel Riparian Maintenance Flow Plan; we recommend this measure be included in a license for the Portal Project).
- Implement the Flow Monitoring and Reservoir Water Level Measurement Plan including installation of gaging equipment at Dam 5 and Mono Creek diversion and modifying MIF release facilities at the Bolsillo Creek and Camp 62 diversions.
- Implement temperature monitoring programs in the South Fork San Joaquin River, Big Creek, Florence Lake, and North Fork Stevenson Creek, including real-time telemetry monitoring of water temperatures in the South Fork San Joaquin River downstream of Florence Lake.
- Implement the Small Diversions Decommissioning Plan on Crater Creek, Tombstone Creek, North Slide Creek, and South Slide Creek.
- Implement the Riparian Monitoring Plan at the South Fork San Joaquin River (Jackass Meadow Complex) and Mono creeks. (The Settlement Agreement also includes Camp 61 Creek in the Riparian Monitoring Plan; we recommend this measure be included in a license for the Portal Project).
- Implement the sediment management prescriptions at small diversions on Balsam, Bolsillo, Camp 62, Chinquapin, Hooper, Mono, and Pitman creeks.
- Implement the sediment management prescriptions at Dam 5, Portal, and Balsam Meadows forebays.
- *Monitor spawning gravel embeddedness after sediment pass-through at Dam 5*.
- Implement the LWD Management License Article at the Bear Creek diversion.
- Implement the VELB Management Plan.
- Implement proposed license articles for mule deer, special-status species, and bats.
- Perform operation and maintenance of recreational facilities.
- Implement rehabilitation of existing recreation facilities, *but not including Dorabelle Campground located in the Sierra National Forest outside of the project boundary*.
- Construct new recreational facilities including an accessible fishing platform at Jackass Meadows and an accessible boat loading platform at Florence Lake.

- Provide maintenance of the accessible fishing platform.
- Manage reservoir water surface elevations at Florence Lake.
- *Stock fish in project reservoirs and stream reaches.*
- *File an annual stocking report with the Commission.*
- Disseminate to the public flow information for whitewater boating.
- Install interpretive signs.

5.2.3 Big Creek Nos. 1 and 2 Project

- Install minimum flow devices and gaging equipment at Ely Creek diversion, Balsam Creek diversion, and Dam 4.
- Implement the sediment management prescriptions at Ely Creek diversion.
- Implement the sediment management prescriptions at Dam 4.
- *Remove Rancheria Creek from the Big Creek Nos. 1 and 2 Project license*.
- *Monitor spawning gravel embeddedness after sediment pass-through at Dam 4*.
- Implement the Small Diversions Decommissioning Plan at Pitman Creek and Snow Slide Creek domestic diversions.
- Implement proposed license articles for special-status species, bats, and bear-human interactions.
- Implement rehabilitation of existing recreation facilities, *but not including Upper Billy Creek, Catavee, and Kinnikinnick campgrounds located in the Sierra National Forest outside of the project boundary*.
- Construct new recreational facilities including a day-use area at Dam 3 and an accessible fishing platform.
- *Stock fish in project reservoirs and stream reaches.*
- *File an annual stocking report with the Commission.*
- Install interpretive signs.
- Implement the Visual Resources Plan.

5.2.4 Mammoth Pool Project

- Implement fishwater turbine upgrade.

- Install minimum flow devices and gaging equipment at Mammoth Pool dam and the Ross and Rock Creek diversions.
- Implement temperature monitoring programs in the San Joaquin River and Mammoth Pool reservoir, including real-time telemetry monitoring of water temperatures in the Mammoth Pool reach.
- Implement the sediment management prescriptions at Ross and Rock creeks.
- Implement the sediment management prescriptions at Mammoth Pool reservoir.
- *Conduct a feasibility assessment to evaluate the effects of gravel augmentation into, or immediately below, the Mammoth Pool spillway channel on project facilities. (This measure was included in the Settlement Agreement but not to be included in a new license).*
- Implement the VELB Management Plan.
- Implement proposed license articles for mule deer, special-status species and bats.
- Implement rehabilitation of existing recreation facilities, *but not including Mammoth Pool Campground located in the Sierra National Forest outside of the project boundary.*
- *Stock fish in project reservoirs and stream reaches.*
- *File an annual stocking report with the Commission.*
- Disseminate flow information for whitewater boating.
- Provide pre-spill whitewater boating releases.
- Provide interpretive signs.
- Implement the Visual Resources Plan.

5.2.5 Big Creek No. 3 Project

- Install minimum flow devices and gaging equipment at Dam 6.
- Implement temperature monitoring programs in the San Joaquin River, including real-time telemetry monitoring of water temperatures in the Stevenson reach.
- Implement a supplemental fish, water temperature, and DO study in the San Joaquin River - Stevenson reach to evaluate use and importance of this reach for transitional zone fish species.

- Implement the sediment management prescriptions at Dam 6.
- *Monitor spawning gravel embeddedness after sediment pass-through at Dam 6.*
- Implement the VELB Management Plan.
- Implement proposed license articles for special-status species and bats.
- Attend annual consultation meeting for terrestrial resources.
- Implement rehabilitation of existing recreational facilities.
- Disseminate flow information for whitewater boating.

Our recommended measures include all but two of the project-specific conditions specified by the Forest Service: (1) manage reservoir surface elevations at Huntington and Shaver lakes and Mammoth Pool in accordance with unspecified criteria during the summer recreational season; and (2) fund the rehabilitation of five campgrounds in the Sierra National Forest that are located entirely outside of any project boundary (Dorabelle, Upper Billy Creek, Cavatee, Kinnikinnick, and Mammoth Pool). We note that section 4(e) of the FPA provides that any license issued by the Commission "for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation." Thus, any 4(e) condition that meets the requirements of the law must be included in any license issued by the Commission, regardless of whether we include the condition in our staff alternative.

5.2.6 Rationale for Staff Recommendations

This section describes the rationale for some of our recommendations on measures that we conclude should be included as conditions of any licenses issued, as well as any measures that we do not recommend as license conditions. This section is arranged by major resource topic. Within each topic we discuss each of the Big Creek ALP Projects or provide our rationale for recommending or not recommending specific measures.

Aquatic Resources

Project operations could affect aquatic habitats and sediment transport in the stream reaches. The Settlement Agreement includes a set of measures (Proposed Articles 1.1.1 through 1.5) focused on the ecological health and suitability of reaches downstream of project dams to support native fish, amphibian, and reptile populations.

Minimum Instream Flows

Under Settlement Agreement measure A1.1.1, SCE proposes to implement increased MIFs in 21 of the bypassed reaches downstream of project diversion dams. In most cases, the MIFs vary by season and by water type, and include both minimum daily average and instantaneous minimum flows (see section 3.3.1.2 for specific flows and analysis). The Forest Service filed a 4(e) condition and Interior filed a 10(j) recommendation for all four Big Creek ALP Projects consistent with this measure.

Many of the bypassed reaches were naturally fishless, but most currently support self-sustaining populations of introduced rainbow, brown, and/or brook trout because of stocking efforts by Cal Fish & Game. In many of the project reaches, low flows due to project operations create barriers to fish passage, limit the quantity of available fish habitat, and contribute to daily mean and maximum water temperatures that exceed optimal levels for trout growth.

SCE conducted a series of studies in collaboration with the agencies and other interested parties to identify limiting factors in each reach, including habitat surveys and fish population evaluations, habitat modeling to evaluate the effects of streamflow on fish habitat, evaluation of current and historic flow regimes, temperature monitoring, and evaluation of the effect of stream flows on fish passage at potential barriers to upstream migration. Based on this collaborative effort, SROs were developed for each reach, and the flow regimes included in the Settlement Agreement were designed to meet the resource objectives while minimizing reductions in hydropower generation.

Based on our analysis of the proposed flows in section 3.3.1.2, *General Streamflow Requirements*, we conclude that the proposed MIFs would enhance aquatic conditions and would benefit fisheries for naturally produced and stocked trout in each of the 21 reaches where MIFs would be implemented. Specific environmental benefits for each of the individual 21 reaches comparing baseline conditions to those under proposed MIFs are presented in section 3.3.1.2; however, overall these benefits would mainly improve conditions for cold water species such as brook, rainbow, brown, and rainbow x golden trout hybrids. Overall, the proposed MIFs would benefit these species by increasing rearing habitat, increasing spawning habitat, increasing invertebrate production, improving water temperatures, improving passage for spawning migrations, and improving habitat connectivity during the rearing season.

Camp 61 Creek currently does not have a MIF requirement under the Portal Project license (Project No. 2174). To improve habitat access and increase the amount of spawning habitat during the brown trout spawning period, in the Portal Project final EA, Commission staff recommended, consistent with SCE's proposal, that during all water year types, a MIF of 1.0 cfs should be provided to Camp 61 Creek from March 1 through July 31 and a MIF of 0.5 cfs from August 1 through February. Commission staff further recommended that SCE should provide an additional 0.5 cfs during the period of October 1 through December 15. Commission staff concluded that its recommended flow regime in the Portal Project final EA would substantially improve aquatic habitat conditions in Camp 61 Creek for both brown trout and benthic macroinvertebrates, improve fish passage conditions, and improve water quality downstream of the Portal forebay.

MIFs proposed in the Settlement Agreement for Camp 61 Creek are slightly greater than those recommended by Commission staff in the Portal Project final EA, and are consistent with the Forest Service revised final 4(e) conditions filed for the Portal Project. For wet, above, and below normal water year types, the following MIFs would be released to Camp 61 Creek: October 1 through March 31, 2 cfs; April 1 through June 30, 4 cfs; July through September 30, 3 cfs; and during dry and critical water year types, 1.25 cfs would be released. Although, the MIFs proposed in the Settlement Agreement for Camp 61 Creek are slightly greater than those Commission staff recommended in the Portal Project final EA, we find that these additional flows proposed in the Settlement Agreement would provide an additional amount of wetted area and habitat for brown trout in Camp 61 Creek, provide conditions more conducive to fish passage, and decrease thermal warming in Camp 61 Creek, as further discussed in section 3.3.1.2. Therefore, we recommend the MIFs as proposed in the Settlement Agreement for Camp 61 Creek.

Collectively, implementation of the MIFs included in the Settlement Agreement would have an annualized cost of $9,819,970 (which also includes channel and riparian maintenance flows as discussed below), including a loss of 187,404 MWh of generation. Because the proposed MIFs would provide substantial benefits to recreational fisheries and to aquatic ecosystems and improve compliance with water temperature objectives in the basin plan, we conclude that these benefits warrant the cost of this measure.

We estimate that our recommended MIFs would decrease the annual benefit of the Portal Project by about $214,900, which is about $128,000 greater than the annualized cost of the MIFs that we recommended in the Portal Project final EA. However, we note that any flows diverted from the Portal Project into Camp 61 Creek would enter the South Fork of the San Joaquin River upstream of the Mammoth Pool Project. Consequently, much of this flow would be available for generation purposes at the Mammoth Pool Project and the net loss in generation and associated revenue would be minimal.

Removal of Adit 8 and Rancheria Creeks from the Project Licenses

The Forest Service specifies in its 4(e) conditions that Adit 8 and Rancheria creeks should be removed from the Big Creek Nos. 1 and 2 Project license. Interior, in its 10(j) recommendation 1.3 states that “the current diversion at Adit 8 Creek is not to be used per the Settlement Agreement.” No resource issues were identified with either Adit 8 or Rancheria creeks in SCE’s study and neither the Forest Service nor Interior provides an explanation discussing why these creeks should be removed from the Project license.[53] Interior’s recommendation is not a specific measure to protect or enhance fish and wildlife, but we consider it under section 10(a) of the FPA.

[53] Section 1.1.1.0 of the Settlement Agreement does not specifically mention Adit 8 diversion.

In its response to the 4(e) conditions filed on April 9, 2008, SCE states that this 4(e) condition is not needed because in its license application, SCE does not propose to include Adit 8 and Rancheria creeks in the project boundary for the Big Creek Nos. 1 and 2 Project.

Because of the lack of identified aquatic issues in the reach and the fact that the diversion dam is infrequently if ever used, a decision to include or remove Adit 8 Creek and the Adit 8 Creek diversion dam from the Big Creek Nos. 1 and 2 Project license would have little if any effect on aquatic resources. Although the diversion on Adit 8 Creek has not been used for several decades, the dam gives SCE the flexibility to divert water from Tunnel 5 to Tunnel 2 in the event of an outage at Powerhouse 2A, which would help to avoid adverse effects associated with a large and sudden increase in flows in Stevenson Creek. For these reasons, we recommend that the Adit 8 Creek diversion dam remain within the project boundary.

Rancheria Creek conveys outflows from the Portal powerhouse and any flows that pass from the Portal surge chamber into Huntington Lake. Both of these facilities are part of the Portal Project. SCE proposes to take out of the project boundary the area surrounding Rancheria Creek from Portal powerhouse to the high water line of Huntington Lake (Portal tailrace). This reach is primarily affected by flow through the Ward Tunnel and is currently included in the project boundaries of two other FERC licensed projects (Big Creek Nos. 2A, 8, and Eastwood [Project No. 67]; and Portal Project [Project No. 2174]). Rancheria Creek supports self-sustaining populations of rainbow, brown, and brook trout and Sacramento sucker, and kokanee from Huntington Lake have been observed spawning in the Portal powerhouse tailrace and in the lower portion of Rancheria Creek. Because the Portal surge chamber and powerhouse are not part of the Big Creek ALP Projects, removal of Rancheria Creek would not have any effect on the ability of the Commission to implement any measures that are determined to be needed to protect aquatic and other resources in Rancheria Creek downstream of the Portal surge chamber and powerhouse. As a result, we recommend that Rancheria Creek should be removed from the Big Creek Nos. 1 and 2 Project license as proposed in the Settlement Agreement. Because this reach is the primary water conveyance from the back-country diversions, which are largely part of Big Creek Nos. 2A, 8, and Eastwood Project (Project No. 67), protection of this reach under this license would ensure the project's continued operation.

Channel and Riparian Maintenance Flows

Under Settlement Agreement measures A1.2 through A1.5, SCE would implement channel and riparian maintenance flows in the South Fork San Joaquin River and six of its tributaries: Bear, Bolsillo, Camp 62, Chinquapin, Mono, and Camp 61 creeks. Detailed plans for implementing channel and riparian maintenance flows in the South Fork San Joaquin River and in Mono and Camp 61 creeks are provided in appendices D, E, and F to the Settlement Agreement. The Forest Service filed 4(e) conditions and

Interior filed 10(j) recommendations that are consistent with the channel and riparian maintenance flows proposed in the Settlement Agreement measures and listed above.

Under the Riparian Monitoring Plan (Settlement Agreement measure A1.11), SCE would monitor trends in riparian and meadow health in response to the channel and riparian maintenance flows in the South Fork San Joaquin River (Jackass Meadow Complex), Camp 61 Creek, and Mono Creek throughout the term of the new license.

The flow regime in the South Fork San Joaquin River and in the bypassed reaches of its tributary streams has been substantially altered by diversion of flow into Huntington Lake and the Big Creek System. Project bypassed reaches have been affected by disruption of natural geomorphic processes including sediment retention behind dams and diversion, altered floodplain connectivity, and flow regulation that alters the timing, magnitude, and duration of peak flows and base flows. These alterations affect aquatic habitat conditions including the condition of spawning gravels and the extent and condition of riparian vegetation.

The proposed channel and riparian maintenance flow releases would occur during the peak spring hydrograph to maximize the channel's ability to mobilize and transport sediment and increase riparian vegetation regeneration. Spring channel and riparian maintenance flow releases would also contribute flow to the South Fork San Joaquin River to benefit spring spawning trout.

Channel and riparian maintenance flows would increase the magnitude and duration of spring peak flows compared to current project operations and would ensure that overbank flows would occur during most wet water years (see section 3.3.1.2 for analysis). These increased peak flows would benefit riparian habitats by helping to (1) scour encroaching upland and riparian vegetation in the formerly active channel and on the channel bars; (2) deposit fresh alluvium; (3) regenerate and/or establish riparian vegetation; (4) provide higher soil moisture and water table to support riparian vegetation; and (5) discourage continued encroachment of upland species on the channel bars.

The higher peak flows would have a greater capacity to mobilize and transport accumulated sediments; increase the recruitment of LWD to the channel; contribute to the formation of physical habitat features such as riffles, pools, runs, and point bars; support dynamic geomorphic processes over time; and decrease spawning gravel embeddedness. As spawning substrate conditions improve and LWD increases over time, we expect trout recruitment would increase, benthic macroinvertebrate productivity would increase, and young-of-the-year trout would have increased access to spaces within the substrate, which provide cover during floods.

In the Portal Project (Project No. 2174) final EA, Commission staff recommended that: (1) SCE release a channel and riparian maintenance flow to Camp 61 Creek during a 10-day period between June 1 and July 31, ramping up to 28 cfs in an above normal water year and up to 39 cfs in a wet water year; and (2) flows be released between June 1 and July 31. In the final EA, Commission staff concluded this recommended channel and riparian maintenance flow would likely mobilize and transport accumulated sediments out of the Camp 61 Creek system, leading to improved aquatic and riparian habitat conditions. Commission staff further concluded that channel and riparian maintenance flow releases after June 1 would avoid potential adverse effects on brown trout recruitment due to redd scour, and the later releases are less likely to adversely affect young brown trout because juveniles would be able to seek cover from high flows.

SCE's proposal for a channel and riparian maintenance flow in Camp 61 Creek in the Settlement Agreement differs from Commission staff's recommendation in the Portal Project final EA, and is consistent with Forest Service revised final 4(e) condition submitted for the Portal Project. Under the proposal in the Settlement Agreement, channel and riparian maintenance flows would be slightly greater in magnitude (30 cfs versus 28 cfs in above normal years; 40 cfs versus 39 cfs in wet water years), flows would be released between May 1 and June 30, as opposed to June 1 and July 30, and if the weighted mean value of the level of fine sediments measured downstream of Portal forebay is greater than 0.25 following the release of two wet water year flows, the duration of the channel and riparian maintenance flows would be increased by adding two days of flows at 30 cfs in above normal years and two days at 40 cfs in wet years.

We conclude that the slightly greater flows and the extended release periods under the Settlement Agreement proposal would have a somewhat greater capacity to mobilize and transport accumulated sediments and contribute to the formation of physical habitat features in Camp 61 Creek. These increased flows would also help support dynamic geomorphic process over time and decrease spawning gravel embedddedness; therefore, we recommend the slightly greater channel and riparian maintenance flows and extended release periods proposed in the Settlement Agreement.

Movement of gravels prior to brown trout emergence could result in physical damage to the incubating embryos and alevins still present in redds or among other substrate. Following emergence, juvenile brown trout would be able to seek cover from high flows along the channel margins and would not be subject to redd scour. Brown trout in California are fall or winter spawners (November and December) with embryos typically hatching 7 to 8 weeks thereafter, and alevins emerging from the gravel and beginning to feed 3 to 6 weeks after hatching (Moyle, 2002). This indicates brown trout emergence from the gravel would typically occur by March or April, prior to the May 1 through June 30 channel and riparian maintenance flows proposed in the Settlement Agreement. Therefore, we recommend releasing channel and riparian maintenance flows to Camp 61 Creek between May 1 and June 30, because it would protect young brown trout and likely minimize impacts on juvenile trout recruitment, as emergence from the gravel would occur prior to May 1.

Implementing channel and riparian maintenance flows in the South Fork San Joaquin River and in these six tributaries would provide a substantive benefit to recreational fisheries for naturally produced trout, aquatic ecosystems, and riparian-dependent wildlife species. The annual costs of implementing channel and riparian maintenance flows in these reaches (estimated to be $1,555,760 for those reaches associated with the Big Creek ALP Projects) and the reduction in the average annual value of power generation are included in the total costs of the MIFs. However, given the substantial benefits identified above, we conclude that these benefits justify the costs.

We estimate that our recommended channel and riparian maintenance flows would decrease the annual benefit of the Portal Project by about $58,800, which is about $19,600 greater than the annualized cost of the channel and riparian maintenance flows that we recommended in the Portal Project final EA. As noted in our previous discussion of MIFs, any flows diverted from the Portal Project into Camp 61 Creek would enter the South Fork of the San Joaquin River upstream of the Mammoth Pool Project. As a result, much of this flow would be available for generation purposes at the Mammoth Pool Project and the net loss in generation and associated revenue would be minimal.

Streamflow and Reservoir Elevation Monitoring

SCE plans to add or upgrade gages (see table 3-11) within the vicinity of the Big Creek ALP Projects to ensure compliance with MIFs and other flow requirements that may be specified in new licenses for these projects in accordance with the Flow Monitoring and Reservoir Water Level Measurement Plan (appendix L of the Settlement Agreement). SCE proposes to continue to monitor water levels in Mammoth Pool reservoir and Huntington, Florence, and Shaver lakes. Accurate measurement and documentation of flows is necessary to ensure compliance with MIFs, channel and riparian maintenance flows, and seasonal high flow events. In reaches used for recreational purposes (angling and boating), telemetried flow and reservoir level information that SCE plans to make available to the public via the Internet or other suitable means, would enable recreational visitors to better plan their visits to the project area. SCE plans to use existing gages to measure reservoir water levels, thus there would be no incremental cost associated with this continued monitoring. The cost to modify or replace streamflow gages, including structural modifications needed to accommodate the gages, would result in an annualized cost of $579,710 at the Big Creek Nos. 2A, 8, and Eastwood Project; $468,880 at the Big Creek Nos. 1 and 2 Project; $1,786,360 at the Mammoth Pool Project; and $348,720 at the Big Creek No. 3 Project. However, because of the complexity of the interactions of flows within the Big Creek ALP Projects, sophisticated flow monitoring schemes are necessary for Big Creek System water management and to document compliance of project flows with license conditions; therefore, we conclude that the costs are warranted.

Small Diversions Decommissioning

Under Settlement Agreement measure A1.6, SCE would implement the proposed Small Diversions Decommissioning Plan included as Settlement Agreement, appendix G. SCE proposes to complete the decommissioning of the six small diversions within 5 years following issuance of the new licenses, assuming required permits are obtained.

The small diversions that would be decommissioned include four backcountry hydroelectric generation diversions on North Slide, South Slide, Tombstone, and Crater creeks, and two domestic water diversions on Pitman and Snow Slide creeks. The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations that are consistent with this measure.

Under the Settlement Agreement, these six diversions would be decommissioned because they (1) are currently not in service, (2) are no longer needed for the operation and maintenance of the project, or (3) have been requested to be removed by resource agencies participating in the ALP. Decommissioning and removing these diversions would maintain or restore natural flow to the affected bypassed reaches, which would serve to provide cooler water temperatures to these streams and the South Fork San Joaquin River bypassed reach. Decommissioning these diversions would generally enhance the aquatic and riparian habitats associated with these bypassed reaches, improve fish passage, and increase the recruitment of spawning gravel to the South Fork San Joaquin River bypassed reach, which has a spawning gravel deficit due to impoundments. The combined annualized cost of decommissioning these six diversions is $141,830. We expect the energy loss associated with the decommissioning of these diversions to be minimal, given the small amount of water impounded and diverted by each of these diversions. Based on the benefits identified above, we conclude that the benefits warrant the costs.

Large Wood Debris Management at Bear Creek

The Bear Creek diversion dam blocks the transport of LWD from the upper watershed to the Bear Creek bypassed reach. Under Settlement Agreement measure A1.7, SCE would return large wood to Bear Creek by allowing LWD to pass over the Bear Creek diversion spillway during spill. SCE would also collect LWD from the impoundment in the vicinity of the intake gates and dam for placement in the bypassed reach. For purposes of this measure, LWD is defined as dead or dying wood 10-feet or longer and at least 4-inches in diameter. SCE may cut large pieces of wood that otherwise would not be feasible to collect and move the wood from the Bear Creek forebay as long as the minimum dimensions for LWD, as defined above, are maintained. SCE would consult with the resource agencies annually to decide if the amount of LWD is sufficient or the LWD procedures are adequate to transport downstream during spill events. The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations that are consistent with this measure.

In the reference reach upstream of the Bear Creek diversion, more than half of the habitat units had 1 to 15 pieces of LWD. Most of the habitat units in the bypassed reach did not have LWD; six habitat units had 1 to 5 pieces of LWD and one unit had 5 to 10 pieces of LWD. The limiting factors analysis of the bypassed reach suggests that adult rearing and spawning habitat is heavily used by an abundant trout population, and the physical habitat may be approaching limiting values.

LWD contributes to productive aquatic ecosystems, and is an important component in the formation of complex aquatic habitat units and channel maintenance. The proposed LWD supplementation in the bypassed reach would increase the amount of available trout habitat by creating deep pools that provide thermal refugia and increasing habitat complexity. LWD creates high flow velocity breaks and provides cover from predators, including other trout. Snorkel surveys conducted by the Sierra National Forest indicate that the highest trout densities are associated with LWD. The velocity breaks created by LWD also retain and sort substrate to create gravel bars and spawning habitat for salmonids. The annualized cost of this measure is estimated to be $6,850. Given the relatively low cost of this measure and the substantial resource benefits identified above, we conclude that the benefits warrant the costs.

Temperature Monitoring and Management

Under Settlement Agreement measure A1.8, SCE would implement a Temperature Monitoring and Management Plan, included as Settlement Agreement, appendix H, to document the effects of proposed MIFs on water temperatures and allow for adaptive management where needed. SCE would monitor water temperatures during at least the first 3 to 5 years that new MIFs are released, including at least one dry or critically dry water year. Water temperature monitoring would be conducted at seven sites on the South Fork San Joaquin River and in two of its tributaries (Camp 61 and Mono creeks), at six sites in the Mammoth and Stevenson reaches of the San Joaquin River, at four sites in the middle and lower Big Creek reaches, and at two sites in North Fork Stevenson Creek. In addition, monthly temperature profiles would be measured in Mammoth Pool and in Florence Lake during the summer. Water temperature monitoring programs would be implemented in the San Joaquin River, South Fork San Joaquin River, Mammoth Pool reservoir, Florence Lake, and North Fork Stevenson Creek, including real-time telemetry monitoring of water temperatures in the Mammoth and Stevenson reaches and in the South Fork San Joaquin River downstream of Florence Lake. The monitoring results would be presented and discussed at an annual agency consultation meeting, and would be used to develop interim and long-term water temperature control programs including measures that may be feasibly implemented by SCE to maintain water temperatures below target temperatures. Interior filed 10(a) recommendations for all four Big Creek ALP Projects that are consistent with Settlement Agreement measure A1.8, except that it would expand the program to include monitoring of all of stream reaches and reservoirs affected by the projects.

The proposed Temperature Monitoring and Management Plan would benefit coldwater fisheries for trout by documenting how project operations affect water temperatures so that flows could be adjusted through adaptive management if needed, based on monitoring results. The plan includes measurement of water temperatures at 19 sites in 6 bypassed stream reaches where daily mean water temperatures exceeded 20°C or daily maximum water temperatures exceeded 22°C in 2000 or 2001, based on criteria supplied by the Water Board to protect coldwater beneficial uses. The estimated annualized cost of the temperature monitoring program as proposed by SCE is $96,190. The program would help to determine the effectiveness of proposed MIFs in attaining temperature objectives, and in conjunction with the proposed fish monitoring program described below, would help to determine associated fish population responses. Because this information would help to foster cost-effective adaptive management of MIFs, we conclude that the benefits of this measure warrant its costs.

Interior's 10(a) recommendation would expand the monitoring program to include 9 additional bypassed stream reaches (Stevenson, Upper Balsam, Bear, Mono, Hooper, Pitman, Bolsillo, Chinquapin, and Camp 62 creeks), none of which exceeded a daily mean temperature of 20°C or a daily maximum water temperature of 22°C in 2000 or 2001. Short-term (3 year) water temperature monitoring is proposed for Mono Creek upstream of the San Joaquin River at RM 0.1 in the Temperature Monitoring and Management Plan due to thermal heating in the reach that exceeds the Basin Plan standard (>5ºF). Based on monitoring data collected in 2000 and 2001, these reaches currently support all beneficial uses of coldwater aquatic life, would continue to do so under the MIFs proposed in the Settlement Agreement, and the proposed Mono Creek MIF is expected to decrease thermal warming to meet Basin Plan standards. Therefore, Interior's 10(a) recommendation is unnecessary.

Interior's 10(a) recommendation would also expand the monitoring program to include all 15 affected reservoirs and impoundments. However, only two project reservoirs (Shaver and Huntington) besides Mammoth Pool and Florence Lake have sufficient storage to suggest that they have the potential to be used to manage downstream water temperatures. Shaver Lake has a maximum storage of 135,568 acre-feet and likely could be used to manage water temperatures in the downstream reach of Stevenson Creek, but SCE's temperature monitoring data from 2000 and 2001 indicate that the temperature in this reach already meets the objectives to support coldwater life, and would continue to do so under the increased MIFs proposed in the Settlement Agreement. Similarly, Huntington Lake has a substantial amount of usable storage capacity (89,166 acre-feet), but the upper Big Creek reach downstream of the reservoir already meets the objectives to support coldwater life, and would also be expected to do so under the increased flows proposed in the Settlement Agreement.

Expanding the program to include monitoring of 9 additional stream reaches and 13 additional reservoirs as recommended by Interior, would increase the annualized cost of the temperature monitoring program by about $192,380, to approximately $288,570. Based on the results of temperature monitoring conduced by SCE in 2000 and 2001, all of the additional stream reaches that would be monitored under Interior's 10(a) recommendation currently support coldwater life, and would continue to do so under the MIFs proposed in the Settlement Agreement. In addition, only four of the project reservoirs appear to have sufficient storage to provide opportunities to control downstream water temperatures, and water temperatures in reaches downstream of Huntington Lake and Shaver Lake already fully support the beneficial use of coldwater life. As a result, we conclude there would be little benefit in expanding the temperature monitoring program to include the additional reaches and reservoirs included in Interior's 10(a) recommendation and conclude that these limited benefits do not justify its costs. We note that SCE's proposed annual consultation meeting would provide an opportunity for the potential need for inclusion of additional reaches to be considered, if warranted.

Fish Monitoring

Under Settlement Agreement measure A1.9, SCE would implement the Fish Monitoring Plan included in Settlement Agreement, appendix I. The Fish Monitoring Plan would evaluate the response of fish populations in selected reaches and major reservoirs to the MIFs and other enhancement measures (channel and riparian maintenance flows, LWD, sediment) included in the new licenses. Species composition, relative abundance, size and age distribution, biomass, density, and condition factor would be monitored during the months of August and September. Fish monitoring would be conducted at seven sites on the South Fork San Joaquin River, in Mono, North Fork Stevenson, and Bear creeks, and in two of its tributaries, in the Mammoth and Stevenson reaches of the San Joaquin River, in the middle and lower Big Creek reaches, and in Stevenson Creek. Fish monitoring in reservoirs would occur in Mammoth Pool reservoir, Huntington Lake, Florence Lake, and Shaver Lake. Monitoring would be implemented at years 3, 8, 18, 28 (and in year 38, if a 50-year license is granted). Monitoring would not begin until the new MIFs have been implemented in each survey reach. If monitoring is scheduled for a wet water year, it would be postponed until the next non-wet water year to prevent confounding the effect of high flows on fish recruitment and populations. The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations for all four Big Creek ALP Projects that are consistent with this measure.

Trout populations in a number of the bypassed reaches have low densities, fragmented distributions, or skewed age class distributions (see our analysis in section 3.3.1.2). In many cases, fish populations appear to be constrained by the effects of flow diversions and project structures on stream flows, water temperatures, fish passage, and the transport and supply of spawning gravel and LWD. The Settlement Agreement includes measures that are expected to enhance fish populations by addressing many of these project-related effects. Monitoring fish populations in the specified bypassed reaches would provide a means of assessing the effects of the new MIFs and other enhancement measures on fish populations in these reaches and would apply adaptive management based on monitoring, as needed. Fish population monitoring in bypassed reaches would also help determine if the Forest Service, Interior, and Basin Plan objectives are being met in these reaches. Monitoring fish populations in project reservoirs would provide a means of assessing the effects of the new MIFs on fish populations in the major reservoirs, including potential effects of earlier depletion of cool water in dry years on reservoir trout. This information would help to determine if Cal Fish & Game's management objectives for these reservoirs are being met, and would assist in guiding adaptive management.

A supplemental study that includes fish, water temperature, and DO data collection would be implemented to evaluate the use and importance of the Stevenson reach for transitional zone species including hardhead, Sacramento pikeminnow, and Sacramento sucker. If the supplemental study concludes that Stevenson reach is an important native fish transition zone, and the consensus recommendation of SCE and the resource agencies is to change the beneficial use designation of the reach or the lower portion of the reach (downstream of the Stevenson Creek confluence), SCE would propose an amendment of the coldwater habitat designation in the Basin Plan.

The estimated annualized cost of fish monitoring in project bypassed reaches and reservoirs is $35,340. Because the monitoring effort would help to determine the effectiveness of proposed measures and facilitate adaptive management, we conclude that the benefits warrant the costs of this measure.

Sediment Management

Project dams impede or interrupt the flow of sediments, spawning gravels, and other materials beneficial to fish and wildlife from continuing downstream through the project affected stream reaches. Under Settlement Agreement measure A1.10, SCE would implement the sediment management measures described in Settlement Agreement, appendix J. These include measures for passing accumulated sediment through project facilities followed by flushing flows to redistribute passed sediments, removing accumulated sediment from behind dams, if needed, that may block low level outlets or intake structures, and monitoring of turbidity and pool filling. The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations for all four Big Creek ALP Projects that are consistent with this measure.

Sediment retention behind project dams has resulted in depletion of spawning gravels in the bypassed reaches. Sediment pass-through activities, as proposed in the Settlement Agreement, would restore sediment transport processes in four tributaries to the South Fork San Joaquin River (Hooper, Chinquapin, Camp 62, and Bolsillo creeks), which would help to restore spawning gravels in the bypassed reaches of these creeks and in the South Fork San Joaquin River. Sediment pass-through would also occur in three tributaries and three mainstem dams within Big Creek (Balsam, Pitman, and Ely creeks, and Dams 4, 5 and 6), providing similar benefits to the bypassed reaches downstream of each of these dams. Within the mainstem San Joaquin River, sediment pass-through would occur at the Rock and Ross creek dams and at Mammoth Pool dam. Likely benefits of restoring the passage of sediment into downstream reaches include: increasing the volume of spawning gravels,[54] improving benthic macroinvertebrate production, creating greater quality and diversity of aquatic habitat to benefit native fishes, and

[54] Except below Mammoth Pool dam, where our analysis (see section 3.3.1.2) indicates that the proposed pass-through activities are unlikely to restore movement of spawning gravels because of the large size of the reservoir.

fostering point bar development to enhance riparian habitat. Sediment pass-through activities would be implemented in wet water years, prior to the implementation of channel and riparian maintenance flows in the reaches where they are proposed. Both of these provisions would assist with ensuring flows re-distribute spawning gravel, maintain pool depths via scouring, and flush fine sediment from the stream channel.

Sediment removal activities would help to prevent MIF release structures from becoming blocked by sediment, and would reduce the transport of fine sediments into downstream reaches, which could prevent potential adverse effects from fine sediment such as reducing the permeability of spawning gravels and smothering incubating trout eggs. As proposed in the Settlement Agreement, sediment removal activities would be implemented, if needed, at each of the dams where sediment pass-through activities are proposed, except for Dam 4 and Mammoth Pool dam where sediment build-up is not an issue. Removed sediments would be either placed above the mean annual flood elevation where they would not be re-entrained or removed to pre-approved, off-site locations. Therefore, mechanical sediment removal would have no adverse effects on fish habitat in downstream areas.

The sediment management measures in the Settlement Agreement include monitoring of turbidity levels downstream of seven of the larger dams to ensure that turbidity levels do not rise to levels that would be harmful to aquatic biota (see table 3-14). Monitoring of pool depths would also be performed downstream of Dams 4, 5 and 6 prior to and after implementation of sediment pass-through measures, to determine whether deposition of fine sediments has caused pools to fill with sediments and the volume of the pools reduced. Monitoring pool depth in these reaches would allow effects of sediment pass-through on pool habitat to be assessed, and would provide information that could be used to alter the implementation of sediment pass-through measures if excessive pool filling occurs, which would adversely affect habitat availability and thermal refugia for adult trout.

The Settlement Agreement does not require monitoring of pool depths for the other dams where sediment pass-through measures would be implemented, including Mammoth Pool and nine smaller headwater diversions. Because of the large size of the Mammoth Pool impoundment (approximately 8 miles in length), we expect that most of the sediment retained in this reservoir is deposited in the upstream portion of the reservoir, and that only small amounts of fine sediments would be released when pre-spill whitewater flows are released via the Howell-Bunger valve, and that these sediments would be easily transported downstream and pose little threat of pool-filling. The nine headwater diversions are on high gradient streams with very small impoundments, all of which have a surface area of less than 1 acre and a volume of less than 1 acre-foot. Given the relatively small amount of sediment that could be retained in these impoundments and the high transport capacity of these headwater streams, we conclude there is little risk of pool-filling from sediment pass-through activities on the tributaries.

The estimated annualized cost of sediment pass-through, removal and sediment monitoring measures proposed in the Settlement Agreement is $85,340. Given the importance of keeping minimum flow structures open and the ecological benefits of restoring sediment transport processes, we conclude that these measures are warranted and justify these costs.

Expansion of the monitoring of pool-filling proposed for Dams 4, 5 and 6 to include an assessment of embeddedness of spawning gravels with fine sediment at representative potential spawning sites would allow potential adverse effects on spawning gravel and the adequacy of flushing flows to be evaluated and adjusted if warranted. A relatively simple visual assessment of the abundance of fine sediment on the surface of potential spawning areas, such as the method for estimating percent cobble embeddedness described in the California Salmonid Stream Habitat Restoration Manual (Cal Fish & Game, 1998), could be conducted at a relatively low cost, especially if it were conducted in association with monitoring of pool-filling at the reaches downstream of Dams 4, 5 and 6.[55] We estimate that this additional effort would add approximately $5,820 to the annualized cost of the sediment management measures included in the Settlement Agreement, assuming that sediment pass-through and monitoring activities would occur every 5 years. Because of its low cost and its importance in detecting and addressing any adverse effects of sediment pass-through activities on spawning gravel, we conclude that the benefits of this additional measure warrant its costs. We also conclude that limiting this monitoring effort to Dams 4, 5 and 6 is appropriate, given the more limited volume of sediments likely to be passed through at other project diversions.

Gravel Augmentation

To address project effects on the recruitment of spawning gravels in the Mammoth reach, SCE proposes to implement the Gravel Augmentation Plan described in Settlement Agreement measure B.1.2. Interior filed a 10(j) recommendation consistent with this measure.

Under the proposed plan, SCE would coordinate with the Forest Service, FWS, Cal Fish & Game, Water Board, and other interested resource agencies to implement a gravel augmentation feasibility assessment to determine if placing gravel in or near the spillway channel at Mammoth Pool dam is feasible and whether gravel placed at this location would be moved and redistributed by spill flows. The feasibility assessment would include assessing whether placing gravel at this location would cause any adverse effects on project operation or to dam safety by assessing whether it would impair the Mammoth Pool dam spillway function, cause erosion and undermine the access road, result in dam instability, or impair the operation of release structures or hinder inspection of the dam and release structures.

[55] We anticipate that the specific methodology to be used at Dams 4, 5, and 6 to assess embeddedness would be determined in consultation with the agencies.

If the assessment concludes that the placement of gravel in or below the spillway channel would lead to any of these problems or would create other reliability or operational problems, then alternative locations for gravel placement would be evaluated. The alternative locations must have sufficient physical space and access for placement of gravels and be comparable in cost to the placement of gravels in or below the spillway. These alternative locations would include, but would not be limited to, a location below the confluence of Rock Creek.

Gravel augmentation would begin after the first fish monitoring effort has been completed following the initiation of the new flow regime. SCE would place 300 tons of gravel into the Mammoth reach immediately below the Mammoth dam spillway, or at alternative feasible location(s). SCE would monitor gravel transport and distribution and evaluate whether the next two above normal or wet water year spill events with a peak flow of at least 5,000 cfs are capable of moving the gravel from the emplacement site. The pilot project may be considered successful if after the two spill events, more than 50 percent of the gravel has moved downstream from the emplacement site.

SCE would prepare a report following the completion of gravel monitoring after the second spill event for agency review and comment. If the feasibility assessment is successful SCE and the agencies would meet and decide whether to continue or modify the gravel augmentation program. If the gravel augmentation program is not implemented, then a supplemental fish stocking program in the Mammoth reach would be implemented by Cal Fish & Game.

If gravel augmentation is conducted, the proposed feasibility assessment would be needed to assess the potential for gravel augmentation to cause adverse effects to project facilities, including the Mammoth Pool dam, spillway, and access road.

We conclude that the proposed gravel augmentation feasibility assessment would be necessary in order to assess the potential for gravel augmentation to cause adverse effects to project facilities, including the Mammoth Pool dam, spillway, and access road. The estimated annualized cost of conducting the feasibility assessment, as proposed in Settlement Agreement measure B.1.2, is $5,250. Given that the feasibility assessment is needed to ensure dam safety, we conclude that the benefits of this measure warrant its costs and that this measure should be included as a condition of a new license. In order to ensure that gravel augmentation does not adversely affect dam safety or the integrity of project facilities, SCE should file a detailed study plan with the Commission for approval prior to conducting the feasibility assessment. Upon completing the feasibility assessment, we also recommend that notification be provided to the Commission, in addition to the agencies noted above, detailing the results of the feasibility assessment. Further, if the pilot project is successful, and gravel augmentation is proposed by SCE to be implemented over the life of the license, SCE would be required to request an amendment to its license.

Wildlife and Plant Protection Measures

Vegetation and Integrated Pest Management Plan

Vegetation management, including trimming of vegetation by hand or equipment and the use of herbicides, occurs at several locations within the Big Creek ALP Projects. This regularly occurring management could have both beneficial and adverse effects on special-status plans and wildlife and the proliferation of noxious weeds. SCE's proposed Vegetation and Integrated Pest Management Plan specifies measures that would be implemented to ensure vegetation management in a manner that minimizes adverse effects on the environment, protects sensitive plants and wildlife, controls the spread of noxious weeds, ensures revegetation of disturbed sites, and provides for weed-free erosion control measures. SCE also would monitor the effectiveness of vegetation management activities that it implements. In addition, SCE would implement multifaceted training programs to ensure that employees are aware of sensitive plants and wildlife that could be affected by operation and maintenance of the Big Creek ALP Projects. SCE would also attend annual consultation meetings with the Forest Service, Interior, and Cal Fish & Game to discuss past and proposed terrestrial resource management activities. The resource and land management agencies support SCE's proposed approach to vegetation management. We consider the proposed measures to manage vegetation and control the spread of noxious weeds to represent an effective approach to minimizing and avoiding project related effects on vegetation and the wildlife that depend on this vegetation for habitat. We estimate the annual cost of implementing the Vegetation and Integrated Pest Management Plan and associated training and agency consultation would be $57,110 at the Big Creek Nos. 2A, 8, and Eastwood Project; $57,110 at the Big Creek Nos. 1 and 2 Project; $57,110 at the Mammoth Pool Project; and $22,850 at Big Creek No. 3 Project. Given the benefits of implementing these measures, we consider these costs to be warranted.

Riparian Monitoring

Quantitative and qualitative riparian studies completed for the Big Creek ALP Projects identified potential riparian or meadow resource issues along certain bypassed streams associated with the Big Creek Nos. 2A, 8, and Eastwood Project. Under Settlement Agreement measure A1.11, SCE would implement the Riparian Monitoring Plan included as Settlement Agreement, appendix K, to determine the effectiveness of channel and riparian maintenance flows for maintaining channels and riparian and meadow ecosystems. The Riparian Monitoring Plan would be designed to monitor the status and trends of the riparian resources along the Mono Creek, South Fork San Joaquin River, and Camp 61 Creek bypassed reaches in response to the channel and riparian maintenance flows and MIFs required under the new licenses. Specific objectives for the plan include monitoring riparian and meadow vegetation composition in selected reaches; riparian vegetation age class structure, including regeneration, in selected bypassed reaches; and trends in riparian and meadow health in selected reaches over the length of the new license. The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations that are consistent with this measure.

Under the Settlement Agreement, monitoring in Camp 61 Creek would occur the first year after license issuance, and at 10-year intervals thereafter, consistent with Commission staff recommendations in the Portal Project final EA. However, under the Settlement Agreement, monitoring would also occur 5 years following the channel and riparian maintenance flow releases made in the first wet water year for Camp 61 Creek. We support this additional monitoring event recommended in the Settlement Agreement as it would provide additional information in the short-term to determine the effectiveness of channel and riparian maintenance flows in Camp 61 Creek.

Overall, the proposed monitoring effort would provide information to determine whether or not the proposed channel and riparian maintenance flows and MIFs promote healthy riparian and meadow communities; result in successful establishment of native species' on alluvial surfaces in reaches with identified age class resource issues; support native riparian or meadow species; and discourage the establishment of mature woody vegetation and upland species on lower surfaces within the channel causing channel encroachment. Adaptive management would be implemented to ensure that the channel and riparian management goals are met in Bear, Bolsillo, Camp 62, Chinquapin, Mono, Camp 61, and South Fork San Joaquin River bypassed reaches. The estimated annualized cost of Settlement Agreement measures A1.11 is $17,170, and based on the benefits described above, we conclude that the cost of this measure is warranted.

Wildlife Protection

Numerous special-status wildlife species, including bald eagles, western red bat, Townsend's western big-eared bat, and pallid bat are known to occur in the vicinity of the Big Creek ALP Projects. SCE proposes to consult with the Forest Service, Interior, and Cal Fish & Game prior to conducting any non-routine maintenance at structures known to support sensitive bats, and would implement appropriate avoidance and protection measures as necessary to minimize disturbance of bats and their habitat. SCE also plans to implement its Bald Eagle Management Plan, which would ensure that disturbance of nesting bald eagles is minimized and foraging and roosting habitat is protected. Known nest sites would be monitored, as would wintering bald eagle populations. In addition, cases of raptor mortality at project transmission lines would be investigated and potential corrective actions developed in consultation with the Forest Service, Interior, and Cal Fish & Game. We consider these proposed measures to represent best management practices for the protection of bats and bald eagles; however, the final plan should include the most recent APLIC guidelines to assess potential corrective actions when investigating any raptor mortality that may be associated with a project transmission line.

Mule deer migration routes cross the San Joaquin River, specifically in the Mammoth Pool Project area. In addition, project roads in the vicinity of the Big Creek Nos. 2A, 8, and Eastwood Project have the potential to disturb mule deer migrations in that area. SCE proposes to install fences at specific locations where deer crossing of the river would be unsafe and ensure that sand is present on the Mammoth Pool dam road to encourage deer to use this road as a means to safely cross the river. Monitoring of debris at the floating boom upstream of the Mammoth Pool spillway would be used to facilitate annual consultations with the Forest Service, Interior, and Cal Fish & Game. Road closures at Mammoth Pool and Big Creek Nos. 2A, 8, and Eastwood projects during the deer migration season would minimize potential disturbance of migrating deer. Implementation of these measures would address known sources of deer mortality and disturbance during annual migrations.

Human interactions with black bears in the wild can result in injury to humans, loss of wild instincts by bears that can easily obtain food in trash receptacles, and litter from bears strewing trash during their search for food. SCE proposes to minimize these effects by installing and maintaining bear-proof dumpsters at the Big Creek No. 1 administrative offices and company housing, and other project facilities where people may dispose of or store food waste. Such bear-proof receptacles are the standard means to minimize bear/human interactions.

The resource and land management agencies are in agreement with SCE's proposed measures to protect bats, bald eagles, mule deer, and black bears. We estimate that the total annual cost of implementing these measures at all four Big Creek ALP Projects would be $48,120, but the cumulative protection of wildlife that would be afforded by these measure is warranted.

Valley Elderberry Longhorn Beetle Management Plan

SCE conducted VELB habitat surveys at the Big Creek ALP Projects and found potential occurrences and habitat at all projects except Big Creek Nos. 1 and 2. To ensure the protection of VELB habitat (elderberries with stems greater than 1 inch in diameter), SCE developed the VELB Management Plan, which includes such protective measures as using flags and signage to identify mature elderberry shrubs, limitation on trimming of elderberry branches >1-inch in diameter, herbicide restrictions near elderberries, and limitations on when non-emergency road grading would occur. To compensate for project-related losses of elderberry shrubs, SCE proposed to plant elderberry seedlings at a location agreed upon by the Forest Service, Interior, and SCE, and to monitor the seedlings to ensure pre-determined success rates are achieved. SCE established a 1.5 acre elderberry conservation area in consultation with FWS and is currently monitoring that site. Interior's 10(j) recommendations and the Forest Service's 4(e) conditions are consistent with SCE's proposed measure. Measures to protect, monitor, and mitigate project effects on VELB are specified in FWS' 1999 Conservation Guidelines, SCE's proposed plan is consistent with provisions specified in these guidelines, and we recommend implementation of the VELB Management Plan. In addition, we recommend that SCE provide the Commission with the location of any VELB conservation area that is established and include this area in the project boundary.

We estimate the total annual cost of implementing the VELB Management Plan would be $44,550, but this cost is warranted to ensure the protection of the federally listed VELB.

Recreation Management Plan

Recreation Operation, Maintenance, and Administration

Existing recreational use during high use periods at some of the project facilities reaches up to 70 to 80 percent capacity. Future recreational use at the projects is projected to increase from between 4 and 20 percent by the year 2040, depending on the project. Therefore, recreational use at the projects is anticipated to increase over the term of any new licenses. SCE proposes to meet annually with the Forest Service to ensure protection and use of the recreational facilities at the Big Creek ALP Projects. Long-term planning and the implementation schedule for major facility rehabilitation and new capital improvements would be reviewed and adjustments to the Recreation Management Plan or implementation schedule considered, as needed. SCE would also complete a recreational use and facilities condition survey every 6 years, and file the results with the Commission along with the required Form 80 report. This report would summarize capacity data, including parking and campsite capacity, at formal recreational sites, days when recreational access to the projects was available to vehicular traffic, major reservoir water surface elevations during the recreational season, boat ramp accessibility, and the number of whitewater boating opportunity days provided at boatable reaches (downstream of Florence Lake and Mammoth Pool). The results of this survey would provide a basis for SCE and the Forest Service to make adjustments to the Recreation Management Plan. We recommend implementation of the survey and annual consultation with the Forest Service.

Currently, the Forest Service operates and maintains the majority of recreational facilities that provide public access to project lands and waters (see table 3-23). A sufficient number of recreational access sites are within the project boundary to ensure continued public access to project lands and waters. Those facilities outside the project boundary are on Sierra National Forest lands and are managed by the Forest Service; consequently, public access to those facilities is expected to continue in the future. SCE would continue to operate and maintain its existing facilities at the Big Creek ALP Projects. In addition, SCE proposes to maintain the section of the San Joaquin River Trail that is co-aligned with the Mammoth Pool transmission line, which would ensure that this portion of the trail would remain functional. Finally, SCE proposes to use specific snow plowing techniques at Kaiser Pass Road and Florence Lake Road to ensure that snowmobiling and cross-country skiing opportunities are retained along these roads during the winter. SCE's proposed operation and maintenance measures would ensure continued public recreational opportunities to project lands and waters and we recommend that they should be implemented.

We estimate the annualized cost to SCE for annual meetings, recreational use surveys, and operation and maintenance at the Big Creek ALP Projects would be

$102,660. However, given the need to coordinate with the Forest Service on various aspects of recreational use within the Sierra National Forest, and the appropriateness of SCE maintaining its own recreational facilities at the projects, we consider the benefits that would result from these measures to be worth the cost.

Major Recreation Facility Rehabilitation and Capital Improvements

As previously noted, the Forest Service currently maintains the majority of recreational sites that provide public access to project lands and waters. To assist the Forest Service with its maintenance of these facilities, SCE proposes numerous one-time major rehabilitation projects at each of these sites as discussed in section 3.3.2.2, *Recreational Resources* (and shown in table 3-23). We consider this a reasonable approach to share the responsibilities of continuing to provide recreational opportunities to those visitors who are attracted to the area because of its location within the Sierra National Forest and its project-related features (i.e., reservoirs). However, the licensee is ultimately responsible for the operation and maintenance of the project's recreation facilities located within the project boundary.

In addition, SCE proposes and Forest Service conditions specify that SCE undertake major rehabilitation at five campgrounds in the Sierra National Forest that are located entirely outside of any project boundary—the Dorabelle, Upper Billy Creek, Cavatee, Kinnikinnick, and Mammoth Pool campgrounds. In our analysis, we conclude that SCE already provides adequate camping facilities at these lakes. Therefore, we do not recommend that these additional campgrounds be included in the project boundary or that SCE's cost to undertake major rehabilitation at these facilities be made a condition of the license.

SCE also proposes to construct new recreational facilities at areas where specific recreational needs were identified during its studies and consultations with stakeholders. At the Big Creek Nos. 2A, 8, and Eastwood Project, SCE would develop an accessible fishing platform on the South Fork San Joaquin River near Jackass Meadows Campground and an accessible boat loading facility at the Florence Lake boat ramp. At the Big Creek Nos. 1 and 2 Project, SCE would develop a day-use area adjacent to Dam 3 at Huntington Lake that would include accessible access and develop an accessible fishing platform at Huntington Lake. These four proposed new recreational facilities would provide public access, especially for those with disabilities, and alleviate informal recreational use that can lead to adverse environmental effects and unsafe conditions associated with crowding. We recommend that all four proposed measures be implemented and that the new recreational facilities be included within the project boundary. We also recommend that the plans for these new facilities include best management practices to minimize effects on sensitive resources and the potential for water quality degradation of adjacent water bodies.

We estimate the annual cost of implementing SCE's proposed major rehabilitation of facilities currently operated and maintained by the Forest Service at the Big Creek

ALP Projects (with exception of the five campgrounds located outside the project boundaries) and the construction of new recreational facilities at two of the four projects to be $1,947,390, but we consider the benefits associated with maintaining existing recreational infrastructure and expanding recreational opportunities to be worth this cost. These recreational facilities provide public access to project lands and waters and would provide more formal facilities where informal recreational use currently occurs, enhance access, particularly for those individuals with disabilities, and provide the means to help meet future recreational demand at the Big Creek ALP Projects.

Fish Stocking, Recreational Flow Releases, Reservoir Water Level Management, and Information Distribution

SCE proposes to provide resources to match stocking of Big Creek ALP Project reservoirs and stream reaches conducted by Cal Fish & Game. SCE proposes to provide this match by either acquiring fish directly or by reimbursing Cal Fish & Game for half the cost of annual stocking. Although we agree enhanced stocking would improve the recreational experience of visitors to the four Big Creek ALP Projects, funding Cal Fish & Game's stocking is contrary to the Commission's policy on the imposition of funds and cost caps. Although we encourage the cooperation between SCE and Cal Fish & Game, we note that SCE should be solely responsible for ensuring that the Big Creek ALP Project reservoirs and stream reaches are stocked. Therefore, we recommend that SCE, after consultation with Cal Fish & Game, file an annual fish stocking report with the Commission detailing the quantity, species, size, location, and frequency of stocking efforts in Big Creek ALP Project reservoirs and stream reaches.

SCE proposes to provide channel and riparian maintenance flows from Florence Lake during wet and above average water years so that the descending portion of the flow release is timed to facilitate whitewater boating opportunities. In addition, SCE proposes to provide pre-spill whitewater flow releases from Mammoth Pool to the extent practical and controllable by SCE. As previously discussed, SCE proposes to include the number of recreational boating opportunity days in its recreational use and facility condition report that would be submitted to the Commission at 6 year intervals, which would provide a measure of effectiveness of these flow releases for whitewater boating and whether adjustments to release procedures need to be considered. We conclude the proposed releases have the potential to enhance boating opportunities and concur with SCE's proposed measure.

SCE also proposes to make a good faith effort to maintain water surface elevations of Shaver and Huntington lakes and Mammoth Pool at a level that would support flatwater recreational opportunities during the recreational season. However, SCE proposes no specific elevation ranges associated with the reservoir level operations for these lakes. We note that the terminology in the Settlement Agreement "to make every effort" or "to make every reasonable effort" relative to water surface elevations at the reservoir is extremely difficult for the Commission to enforce. Because of our inability to enforce compliance with these conditions and the fact that the proposed conditions for Huntington and Shaver lakes and Mammoth Pool do not differ from how SCE now operates these reservoirs, we do not recommend including these measures in the Big Creek Nos. 1 and 2 (Huntington Lake), Big Creek Nos. 2A, 8, and Eastwood Project (Shaver Lake), and Mammoth Pool licenses. However, we conclude that SCE's "good faith effort" to maintain these three reservoirs at full pool during the recreational season should enhance recreational opportunities.

At Florence Lake, SCE proposes to implement more specific minimum water surface elevations. SCE's proposed measure would result in higher water levels during July and August about 20 percent more often than currently occurs. As such, associated flatwater boating opportunities would be enhanced by SCE's proposed measure to maintain a minimum water surface elevation of 7,276 feet during July and August and we recommend inclusion of this measure in a new license for the Big Creek Nos. 2A, 8, and Eastwood Project. The estimated annualized cost for implementing water level management at Florence Lake would be about $2,150.

Additionally, SCE proposes to provide streamflow and water level information to the public via the Internet, and install staff gages at representative locations to allow visitors to know the approximated flow and reservoir level when they visit specific sites. Recreation and other project-related information would be also be available to the public at interpretive display exhibits that SCE proposes to construct at locations heavily used by the public. We conclude that SCE's proposed water management plans and its proposed means to publicize flows, reservoir water levels, and other project-related recreational and cultural resources would enhance recreational opportunities at the Big Creek ALP Projects, and we recommend that they be implemented.

The cost of fish stocking, pre-spill recreational releases at Mammoth Pool, water level management at Florence and Shaver lakes, and information distribution to the public would have an annualized cost of $190,610 (the cost of releases from Florence Lake is included under our discussion of channel and riparian maintenance flows). We consider the benefits to the public who visit these project areas that would result from these measures to be worth the cost.

Cultural Resources

SCE proposes to provide for the continued protection of cultural resources through finalization of an HPMP for the Big Creek ALP Projects. SCE's cultural consultant identified a number of cultural resources within the APE and made recommendations pertaining to their National Register eligibility in its report. The SHPO has not yet reviewed and evaluated the recommendations in this report. Our review leads us to conclude that the unevaluated resources identified in that report warrant consideration regarding their eligibility for inclusion in the National Register. SCE's finalization of its HPMP in accordance with the provisions of the Settlement Agreement would provide for management and protection of historic properties and important cultural resources throughout the Big Creek ALP Projects APE over the license terms. It would also address Forest Service concerns (expressed in its preliminary 4(e) conditions) regarding participation in the management and protection of cultural resources in those portions of the APE lying in or adjacent to the Sierra National Forest. In addition, SCE would implement environmental programs for cultural resource awareness, and conduct annual meetings with the Big Creek Advisory Committee, which would be open to the Tribes and organizations that participated in the Cultural Resources Working Group during the Big Creek ALP. The Commission would execute a PA with the SHPO and Advisory Council, which would include SCE, the Tribes, the Forest Service, and Interior as consulting parties

Finalization and implementation of SCE's HPMP in consultation with the SHPO, Tribes, and the Forest Service would ensure that adverse effects on historic properties arising from project operations or project-related activities over the term of the license would be avoided or satisfactorily resolved. Annual consultation would facilitate development of management and monitoring plans, review and evaluation of cultural resources data, and development and implementation of cultural resources protective measures. We recommend finalizing and implementing the HPMP. We estimate that implementation of the final HPMP, implementation of programs for cultural awareness, and annual consultation would cost about $90,180 annually at the four Big Creek ALP Projects and the benefit of protecting cultural resources would outweigh the cost of these measures.

The Tribes made the following recommendations: (1) develop a tribal-specific communications protocol for future negotiations between SCE and the Tribes; (2) retain a third-party facilitor for those negotiations; (3) develop Native American interpretive and signage programs; (4) construct a Native American historical monument; (5) address archaeological sites threatened by erosion on reservoir shorelines; (6) conduct comprehensive ethnographic studies and evaluation of TCPs within the APE; (7) construct and fund the operation of a Native American center at Shaver Lake; (8) develop a solar-powered infrastructure and delivery program for the Tribes; and (9) reimburse the Tribes for expenses incurred during the participation in the Big Creek ALP. We conclude that Tribal participation in the Big Creek Advisory Committee would facilitate implementation of the first five recommendations, which are provided for or, in the case of recommendation 4, could be provided for, in the draft HPMP. Regarding recommendation 6, we conclude that the ethnographic and TCP descriptions in SCE's existing cultural report are sufficient, but Tribal participation on the Advisory Committee would enable updates to those descriptions to be made as they may choose. We conclude that recommendations 7 and 8 do not have a sufficient nexus to the Big Creek ALP Projects for us to recommend that they be included in the licenses for these projects. Regarding recommendation 9, we recognize that numerous parties included the Tribes have spent thousands of hours and incurred substantial expenses to participate in the ALP process. However the Commission has no authority to require an applicant to reimburse these costs to participating parties.

Land Use Management and Visual Resources Protection

SCE proposes to implement its Transportation System Management Plan to ensure that responsibilities and schedule for maintaining, monitoring, and rehabilitating project-related roads is clearly defined. In addition, Proposed Article 3.1 for the Big Creek Nos. 1 and 2 and Mammoth Pool projects provides for the implementation of Visual Resources Plan to ensure to the extent possible, project features are consistent with the Forest Service VQOs for the Big Creek ALP Projects. Many project roads pass through land managed by the Forest Service, and therefore we consider it important to delineate SCE's and the Forest Service's responsibilities to ensure that these roads are well maintained and ensure appropriate access to project facilities for inspection, operation, and maintenance purposes as well as provision of appropriate public access to project lands and waters. When project facilities require painting, the consultation with the Forest Service specified in the Visual Resources Plan would enable the current inconsistencies with the VQOs at the Big Creek Nos. 1 and 2 and Mammoth Pool projects to be addressed to the extent practical. We recommend that both plans be implemented. The annualized cost associated with implementing the Visual Resources Plan at these two projects would be $27,450, and this relatively modest cost would be worth the benefits to the aesthetic resources of the Big Creek ALP Projects. The annualize cost of implementing the Transportation System Management Plan, and associated annual consultation with the Forest Service regarding land use issues in general at all four projects would be $1,702,190. Although this would be a costly measure, considering the rough terrain and winter conditions at high altitudes, this high cost associated with maintaining project roads is not unexpected and the benefits of this plan would be worth the cost.

The Forest Service specifies three land use management measures that are not include in the Settlement Agreement but would be consistent with the Land Use Management Plan for the Sierra National Forest; a Fire Management Plan, a Spill Prevention and Countermeasure Plan, and a sign plan. SCE already has developed fire management procedures in place at each of its project facilities, and packaging them into a plan for Forest Service review would ensure coordination of efforts to prevent, control, report, and investigate fires in the vicinity of the project. Spill Prevention and Countermeasures Plan are required to be in place at all facilities that store hazardous waste in excess of threshold levels. It is therefore likely that SCE has already developed these plans for appropriate project facilities. Providing such plans for review by the Forest Service would ensure that appropriate input is provided to protect the resources associated with the Sierra National Forest. Finally, SCE proposes to install a number of interpretive signs and would also place signs at appropriate places along project roadways. Ensuring that such signage is consistent with the signage standards of the Forest Service is appropriate when SCE signage is within or visible from National Forest System lands. We recommend implementation of the three plans specified by the Forest Service. We expect that the information needed to prepare these plans already exists or would be developed under the auspices of other plans. Therefore, we expect the annual cost of implementing these three plans would be $32,080, and worth the benefits that would accrue from such coordination with the Forest Service.

Project Boundary Revisions

As discussed in section 3.3.6.2, *Land Use and Aesthetic Resources*, SCE proposes to add 27 parcels to the project boundary at the Big Creek Nos. 2A, 8, and Eastwood Project, including: 11 roads; 4 foot trails leading to project facilities; 3 gaging stations; and 9 helicopter landing sites. We reviewed these proposed additions and conclude that they all would be necessary for continued operation and maintenance of this project under the conditions of a new license.

SCE proposes to delete 8 parcels from the Big Creek Nos. 2A, 8, and Eastwood Project boundary: (1) surplus land along Rancheria Creek; (2) land formerly occupied by company housing that is no longer there; (3) land formerly occupied by Chinquapin diversion piping; (4) a Forest Service Road (No. 5580H) that does not provide sole access to any project facility; (5) a Forest Service Road (No. 9S311) that is no longer used to provide access to the Eastwood power station switchyard; (6) the Eastwood Overflow Campground; (7) the Eastwood Overlook; and (8) the Florence Lake day-use area. We agree with SCE that lands associated with items 1 through 5 either no longer serve project purposes or, in the case of item 4, provide exclusive access to project-related facilities. Items 6 and 7 would be deleted from the project boundary of this project and included in the project boundary of the Big Creek Nos. 1 and 2 Project. We agree with this deletion. It would not affect the Commission's jurisdiction over these two facilities and is primarily administrative. Regarding item 8, we conclude that the Florence Lake day-use area provides recreational day-use facilities associated with the project and is located adjacent to the Florence Lake boat ramp, a project facility, which also provides public access to project waters. SCE has not demonstrated that this facility is no longer required for project purposes (providing public access to project lands and waters). Therefore, we recommend that the Florence Lake day-use-area remain in the existing project boundary.

SCE proposes to add four parcels to the Big Creek Nos. 1 and 2 Project boundary: (1) the Eastwood Overflow Campground (discussed in the previous paragraph); (2) the Eastwood Overlook (discussed in the previous paragraph); (3) a portion of Forest Service Road No. 8S66 that provides access to Dams 1 and 2; and (4) a portion of Forest Service Road No. 8S83 that also provides access to Dams 1 and 2. We reviewed the proposed additions of road segments associated with items 3 and 4 and conclude that they would be appropriately included in the project boundary for the Pig Creek Nos. 1 and 2 Project.

SCE proposes to delete six parcels from the Big Creek Nos. 1 and 2 Project boundary: (1) land associated with Rancheria Creek which is also included in the project boundary of the Big Creek Nos. 2A, 8, and Eastwood Project; (2) land associated with narrowing the right-of-way associated with Forest Service Road Nos. 8S66 and 8S66A, which provide access to a gaging station on Big Creek, from 100 feet to 50 feet; (3) land associated with a communication line that has been removed; (4) land associated with former company housing that has been removed; (5) portions of Forest Service Road Nos. 8S13 and 8S08 that are no longer used for access to the area near the penstocks of Powerhouses 2 and 2A; and (6) excess land not needed for project purposes near Powerhouses 2 and 2A. We agree that lands associated with items 1 through 6 are not necessary for project purposes and recommend they be deleted from the project boundary.

SCE proposes to add land associated with a helicopter landing site near Shakeflat Creek and a trail along Shakeflat Creek to a gage on the San Joaquin River to the project boundary of the Mammoth Pool Project. Both of these proposed additions would facilitate operation and maintenance of a stream gage that we recommend be included in a new license for this project. Therefore, we recommend that these two parcels be included in the project boundary.

SCE proposes to delete about 44 acres of land above the high water mark around the Dam 6 forebay, which are not needed for project purposes. This land is on land managed by the Forest Service and is not necessary for project operation and maintenance. We recommend deletion of this land from the project boundary.

As shown in table 3-24, many of the recreational facilities that SCE would rehabilitate are located partially outside of the project boundary. Partial inclusion in the project boundary raises questions about the responsibility for the long-term management of these recreation facilities. Because these recreational facilities provide public access to project lands and water, and because SCE is undertaking major rehabilitation that includes components of facilities that are on lands partially outside the project boundary, following the Commission's settlement policies on project boundaries, we recommend that these facilities be included in the respective project boundary in their entirety.

5.3 UNAVOIDABLE ADVERSE EFFECTS

Project dams and diversions would continue to block upstream migration to higher quality spawning and rearing habitat upstream of the bypassed reaches, and block downstream transport of sediment and LWD from the upper watersheds to the bypassed reaches. Big Creek project operations would continue to alter natural flow regimes, adversely affecting the quality and quantity of coldwater fish habitat in some project bypassed reaches, although cool tailwater releases also improve trout habitat in some reaches. Changes in the timing, magnitude, and duration of peak and base flows, and loss of sediment and LWD recruitment from the upper watersheds would continue to adversely affect channel morphology and aquatic and riparian habitat in the project bypassed reaches. Mortality of some fish entrained into project diversions would continue to be caused due to pressure changes or other injuries associated with turbine passage. The low densities of fish observed near the powerhouse intakes during hydroacoustic surveys and the lack of fish encountered during tailrace sampling conducted by SCE at several of the project powerhouses suggest that the magnitude of entrainment mortality at the Big Creek ALP Project powerhouses is generally low.

The proposed decommissioning and removal of five small diversion dams would result in the unavoidable release of sediment that may have accumulated behind the dams, resulting in a short-term, minor effect on aquatic habitat.

The proposed conservation measures would reduce some of these effects to varying degrees, particularly increased MIFs, channel and riparian maintenance flows, and LWD management. However, many of the current adverse effects (e.g., blocked upstream passage at dams and diversions and entrainment mortality) would continue as unavoidable adverse effects to native, coldwater fishes.

We have identified no other unavoidable adverse effects to resources influenced by project operations.

5.4 RECOMMENDATIONS OF FISH AND WILDLIFE AGENCIES

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that, whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of the agency.

In response to the Commission's notice soliciting final terms and conditions for SCE and the REA notice for the Big Creek ALP Projects issued on December 5, 2006, for the Mammoth Pool Project and January 8, 2008, for the remaining three projects, NMFS filed letters in response to the REA notice but did not make specific recommendations pursuant to section 10(j). NMFS requested inclusion of a reopener provision in new licenses should the need arise. The Commission typically includes such a standard fish and wildlife reopener provision in new licenses that it issues. Interior filed letters of comment that included section 10(j) recommendations.[56] Interior is also a party to the Settlement Agreement.[57] In its letters, Interior recommends that the Commission approve the Settlement Agreement and all the provisions thereof. Commission staff is also recommending the provisions of the Settlement Agreement that are within the scope of section 10(j) be included as terms of any new licenses. Among

[56] NMFS filed letters in response to the initial notice dated February 5, 2007, August 31, 2007, and September 1, 2007. Interior filed letters in response to the initial notice dated February 2, 2007 and March 5, 2008.

[57] The Settlement Agreement was filed with the Commission on February 23, 2007.

the measures that Interior filed under section 10(j), we consider one component of one measure to be outside of the scope of section 10(j)—Interior's provision within its streamflow recommendations that the Adit 8 Creek "not be used." We evaluate this measure under section 10(a) in section 5.2, *Comprehensive Development and Recommended Alternative*.

5.5 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2) of the FPA requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving waterways affected by the project. Under section 10(a)(2), federal, state, and local agencies filed comprehensive plans that address various resources in California. The continued operation of the Big Creek ALP Projects, as recommended in this EIS, is consistent with the 13 state and federal plans listed below that are applicable to the projects.

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APPENDIX A

BIG CREEK ALP PROJECTS MITIGATION AND MONITORING SUMMARY

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Appendix A. Big Creek ALP Projects mitigation and monitoring summary.

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	**Mitigation**	**One-time or Ongoing**	**One-time or Ongoing**	**Mitigation Implementation**	**Mitigation Monitoring**
Increased air emissions from gas-fired generation plant(s) to offset lost generation associated with proposed new flow regimes.	Best available control technology in accordance with the requirements of the geographic area where the replacement power is generated.	**Ongoing:** SCE would purchase replacement energy from the power grid market; although mitigation would be ongoing, the nature of the mitigation may shift if the source of replacement energy shifts.	**Ongoing:** Monitoring of air emissions is typically required at fossil fuel generating facilities.	Owner of replacement energy generation facility	Owner of replacement energy generation facility
Installation of new flow release mechanisms, gaging equipment, and recreational facilities may result in disturbance to special status plants or animals.	Prepare a Biological Evaluation and Biological Assessment or other required document, as appropriate, prior to construction of new project features on National Forest Service land that may affect special-status species and their habitat. Obtain any necessary permits or approvals for potentially affected special-status species and their habitats.	**One-time:** Protective measures would be established prior to construction and implemented during and after construction.	**One-time:** Monitoring requirements, if any, would be established in the approved Biological Evaluation and Assessment.	SCE	SCE

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	**Mitigation**	**One-time or Ongoing**	**One-time or Ongoing**	**Mitigation Implementation**	**Mitigation Monitoring**
Increased bank erosion due to implementation of channel riparian maintenance flows at Mono and Camp 61 creeks and the South Fork San Joaquin River downstream of Florence Lake.	Need for mitigation would be dependent on monitoring results and consultation between SCE, the Forest Service, FWS, Cal Fish & Game, the Water Board, and the Commission and could entail either adjusting the amount of flow released, limiting grazing access to the creek, or stabilizing banks.	**One-time:** If mitigation is determined to be needed, it would likely be a one-time event; however, if subsequent monitoring indicates that additional protective measures are needed, follow-up mitigation would be implemented.	**Ongoing:** Monitoring of sediment accumulation in pools in Mono and Camp 61 creeks would occur within 6 months following any wet water year channel and riparian maintenance flow release. Riparian vegetation monitoring after the first year of license issuance to establish baseline and 5 years following channel and riparian maintenance flow releases made in the first wet water year for Mono Creek and Camp 61 Creek and the second wet water year for the South Fork San Joaquin River, and at 10 year intervals for the remainder of the license term. **One-time:** Jackass Meadow Inundations Study would entail surveying the Jackass Meadow complex to establish microtopography and during first two wet	SCE (if flow adjustment needed); the Forest Service (if adjustments to grazing practices and resulting bank instability needed)	SCE

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	**Mitigation**	**One-time or Ongoing**	**One-time or Ongoing**	**Mitigation Implementation**	**Mitigation Monitoring**
			years to map inundation level at three flow levels to establish basis for retaining or adjusting channel riparian maintenance flows releases from Florence Lake dam to South Fork San Joaquin River.		
Potential sediment releases (primarily at North Slide Creek diversion), asbestos release and disposal (as applicable), air emissions, and noise associated with decommissioning activities related to dismantling of five diversions and abandoning of one diversion (South Slide Creek, which is already breached) in place	SCE would consult with applicable agencies during the first year from license issuance regarding appropriate protective measures; prepare permit applications and supporting documentation and a health and safety plan for any asbestos containing material that may be present at any of the diversion dam sites. Beyond Commission approval	**One-time:** Duration of any mitigation would be set in specific permit and approval conditions.	**One-time:** Duration of any monitoring would be set in specific permit and approval conditions. SCE proposes to prepare a summary report following each diversion decommissioning that includes before and after photographs to document completed activities.	SCE	SCE

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	**Mitigation**	**One-time or Ongoing**	**One-time or Ongoing**	**Mitigation Implementation**	**Mitigation Monitoring**
	of dam decommissionings, the following approvals and permits may also be needed: Wilderness Variance and Special Use Permit from the Forest Service; Streambed Alteration Agreement from Cal Fish & Game; 401 Water Quality Certificate from the Water Board; Nationwide 404 Permit from the Corps; and consultation with FWS.				
Altered flow regimes could, under certain circumstances, cause water temperatures in specific reaches to be inconsistent with Basin Plan objectives for daily mean and maximum water temperatures.	Develop an interim water temperature control program within 1 year of license issuance that identifies feasible measures that SCE could implement to ensure water temperatures are within Basin Plan objectives, when water temperature is a project controllable factor.	**Ongoing:** Implement the approved long-term water temperature control program throughout the term of a new license.	**Ongoing:** Monitoring during at least the first 3 to 5 years that new flow regimes are implemented under the new project licenses, including during at least one dry or critically dry water year type during the summer months (June 1-September 30). Annual Progress Report would be prepared 90 days following the	SCE	SCE

Impact	Mitigation	Mitigation Implementation Duration One-time or Ongoing	Monitoring Duration One-time or Ongoing	Responsibility Mitigation Implementation	Responsibility Mitigation Monitoring
	Use the results of water temperature monitoring, supplemented by fish and dissolved oxygen monitoring, to develop a long-term water temperature control program in consultation with the Water Board and other agencies, and implement when approved by the Commission.		completion of each year of temperature monitoring and submitted to the Forest Service, Cal Fish & Game, the Water Board, and FWS. This annual report would serve as the basis for discussions with agencies at an annual meeting, when adjustments to the monitoring plan would be considered.		
Implementation of the proposed flow regimes could have adverse effects on some fish populations in affected stream reaches or in reservoirs where depletion of cool water at deeper strata may occur earlier than under current conditions.	Monitoring fish populations would provide the data needed to enable agencies to assess whether their resource objectives are being met under the new operating regimes specified in any new licenses and whether adjustments need to be considered based on the monitoring results.	**Ongoing:** The nature and duration of any mitigation would be adaptively crafted during consultations by SCE and the resource agencies based on the monitoring results. Any recommended changes to measures that may be included in a license order would need to be approved by the Commission.	**Ongoing:** Fish surveys and associated reporting would begin in the 3rd full year following license issuance during years 8, 18, 28, and 38. Monitoring would occur during August and September in listed reaches along medium and large diversions that were surveyed in 2002.	SCE	SCE

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	Mitigation	One-time or Ongoing	One-time or Ongoing	Mitigation Implementation	Mitigation Monitoring
Potential short-term increases in turbidity and decreases in the quality of spawning habitat following proposed sediment pass-through and removal activities at Balsam, Bolsillo, Camp 62, Chinquapin, Hooper, Pitman, Ross, Rock, and Ely creeks.	Timing of sediment pass-through activities would occur only during the spring of wet years, corresponding with naturally occurring high flow and sediment transport events. Timing of sediment removal activities, if needed, would be done during low-flow periods, minimizing potential increases in turbidity and decreases in spawning habitat.	**Ongoing:** Sediment pass-through activities would occur during all wet years; sediment removal activities would occur only as-needed.	Monitoring of pool-filling and turbidity is not proposed or recommended, as all indicated streams are high gradient with predominantly bedrock and boulder channels downstream of diversion dams, that would not be susceptible to long-term adverse effects on aquatic habitat.	SCE	Not applicable
Potential short-term increases in turbidity and decreases in the quality of spawning habitat following proposed sediment pass-through at Dams 4, 5, and 6 and if sediment removal is necessary when Dams 5 and 6 impoundments are drained for tunnel inspections every 7	Timing of sediment pass-through activities (between January 1 and March 31) would minimize effects on rainbow trout spawning, especially if conducted earlier in the designated time frame. Once pass-through activities are completed, flushing flows released for 24	Implement sediment pass-through or sediment removal activities within 5 years of approval of the sediment management measures and every 5 years after the initial implementation throughout project operation.	**Ongoing:** Monitoring of pool filling and turbidity would be conducted prior to, and after prescription implementation. Weighted mean value of the level of fine sediments in a representative set of 5 pools would be measured according to procedures defined by Hilton and Lisle (1993). Turbidity would be monitored	SCE	SCE

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	Mitigation	One-time or Ongoing	One-time or Ongoing	Mitigation Implementation	Mitigation Monitoring
years.	hours would likely transport fine-grained sediments from spawning gravel prior to trout spawning. Monitoring results would provide a basis for adjusting mitigation measures in an adaptive manner, as appropriate.		during 2 storm events each year prior to implementation at the same locations to provide a basis for comparing turbidity measurements taken during implementation of sediment management measures. Following submittal of monitoring results, the Forest Service, FWS, Cal Fish & Game, the Water Board, and the Commission would determine if sediment prescription modifications are warranted. Monitoring would be discontinued in subsequent years, upon agency and Commission approval.		

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	**Mitigation**	**One-time or Ongoing**	**One-time or Ongoing**	**Mitigation Implementation**	**Mitigation Monitoring**
Potential short-term increases in turbidity and decreases in the quality of spawning habitat if sediment removal is necessary at Balsam Meadows and Portal forebays	Timing of proposed sediment removal activities (late fall for Portal and Balsam Meadows forebays, during low flow periods) would avoid spawning and incubation periods for rainbow trout. Monitoring results would provide a basis for considering additional mitigation measures, if warranted.	**Ongoing:** As needed.	**Ongoing:** Turbidity would be monitored during 2 storm events each year prior to implementation of planned sediment removal events to provide a basis for comparing turbidity measurements taken during implementation of sediment removal activities.	SCE	SCE

Impact	Mitigation	Mitigation Implementation Duration	Monitoring Duration	Responsibility	
		One-time or Ongoing	One-time or Ongoing	Mitigation Implementation	Mitigation Monitoring
Potential effects on special-status bats of increased noise from proposed reconstruction and painting activities.	Protective measures for special-status bats at project facilities would be implemented prior to conducting any non-routine maintenance activities that could result in harm to special-status bat species or their habitat, in structures that are known to support maternal or roosting bat species (including but not limited to, reconstruction and painting).	**Ongoing:** Implementation of appropriate measures based on agency consultation.	None proposed or recommended/	SCE	SCE
Construction-related disturbance of bald eagles and their habitat.	5.4 Bald Eagle Management Plan	**One-time:** File the bald eagle management plan. **Ongoing:** Implement the approved plan throughout project operation.	**Ongoing:** Nesting and wintering surveys every 5 years beginning within 1 year of plan approval by the Commission throughout project operation.	SCE	SCE
Destruction or disturbance of VELB habitat during vegetation and road maintenance and	Protect VELB habitat in accordance with the Valley Elderberry Longhorn Beetle Management Plan;	**Ongoing:** Implement the approved plan throughout project operation	**Ongoing:** Monitoring the mitigation site following planting of shrubs during years 1, 2, 3, 5, 7, 10, and	SCE	SCE

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	Mitigation	One-time or Ongoing	One-time or Ongoing	Mitigation Implementation	Mitigation Monitoring
construction of new project facilities in previously unsurveyed areas.	establish a mitigation site where elderberry shrubs would be planted and replace any failed plantings.		15.		
Spread of noxious weeds and invasive plants resulting from new construction and rehabilitation activities.	Control the spread of noxious and invasive species in accordance with the Vegetation and Integrated Pest Management Plan.	**Ongoing:** Implement the approved plan throughout project operation.	**Ongoing:** Surveys for noxious weeds would be conducted in conjunction with special-status plant surveys within the boundaries of the projects every 10 years. Monitoring of noxious weed treatment areas, erosion control and revegetation areas would occur within 1 year of treatment or completion of activity.	SCE	SCE

		Mitigation Implementation Duration	Monitoring Duration	Responsibility	
Impact	**Mitigation**	**One-time or Ongoing**	**One-time or Ongoing**	**Mitigation Implementation**	**Mitigation Monitoring**
Effects of gravel augmentation at the Mammoth Pool dam on dam safety and integrity of project facilities.	Implement the Gravel Pilot Project Feasibility Study following Commission approval.[a]	**One-time:** The pilot study would be implemented on a one-time basis. Depending on the results of the pilot study, gravel augmentation could either be discontinued or continued for the duration of the project license. If the latter, a license amendment, specifying mitigation, if appropriate, would likely be required.	**Ongoing:** Monitoring of gravel transport and distribution would occur during the subsequent two above average or wet water year spill events following the initial gravel placement. Following the monitoring, a report would be filed for agency and Commission review and consideration regarding the viability of gravel augmentation at the Mammoth reach.	SCE	SCE
Potential impacts to prehistoric remains encountered on project lands resulting from construction-related ground disturbing activities.	Negotiate agreement with Native American Advisory Group on reburial of prehistoric human remains encountered on SCE lands in accordance requirements in the California Public Resources Code and other applicable laws.[a]	**One-time:** The agreement would be a one-time event. **Ongoing:** Implement the agreement, as appropriate.	**Ongoing:** Implement throughout project operation, as appropriate.	SCE	SCE

[a] Non-FERC SA provisions.

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APPENDIX B

CAPITAL AND ANNUAL COSTS OF MEASURES

FOR THE BIG CREEK ALP PROJECTS AND THE PORTAL PROJECT

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In this appendix, we present costs of environmental measures associated with the Big Creek ALP Projects (tables B-1 through B-4. In addition, although the Portal Project (FERC No. 2174) is not part of this proceeding, certain measures included in the Big Creek ALP Projects Settlement Agreement pertain to Camp 61 Creek. Camp 61 Creek provides inflows to the Portal Project, which are diverted from the South Fork San Joaquin River upstream of the Mammoth Pool reservoir. Table B-5 presents costs of environmental measures associated with the Portal Project.

Table B-1. Summary of capital costs, operations and maintenance costs, annualized costs and reduction in annual energy benefits for measures included in the Proposed Action and Proposed Action with Staff Modification alternatives for the Big Creek Nos. 2A, 8 and Eastwood Project. (Source: SCE, 2007a, and staff)

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
1	Implement new MIF releases and channel and riparian maintenance flow releases[a]	$0	$9,140	$2,508,230	$2,517,370	Aquatic	Yes
2	Maintain existing and new gaging stations	$0	$114,220	$0	$114,220	Aquatic	Yes
3	Install minimum flow devices and gaging equipment at Dam No. 5	$2,245,180	$0	$0	$277,080	Aquatic	Yes
4	Install minimum flow devices and gaging equipment at Mono Creek Diversion	$1,347,110	$0	$0	$166,250	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
5	Make modifications needed to release MIFs at Bolsillo Creek Diversion	$89,810	$0	$0	$11,080	Aquatic	Yes
6	Make modifications needed to release MIFs at Camp 62 Creek Diversion	$89,810	$0	$0	$11,080	Aquatic	Yes
7	Decommission Crater Creek Diversion	$409,870	$0	$0	$50,580	Aquatic	Yes
8	Decommission Tombstone Creek Diversion	$667,230	$0	$0	$82,340	Aquatic	Yes
9	Decommission North Slide Creek Diversion	$22,170	$0	$0	$2,740	Aquatic	Yes
10	Decommission South Slide Creek Diversion	$8,870	$0	$0	$1,090	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
11	Implement temperature monitoring programs	$0	$36,880	$0	$36,880	Aquatic	Yes
12	Implement flow monitoring programs	$0	$159,910	$0	$159,910	Aquatic	Yes
13	Implement fish monitoring programs	$0	$13,180	$0	$13,180	Aquatic	Yes
14	Implement riparian monitoring programs	$0	$17,170	$0	$17,170	Terrestrial	Yes
15	Implement Jackass Creek monitoring programs	$0	$20,580	$0	$20,580	Aquatic	Yes
16	Implement the sediment management plan at small diversions	$0	$6,210	$0	$6,210	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
17	Implement the sediment management plan at Dam No. 5 and Mono Creek	$0	$5,230	$0	$5,230	Aquatic	Yes
18	Monitoring of spawning gravel embeddedness after sediment pass-through at Dam 5[b]	$0	$1,940	$0	$1,940	Aquatic	Yes
19	Implement the sediment removal at Dam No. 5, Mono Creek and Balsam Meadows forebays	$0	$31,370	$0	$31,370	Aquatic	Yes
20	Implement the sediment management plan for Mono Creek	$0	$19,400	$0	$19,400	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
21	Implement the LWD measure at the Bear Creek Diversion	$0	$6,850	$0	$6,850	Aquatic	Yes
22	Attend annual consultation meeting for water and aquatic resources	$0	$570	$0	$570	Aquatic	Yes
23	Implement wildlife habitat enhancements	$0	$2,280	$0	$2,280	Terrestrial	Yes
24	Implement the Bald Eagle Management Plan	$0	$2,840	$0	$2,840	Terrestrial	Yes
25	Implement the VELB Management Plan	$0	$14,850	$0	$14,850	Terrestrial	Yes
26	Implement the Vegetation and Integrated Pest Management Plan	$0	$57,110	$0	$57,110	Terrestrial	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
27	Implement proposed license articles for mule deer, special-status species and bats	$1,880	$6,850	$0	$7,080	Terrestrial	Yes
28	Implement environmental programs for environmental training, ESAP, avian protection, noxious weeds, NHSSIP, and environmental compliance	$23,470	$2,860	$0	$5,760	Terrestrial	Yes
29	Attend annual consultation meeting for terrestrial resources	$0	$570	$0	$570	Terrestrial	Yes
30	Perform operation and maintenance of recreational facilities	$0	$71,390	$0	$71,390	Recreation	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
31	Implement rehabilitation of existing recreational facilities	$2,703,330	$0	$0	$333,620	Recreation	Yes
32	Implement new recreational facilities including an accessible fishing platform at Jackass Meadows and a handicapped boat loading platform	$381,700	$0	$0	$381,700	Recreation	Yes
33	Provide maintenance of the accessible fishing platform	$0	$1,600	$0	$1,600	Recreation	Yes
34	Manage reservoir water surface elevations	$0	$2,150	$0	$2,150	Recreation	Yes
35	Fund fish stocking with a 50% cost share	$0	$85,670	$0	$85,670	Recreation	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
36	Disseminate flow information for whitewater boating	$0	$5,710	$0	$5,710	Recreation	Yes
37	Install interpretive signs	$77,300	$0	$0	$9,540	Recreation	Yes
38	Prepare a report on recreational resources	$0	$14,010	$0	$14,010	Recreation	Yes
39	Attend annual consultation meeting for recreational resources	$0	$570	$0	$570	Recreation	Yes
40	Implement the Transportation System Plan	$0	$45,690	$0	$45,690	Land Management	Yes
41	Implement the Fire Plan	$0	$570	$0	$570	Land Management	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
42	Implement the Spill Prevention and Countermeasure Plan	$0	$570	$0	$570	Land Management	Yes
43	Attend annual meeting for land management resources	$0	$570	$0	$570	Land Management	Yes
44	Provide transportation system plan labor and equipment	$0	$400,130	$0	$400,130	Land Management	Yes
45	Implement an HPMP	$228,120	$34,270	$0	$62,420	Cultural	Yes
46	Implement environmental programs for cultural resource awareness	$0	$1,140	$0	$1,140	Cultural	Yes
47	Attend annual consultation meeting for cultural resources	$0	$570	$0	$570	Cultural	Yes

[a] SCE included in its costs for the Big Creek Nos. 2A, 8, and Eastwood Project No. 67 some measures that actually apply to the Portal Project No. 2074. These measures include proposed minimum flow releases and channel and riparian maintenance releases, water and aquatic monitoring, and sediment management. The monitoring and sediment management measures have been removed from the proposed measures for Project No. 67 and have been presented separately below in table B-5. SCE did not provide a breakdown of the costs associated with the minimum flows and channel and riparian maintenance flows for Camp 61 Creek, although we expect them to be small in proportion to the overall costs for minimum flows and channel and riparian maintenance flows provided for Project No. 67 with Camp 61 Creek costs included. Therefore, we have not removed a proportional amount of the Camp 61 Creek costs from Project No. 67 in table B-1, nor have we shown that portion of the costs in table B-5.

[b] This cost of this measure was estimated by staff.

Table B-2. Summary of capital costs, operations and maintenance costs, annualized costs and reduction in annual energy benefits for measures included in the Proposed Action and Proposed Action with Staff Modification alternatives for the Big Creek Nos. 1 and 2 Project. (Source: SCE, 2007a, and staff)

Row No.	**Environmental Measure**	**Capital Cost**	**Annual O&M Cost**	**Reduction in Annual Energy Benefits**	**Annualized Cost**	**Discipline**	**Staff Adopting?**
1	Implement new MIF releases	$0	$2,880	$5,680,740	$5,683,020	Aquatic	Yes
2	Maintain existing and new gaging stations	$0	$114,220	$0	$114,220	Aquatic	Yes
3	Install minimum flow devices and gaging equipment at Ely Creek Diversion	$314,330	$0	$0	$38,790	Aquatic	Yes
4	Install minimum flow devices and gaging equipment at Balsam Creek Diversion	$314,330	$0	$0	$38,790	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
5	Install minimum flow devices and gaging equipment at Dam No. 4	$2,245,180	$0	$0	$277,080	Aquatic	Yes
6	Decommission Pitman Creek Domestic Diversion	$20,620	$0	$0	$2,540	Aquatic	Yes
7	Decommission Snow Slide Creek Domestic Diversion	$20,620	$0	$0	$2,540	Aquatic	Yes
8	Implement temperature monitoring programs	$0	$10,540	$0	$10,540	Aquatic	Yes
9	Implement flow monitoring programs	$0	$57,110	$0	$57,110	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
10	Implement fish monitoring programs	$0	$9,150	$0	$9,150	Aquatic	Yes
11	Implement the sediment management plan at small diversions	$0	$1,030	$0	$1,030	Aquatic	Yes
12	Implement the sediment management plan at Dam No. 4	$0	$5,230	$0	$5,230	Aquatic	Yes
13	Monitoring of spawning gravel embeddedness after sediment pass-through at Dam 4[a]	$0	$1,940	$0	$1,940	Aquatic	Yes
14	Attend annual consultation meeting for water	$0	$570	$0	$570	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
	and aquatic resources						
15	Implement wildlife habitat enhancements	$0	$2,280	$0	$2,280	Terrestrial	Yes
16	Implement the Bald Eagle Management Plan	$0	$2,690	$0	$2,690	Terrestrial	Yes
17	Implement the Vegetation and Integrated Pest Management Plan	$0	$57,110	$0	$57,110	Terrestrial	Yes
18	Implement proposed license articles for special-status species, bats, and bear-human interactions	$1,880	$6,850	$0	$7,080	Terrestrial	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
19	Implement environmental programs for environmental training, ESAP, avian protection, noxious weeds, NHSSIP, and environmental compliance	$23,470	$2,860	$0	$5,760	Terrestrial	Yes
20	Attend annual consultation meeting for terrestrial resources	$0	$570	$0	$570	Terrestrial	Yes
21	Implement rehabilitation of existing recreational facilities	$9,283,890	$0	$0	$1,145,740	Recreation	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
22	Implement new recreational facilities including a day-use area at Dam No. 3 and an accessible fishing platform	$2,807,920	$0	$0	$346,530	Recreation	Yes
23	Fund fish stocking with a 50% cost share	$0	$57,110	$0	$57,110	Recreation	Yes
24	Install interpretive signs	$124,480	$0	$0	$15,360	Recreation	Yes
25	Prepare a report on recreational resources	$0	$9,180	$0	$9,180	Recreation	Yes
26	Attend annual consultation meeting for recreational resources	$0	$570	$0	$570	Recreation	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
27	Implement the Visual Resources Plan	$8,980	$0		$1,110	Land Use and Aesthetics	Yes
28	Implement the Transportation System Plan	$0	$19,420	$0	$19,420	Land Use and Aesthetics	Yes
29	Implement the Fire Plan	$0	$570	$0	$570	Land Use and Aesthetics	Yes
30	Implement the Spill Prevention and Countermeasure Plans	$0	$570	$0	$570	Land Use and Aesthetics	Yes
31	Attend annual meeting for land management resources	$0	$570	$0	$570	Land Use and Aesthetics	Yes
32	Provide transportation system plan labor	$0	$400,130	$0	$400,130	Land Use and Aesthetics	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
	and equipment						
33	Implement an HPMP	$36,820	$4,190	$0	$8,730	Cultural	Yes
34	Implement environmental programs for cultural resource awareness	$0	$1,140	$0	$1,140	Cultural	Yes
35	Attend annual consultation meeting for cultural resources	$0	$570	$0	$570	Cultural	Yes

[a] This cost of this measure was estimated by staff.

Table B-3. Summary of capital costs, operations and maintenance costs, annualized costs and reduction in annual energy benefits for measures included in the Proposed Action and Proposed Action with Staff Modification alternatives for the Mammoth Pool Project. (Source: SCE, 2007a, and staff)

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
1	Implement new MIF releases	$0	$2,890	$591,330	$594,220	Aquatic	Yes
2	Maintain existing and new gaging stations	$0	$114,220	$0	$114,220	Aquatic	Yes
3	Implement fishwater generator upgrade	$13,413,330	$0	$0	$1,655,360	Project Safety	Yes
4	Install minimum flow devices and gaging equipment at Mammoth Pool Dam	$12,865,850	$0	$0	$1,587,800	Aquatic	Yes
5	Install minimum flow devices and gaging equipment at Ross Creek Diversion	$341,670	$0	$0	$42,170	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
6	Install minimum flow devices and gaging equipment at Rock Creek Diversion	$341,670	$0	$0	$42,170	Aquatic	Yes
7	Implement temperature monitoring programs	$73,090	$15,560	$0	$24,580	Aquatic	Yes
8	Implement temperature (telemetry) monitoring programs	$0	$5,130	$0	$5,130	Aquatic	Yes
9	Implement flow monitoring programs	$0	$28,560	$0	$28,560	Aquatic	Yes
10	Implement fish monitoring programs	$0	$5,270	$0	$5,270	Aquatic	Yes
11	Implement the sediment management plan at small diversions	$0	$2,070	$0	$2,070	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
12	Gravel augmentation feasibility assessment[a]	$0	$6,610	$0	$6,610	Aquatic	Yes
13	Attend annual consultation meeting for water and aquatic resources	$0	$570	$0	$570	Aquatic	Yes
14	Implement wildlife habitat enhancements	$0	$2,280	$0	$2,280	Terrestrial	Yes
15	Implement the Bald Eagle Management Plan	$0	$2,690	$0	$2,690	Terrestrial	Yes
16	Implement the VELB Management Plan	$0	$14,850	$0	$14,850	Terrestrial	Yes
17	Implement the Vegetation and Integrated Pest Management Plan	$0	$57,110	$0	$57,110	Terrestrial	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
18	Implement proposed license articles for mule deer, special-status species and bats	$2,030	$6,850	$0	$7,100	Terrestrial	Yes
19	Implement environmental programs for environmental training, ESAP, avian protection, noxious weeds, NHSSIP, and environmental compliance	$25,390	$2,860	$0	$5,990	Terrestrial	Yes
20	Attend annual consultation meeting for terrestrial resources	$0	$570	$0	$570	Terrestrial	Yes
21	Implement rehabilitation of existing recreational facilities	$496,380	$0	$0	$61,260	Recreation	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
22	Fund fish stocking with a 50 percent cost share	$0	$28,560	$0	$28,560	Recreation	Yes
23	Disseminate flow information for whitewater boating	$0	$5,710	$0	$5,710	Recreation	Yes
24	Provide pre-spill whitewater boating releases	$0	$2,140	$0	$2,140	Recreation	Yes
25	Prepare a report on recreational resources	$0	$3,500	$0	$3,500	Recreation	Yes
26	Provide interpretive signs	$21,240	$0		$2,620	Recreation	Yes
27	Attend annual consultation meeting for recreational resources	$0	$570	$0	$570	Recreation	Yes
28	Implement the Visual Resources Plan	$213,400	$0		$26,340	Land Management	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
29	Implement the Transportation System Plan	$0	$22,850	$0	$22,850	Land Management	Yes
30	Implement the Fire Plan	$0	$570	$0	$570	Land Management	Yes
31	Implement the Spill Prevention and Countermeasure Plans	$0	$570	$0	$570	Land Management	Yes
32	Attend annual meeting for land management resources	$0	$570	$0	$570	Land Management	Yes
33	Provide transportation system plan labor and equipment	$0	$400,130	$0	$400,130	Land Management	Yes
34	Implement an HPMP	$41,640	$4,570	$0	$9,710	Cultural	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
35	Implement environmental programs for cultural resource awareness	$0	$1,140	$0	$1,140	Cultural	Yes
36	Attend annual consultation meeting for cultural resources	$0	$570	$0	$570	Cultural	Yes

Table B-4. Summary of capital costs, operations and maintenance costs, annualized costs and reduction in annual energy benefits for measures included in the Proposed Action and Proposed Action with Staff Modification alternatives for the Big Creek No. 3 Project. (Source: SCE, 2007a, and staff)

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
1	Implement new MIF releases	$0	$3,430	$1,039,670	$1,043,100	Aquatic	Yes
2	Maintain existing and new gaging stations	$0	$114,220	$0	$114,220	Aquatic	Yes
3	Install minimum flow devices and gaging equipment at Dam No. 6	$1,900,170	$0	$0	$234,500	Aquatic	Yes
4	Implement temperature monitoring programs	$52,350	$8,930	$0	$15,390	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
5	Implement temperature (telemetry) monitoring programs	$0	$3,670	$0	$3,670	Aquatic	Yes
6	Implement temperature (Hardhead and DO study) programs	$0	$7,330	$0	$7,330	Aquatic	Yes
7	Implement flow monitoring programs	$0	$28,560	$0	$28,560	Aquatic	Yes
8	Implement fish monitoring programs	$0	$7,740	$0	$7,740	Aquatic	Yes
9	Implement the sediment management plan at Dam No. 6	$0	$2,090	$0	$2,090	Aquatic	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
10	Implement the sediment removal at Dam No. 6	$0	$12,710	$0	$12,170	Aquatic	Yes
11	Monitoring of spawning gravel embeddedness after sediment pass-through at Dam 6[a]	$0	$1,940	$0	$1,940	Aquatic	Yes
12	Attend annual consultation meeting for water and aquatic resources	$0	$570	$0	$570	Aquatic	Yes
13	Implement wildlife habitat enhancements	$0	$2,280	$0	$2,280	Terrestrial	Yes
14	Implement the Bald Eagle Management Plan	$0	$2,690	$0	$2,690	Terrestrial	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
15	Implement the VELB Management Plan	$0	$14,850	$0	$14,850	Terrestrial	Yes
16	Implement the Vegetation and Integrated Pest Management Plan	$0	$22,850	$0	$22,850	Terrestrial	Yes
17	Implement proposed license articles for special-status species and bats	$0	$6,850	$0	$6,850	Terrestrial	Yes
18	Implement environmental programs for environmental training, ESAP, avian protection, noxious weeds, NHSSIP, and environmental compliance	$25,390	$2,850	$0	$5,990	Terrestrial	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
19	Attend annual consultation meeting for terrestrial resources	$0	$570	$0	$570	Terrestrial	Yes
20	Implement rehabilitation of existing recreational facilities	$76,200	$0	$0	$9,400	Recreation	Yes
21	Prepare a report on recreational resources	$0	$700	$0	$700	Recreation	Yes
22	Disseminate flow information for whitewater boating	$0	$5,710	$0	$5,710	Recreation	Yes
23	Attend annual consultation meeting for recreational resources	$0	$570	$0	$570	Recreation	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
24	Implement the Transportation System Plan	$0	$13,710	$0	$13,710	Land Management	Yes
25	Implement the Fire Plan	$0	$570	$0	$570	Land Management	Yes
26	Implement the Spill Prevention and Countermeasure Plans	$0	$570	$0	$570	Land Management	Yes
27	Attend annual meeting for land management resources	$0	$570	$0	$570	Land Management	Yes
28	Provide transportation plan labor and equipment	$0	$400,130	$0	$400,130	Land Management	Yes
29	Implement an HPMP	$38,490	$4,570	$0	$9,320	Cultural	Yes

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
30	Implement environmental programs for cultural resource awareness	$0	$1,140	$0	$1,140	Cultural	Yes
31	Attend annual consultation meeting for cultural resources	$0	$570	$0	$570	Cultural	Yes

[a] This cost of this measure was estimated by staff.

Table B-5. Summary of capital costs, operations and maintenance costs, annualized costs and reduction in annual energy benefits for measures included in the Proposed Action and Proposed Action with Staff Modification alternatives for the Portal Project. (Source: SCE, 2007a, and staff)

Row No.	Environmental Measure	Capital Cost	Annual O&M Cost	Reduction in Annual Energy Benefits	Annualized Cost	Discipline	Staff Adopting?
1	Implement new MIF and channel and riparian maintenance flow releases[a, b]	$0	$0	$0	$0	Aquatic	Yes
2	Implement Camp 61 Creek monitoring programs[b]	$0	$9,150	$0	$9,150	Aquatic	Yes
3	Implement the sediment management plan for Camp 61 Creek[b]	$0	$25,060	$0	$25,060	Aquatic	Yes

[a] SCE included in its costs for the Big Creek Nos. 2A, 8, and Eastwood Project No. 67 some measures that actually apply to the Portal Project No. 2074. These measures include proposed minimum flow releases and channel and riparian maintenance releases, water and aquatic monitoring, and sediment management. The monitoring and sediment management measures have been removed from the proposed measures for Project No. 67 and have been presented separately below in table B-5. SCE did not provide a breakdown of the costs associated with the minimum flows and channel and riparian maintenance flows for Camp 61 Creek, although we expect them to be small in proportion to the overall costs for minimum flows and channel and riparian maintenance flows provided for Project No. 67 with Camp 61 Creek costs included. Therefore, we have not removed a proportional amount of the Camp 61 Creek costs from Project No. 67 in table B-1, nor have we shown that portion of the costs in table B-5.

[b] Although we recommend these measures, they would need to be addressed in the license order for the Portal Project.

APPENDIX C

SUMMARY OF FISH ABUNDANCE AND CONDITION FACTOR BY STREAM AND LOCATION

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Drainage Sub-Basin		South Fork San Joaquin River Basin							
	Stream	**South Fork San Joaquin River**							
	Order	5	5	5	5	5	5	5	5
	Reach	Upstream of Florence Lake	Florence Lake to Bear Creek		Bear Creek to Mono Crossing			Mono Crossing to Rattlesnake Creek	Rattlesnake Creek to SJR
	Rosgen Level I Channel Type (Rosgen, 1996)	B	B	C	G	C	B	B	G
Species	**Estimate of**								
Brown Trout	Density (#/km)	206	522	303	306	226	220	350	385
	Density (#/ha)	225	713	312	261	137	123	174	262
	Biomass (kg/ha)	N/A	35.1	11.1	8.6	9.3	8.3	4.7	10.2
	Condition Factor		1.37	1.45	1.38	1.35	1.32	1.24	1.27
Rainbow Trout	Density (#/km)		174	21	32	632	700	984	837
	Density (#/ha)		238	22	27	382	391	490	571
	Biomass (kg/ha)		13.0	2.0	0.4	6.7	23.9	5.8	9.3
	Condition Factor		1.31	1.84	1.44	1.60	1.31	1.38	1.43

Drainage Sub-Basin		**South Fork San Joaquin River Basin**						
	Stream	**Tombstone Creek**			**South Slide Creek**		**North Slide Creek**	
	Order	1	1	1	1	1	1	1
	Reach	Above Diversion	Below Diversion		Above Diversion	Below Diversion	Above Diversion	Below Diversion
	Rosgen Level I Channel Type (Rosgen, 1996)	Aa+	Aa+	C/E	Aa+	Aa+	Aa+	Aa+
Species	**Estimate of**							
Brown Trout	Density (#/km)	No Fish	416	No Fish	No Fish	No Fish	No Fish	No Fish
	Density (#/ha)		2,960					
	Biomass (kg/ha)		188.4					
	Condition Factor		1.37					

Drainage Sub-Basin		South Fork San Joaquin River Basin					
	Stream	**Hooper Creek**		**Crater Creek**			
	Order	3	3	1	1	1	1
	Reach	Above Diversion	Below Diversion	Above Diversion	Below Diversion	Below Diversion	Diversion Channel
	Rosgen Level I Channel Type (Rosgen, 1996)	Aa+	Aa+	Aa+	Aa+	C	Aa+
Species	**Estimate of**						
Brown Trout	Density (#/km)					No Fish	
	Density (#/ha)						
	Biomass (kg/ha)						
	Condition Factor						
Brook Trout	Density (#/km)			547	276		1,193
	Density (#/ha)			1,495	1,919		3,872
	Biomass (kg/ha)			21.2	29.8		81.4
	Condition Factor			1.46	1.05		1.33
Rainbow x Golden Trout Hybrid	Density (#/km)	663	962				
	Density (#/ha)	2,029	4,229				
	Biomass (kg/ha)	71.3	124.9				
	Condition Factor	1.23	1.31				

Drainage Sub-Basin		South Fork San Joaquin River Basin					
	Stream	Bear Creek		Chinquapin Creek		Camp 62 Creek	
	Order	4	4	1	1	2	2
	Reach	Above Diversion	Below Diversion	Above Diversion	Below Diversion	Above Diversion	Below Diversion
	Rosgen Level I Channel Type (Rosgen, 1996)	B	A	Aa+	Aa+	Aa+	Aa+
Species	**Estimate of**						
Brown Trout	Density (#/km)	470	1,406				
	Density (#/ha)	514	3,211				
	Biomass (kg/ha)	18.6	131.3				
	Condition Factor	1.20	1.23				
Brook Trout	Density (#/km)			665	2,034	945	1,162
	Density (#/ha)			5,452	13,094	5,928	6,780
	Biomass (kg/ha)			122.3	215.8	152.3	124.4
	Condition Factor			1.35	1.01	1.21	1.21

Drainage Sub-Basin		South Fork San Joaquin River Basin							
Stream		Bolsillo Creek			Adit No. 2[a]		East Fork Camp 61[a]	West Fork Camp 61[a]	Camp 61 Creek[a]
Order		1	1	1	1	1	1	1	1
Reach		Above Diversion	Below Diversion	Below Diversion	Upper Site	Lower Site	Above Portal Forebay	Above Portal Forebay	Below Portal Forebay[2]
Rosgen Level I Channel Type (Rosgen, 1996)		B	Aa+	B	Aa+	Aa+	Aa+	Aa+	B
Species	**Estimate of**								
Brown Trout	Density (#/km)				No Fish	601	49		940
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor					1.07	1.00		1.07
Rainbow Trout	Density (#/km)						81	65	
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor						0.90	1.00	
Brook Trout	Density (#/km)	2,187	143	1,509			1,299	2,040	
	Density (#/ha)	20,503	1,087	12,378					
	Biomass (kg/ha)	431.9	22.6	216.5					
	Condition Factor	1.11	1.22	1.24			0.97	1.02	

Drainage Sub-Basin		South Fork San Joaquin River Basin							
Stream		Bolsillo Creek			Adit No. 2[a]		East Fork Camp 61[a]	West Fork Camp 61[a]	Camp 61 Creek[a]
Order		1	1	1	1	1	1	1	1
Reach		Above Diversion	Below Diversion	Below Diversion	Upper Site	Lower Site	Above Portal Forebay	Above Portal Forebay	Below Portal Forebay[2]
Rosgen Level I Channel Type (Rosgen, 1996)		B	Aa+	B	Aa+	Aa+	Aa+	Aa+	B
Species	**Estimate of**								
Rainbow x Golden Trout Hybrid	Density (#/km)						16		
	Density (#/ha)								
	Biomass (kg/ha)								
	Condition Factor						1.11		

Drainage Sub-Basin		**South Fork San Joaquin River Basin**						
	Stream	**Cold Creek[c]**	**Mono Creek**			**Boggy Meadow Creek[c]**	**Warm Creek[c]**	
	Order	4	4	4	4	2	2	2
	Reach		Above Lake Edison	Below Lake Edison	Below Diversion		Upper	Lower
	Rosgen Level I Channel Type (Rosgen, 1996)	B	C	B	B	C/G	G	G
Species	**Estimate of**							
Brown Trout	Density (#/km)	632	2,462	1,259	64	848		
	Density (#/ha)				113			
	Biomass (kg/ha)				3.3			
	Condition Factor	1.01	1.07	1.17	1.10	1.08		
Rainbow Trout	Density (#/km)	74	393	259	11	141		
	Density (#/ha)				19			
	Biomass (kg/ha)				0.9			
	Condition Factor	1.05	1.09	1.20	0.91	1.02		
Brook Trout	Density (#/km)	11	243			576		
	Density (#/ha)							
	Biomass (kg/ha)							
	Condition Factor	N/A	1.07			1.05		
Rainbow x Golden Trout Hybrid	Density (#/km)	11					440	374
	Density (#/ha)							
	Biomass (kg/ha)							
	Condition Factor	N/A					1.06	1.08

Drainage Sub-Basin		**South Fork San Joaquin River Basin**					
	Stream	**Mammoth Reach**		**Rock Creek**		**Stevenson Reach**	
	Order	6	6	3	3	6	6
	Reach	Upper Site	Lower Site	Above Diversion	Below Diversion	Upper Site	Lower Site
	Rosgen Level I Channel Type (Rosgen, 1996)	B	B	Aa+	Aa+	G	G
Species	**Estimate of**						
Brown Trout	Density (#/km)	125	52	930	481	7	7
	Density (#/ha)	83	46	2,407	1,155	5	6
	Biomass (kg/ha)	2.0	4.7	91.5	42.4	0.1	0.0
	Condition Factor	1.09	1.18	1.31	1.30	1.22	1.16
Rainbow Trout	Density (#/km)	91	384	241	432	100	
	Density (#/ha)	61	340	623	1,037	76	
	Biomass (kg/ha)	2.1	12.5	29.5	29.0	0.3	
	Condition Factor	1.69	2.25	1.19	1.46	1.36	
Sacramento Sucker	Density (#/km)	498	1,197			514	15
	Density (#/ha)	331	1,061			389	12
	Biomass (kg/ha)	29.3	35.7			3.6	2.2
	Condition Factor						
Hardhead	Density (#/km)						295
	Density (#/ha)						233
	Biomass (kg/ha)						2.2
	Condition Factor						0.97
Sacramento Pikeminnow	Density (#/km)						597
	Density (#/ha)						471
	Biomass (kg/ha)						4.6
	Condition Factor						
Prickly Sculpin	Density (#/km)					43	
	Density (#/ha)					32	
	Biomass (kg/ha)					0.2	

Drainage Sub-Basin		**South Fork San Joaquin River Basin**					
	Stream	**Mammoth Reach**		**Rock Creek**		**Stevenson Reach**	
	Order	6	6	3	3	6	6
	Reach	Upper Site	Lower Site	Above Diversion	Below Diversion	Upper Site	Lower Site
	Rosgen Level I Channel Type (Rosgen, 1996)	B	B	Aa+	Aa+	G	G
Species	**Estimate of**						
	Condition Factor						

Drainage Sub-Basin		Big Creek Basin						
	Stream	Big Creek						
	Order	4	4	4	4	5	5	5
	Reach	Dam 1 to Powerhouse 1				Dam 4 to Powerhouse 2	Dam 5 to Powerhouse 8	
	Rosgen Level I Channel Type (Rosgen, 1996)	B	G	A	Aa+	A	A	Aa+
Species	Estimate of							
Brown Trout	Density (#/km)	320	648	1,214	497	363	602	160
	Density (#/ha)	462	1,852	3,572	1,579	811	946	331
	Biomass (kg/ha)	16.0	50.9	N/A	117.6	N/A	N/A	N/A
	Condition Factor	0.92	1.17		1.42			
Rainbow Trout	Density (#/km)					363	930	769
	Density (#/ha)					811	1,463	1,594
	Biomass (kg/ha)					N/A	N/A	N/A
	Condition Factor							
Prickly Sculpin	Density (#/km)		14					
	Density (#/ha)		4.051					
	Biomass (kg/ha)							

Drainage Sub-Basin		**Big Creek Basin**						
	Stream	**Pitman Creek**			**Balsam Creek**		**Ely Creek**	
	Order	3	4	4	3	3	1	2
	Reach	Above Diversion	Below Diversion		Above Diversion	Below Diversion	Above Diversion	Below Diversion
	Rosgen Level I Channel Type (Rosgen, 1996)	B	B	Aa+	Aa+	Aa+	Aa+	Aa+
Species	**Estimate of**							
Brown Trout	Density (#/km)	338	22					
	Density (#/ha)	780	50					
	Biomass (kg/ha)	45.4	3.2					
	Condition Factor	1.12	1.23					
Rainbow Trout	Density (#/km)	1,066	613	1,647	1,335	12	190	266
	Density (#/ha)	2,458	1,426	5,496	8,101	33	1,605	1,635
	Biomass (kg/ha)	57.3	38.2	77.5	171.6	2.3	133.9	76.7
	Condition Factor	1.20	1.71	1.45	1.56	2.07	1.25	1.38
BrookTrout	Density (#/km)	82	22					
	Density (#/ha)	189	50					
	Biomass (kg/ha)	1.5	1.0					
	Condition Factor	1.00	1.06					
Rainbow x Golden Trout Hybrid	Density (#/km)							102
	Density (#/ha)							629
	Biomass (kg/ha)							31.4
	Condition Factor							1.40

Drainage Sub-Basin		Big Creek			
	Stream	**Adit No. 8**	**Rancheria Creek**[1]		
	Order	1	3	3	3
	Reach	Below Diversion	Above Energy Dissipater	Below Energy Dissipater	Below Energy Dissipater
	Rosgen Level I Channel Type (Rosgen, 1996)	Aa+	B	B	A
Species	**Estimate of**				
Brown Trout	Density (#/km)	No Fish	132	110	22
	Density (#/ha)				
	Biomass (kg/ha)				
	Condition Factor		1.71	1.40	1.11
Rainbow Trout	Density (#/km)		963	679	580
	Density (#/ha)				
	Biomass (kg/ha)				
	Condition Factor		1.39	1.39	1.18
Brook Trout	Density (#/km)		569	154	33
	Density (#/ha)				
	Biomass (kg/ha)				
	Condition Factor		1.40	1.12	1.06
Sacramento Sucker	Density (#/km)		307	88	33
	Density (#/ha)				
	Biomass (kg/ha)				
	Condition Factor				

Drainage Sub-Basin		Stevenson and North Fork Stevenson Reach						
	Stream	**North Fork Stevenson Creek**				**Stevenson Creek**		
	Order	2	2	2	2	3	3	3
	Reach	Upstream of Tunnel 7 Outlet	Downstream of Tunnel 7 Outlet			Downstream of Shaver Lake Dam		
	Rosgen Level I Channel Type (Rosgen, 1996)	Aa+	Aa+	G	C	B	Aa+	A
Species	**Estimate of**							
Brown Trout	Density (#/km)	No Fish		305	430			
	Density (#/ha)			703	2,170			
	Biomass (kg/ha)			43.7	33.2			
	Condition Factor			1.23	1.39			
Rainbow Trout	Density (#/km)			210	314	751	966	128
	Density (#/ha)			485	1,588	2,829	3,161	309
	Biomass (kg/ha)			13.5	29.8	52.3	74.9	N/A
	Condition Factor			1.27	1.27	1.04	1.34	
Rainbow x Golden Trout Hybrid	Density (#/km)		583	11				
	Density (#/ha)		487	24				
	Biomass (kg/ha)		9.0	1.3				
	Condition Factor		0.98	1.35				
Sacramento Sucker	Density (#/km)			11	42			
	Density (#/ha)			24	212			
	Biomass (kg/ha)			13.5	65.9			
	Condition Factor							

[a] Data collected in 2002 for Portal Hydroelectric Power Project Relicensing.
[b] In 2001, brook trout were also captured with a density estimate of 1,299 fish/km.
[c] Data collected in 2000 for Vermilion Valley Hydroelectric Project Relicensing.

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APPENDIX D

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSES FOR THE BIG CREEK NOS. 2A, 8, AND EASTWOOD PROJECT (FERC PROJECT NO. 67), BIG CREEK NOS. 1 AND 2 PROJECT (FERC PROJECT NO. 2175), MAMMOTH POOL PROJECT (FERC PROJECT NO. 2085), AND BIG CREEK NO. 3 PROJECT (FERC PROJECT NO. 120)

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The U.S. Environmental Protection Agency's (EPA) notice of availability of the draft environmental impact statement (EIS) was issued on September 19, 2008, and comments on the draft EIS were due on November 3, 2008. In addition, Federal Energy Regulatory Commission (Commission) staff conducted a public meeting in Fresno, California, on October 15, 2008.

Five of the six persons attending the public meeting spoke. All made statements that supported the Settlement Agreement. A representative of the U.S. Department of Agriculture, Forest Service (Forest Service) encouraged Commission staff to use a collaborative approach in finalizing the Historic Properties Management Plan (HPMP) for the Big Creek projects.

In this appendix, we[58] summarize the written and oral comments received; provide responses to those comments; and indicate, where appropriate, how we modified the text in the final EIS. We grouped the comment summaries and responses by topic for convenience. We did not summarize statements that are simply in support of the Settlement Agreement or staff alternative measures without providing any new information. We also did not summarize comments that point out minor edits to the draft EIS; however, we have made these edits in the final EIS. The following entities filed comments on the draft EIS.

Commenting Entity	Filing Date
U.S. Department of the Interior	October 20, 2008
U.S. Department of Agriculture, Forest Service	October 30, 2008
Southern California Edison	October 30, 2008
California State Water Resources Control Board	November 3, 2008
U.S. Environmental Protection Agency	November 4, 2008

PROCEDURAL AND GENERAL

Comment 1: The Forest Service asks if our listing of kV on page xvii (Acronyms and Abbreviations) should be Kv.

Response: Our abbreviation for kilovolt is consistent with common practice in the industry.

Comment 2: The Forest Service, commenting on page 1-12 of the draft EIS asks: "Why is there going to be 'no response to Mammoth comments?' Public comments should be addressed."

[58] In this section "we" means the Commission staff.

Response: The statement in question pertains to our documentation of the responses to the Commission's Ready for Environmental Analysis Notice pertaining to the Mammoth Pool Project. The statement reads as follows: "SCE did not respond to the recommendations, terms, and conditions filed for the Mammoth Pool Project." The Commission affords applicants the opportunity to respond to recommendations, terms, and conditions within 45 days of the end of the comment period. Applicants are not obligated to file any responses. We addressed agency and public comments received in response to the Ready for Environmental Analysis notice in section 3 of the draft EIS.

Comment 3: The California State Water Resources Control Board (Water Board) requests clarification regarding whether those environmental protection and enhancement measures not identified in the Settlement Agreement but recommended by Commission staff for the Portal (FERC Project No. 2174) and Vermilion Valley (FERC Project No. 2086) projects would be recommended for inclusion in any new licenses issued by the Commission.

Response: Environmental measures not identified in the Settlement Agreement, but recommended by Commission staff in the National Environmental Policy Act (NEPA) documents for the Portal Project (filed on April 27, 2006) and Vermilion Project (filed on May 4, 2004) remain the same. Only those flow-related measures proposed in the Settlement Agreement that supersede measures analyzed in the Portal Environmental Assessment (EA) have been modified. We identified those superseded recommendations on pages 5-9 and 5-10 (minimum instream flows) and page 5-13 (channel and riparian maintenance flows) of the draft EIS.

Comment 4: The Water Board recommends that we include as appendices to the final EIS the following: (1) the final EA for the Portal Project; (2) the final EA for the Vermilion Valley Project; and (3) the full Big Creek alternative licensing process (ALP) Settlement Agreement.

Response: The three referenced documents are currently available to the Water Board and the general public via the Commission's eLibrary system (Portal Project: P-2174-12, accession number 20060427-3060, filed April 27, 2006; Vermilion Valley Project: P-2086-035, accession number 20040504-3076, filed May 4, 2004; and Big Creek ALP Settlement Agreement: P-2085-014, 2175-014, 67-173, 120-020, accession number 20070223-4013, filed February 21, 2007). Including them as appendices to the final EIS would increase the size of the document by nearly 1,000 pages. Given that all three documents are currently accessible in electronic format, we find little additional value in including them as appendices to the final EIS.

Comment 5: The Water Board comments that many of the impacts listed in the first column of appendix A of the draft EIS would not be considered impacts under the California Environmental Quality Act (CEQA) because they are impacts that have already occurred or currently occur. The Water Board suggests that when evaluating the potential for environmental impacts for the purpose of CEQA, Commission staff should identify impacts associated with proposed environmental measures, rather than identifying ongoing impacts of the project.

Response: We modified appendix A, *Big Creek Projects Mitigation and Monitoring Summary,* in the final EIS to respond to the Water Board's suggestion. This appendix is intended to serve as an aid to the Water Board in its CEQA analysis relating to its consideration of Water Quality Certification of the Big Creek projects.

Comment 6: EPA comments that the draft EIS has no analysis of the environmental impacts on each resource area that would result from implementation of the no-action alternative. It states that the final EIS should provide additional information on the no-action alternative to describe the environmental impacts of continuing to operate the project under the terms and conditions of the current license.

Response: The broad environmental effects of operating the projects under the no-action alternative are described in section 2.1.2, *Existing Project Operations*, of the EIS. Specific environmental effects of the no-action alternative are contained in the affected environment portion of each resource section. For example, current water level manipulation of project reservoirs is described on pages 3-3 through 3-21 of the draft EIS. Project-related flow diversions are described on pages 3-22 through 3-30 and project-related effects on water temperature are shown in table 3-8 (pages 3-36 and 3-37) of the draft EIS. Project-related effects on aquatic habitat are described on pages 3-48 (Crater Creek), 3-49 and 3-50 (Camp 61 Creek), 3-57 (Lower Big Creek), 3-60 (Florence Lake), 3-61 (Shaver Lake), 3-62 and 3-63 (Huntington Lake), 3-63 and 3-64 (Balsam Meadows forebay), and 3-64 and 3-65 (Mammoth Pool). In some instances, we describe the effects of the no-action alternative to set up our environmental analysis. For example, on pages 3-71, 3-120, and 3-126, we indicate that the lack of high quality spawning gravel and large woody debris in some bypassed reaches may be attributed to trapped materials in project reservoirs, and on page 3-108 we indicate that current project operations decrease the duration, magnitude, and frequency of high spring flows at Bear, Bolsillo, Camp 62, and Chinquapin creeks. Similarly, we describe the visual effects of the no-action alternative on page 3-243 of the draft EIS to set up our analysis of the need for a visual resources plan.

Comment 7: The Water Board states that CEQA requires the disclosure of all potential environmental impacts for a given project, a determination of the level of significance of each impact, and a statement regarding whether mitigation measures have been incorporated into the project to offset or reduce the impact. To meet this requirement, the Water Board comments that it would be helpful if we included a table in each resource section that identifies all of the potential significant impacts relative to baseline conditions and any associated mitigation. EPA also recommends that we include a table in each of the resource sections that summarizes: (1) the impacts of the hydroelectric project operation on that resource (the no-action alternative); (2) the environmental measures that are proposed under each alternative; and (3) the impacts of the project after implementing the environmental measures under each alternative.

Response: With regard to EPA's comment, we do not include staff-recommended environmental measures in section 3 of the EIS, *Environmental Analysis*, because our recommendations are also based on our developmental analysis (costs) of implementing various environmental measures as described in section 4 of the EIS. However, with respect to the Water Board's comment, our revisions to the CEQA summary table in the final EIS should address the comment of the Water Board, to some degree. The typical organization of our environmental effects section in each resource area is to define the issue that environmental measures are intended to address if not obvious, list the measures proposed by the applicant and recommended by any other entities that would address the issue (with the exception of Commission staff, as explained above), and our analysis of the effects of the various proposed and recommended measures on the environment. In some instances, we present proposed or recommended measures in tabular form to assist the reader, but since any table in the format that EPA proposes would not include the staff recommendations, the suggested table would not be an accurate representation.

Comment 8: EPA recommends that the final EIS provide additional detail describing how activities would be performed for all proposed dismantling or construction actions, including in-water work activities associated with small diversion decommissioning, sediment removal, and recreational improvements including construction of boat ramps and docks. EPA also recommends that the final EIS include measures that would be taken to avoid and minimize both short- and long-term adverse impacts to water quality, aquatic resources, and other resources and should propose mitigation to compensate for unavoidable impacts. EPA states these measures and mitigation should be included in the Record of Decision.

Response: Commission approval of specific measures that would be included in a new license for a project does not dismiss the need for additional permits and approvals that may be associated with each measure. SCE recognizes this fact in many of the plans that it includes in its proposed project.

For example, although the proposed removal of five small back country diversion dams that are 5 feet or less in height would be accomplished primarily by equipment that can be carried to the site (hand tools and explosives), SCE expects to spend the first year from license issuance consulting with agencies and obtaining appropriate permits for this work, which may include a water quality certificate from the Water Board. We added text to the final EIS to reiterate the proposed agency consultation regarding what, if any, additional measures should be taken to protect water quality and aquatic resources. Only one of these dams (North Slide Creek) is known to have any substantive sediment behind it, which when the dam is breached would have the potential to temporarily increase turbidity. However, all dam removals would occur during late summer or early fall, when flows would be low and potential for adverse effects on aquatic habitat from sedimentation would be minimal and short-term, which we point out on pages 3-117 and 3-118 of the draft EIS. We consider the removal of these five diversion dams to represent a net benefit to aquatic habitat by removing migratory barriers and restoring geomorphological processes, which would more than compensate for any short-term effects during the removal process. SCE would submit its permit applications and supporting material to the Commission when it submits them to other permitting agencies. The Commission would analyze the potential environmental effects of the proposed future specific decommissioning measures in the permit applications.

Monitoring is proposed at most diversions where sediment removal may occur, as indicated in table 3-14 of the draft EIS. Sediment removal would occur during low flow periods when potential water quality degradation from sedimentation would be minimized. Monitoring results would be submitted to regulatory agencies, including the Water Board, and the need for adjustments to sediment management activities evaluated in an adaptive manner. We added text in the final EIS that underscores the adaptive approach that SCE proposes to take regarding sediment management.

SCE also proposes numerous recreational facility enhancements. Many of these represent rehabilitation of existing facilities, some of which are managed by SCE, others by the Forest Service. Rehabilitation of existing recreational facilities, as needed, is part of the expected maintenance of existing facilities and use of best management practices would minimize the potential for adverse effects to water quality and aquatic habitat. We note that proposed rehabilitation or construction of new boat ramps and docks occur at reservoirs that are seasonally drawn down outside the peak recreational season. Thus rehabilitation or new construction of ramps and docks can readily be accomplished without any in-water work. SCE proposes to consult annually with the Forest Service to coordinate plans for recreational facility construction that would occur during the following year. This would include identifying permitting needs and sensitive natural resources that would need to be protected. We added text to the final EIS that reiterates SCE's (and our recommended) approach to working with the Forest Service to minimize adverse effects to natural resources. We also added text to the discussion of recommended measures pertaining to the Recreation Management Plan in section 5.2 of the final EIS to specify that SCE provide best management practices to minimize effects on natural resources in its specific plans for the proposed four new recreational facilities. These plans would be prepared prior to the scheduled implementation of new facility construction.

Comment 9: The Water Board states that clarification and possibly additional analysis would be needed in the final EIS if that document is to serve as the environmental review document under CEQA. Specifically, the final EIS should address whether the potential exists for impacts in the following areas: (1) noise; (2) traffic; (3) hazardous materials; (4) utilities/service systems; (5) air quality; and (6) agricultural resources.

Response: In response to the Water Board's comment, we added sections to the final EIS that discuss noise and air quality. The effects of relicensing on road use and management is addressed in the context of SCE's proposed Transportation System Management Plan, which we discuss on pages 3-240 and 3-241 of the draft EIS. Relicensing the Big Creek ALP Projects should not have a bearing on traffic over the long-term, because recommended recreational measures would do little to increase the capacity of existing recreational facilities. Measures to protect the public and the environment from the accidental release of hazardous materials are required by state and federal regulations, and must be in place regardless of the status of this relicensing proceeding, as we discuss on page 5-31 of the draft EIS. However, the Forest Service specifies that SCE develop a Spill Prevention and Countermeasure Plan as a section 4(e) condition. This would ensure that protection from hazardous materials is appropriately addressed. The effects of relicensing of the Big Creek ALP Projects on the economic aspects of those four utility projects is addressed in section 4, *Developmental Analysis*. Relicensing the Big Creek ALP Projects would have no effect on agricultural resources. As noted in section 2.1.2, *Existing Project Operations*, the Big Creek System projects must be operated in compliance with the Mammoth Pool Operating Agreement between SCE and the U.S. Bureau of Reclamation. This agreement ensures that sufficient water is available from releases at Friant dam for downstream irrigators independent of this relicensing proceeding. Therefore, relicensing the Big Creek ALP Projects would have no effect on agricultural resources.

Comment 10: EPA comments that the final EIS should include a discussion of existing air quality and conformity with the state and federal air regulations. It should describe and estimate air emissions from potential construction and other activities, as well as propose mitigation measures to minimize those emissions. EPA states that the final EIS should include an analysis of impacts expected from implementation of a fire management and response plan.

Response: As noted in the previous response, we added a section to the final EIS that addresses air quality. Implementation of a fire management and response plan by SCE would focus on measures to prevent, control, report, and investigate fires in the vicinity of the projects. SCE would not be in a position to implement controlled burns within the Sierra National Forest, which is managed by the Forest Service. Therefore, implementation of a fire management and response plan by SCE would have no effect on air quality.

NEED FOR POWER

Comment 11: The Water Board comments that it would be helpful if the final EIS included a discussion of how SCE plans to make up for lost generation that would accompany implementation of the proposed measures. This would address potential indirect impacts that may result from the proposed action.

Response: We cannot predict how SCE would make up for lost generation that would accompany implementation of proposed, flow-related measures. SCE states that it must purchase its unmet capacity and energy requirements from the existing market because it does not have any deactivated or retired generation plants that could be restarted to replace lost capacity and energy and has no plans to construct new generation facilities (SCE, 2007a). Depending on the source of the replacement power that SCE would purchase, indirect environmental effects would vary. The power produced by the Big Creek ALP Projects cannot be replaced by an alternative source at a lower cost (SCE, 2007a). Consequently, there would be an increase in energy costs to SCE customers.

PROJECT DESCRIPTION

Comment 12: SCE comments that the Big Creek No. 4 Project is one of the seven projects that make up the Big Creek System and should be included in table 2-1, Big Creek System hydroelectric projects.

Response: We excluded the Big Creek No. 4 Project from this table in an effort to focus the reader's attention on the four projects that are the subject of this EIS and the two additional projects that influence operations at these four projects. All Big Creek System flow chains converge at the upstream end of Redinger reservoir (the Big Creek No. 4 impoundment), and the Big Creek No. 4 Project has already received its license from the Commission. The relationship of the Big Creek No. 4 Project to upstream projects is shown in figures 2-1, 3-1, and 3-6. In response to this comment, we changed the caption of table 2-1 to "Big Creek System hydroelectric projects that are relevant to this proceeding."

Comment 13: SCE recommends modifying the dependable operating capacity values shown in figure 2-1 as follows: (1) Big Creek powerhouse 2A should be 98.5 megawatts (MW); (2) Big Creek powerhouse 1 should be 82.9 MW; (3) Mammoth Pool powerhouse should be 187 MW; and (4) Big Creek powerhouse 3 should be 181.9 MW. In addition, Florence Lake usable storage is 64,406 acre-feet.

Response: We have adjusted figure 2-1 to more accurately reflect the description of various project features.

Comment 14: The Forest Service notes that the schematic shown in figure 2-1 (page 2-3 of the draft EIS) does not indicate that Balsam Creek releases from the forebay are recaptured downstream within the Big Creek System.

Response: The purpose of figure 2-1 is to show the geographical relationship of existing project facilities associated with the Big Creek System, not the flow through the system. The complex nature of flows through the Big Creek System, including the fate of water released to Balsam Creek from the Balsam Meadows forebay, is shown in figures 3-1 (page 3-5 of the draft EIS) and 3-6 (page 3-46 of the draft EIS).

Comment 15: SCE suggests changing the column heading for table 2-2 from "Usable Storage at Maximum Pool (acre-feet)" to "Usable Capacity at Maximum Pool (acre-feet)" because this better defines the volume of water that can be impounded at each facility.

Response: We have modified the referenced column heading to read "Usable Storage Capacity at Maximum Pool (acre-feet)" to be consistent with terminology in the Commission's regulations.

Comment 16: SCE comments that our summary of sediment management prescriptions on page 2-27 infers that sediment management would only occur at Dam 4, 5, and 6. Article 1.10 of the Settlement Agreement calls for sediment management at other small, moderate, and large diversions. Alternative language is offered that reflects the actual proposed measure.

Response: We modified the description of this measure in the final EIS to reflect SCE's suggested clarification.

CUMULATIVELY AFFECTED RESOURCES

Comment 17: The Water Board states that it would be helpful for its CEQA review if we revised the discussion of cumulative impacts to distinguish between ongoing project impacts and impacts associated with the implementation of the proposed environmental measures at the projects.

Response: We modified the cumulative effects discussion of sections 3.3.1.3, *Aquatic Resources*, 3.3.2.3, *Terrestrial Resources*, and 3.3.4.3, *Recreational Resources*, in the final EIS to distinguish between ongoing project effects and effects associated with implementation of proposed environmental measures as requested by the Water Board.

Comment 18: The Water Board requests that we clarify in section 5 of the final EIS whether the potential cumulative environmental effects for the Big Creek ALP Projects are less than significant pursuant to NEPA.

Response: We included a statement that the proposed relicensing of the Big Creek ALP Projects would result in less than significant cumulative environmental effects in the three subsections referenced in the previous response.

Comment 19: The Water Board notes that the Settlement Agreement includes environmental measures for the Portal and Vermilion Valley projects. Consequently, it requests that we clarify whether we consider the cumulative effects of the preferred alternatives for the Portal and Vermilion Valley projects to be less than significant pursuant to NEPA when compared to and included with the potential cumulative effects of the Big Creek ALP Projects.

Response: The Portal and Vermilion Valley projects are integrally related to the Big Creek ALP Projects, and we considered this relationship in our cumulative effects analysis. Therefore, the response to the previous comment would apply to the Portal and Vermilion Valley projects.

Comment 20: EPA states that the draft EIS does not sufficiently evaluate the potential cumulative effects from the projects on resources in the surrounding area other than hydropower operations, nor does it sufficiently describe impacts to resources from other projects or activities within the geographic and temporal scope of the project. EPA recommends that we use the California Department of Transportation Indirect and Cumulative Impacts Analysis in our assessment of cumulative effects. In addition, EPA states that the final EIS should provide a substantive discussion of the cumulative effects of the proposed action, propose mitigation for all cumulative impacts, and clearly state the lead agency's mitigation responsibilities and the mitigation responsibilities of other agencies.

Response: We included a discussion of cumulative effects on applicable resources in sections 3.3.1.3, *Aquatic Resources*, 3.3.2.3, *Terrestrial Resources*, and 3.3.4.3, *Recreational Resources* of the draft EIS. As indicated in our responses to comments 21 and 22, we consider the cumulative effect of relicensing the Big Creek ALP Projects to be less than significant. Therefore, we conclude that no mitigation for cumulative effects is necessary.

Comment 21: EPA recommends including a discussion about the potential effects of climate change relative to the proposed action in the cumulative effects analysis of the final EIS. EPA requests that the discussion summarize the applicable climate change studies, including the findings and recommendations for addressing potential effects on environmental resources and water supplies.

Response: From our review of the reports, EPA references, and other related reports on potential climate change, we conclude that future climate change effects on water resources and water temperatures in the area of the Big Creek System are unknown, although some models may attempt to predict change at the river basin level.

The final EIS examines the effects of operating the projects under a variety of historic flow regimes, including high and low flow years, which shows the flexibility of the Big Creek System to respond to hydrologic change. Brekke et al. (2009) state that adaptive management is an approach that makes decisions sequentially over time and allows adjustments to be made as more information is known. They suggest that this approach may be useful in dealing with the additional uncertainty introduced by potential climate change. Our recommendations in this final EIS incorporate adaptive management principles. The Commission's standard reopener article would be included in any license as the vehicle for making changes to the license if unforeseen and unanticipated adverse environmental effects occur in the future.

AQUATIC RESOURCES

Comment 22: The Forest Service finds the description of lake elevations to be confusing. On page 3-3 of the draft EIS, we describe Florence Lake as the highest elevation storage reservoir in the Big Creek ALP Projects. On page 2-18, we state that Lake Thomas A. Edison is the highest elevation reservoir in the Big Creek System.

Response: We added a footnote on page 3-3 of the final EIS to state that Lake Thomas A. Edison is part of the Vermilion Valley Project, part of the Big Creek System, but not part of the Big Creek ALP Projects that are the subject of this EIS.

Comment 23: The U.S. Department of the Interior (Interior) comments that there are discrepancies between the information presented in table 3-3 and information on the U.S. Geological Survey (USGS) website. Specifically, USGS reports the period of record for station 11230215 is October 1975 to September 2007, not October 1982 to September 2002, and the maximum monthly flows for June, July, and September are different from the data reported by USGS.

Response: We added a footnote to table 3-3 to indicate that the period of record specified in the table should not be interpreted as the total period of record available for these sites. When available, the period of record used for table 3-3 was the 20-year period from water year 1983 to water year 2002, corresponding to the period of record used in the relicensing studies. Several of the gages, such as 11230215, have longer total periods of record, but others, like gage 11237000, have shorter periods of record. We also added footnotes to tables 3-3, 3-4, and 3-7 to clearly indicate that these tables provide the daily minimum and maximum daily flows for each month and not the minimum and maximum monthly flow values.

Comment 24: Interior comments that there are discrepancies between the information presented in table 3-7 and information on the USGS website. Specifically, USGS reports the period of record for station 11237700 is October 1986 to September 2007, not October 1982 to September 2002, and the maximum monthly flow presented for July at station 11230539 is actually the highest daily mean for the period of record. In addition, at station 11230600, table 3-7 presents flow data for December, January, and February, but USGS reports no data collection during these months.

Response: We revised the final EIS to indicate that the period of record used for station 11237700 in table 3-7 was October 1986 to September 2002. We added a footnote to tables 3-3, 3-4, and 3-7 to clearly indicate that these tables provide the minimum and maximum daily flows for each month and not the minimum and maximum monthly flow values. Official year-round data was not available from some of the very small diversions located at high elevations during some winter months when the diversions were not in use. During some winter months, data for gaging stations on Camp 62 Creek (11230600), Bolsillo Creek (11230670), and Chinquapin Creek below the diversion dam (11230560) were based on synthesized data from the SCE license application. A footnote to this effect was added to table 3-7.

Comment 25: SCE comments that the four analytes listed on page 3-35 of the draft EIS, (including benzene, toluene, ethylbenzene, and total xylene) were not detected at concentrations that exceeded Basin Plan standards, and our text should be modified accordingly.

Response: Our text on page 3-35 of the draft EIS was taken directly from page 4-4, lines 3 to 6, of the cited reference (SCE, 2003h. CAWG-4-Chemical water quality), which incorrectly states that values of these analytes occasionally did not meet Basin Plan standards. We reviewed tables CAWG-4-9, 10, 11, and 12 and agree that the four analytes were not detected at concentrations that exceeded Basin Plan objectives. We modified the text to state that these analytes "were occasionally detected, but the measured values did not exceed Basin Plan objectives."

Comment 26: On page 3-47 of the draft EIS, we indicate that natural barriers on Hooper Creek limit brown and brook trout spawning migrations during low flow conditions in the fall. SCE states that brown and brook trout are not found in Hooper Creek, and suggests we modify our text to indicate that the natural barriers would limit brown trout spawning migrations from the South Fork San Joaquin River during low flow conditions in the fall.

Response: We added a footnote that indicates that brook trout and brown trout are not currently known to occur in Hooper Creek, but do occur in nearby streams.

Comment 27: The description of the affected environment of Mono Creek on page 3-51 of the draft EIS, includes the statement: "Streambank erosion in Mono Meadow due to livestock results in large amounts of fine sediment deposition and degraded fish habitat, limiting fish and macroinvertebrate production throughout the bypassed reach." SCE requests that we delete this sentence because no conclusions were made regarding the effects of livestock on instream sediment deposition or the quality of fish habitat in the Amended Preliminary Draft EA or relicensing study reports.

Response: Page 5.2.4-49 of the Amended Preliminary Draft EA states that the low-gradient reach flowing through Mono Meadow is grazed by cattle, and that the abundance and widespread distribution of fine sediments present when habitats were characterized and fish were sampled likely reduced the habitat value of Mono Creek for trout and macroinvertebrates. We modified this text to read: "At the time that SCE conducted its habitat and fisheries surveys in Mono Creek, habitat conditions were adversely affected by the abundance and distribution of fine sediments. SCE reported that fine sediments have been less abundant in pools since high flows occurred in 2005 and 2006."

Comment 28: SCE, commenting on our introductory statement pertaining to minimum instream flows (MIF) on page 3-65 of the draft EIS, notes that flow releases would be the flows specified in the Settlement Agreement or natural inflow, whichever is less.

Response: We added clarifying text to the final EIS in response to SCE's comment.

Comment 29: SCE suggests that we delete footnote 32 on page 3-76 of the draft EIS, which indicates that weighted usable area (WUA) analyses were not completed for the existing brown trout spawning habitat and refers us to CAWG-3, figure-23 for this data.

Response: We have adjusted the text in the final EIS to include a discussion of brown trout spawning WUA for existing and proposed flows in the Stevenson reach.

Comment 30: Page 3-77 of the draft EIS includes the statement: "A WUA analysis was not completed for Sacramento pikeminnow habitat." SCE refers us to CAWG-3, figure 3-25 for WUA analysis data for the Stevenson reach and suggests we delete the indicated sentence.

Response: We have modified the text in the final EIS to include a discussion of WUA results for Sacramento pikeminnow in the Stevenson reach.

Comment 31: On page 3-77 of the draft EIS, we indicate that daily mean and maximum water temperatures in the Mammoth reach were above 20^{o}C and excessive thermal warming was occurring during the summer and early fall months of 2000 and 2001. SCE comments that temperatures above 20^{o}C were not recorded in 2000 and we should delete this reference to 2000.

Response: We have modified the text in the final EIS in response to SCE's comment.

Comment 32: On page 3-80 of the draft EIS we state that Balsam Creek does not have an MIF. SCE states that Upper Balsam Creek currently does have an MIF.

Response: We corrected the text in the final EIS to read as follows: "The current MIF in Upper Balsam Creek downstream of the forebay is 0.5 cfs from October through May and 1 cfs from June through September. Lower Balsam Creek does not have an MIF."

Comment 33: Page 3-83 of the draft EIS, in the description of Upper Big Creek, includes the statement: "The existing MIF (0 to 2 cfs) is much lower than the historic 30-day unregulated minimum flow (639 cfs)." On page 3-84 of the draft EIS, we state that the proposed MIF of 2 to 5 cfs would be substantially lower than the historic 30-day unregulated minimum flow of 639 cfs. The Forest Service and SCE comment that the unregulated 30-day minimum determined by the Indicators of Hydrologic Alteration analysis was 1.6 cfs. SCE states that the regulated value is 2.3 cfs. The 30-day maximum unregulated flow was 639 cfs. SCE suggests we modify the sentence on 3-83 to read as follows: "The existing MIF (0 to 2 cfs) and 30-day regulated minimum flow at the mouth of Big Creek is 2.3 cfs, greater than the historic 30-day unregulated minimum flow at the mouth of Big Creek (1.6 cfs)."

Response: We have changed the values for the 30-day minimum unregulated flows for dry and wet water years according to the values provided in CAWG-6 Appendix L, table 13b (0.4 cfs in dry years and 3.5 cfs in wet years).

Comment 34: Page 3-84 of the draft EIS includes the statement: "IHA (indicators of hydraulic alteration) or WUA analyses were not done for the Ely Creek bypassed reach." SCE suggests that we modify this sentence as follows: "Although IHA and WUA analyses were not done for the Ely Creek bypassed reach, a wetted perimeter analysis was completed."

Response: We have added information from the wetted perimeter analysis to our evaluation of the effects of proposed MIFs on habitat in the Ely Creek bypassed reach.

Comment 35: On page 3-85 of the draft EIS, we list a specific resource objective of the Forest Service and Interior for the North Fork Stevenson Creek bypassed reach as: "Contribute to spring runoff in the South Fork San Joaquin River bypassed reach to provide environmental cues for aquatic and riparian ecosystems." SCE recommends that we remove this bullet because North Fork Stevenson Creek drains into Shaver Lake, not the South Fork San Joaquin River.

Response: The indicated resource objective was identified by Interior, but not by the Forest Service. We agree that this resource objective is not appropriate for North Fork Stevenson Creek and have removed it from the final EIS.

Comment 36: Page 3-86 of the draft EIS includes the statement: "Pitman Creek does not have a current MIF, and IHA and WUA analyses were not done for Pitman Creek." SCE suggests that we change this sentence to: "Pitman Creek has a current MIF of 0.3 cfs throughout the year. Although WUA analyses were not done for Pitman Creek, IHA and wetted perimeter analyses were completed."

Response: We have modified the text in the final EIS to reflect the existing MIF requirement of 0.3 cfs, and we have added information from the wetted perimeter analysis to our evaluation of the effects of proposed MIFs on habitat in the Pitman Creek bypassed reach.

Comment 37: On page 3-87 of the draft EIS, footnote 33, we state: "WUA analyses were not done for the existing conditions in Bear Creek." SCE suggests that we revise this footnote to read: "WUA analysis was completed for flows representing the existing and proposed conditions in Bear Creek."

Response: We have modified the final EIS to include presentation of brown trout WUA under both existing and proposed MIFs in Bear Creek.

Comment 38: Page 3-89 of the draft EIS includes the statement: "The 28-mile long South Fork San Joaquin River bypassed reach is the longest bypassed reach in the project area and receives inflow from 11 tributaries downstream of Florence dam, all of which have flows reduced by hydroelectric diversions." SCE suggests that we clarify this statement by indicating that this bypassed reach also receives flows from undiverted tributaries.

Response: We have clarified this statement in the final EIS.

Comment 39: On page 3-91 of the draft EIS, in our discussion of MIFs for the South Fork San Joaquin River we state: "WUA analyses of adult brown trout habitat and brown trout spawning habitat based on the proposed MIF were not done because existing adult WUA is greater than 90 percent." SCE recommends that we modify this sentence to read: "WUA analyses of adult brown trout habitat and brown trout spawning habitat show that at both the existing and proposed MIFs, WUAs are greater than 90 percent of maximum."

Response: We have modified the text in the final EIS to include WUA values for brown trout adult and spawning habitat.

Comment 40: In our discussion of channel and riparian maintenance flows at Bear, Bolsillo, Camp 62, and Chinquapin creeks on page 3-107 of the draft EIS, we list a project effect as "altered flood plain connectivity" and that "(t)hese alterations also affect the extent and condition of riparian vegetation." SCE comments that no floodplains were identified along these four streams downstream from the diversions in its study reports and no riparian issues were identified on these channels in the amended preliminary draft EA, and these two statements should be deleted.

Response: We have modified the text in the final EIS to reflect that channel and riparian maintenance flows in these reaches would primarily benefit stream geomorphology and sediment transport rather than riparian resources.

Comment 41: On page 3-110 of the draft EIS in our analysis of channel and riparian maintenance flows in Mono Creek we state: "The banks damaged by livestock in Mono Meadow, however, may be susceptible to increased bank erosion under flows of this magnitude. Monitoring would allow a determination of the extent of bank erosion and the potential need to modify channel and riparian maintenance flows or implement bank stabilization measures." SCE recommends that we delete this text because livestock grazing is unrelated to the project, and actions related to monitoring or mitigating for grazing should not be its responsibility.

Response: We recognize that bank erosion caused from livestock grazing is not a project-related direct effect. However, implementation of channel and riparian maintenance flows at Mono Creek would be a project-related action that could result in exacerbation of adverse effects of bank instability caused by grazing. Our statement is meant to support the purpose of the pool monitoring that SCE proposes to implement. If monitoring shows an increase in sediment following implementation of channel and riparian maintenance flows, a possible outcome would be to adjust the magnitude of the flow releases. This would be SCE's responsibility. Another outcome could be to restrict access of livestock to Mono Creek or implement bank stabilization measures, which would not necessarily be SCE's responsibility. We added a statement to this effect in the final EIS.

Comment 42: On page xxii of the draft EIS, we state: "…water temperature would be monitored at selected bypassed reaches and reservoirs to ensure that Basin Plan objectives are met…" SCE suggests that we modify this statement to read: "…water temperature would be monitored at selected bypassed reaches and reservoirs to ensure that water temperature objectives are met to the extent that they are Project controllable effects."

Response: We have adjusted the text in the final EIS in response to SCE's comment.

Comment 43: On pages 5-5 (third bullet under recommended measures at Big Creek Nos. 2A, 8, and Eastwood Project), 5-7 (third bullet under recommended measures at the Mammoth Pool Project), and 5-16 (in our discussion of water temperature monitoring), SCE recommends that we delete references to "telemetry" because not all stations proposed for water temperature monitoring would be monitored via telemetry.

Response: We have adjusted the text in the final EIS in response to SCE's comment.

Comment 44: The Forest Service comments that in our discussion of proposed fish monitoring on pages 3-124 and 3-125 of the draft EIS, no mention is made of the requirement to conduct a minimal amount of night snorkeling in the Mammoth reach of the San Joaquin River.

Response: We added a reference to the night snorkeling element of the proposed fish monitoring plan in the final EIS.

Comment 45: The Forest Service indicates that no mention is made of the number of times that trout livers in Mammoth Pool or tissue from hardhead in Redinger reservoir exceeded the recommended guidelines for mercury or silver in the water quality section or in our discussion of fish tissue sampling that would be conducted in project reservoirs on page 3-126 of the draft EIS.

Response: We added information on the results of fish fillet and tissue sampling to the affected environment, and added text explaining the potential benefits of conducting additional fish tissue sampling for silver as part of the fish monitoring plan.

Comment 46: In table 3-14, we indicate that the need for flushing flows from Portal and Balsam Meadows dam is to be determined. SCE notes that the Settlement Agreement states for both the Portal and Balsam Meadows forebays: "If the licensee determines that 'flushing' flows are required as part of the sediment management, such flows will only be released within the time frames and peak magnitudes specified in the Portal CRM (channel and riparian maintenance) flow unless otherwise agreed to by the USDA-FS (Forest Service) and other interested governmental agencies." SCE points out that since the Portal channel and riparian maintenance flow only specified flows for Camp 61 Creek, not Balsam Creek a flushing flow would only be a possibility at Portal dam. SCE asks us to replace the "TBD" for flushing flows at Balsam Meadows dam with "no." SCE also asks us to adjust the text on page 3-131 where we imply that flushing flows could be implemented at both Balsam and Camp 61 creeks.

Response: We have modified table 3-14 to clarify SCE's intent that flushing flows not be implemented in Balsam Creek and modified the text on page 3-131 accordingly.

Comment 47: The Forest Service agrees with our recommendation to monitor gravel embeddedness downstream of Dam 4, 5, and 6, but adds that the monitoring method should be consistent with other sediment monitoring protocols specified for other reaches, such as V* or riffle sediment monitoring.

Response: We have modified the text to indicate that the specific methodology to be used would be determined in consultation with the agencies. We note that the sediment management prescriptions in the Settlement Agreement include the use of the V* metric to quantify pool-filling downstream of Dam 4, 5, and 6, and that this metric is not appropriate for measuring embeddedness.

TERRESTRIAL RESOURCES

Comment 48: The Forest Service states that the spelling of Klamath weed on page 3-137 of the draft EIS and elsewhere should be corrected to klamathweed, the common name provided by the California Department of Food and Agriculture.

Response: We have corrected the spelling of this species to be "Klamathweed" throughout the EIS, as indicated on the California Department of Food and Agriculture's website (http://www.cdfa.ca.gov/phpps/IPC/weedinfo/winfo_table-commname.htm).

Comment 49: On page 3-152 of the draft EIS, we list where western pond turtles are known to occur at the Mammoth Pool Project. The Forest Service points out that the western pond turtle is also known to occur along Ross Creek.

Response: We have added this information to the final EIS.

Comment 50: On page 3-157 of the draft EIS, in our analysis of riparian monitoring, we state that adaptive management would be implemented based on pool and riparian monitoring results to ensure the channel and riparian management goals are met in Bear, Bolsillo, Camp 62, Chinquapin, Mono, Camp 61, and the South Fork San Joaquin River bypassed reaches. SCE indicates that riparian and sediment monitoring would not be conducted on Bear, Bolsillo, Camp 62, and Chinquapin creeks and asks us to adjust the text in the final EIS accordingly.

Response: We adjusted the text of the final EIS as suggested by SCE.

Comment 51: The Forest Service, commenting on page 3-158, notes that the bald eagle is a Forest Service Sensitive Species.

Response: In our analysis on page 3-158 of the draft EIS, we discuss project effects on special status species, including Forest Service Sensitive Species, that are not federally listed under the Endangered Species Act. This includes the bald eagle. We do not differentiate, in this section, the various special status categories; however, we have revised table 3-16 to reflect the bald eagle's updated status as a Forest Service Sensitive Species that has been delisted under the Endangered Species Act.

Comment 52: The Forest Service states that a table that summarizes the effects determinations for Forest Service sensitive terrestrial and aquatic wildlife and sensitive plants should be included in the effects section of the final EIS. This would ensure the reader understands that Forest Service Manual direct for Sensitive Species has been followed.

Response: Although we list special-status plant and wildlife species that could occur in the vicinity of the Big Creek ALP Projects, and include analysis of those species that we conclude could be affected by the relicensing of the projects, we have not analyzed all plant and wildlife species that could occur in the vicinity of the project. The analysis of all species in the project area is included in SCE, 2007c (Biological Assessment/Biological Evaluation for Southern California Edison's Big Creek

Hydroelectric Projects). This assessment was developed by SCE in consultation with the Forest Service and other stakeholders.

Comment 53: On page 3-156 of the draft EIS, prior to our discussion of riparian monitoring, we state the following: "Additionally, preparing a biological evaluation or assessment, as appropriate, prior to constructing any new project facilities would maintain or enhance the protection of special-status plants and wildlife within the Big Creek ALP Projects during the course of any new licenses." The Forest Service states that both a biological evaluation and assessment would need to be completed, so the "or" should be replaced with "and."

Response: We made the change suggested by the Forest Service in the final EIS. Although in some cases SCE would prepare both a biological evaluation and a biological assessment, this is not always the case. However, the potential that only one of the two documents might be needed is covered by our statement "as appropriate" in the referenced statement.

Comment 54: On page 3-162, we state: "Deer mortality was also caused by the Daulton Creek diversion (steep-sided and hazardous during high-flows), trash buildup at points where deer were trying to swim the reservoir, and harassment from recreational activities on the reservoir." The Forest Service asks if we meant to say the Daulton Creek bridge, since they are unaware of a Daulton Creek diversion.

Response: The referenced document, the TERR-14 Mule Deer Study Report (SCE, 2003i) states that deer mortality was found to be caused by the Daulton Creek diversion. The Daulton Creek diversion was created during the construction of Mammoth Pool when the lower portion of Daulton Creek was diverted. This created a section of creek bed that was steep-sided and hazardous for deer to cross during high water flows. As discussed in the EIS, the Daulton Creek bridge was constructed to aid deer migration.

Comment 55: In our summary of effects of the proposed action and alternatives on page 5-1, we state that "Under SCE's and the staff alternatives: (1) wildlife habitat would be enhanced; …" The Forest asks how wildlife habitat would be enhanced, and suggests that we change this to "wildlife habitat would be maintained;…"

Response: Our analysis indicates that relicensing the projects under the staff alternative would enhance wildlife habitat over current conditions in several ways, including: the release of channel and riparian maintenance flows and additional actions that could result from implementation of riparian monitoring which would enhance riparian habitat; implementation of the vegetation and integrated pest management plan which would limit the spread of noxious weeds thereby enhancing native wildlife habitat; and implementation of mule deer protection measures which would enhance mule deer migration conditions.

THREATENED AND ENDANGERED SPECES

Comment 56: The Forest Service comments that on page 3-169 of the draft EIS, second paragraph, we state "new road will be put in where VELB (valley elderberry longhorn beetle) surveys have not been conducted." They say this sentence should be changed to say "surveys for VELB will be conducted prior to new roads."

Response: The EIS states that, "SCE proposes to include several new roads as project roads that have not yet been surveyed for VELBs." The EIS then continues with, "SCE proposes to survey the roads that are at or below 3,000 feet in elevation to determine the location of potential VELB." Both of these statements are accurate.

RECREATIONAL RESOURCES

Comment 57: SCE comments that in our listing of major rehabilitation measures proposed for the Big Creek Nos. 2A, 8, and Eastwood Project on pages 3-199 and 3-200 of the draft EIS, all but the first two are owned and operated by SCE. As such, SCE conducts rehabilitation and maintenance of signage on an ongoing basis during the term of the license as part of routine maintenance and repair activities, as described in the Recreation Management Plan included as Appendix O of the Settlement Agreement. SCE asks that we add a footnote to this effect to bullets 3 through 8.

Response: The footnote that SCE requests was included in table 3-23 of the draft EIS (page 3-197). It would be redundant to include it again on pages 3-199 and 3-200.

Comment 58: In the first bullet describing proposed rehabilitation measures at the Big Creek Nos. 1 and 2 Project on page 3-201 of the draft EIS, we state that SCE plans to install 3 single standing vault toilets at the Huntington Lake East Boat Ramp. In the third bullet, we state that SCE proposes to rehabilitate 36 picnic sites at the Bear Cove day-use picnic area. SCE states that they only plan on installing two single standing vault toilets at the boat ramp and rehabilitating 30 picnic sites at the day-use area.

Response: In SCE's November 27, 2007, AIR response, in Attachment AIR-2-B, page AIR-2-B-1, SCE states that it would install three single standing toilets at the Huntington Lake East Boat Ramp. We therefore have not changed the first bullet. We have modified the third bullet as requested by SCE.

LAND USE

Comment 59: On pages 3-240 and 3-241, we reference tables included in the Settlement Agreement that specify roads considered project roads, and therefore included within the jurisdiction of new licenses, and non-project roads, which would be regulated by the Forest Service. We note that SCE made a number of corrections to the analogous tables that were included in the Forest Service 4(e) conditions for the Big Creek Nos. 2A, 8, and Eastwood Project, Big Creek Nos. 1 and 2 Project, and Big Creek No. 3 Project. The Forest Service comments that it will provide copies of the tables that should have been included in its 4(e) conditions as agreed to in the Settlement Agreement with its revised final section 4(e) conditions. The Forest Service indicates that our discussion of the Transportation System Management Plan should reflect these tables, and project roads indicated should be subject to 4(e) conditioning.

Response: We added a footnote to the final EIS that indicates that the Forest Service intends to submit revised tables of project roads with its revised final 4(e) conditions to match the tables included in the Settlement Agreement.

DEVELOPMENTAL ANALYSIS

Comment 60: SCE provided updated costs for implementing new environmental measures described under the staff alternative, as well as for measures specified in the non-FERC Settlement Agreements. The estimated cost of implementing certain measures has escalated substantially since the license applications were filed.

Response: We have incorporated the updated values into our developmental analysis and appendix B of the final EIS, as appropriate. The updated values do not change any of the conclusions reached in the draft EIS.

Comment 61: SCE suggests that we replace the reduced power benefits of the proposed and recommended Mammoth Pool Project shown in table 4-12 (13,382 MW) with 11,285 MW.

Response: As SCE pointed out, the reduced power benefit value for the Mammoth Pool Project used in the draft EIS was for the proposed project without channel riparian maintenance flows. We corrected the value in the final EIS to 11,285 MWh to reflect the proposed project with channel riparian maintenance flows.

CONSISTENCY WITH COMPREHENSIVE PLANS

Comment 62: The Forest Service notes that in section 5.5, *Consistency with Comprehensive Plans*, the 2004 Sierra Nevada Forest Plan Amendment, Final Supplemental Environmental Impact Statement, Record of Decision needs to be referenced.

Response: We added this plan to the listing of comprehensive plans.

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COVER SHEET

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSES

BIG CREEK ALP PROJECTS
Docket Nos. P-67, 2175, 2085, and 120

Chapter 1
Purpose and Need for Action
Pages 1-1 to 1-14
FEIS

1.0 INTRODUCTION

1.1 APPLICATION

On November 29, 2005, Southern California Edison (SCE) filed a license application for the Mammoth Pool Project (SCE, 2005) with the Federal Energy Regulatory Commission (FERC or the Commission). On February 23, 2007, SCE filed license applications for Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3 (SCE, 2007a). SCE is using the alternative licensing process (ALP) for these four projects together and as such filed a comprehensive Settlement Agreement (SCE, 2007b). These applications for the Big Creek ALP Projects include a preliminary draft environmental assessment (PDEA).[7]

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The Commission must decide whether to issue licenses to SCE for the Big Creek ALP Projects and what conditions should be placed in any licenses issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (e.g., flood control, irrigation, and water supply), the Commission must give equal consideration to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality.

Issuing new licenses for the Big Creek ALP Projects would allow SCE to generate electricity at the projects for the term of the new licenses, making electric power from a renewable resource available to its customers.

This final environmental impact statement (EIS) assesses the effects associated with operation of the Big Creek ALP Projects, alternatives to the proposed projects, and makes recommendations to the Commission on whether to issue new licenses, and if so, recommends terms and conditions to become a part of any licenses issued.

In this final EIS, we assess the environmental and economic effects of continuing to operate the Big Creek ALP Projects (1) as proposed by SCE, and (2) with our recommended measures. We also consider the effects of the no-action alternative. Important issues that are addressed include establishment of appropriate flow regimes in

[7] The application for the Mammoth Pool Project included a PDEA, but the license applications for the other three of the Big Creek ALP Projects included an amended PDEA that replaces the earlier PDEA.

project-affected stream reaches, protection of wildlife resources, provision of recreational opportunities, and protection of cultural resources.

1.2.2 Need for Power

The Big Creek ALP Projects,[8] with an installed capacity of 865 megawatts (MW) and an annual generation of 3,366,560 megawatt-hours (MWh) per year, play an important role in meeting SCE's power needs. The four projects are also a significant power resource to the state of California and within the Western Electricity Coordinating Council (WECC). The WECC includes the states west of the Rockies; portions of Texas, Nebraska, and Kansas; Alberta and British Columbia, Canada; and a portion of North Baja, California.

Because the Big Creek ALP Projects are located in the California-Mexico Power area of the WECC, we looked at the regional need for power projected by the WECC and reported by the North American Electricity Reliability Corporation (NERC, 2007) to anticipate how the demand for electricity is expected to change in the region.

The California-Mexico Power area, which encompasses most of California and a portion of Baja California in Mexico, has a significant summer peak demand. For the period from 2007 through 2016, the WECC forecasts peak demand and annual energy requirements in the United States portion of the area to grow at annual compound rates of 1.5 and 1.3 percent, respectively. The WECC anticipates that 7,433 MW of new capacity would come on line within the next 10 years in the California-Mexico Power area. The Big Creek ALP Projects could continue to meet part of the existing load requirements within a system in need of resources.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

Licenses for the Big Creek ALP Projects are subject to numerous requirements under the Federal Power Act (FPA) and other applicable statutes. The major regulatory and statutory requirements are summarized in table 1-1 and described below.

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[8] For the remainder of this EIS, we discuss the project developments from upstream to downstream in the following order: Big Creek Nos. 2A, 8, and Eastwood, No. 67; Big Creek Nos. 1 and 2, No. 2175; Mammoth Pool, No. 2085; and Big Creek No. 3, No. 120.

Table 1-1. Major statutory and regulatory requirements for the Big Creek ALP Projects.

Requirement	Agency	Status
Section 18 of the FPA (fishway prescriptions)	Department of the Interior (Interior), U.S. Department of Commerce, National Oceanic and Atmospheric Adminstration, National Marine Fisheries Service (NMFS)	Interior reserved its authority to prescribe upstream fish passage facilities for the Mammoth Pool Project on February 2, 2007, and for the Big Creek Nos. 2A, 8, and Eastwood, Big Creek Nos. 1 and 2, and Big Creek No. 3 projects on March 5, 2008,. NMFS reserved its authority to prescribe fishways for the Mammoth Pool Project on February 5, 2007, for the Big Creek Nos. 2A, 8, and Eastwood Project and Big Creek No. 3 Project on August 31, 2007, and for the Big Creek Nos. 1 and 2 Project on September 1, 2007.
Section 4(e) of the FPA (land management conditions)	U.S. Department of Agriculture, Forest Service (Forest Service)	The Forest Service provided preliminary conditions for the Mammoth Pool Project on February 5, 2007, and indicated that it would file its final conditions within 60 days of the close of the comment period on the draft EIS, which would be January 2, 2009. To date, final conditions have not been filed. The Forest Service provided final conditions for the Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3 projects on February 27, 2008. In its comments on the draft EIS, the Forest Service stated that it would be filing revised final 4(e) conditions but did not specify when.

Requirement	Agency	Status
Section 10(j) of the FPA	Interior	Interior provided section 10(j) recommendations, intended to protect fish and wildlife resources for the Mammoth Pool Project on February 2, 2007, and for the Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2 and Big Creek No. 3 projects on March 5, 2008.
Clean Water Act—water quality certification	State Water Resources Control Board	Application for water quality certification for the Big Creek ALP Projects was received by the State Water Resources Control Board on March 7, 2008. Action on the application is due by March 7, 2009.
Endangered Species Act Consultation	U.S Fish and Wildlife Service (FWS)	Completed; SCE consulted with FWS beginning in 2000 and submitted a preliminary Biological Assessment/Biological Evaluation for the Big Creek ALP Projects to FWS on October 25, 2004. In response to our request for formal consultation regarding the valley elderberry longhorn beetle, FWS stated that no further action pursuant to the ESA is necessary by letter dated December 16, 2008.
Coastal Zone Management Act Consistency	California Coastal Commission	We conclude that relicensing the Big Creek ALP Projects would not influence resources in the designated coastal zone and will seek concurrence from the California Coastal Commission.

1.3.1 Federal Power Act

1.3.1.1 Section 18 Fishway Prescriptions

Section 18 of the FPA states that the Commission is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the secretaries of Commerce or the Interior. Interior, by letter filed on February 2, 2007, for the Mammoth Pool Project, and by letter filed on March 5, 2008, for the Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3 projects, requests that a reservation of authority to prescribe fishways under section 18 be included in any licenses issued for the Big Creek ALP Projects. The U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) also requests that a reservation of authority to prescribe fishways be included in any project licenses by letters filed on February 5, 2007, for the Mammoth Pool Project, August 31, 2007, for the Big Creek Nos. 2A, 8, and Eastwood Project and Big Creek No. 3 Project, and September 1, 2007, for the Big Creek Nos. 1 and 2 Project.

1.3.1.2 Section 4(e) Conditions

Section 4(e) of the FPA provides that any license issued by the Commission for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation. The U.S. Department of Agriculture, Forest Service (Forest Service) provided preliminary conditions on February 5, 2007, for the Mammoth Pool Project, and final conditions on February 27, 2008, for the Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3 projects. The Forest Service indicated that it would file its final conditions for the Mammoth Pool Project within 60 days of the close of comments on the Commission's draft EIS, which was January 2, 2009. To date, no final conditions have been filed.

1.3.1.3 Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

Interior timely filed on February 2, 2007, recommendations under section 10(j) for the Mammoth Pool Project, and March 5, 2008, for the Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3 projects. In section 5.4 we discuss how we address the agency recommendations and compliance with section 10(j).

1.3.2 Clean Water Act

Under section 401of the Clean Water Act, a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the Act. SCE filed its application for water quality certification with the California State Water Resources Control Board (Water Board) by letter dated March 4, 2008. SCE documented that the Water Board received the application on March 7, 2008. Consequently, action on the application is due by the Water Board by March 7, 2009.

The Water Board has indicated its intention to issue a single certification to cover all of the Big Creek projects currently undergoing relicensing in the Upper San Joaquin Watershed. These include the Vermilion Valley Hydroelectric Project (FERC No. 2086), Portal (FERC No. 2174), and the Big Creek ALP Projects considered in this final EIS.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. SCE requested to be designated as the non-federal representative for the purpose of conducting section 7 consultations pertaining to the Big Creek ALP Projects on December 7, 2000, and was granted this request by the Commission on December 21, 2000. SCE included a Biological Assessment/Biological Evaluation with its license applications. Our analyses of project effects on threatened and endangered species are presented in section 3.3.3, *Threatened and Endangered Species*, and our recommendations are presented in section 5.2, *Comprehensive Development and Recommended Alternative*. We conclude that the only federally listed species that could potentially be affected by the projects is the valley elderberry longhorn beetle (VELB). Even with implementation of the proposed VELB Management Plan, there would still be loss of elderberry habitat and potential adverse effects on VELB during the term of the licenses. Therefore, we conclude that relicensing the Big Creek ALP Projects may adversely affect this federally listed species. We requested formal consultation with the U.S. Fish and Wildlife Service (FWS) by letter dated September 18, 2008. In response to our request, FWS comments that the VELB Management Plan has already been implemented and SCE has already compensated for the loss of VELB habitat by planting 30 elderberry seedlings (rather than the originally proposed eight seedlings), and no additional compensation or a biological opinion are necessary (letter from C.C. Goude, Acting Field Supervisor, FWS, Sacramento, CA, to the Commission dated December 16, 2008). FWS states that unless new information that has not been considered is presented, no further action pursuant to the ESA is necessary.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act, 16 U.S.C. §1456(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state coastal zone management agency concurs with the license applicant's certification of consistency with the state's coastal zone management program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

The Big Creek ALP Projects are not located within the state-designated coastal zone, which extends from a few blocks to 5 miles inland from the sea (www.ceres.ca.gov/coastal.com), and relicensing the projects would not affect California's coastal resources. Our assessment is that the Big Creek ALP Projects are not subject to California coastal zone program review and that no coastal zone consistency certification is needed.

1.3.5 National Historic Preservation Act

Section 106 requires that every federal agency "take into account" how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

To meet the requirements of section 106, the Commission intends to execute a Programmatic Agreement (PA) for the protection of historic properties from the effects of the operation of the Big Creek ALP Projects. The terms of the PA would ensure that SCE addresses and treats all historic properties identified within the projects' area of potential effects (APE) through the finalization of the existing draft Historic Properties Management Plan (HPMP). We plan to circulate a final PA for signature in April 2009.

1.3.6 California Environmental Quality Act

The California Environmental Quality Act (CEQA) is the California counterpart to the National Environmental Policy Act (NEPA). CEQA went into effect in 1970 for the purpose of monitoring land development in California through a permitting process. This statute, enacted to protect the health of the environment from current and future development, requires state and local agencies to identify the significant environmental effects of their actions and to avoid or mitigate those effects, if feasible. CEQA applies to all discretionary activities proposed to be undertaken or approved by California state and local government agencies. The Water Board must act on SCE's request for a water quality certificate for the Big Creek ALP Projects (see section 1.3.2, *Clean Water Act*), making CEQA applicable to this licensing proceeding.

Under CEQA, an environmental impact report (EIR) is prepared when the public agency finds substantial evidence that the project may have a significant effect on the environment. An EIR is the public document used to analyze the significant environmental effects of a proposed project, to identify alternatives, and to disclose possible ways to reduce or avoid the possible environmental damage. CEQA guidelines state that when federal review of a project is also required, state agencies are encouraged to integrate the two processes to the fullest extent possible, which may include a joint

EIS/EIR. While this document is not a joint EIS/EIR, SCE has the opportunity to use this document, as appropriate, to satisfy its responsibilities under CEQA. As such, we invite the Water Board's comments on this EIS as they may pertain to the agency's use of the final EIS for CEQA purposes.

The content requirements for an EIR under CEQA are similar to the requirements for an EIS, although an EIR must contain two elements not typically addressed in a Commission NEPA document. The first element needed in an EIR is a discussion of how the proposed project, if implemented, could induce growth. A project can be considered to have a growth-inducing effect if it directly or indirectly fosters economic or population growth or removes obstacles to population growth, strains existing community service facilities to the extent that the construction of new facilities would be needed, or encourages or facilitates other activities that cause significant environmental effects. In an effort to present information that may be useful should the Water Board decide to use this EIS for its CEQA purposes, we considered whether issuing new licenses for the Big Creek ALP Projects would have any growth-inducing effects, and determined that it would not. Under new licenses, the projects would continue to operate essentially as they have in the past (see section 2.2, *Applicant's Proposal*), continuing to provide electricity to meet existing regional power needs.

The second element needed in an EIR, but not typically presented in a Commission NEPA document in a format compatible to CEQA requirements, is a discussion of a program for monitoring or reporting on mitigation measures that were adopted or made conditions of project approval. The monitoring or reporting program must ensure compliance with mitigation measures during project implementation. The program may also provide information on the effectiveness of mitigation measures. Although discussion of the mitigation reporting or monitoring program can be deferred until the final EIR or, in some cases, after project approval, it is often included in the draft EIR to obtain public review and comment.

In section 3 of this final EIS, *Environmental Analysis*, we describe each potential environmental resource effect, our analysis of each recommended mitigation measure, and our conclusion with respect to the effectiveness of each measure in addressing the effect. In section 5.2, *Comprehensive Development and Recommended Alternative*, we list the mitigation measures and monitoring and reporting requirements we recommend for inclusion in any licenses issued for the Big Creek ALP Projects. Additionally, any conditions of a water quality certificate that may be issued for this project will become an enforceable part of any licenses issued for this project. Appendix A, *Big Creek Projects Mitigation and Monitoring Summary*, identifies each potentially significant effect of relicensing the Big Creek ALP Projects, lists the project changes or mitigation measures that are recommended for inclusion in new licenses to avoid or reduce the effect, and describes the monitoring and reporting measures SCE would undertake to ensure the project changes and mitigation measures are implemented as intended. In order to facilitate the Water Board's potential use of this EIS for CEQA purposes, appendix A also includes the measures contained in the Settlement Agreement that are not within the Commission's jurisdiction and would therefore not be part of any new licenses.

The Water Board could adopt this EIS as satisfying its CEQA requirements or could determine that a separate EIR is required for the Big Creek ALP Projects. On November 3, 2008, the Water Board filed comments on the draft EIS, including suggested modifications that would facilitate its use of the final EIS for its CEQA purposes. This final EIS has been modified accordingly and should address the concerns the Water Board had with the draft EIS.

1.4 PUBLIC REVIEW AND CONSULTATION

Commission regulations (18 CFR §16.8) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, ESA, National Historic Preservation Act, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

1.4.1 Scoping

SCE conducted the NEPA scoping process as part of the ALP. SCE held a publicly noticed meeting with interested stakeholders and issued the Initial Information Package for the Big Creek ALP Projects in May 2000. The purpose of this meeting was to outline the ALP goals and objectives; identify process protocols; provide an overview of the Big Creek ALP Projects and associated resources; identify early stakeholder resource interests and issues; and identify opportunities for the public to participate and provide comment.

In May 2000, the Plenary was established. The Plenary, which consists of representatives of the state and federal resource agencies, Native American tribes, local and regional authorities, non-government organizations, and members of the public, received training regarding the "mutual gains" style of negotiation.

SCE held an additional publicly noticed meeting and a site tour of the Big Creek ALP Projects with interested stakeholders in June 2000. In addition, on July 24, 25, and 26, 2007, Commission and SCE staff held a publicly noticed site visit to the projects. The site visit was open to the public and resource agencies.

Based on the scoping process that was built into the collaborative ALP process, SCE conducted 67 relicensing technical studies addressing issues at the Big Creek ALP Projects. The technical reports for the overlapping issues were all filed with SCE's license applications.

1.4.2 Interventions

On December 5, 2006, the Commission issued a public notice accepting the application for the Mammoth Pool Project, and soliciting motions to intervene and protest. This notice set a 60 day period during which interventions could be filed ending on February 5, 2007. On July 5, 2007, the Commission issued a public notice accepting the applications and soliciting motions to intervene and protest for the remaining three projects. This notice set a 60 day period during which interventions could be filed. This period ended on September 5, 2007. In response, the following entities filed motions to intervene in this proceeding.

Intervenors	**Date Filed**
North Fork Mono Tribe	February 22, 2006
U.S. Department of the Interior (Mammoth Pool)	February 1, 2007
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (Mammoth Pool)	February 5, 2007
U.S. Department of Agriculture, Forest Service (Mammoth Pool)	February 5, 2007
Friant Water Authority (Mammoth Pool)	February 6, 2007
Friends of the River, Trout Unlimited, and American Whitewater (Mammoth Pool)	February 8, 2007
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (Big Creek Nos. 2A, 8, and Eastwood)	August 31, 2007
U.S. Department of the Interior (remaining three projects)	August 31, 2007
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (Big Creek Nos. 1 and 2 and Big Creek No. 3)	September 1, 2007
Friends of the River, Trout Unlimited, and American Whitewater (remaining three projects)	September 4, 2007
U.S. Department of Agriculture, Forest Service (remaining three projects)	September 4, 2007

1.4.3 Settlement Agreement

SCE and the parties to the Settlement Agreement have held more than 300 meetings over the last 5 years in the Big Creek ALP for the Big Creek ALP Projects, which are owned and operated by SCE. The Big Creek ALP involved the design and implementation of 67 studies designed to identify effects associated with the Big Creek ALP Projects. Reports were prepared based upon these studies and were reviewed and commented upon by the Parties. These reports were used to identify potential project effects and serve as the basis for a Settlement Agreement (SCE, 2007b). SCE filed the Settlement Agreement on February 23, 2007, concurrently with the applications for three of the Big Creek ALP Projects (the Mammoth Pool license application was filed on November 29, 2005). The Settlement Agreement was signed by representatives of federal and state agencies, and NGOs listed below. We consider the Settlement Agreement to represent the Proposed Actions for these projects.

Signatories to the Settlement Agreement
American Whitewater
California Department of Fish and Game
Fly Fishers For Conservation
Fresno County Sheriff’s Department
Friant Water Authority
Friends of the River
Huntington Lake Association
Huntington Lake Big Creek
Historical Conservancy
Huntington Lake Volunteer Fire Department
Michahai Wuksachi
Natural Resources Defense Council
Sams Coalition
San Joaquin Paddlers Club
San Joaquin River Trail Council
Shaver Crossing
Railroad Station Group
Sierra Mono Museum
Sierra Resource Conservation

Signatories to the Settlement Agreement
District of the County of Fresno
Trout Unlimited
U.S. Department of Agriculture, Forest Service
U.S. Department of the Interior

The Commission issued a notice of the Settlement Agreement on March 7, 2007, and set a comment deadline of April 5, 2007, and a reply comment deadline of April 20, 2007. The following entities filed comments on the Settlement Agreement.

Commenting Entities on Settlement Agreement	Date Filed
North Fork Mono Rancheria (opposing the Settlement Agreement, writing on behalf of the San Joaquin River Tribal Coalition[9])	February 27, 2007
Cold Springs Rancheria (opposing the Settlement Agreement, writing on behalf of the San Joaquin River Tribal Coalition)	February 28, 2007
California Department of Fish and Game	April 5, 2007
U.S. Department of the Interior	April 5, 2007

SCE filed responses to the California Department of Fish and Game (Cal Fish & Game) on May 21, 2007, and to the North Fork Mono Rancheria, Cold Springs Rancheria, and Big Sandy Rancheria (collectively the San Joaquin River Tribal Coalition) on June 18, 2007.

1.4.4 Comments on the Draft EIS

The Commission sent the draft EIS to the U.S. Environmental Protection Agency (EPA) and made the draft EIS available to the public on September 12, 2008. The Commission requested that any written comments on the draft EIS be filed by November 3, 2008. Written comments on the draft EIS were filed by the following entities:

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[9] The San Joaquin River Tribal Coalition comprises three federally recognized Tribes: North Fork Mono Rancheria, Cold Springs Rancheria, and Big Sandy Rancheria.

Comments on Draft EIS	Date Filed
U.S. Department of the Interior	October 20, 2008
U.S. Department of Agriculture, Forest Service	October 30, 2008
Southern California Edison	October 30, 2008
State Water Resources Control Board	November 3, 2008
U.S. Environmental Protection Agency	November 4, 2008

Appendix D lists the commenters, summarizes the comments that were filed, includes our responses to those comments, and indicates where we made modifications to the draft EIS. In addition, the Commission accepted oral testimony on the draft EIS at a public meeting held on October 15, 2008, in Fresno, California. The transcript from this meeting was filed in the administrative record for the project. We modified the text of the EIS in response to oral and written comments received, as appropriate.

1.5 RECOMMENDATIONS, TERMS, AND CONDITIONS

On December 5, 2006, the Commission issued a Ready for Environmental Analysis Notice pertaining to the Mammoth Pool Project and requested comments, recommendations, and terms and conditions (subject to sections 10(j) and 18 of the FPA) with a filing deadline of February 5, 2007. On January 8, 2008, the Commission issued a Ready for Environmental Analysis Notice and requested comments, recommendations, and terms and conditions for Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3 with a filing deadline of March 8, 2008. The following entities filed comments, terms, conditions, prescriptions, or recommendations:

Entity	Date Filed
U.S. Department of the Interior (Mammoth Pool)	February 2, 2007
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (Mammoth Pool)	February 5, 2007
U.S. Department of Agriculture, Forest Service (Mammoth Pool)	February 5, 2007
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (Big Creek Nos. 2A, 8, & Eastwood)	August 31, 2007

Entity	Date Filed
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (Big Creek Nos. 1 and 2 and Big Creek No. 3)	September 10, 2007
U.S. Department of Agriculture, Forest Service (Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3)	February 28, 2008
U.S. Department of the Interior (remaining three projects)	March 5, 2008

SCE did not respond to the recommendations, terms, and conditions filed for the Mammoth Pool Project. SCE responded to recommendations, terms, and conditions for the remaining three projects by letter filed on April 9, 2008.

COVER SHEET

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSES

BIG CREEK ALP PROJECTS
Docket Nos. P-67, 2175, 2085, and 120

Chapter 2
Proposed Action and Alternatives
Pages 2-1 to 2-36
FEIS

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

Under the no-action alternative, the Big Creek ALP Projects would continue to operate under the terms and conditions of the existing licenses, and no new environmental protection, mitigation, or enhancement measures would be implemented. We use this alternative to establish baseline environmental conditions for comparison with other alternatives.

2.1.1 Existing Project Facilities

The Big Creek ALP Projects considered in this final EIS are part of the Big Creek System. The Big Creek System is an integrated operation of nine major powerhouses, six major reservoirs, numerous small diversions, various conveyance facilities, access roads, electrical transmission lines, and appurtenant facilities. The Big Creek System is authorized under seven Commission licenses with coordinated operations to maximize the value of hydropower produced from the available water supply. Table 2-1 shows the average annual generation and dependable capacity of each project. The average annual generation shown in table 2-1 is based on the period from 1991 to 2005. SCE defines dependable operating capacity as "…the capacity that may be available for system use from the individual resources listed under favorable conditions. Where common facilities are shared between units, capacity ratings should be based on the Company's operating experience and exclude capacity associated with auxiliary, house, and fishwater turbine-generators, and emergency engine-generators." SCE's approach to defining dependable capacity is different from that used by the Commission. The Commission defines dependable capacity based on adverse hydrological conditions.

Figure 2-1 presents the locations of the various facilities schematically and table 2-2 describes the project reservoirs. Then, in the following section, we provide detailed descriptions for each of the Big Creek ALP Projects. At the end of the section we describe the existing boundaries for the projects.

Table 2-1. Big Creek System hydroelectric projects that are relevant to this proceeding. (Source: SCE, 2007a, as modified by staff)

Project Name (FERC Project No.)	**License Expiration Date**	**Installed Capacity (MW)**	**Dependable Operating Capacity (MW)**	**Average Annual Generation (MWh)**
Vermilion Valley (No. 2086)	August 31, 2003 (operating under annual license)	0	0	0
Portal (No. 2174)	March 31, 2005 (operating under annual license)	11	10.5	47,400
Mammoth Pool (No. 2085)	November 30, 2007	151	187.0	603,700
Big Creek No. 3 (No. 120)	February 28, 2009	174	181.9	824,080
Big Creek Nos. 1 and 2 (No. 2175)	February 28, 2009	155	150.0	765,480
Big Creek Nos. 2A, 8, and Eastwood (No. 67)	February 28, 2009	385	370.0	1,173,300

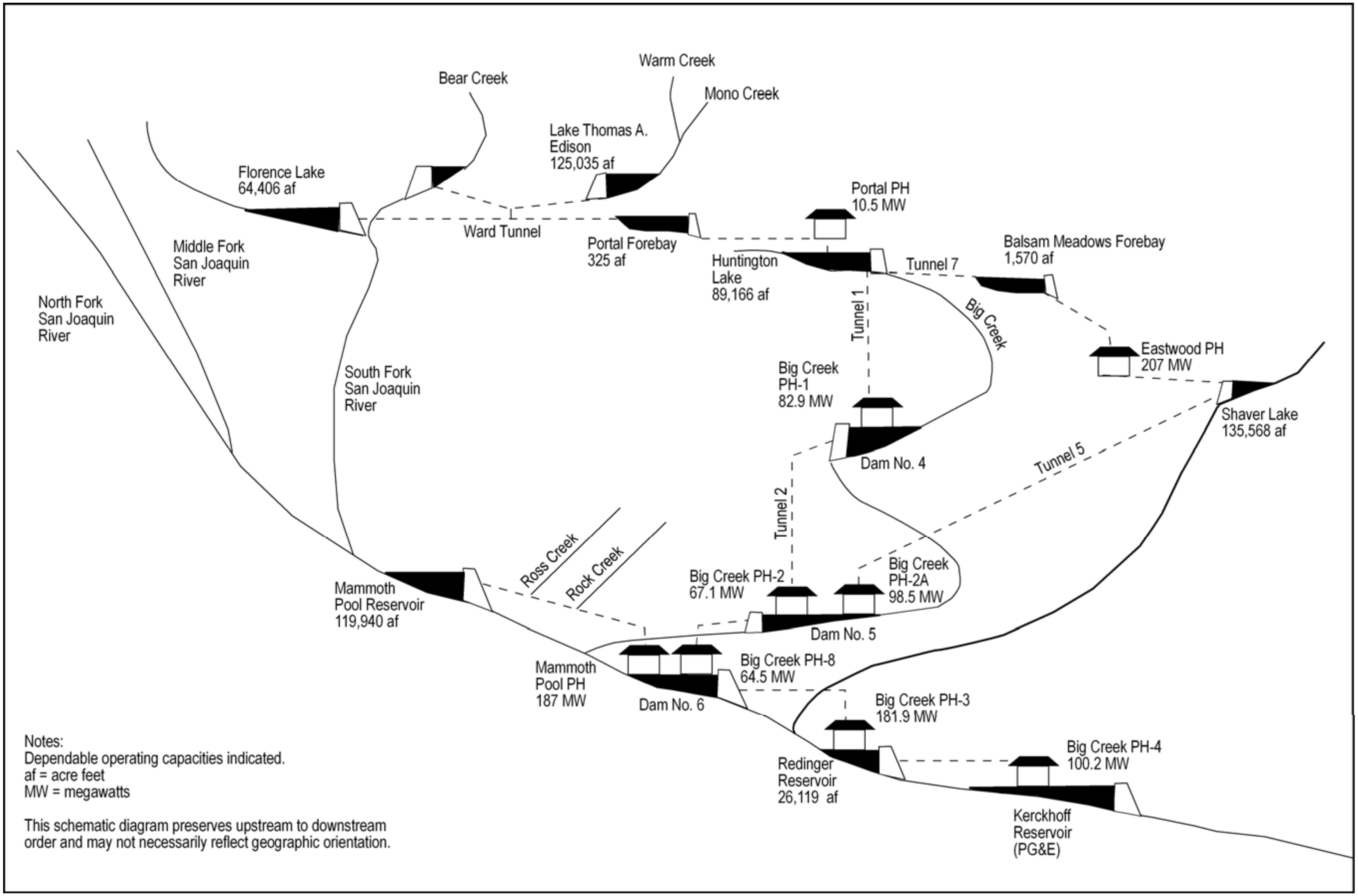

Figure 2-1. Existing facilities in the Big Creek System. (Source: FERC, 2002)

Table 2-2. Reservoir characteristics of the Big Creek ALP Projects. (Source: SCE, 2007a, as modified by staff)

Reservoir	Project No. (Development)	Maximum Pool Elevation (feet, msl)	Usable Storage Capacity at Maximum Pool (acre-feet)	Surface Area at Maximum Pool (acres)
Crater Creek diversion[a]	Project No. 67 (Big Creek 2A)	8,764.6	<1	<1
Tombstone Creek diversion[a]	Project No. 67 (Big Creek 2A)	7,673	<1	<1
Hooper Creek diversion	Project No. 67 (Big Creek 2A)	7,505	3	<1
North Slide Creek diversion[a]	Project No. 67 (Big Creek 2A)	7,501.5	<1	<1
South Slide Creek diversion[a]	Project No. 67 (Big Creek 2A)	7,501.5	<1	<1
Florence Lake	Project No. 67 (Big Creek 2A)	7,327.5	64,406	962
Chinquapin Creek diversion	Project No. 67 (Big Creek 2A)	7,628	<1	<1
Mono Creek diversion	Project No. 67 (Big Creek 2A)	7,350	47	6.7
Bear Creek diversion	Project No. 67 (Big Creek 2A)	7,350	103	13.25

Reservoir	Project No. (Development)	Maximum Pool Elevation (feet, msl)	Usable Storage Capacity at Maximum Pool (acre-feet)	Surface Area at Maximum Pool (acres)
Camp 62 Creek diversion	Project No. 67 (Big Creek 2A)	7,257	<1	<1
Bolsillo Creek diversion	Project No. 67 (Big Creek 2A)	7,532.5	<1	<1
Pitman Creek diversion	Project No. 67 (Big Creek 2A)	6,998	<1	<1
Balsam Meadows	Project No. 67 (Eastwood)	6,670	1,570	60
Shaver Lake	Project No. 67 (Eastwood)	5,370	135,568	2,184
Dam 5	Project No. 67 (Big Creek 8)	2,943	47	3.3
Huntington Lake	Project No. 2175 (Big Creek 1)	6,950	89,166	1,435
Pitman Creek domestic diversion[b]	Project No. 2175 (Big Creek 1)	Approx. 5,210	<1	<1
Snow Slide Creek domestic diversion[b]	Project No. 2175 (Big Creek 1)	Approx. 5,210	<1	<1
Balsam Creek diversion	Project No. 2175 (Big Creek 2)	4,880	<1	<1

Reservoir	Project No. (Development)	Maximum Pool Elevation (feet, msl)	Usable Storage Capacity at Maximum Pool (acre-feet)	Surface Area at Maximum Pool (acres)
Ely Creek diversion	Project No. 2175 (Big Creek 2)	4,844	<1	<1
Adit 8 diversion	Project No. 2175 (Big Creek 2)	4,825	<1	<1
Big Creek Dam 4	Project No. 2175 (Big Creek 2)	4,810	56	<1
Mammoth Pool dam	Project No. 2085 (Mammoth)	3,330	119,940	1,435
Rock Creek diversion	Project No. 2085 (Mammoth)	3,336	<1	<1
Ross Creek diversion	Project No. 2085 (Mammoth)	3,359	<1	<1
Powerhouse 3 forebay	Project No. 120 (Big Creek 3)	2,230	993	23.2

[a] SCE proposes to decommission this diversion as part of this proceeding.

[b] This diversion formerly provided domestic water for the community of Big Creek, but it has not been used in 30 years. SCE proposes to decommission this diversion as part of this proceeding.

2.1.1.1 Big Creek Nos. 2A, 8, and Eastwood Hydroelectric Power Project

The Big Creek No. 2A development was constructed between 1920 and 1928, with additional features added between 1944 and 1948. The two units (Units 1 and 2) were placed into service in 1928. The Big Creek No. 8 development was constructed between 1921 and 1929, and the two units (Units 1 and 2) were placed into service in 1921 and 1929, respectively. The Eastwood development was constructed between 1983 and 1987, and the unit was placed into service in 1987. The project is located within the South Fork San Joaquin River, Big Creek, and Stevenson Creek watersheds which flow into the San Joaquin River. The project's reservoirs and diversions are capable of impounding approximately 201,700 acre-feet of water. There are no transmission lines associated with the Big Creek No. 2A and Big Creek No. 8 developments, but there is one 4.7-mile-long, 230 kilovolt (kV) transmission line associated with the Eastwood development. The project features are located on 2,388.8 acres within the Sierra National Forest (this includes recent mapping corrections). See table 2-2 for reservoir characteristics.

Big Creek No. 2A

The Big Creek No. 2A development consists of two dams, 11 smaller diversion dams, several water conveyances, and a powerhouse. Relevant information about each feature is presented below.

Reservoirs

- Florence Lake dam, a concrete gravity structure that is 3,156 feet long and 149 feet high
- Shaver Lake dam, a concrete gravity structure that is 1,760 feet long and 185 feet high

Diversions

- Tombstone Creek diversion dam, a concrete gravity structure that is 26 feet long and 5 feet high
- Crater Creek diversion dam, a concrete gravity structure that is 21 feet long and 3 feet high
- North Slide Creek diversion dam, a concrete gravity structure that is 19 feet long and 5 feet high
- South Slide Creek diversion dam, a concrete gravity structure that is 22 feet long and 5 feet high
- Hooper Creek diversion dam, a concrete gravity structure that is 158 feet long and 30 feet high
- Chinquapin Creek diversion dam, a concrete gravity structure that is 32 feet long and 8 feet high
- Camp 62 Creek diversion dam, a concrete gravity structure that is 45 feet long and 7 feet high
- Bear Creek diversion dam, a concrete gravity structure that is 293 feet long and 55 feet high
- Mono Creek diversion dam, a concrete gravity structure that is 156 feet long and 64 feet high
- Bolsillo Creek diversion dam, a concrete gravity structure that is 54 feet long and 6 feet high
- Pitman Creek diversion dam, a concrete gravity structure that is 68 feet long and 8 feet high

Conveyances

- Ward Tunnel, a 67,619-foot-long, 15-foot by 15-foot horseshoe-shaped unlined tunnel from Florence Lake to the penstock for the Portal powerhouse (the Portal Project [FERC No. 2174] is not included in the Big Creek ALP Projects)
- Mono-Bear Conduit (a.k.a. Mono-Bear Siphon), a conveyance that consists of: (a) a 7,596-foot-long unlined tunnel from the Bear Creek diversion dam, (b) a 4,538-foot long flowline from the Mono Creek diversion dam that connects to a 3,933-foot unlined tunnel; and (c) a 13,806-foot-long steel pipe that carries the water from the two tunnels to the Ward Tunnel via a construction adit
- Tunnel 7 (a.k.a. Huntington-Pitman Siphon), which conveys water from Huntington Lake to the Balsam Diversion Tunnel and then to Shaver Lake through the Eastwood powerhouse, and consists of four sections: (a) a 680-foot-long, 21-foot diameter steel pipe; (b) a 2,642-foot-long, 14-foot by 14-foot horseshoe-shaped tunnel; (c) a 2,425-foot-long, steel pipe that varies from 120 inches to 96 inches and back to 120 inches in diameter; and (d) a 22,843-foot-long, 14-foot by 14-foot horseshoe-shaped tunnel
- Tunnel 5, a 13,900-foot-long, 11-foot by 11-foot unlined tunnel conveyance from Shaver Lake to the Powerhouse 2A penstock
- A 6,218-foot-long single steel pipe penstock that ranges from 66- to 108-inches in diameter and branches into two 48-inch lines outside of the powerhouse

Construction Adits

- Adit 1 and 2 connected to Tunnel 5

Powerhouse

- A powerhouse containing two generating units

Big Creek No. 8

The Big Creek No. 8 development consists of a dam, conveyance, penstocks, and a powerhouse. Relevant information about each feature is listed below.

- Big Creek dam 5, a concrete arch dam that is 224 feet long and 60 feet high and includes 19 ungated spillway bays with flashboards
- A conveyance from Big Creek dam 5 to Powerhouse 8 that consists of: (a) Tunnel 8, which is 5,570 feet long and 20-feet by 20-feet in cross section, and b) a 35-foot-diameter, 90-foot-high steel surge tank

- Two steel pipe penstocks, one 2,668 feet long and 96 to 72 inches in diameter and one 2,698 feet long and 120 to 84 inches in diameter
- A powerhouse containing two generating units

Eastwood Power Station

The Eastwood development consists of a dam, spillway, two water conveyances, a surge chamber, powerhouse, tailrace tunnel, and a transmission line. Relevant information about each feature is presented below.

- Balsam Meadows forebay dam, a compacted rockfill dam that is 1,325 feet long and 123 feet high
- A spillway with a concrete weir that is 280 feet
- Balsam forebay tunnel, a 5,866-foot-long, 16-foot by 16-foot horseshoe-shaped tunnel that intersects Tunnel 7 (the Huntington-Pitman-Shaver Conduit that is part of the Big Creek No. 2A development)
- A conveyance from the Balsam Meadows forebay to the Eastwood powerhouse consisting of three sections: (a) a 2,832-foot-long, 18-foot by 18-foot horseshoe-shaped upper tunnel; (b) a vertical shaft that is a 1,043-foot-long vertical bore connecting the upper and lower tunnels; and (c) a 1,328-foot-long, 12-foot-diameter lower steel-lined tunnel connected to the turbine shutoff valve
- An underground surge chamber consisting of a 30-foot diameter, 275-foot high vertical shaft connected to the conveyance tunnel by a 33-foot-long, 15-foot diameter shaft
- A powerhouse containing one pump/generating unit
- A tailrace tunnel that conveys water from the draft tube to Shaver Lake (and vice-versa during pumping operations), and consists of three sections: (a) a 35-foot-long draft tube transition; (b) a 440-foot-long, 15-foot diameter concrete-lined section; and (c) a 7,068-foot-long, 18-foot by 18-foot horseshoe-shaped section
- A 4.7-mile-long, 230 kV transmission line extending from the project switchyard at the surface to the Big Creek No. 1 switchyard

2.1.1.2 Big Creek Nos. 1 and 2 Hydroelectric Power Project

The Big Creek Nos. 1 and 2 Project was constructed between 1912 and 1917 and was placed into service between 1913 and 1925. The project's two developments are located in Fresno County, California, along Big Creek, a tributary of the San Joaquin River. The project's five reservoirs are capable of impounding more than 89,222 acre-feet of water, all but 56 acre-feet of which is stored for use by the Big Creek No. 1

development in Huntington Lake. There are no transmission lines associated with the project. The project features are all located on 2,017.78 acres within the Sierra National Forest (including recent mapping corrections). Reservoir characteristics are shown in table 2-2.

Big Creek No. 1

The Big Creek No. 1 development consists of four dams on Huntington Lake, a water conveyance, penstocks, a construction adit, and powerhouse. Relevant information about each feature is provided below.

Dams

- Huntington Lake dam 1, a concrete gravity structure that is 1,335 feet long and 170 feet high
- Huntington Lake dam 2, a concrete gravity structure that is 1,862 feet long and 120 feet high
- Huntington Lake dam 3, a concrete gravity structure that is 640 feet long and 165 feet high
- Huntington Lake dam 3A, a concrete gravity structure that is 263 feet long and 22.5 feet high

Conveyances

- A conveyance that consists of: (a) a 3,946-foot-long, 12-foot-diameter generally unlined tunnel (Tunnel 1); (b) a 409-foot long, 108-inch diameter riveted steel pipe liner in the lower end of the tunnel that branches into two riveted steel pipe branches; a 6,459-foot-long, 84-inch diameter branch to the Unit 1, 2 and 3 penstocks and a 6,478-foot-long, 60-inch diameter branch to the Unit 4 penstock

Penstocks

- Two 4,311-foot-long welded steel pipe penstocks for Units 1 and 2 which begin as a single 44-inch-diameter pipe that reduces in diameter and splits into branches with a final diameter of 24 inches
- A 4,360-foot-long welded steel pipe penstock for Unit 3 which begins as a single 42-inch-diameter that reduces in diameter and then splits into branches with a final pipe diameter of 24 inches
- A 4,301-foot-long welded steel pipe penstock for Unit 4 which begins as a single 54-inch-diameter that reduces in diameter and then splits into branches with a final pipe diameter of 24 inches

Construction Adit

- A construction adit to Tunnel 1

Diversions and Conveyances

- Pitman Creek domestic diversion, a concrete diversion structure and piping that has not been in operation for about 30 years
- Snow Slide Creek domestic diversion, a concrete diversion structure and piping that has not been operational for about 30 years

Powerhouse

- A powerhouse containing four generating units

Big Creek No. 2

The Big Creek No. 2 development consists of a dam, water conveyance penstocks, nine construction adits, three diversion dams with water conveyances, and a powerhouse. Relevant information about each feature is provided below.

Dam

- Big Creek Dam 4, a concrete arch dam that is 287 feet long and 75 feet high and includes 27 ungated spillway bays with flashboards

Conveyances

- A conveyance from Big Creek Dam 4 to the Powerhouse 2 that consists of: (a) Tunnel 2, which is 21,759 feet long and 12 feet in diameter; (b) a 30-foot-diameter, 115-foot-high surge tank; (c) a 255-foot-long, 108-inch-diameter riveted steel pipe from the surge tank to the unit penstocks

Penstocks

- Four steel pipe penstocks that begin as a single 54-inch diameter pipe that reduces in diameter and then splits into branches with a final pipe diameter of 24 inches

Construction Adits

- Nine construction adits for Tunnel 2

Diversions with Conveyances

- Balsam Creek diversion dam, a 72-foot-long, 9-foot-high concrete diversion dam, located across Balsam Creek 2 miles southwest of Big Creek, with a conveyance from the diversion to Tunnel 2 that consists of a 400-foot-long, 12-inch-diameter steel pipe that enters Adit 3
- Ely Creek diversion dam, a 44-foot-long, 7-foot-high concrete diversion dam located approximately 3 miles southwest of Big Creek with a conveyance from the diversion to Tunnel 2 that consists of a 300-foot-long, 12-inch-diameter steel pipe that enters Adit 6

- Adit 8 diversion dam, a 44-foot-long, 30-foot-high concrete diversion dam located on Adit 8 Creek about 3.5 miles southwest of Big Creek, with a vertical borehole into Tunnel 2 at Adit 8

Powerhouse

- A powerhouse containing four generating units

2.1.1.3 Mammoth Pool Project Hydroelectric Power Project

The Mammoth Pool Project was constructed from 1958 to 1960 and placed in service in 1960. The project is located in Fresno County, California, on the San Joaquin River. The project's reservoir is capable of impounding about 119,940 acre-feet of water. There are two transmission lines associated with the project, which are described in more detail below. The project features are all located on 2,029.68 acres within the Sierra National Forest. Reservoir characteristics are shown in table 2-2.

The Mammoth Pool development consists of a dam, two smaller diversion dams, three water conveyances, a small generating unit in the power tunnel, two construction adits, two transmission lines, and a powerhouse. Relevant information about each feature is provided below.

Dam

- Mammoth Pool dam, a compacted earthfill structure that is 828 feet long and 330 feet high

Diversions

- Rock Creek diversion dam, a concrete gravity structure that is 93 feet long and 9 feet high
- Ross Creek diversion dam, a concrete gravity structure that is 53 feet long and 7 feet high

Water Conveyances

- Mammoth power tunnel, a water conveyance from Mammoth Pool dam to the powerhouse (Mammoth power tunnel) consisting of: (a) a 39,350 foot long, 20-foot nominal diameter, horseshoe-shaped tunnel that is partially lined; (b) a 211-foot-long, 13-foot-diameter steel pipe at the Shakeflat Creek crossing; (c) a surge chamber that is 23 feet in diameter and 350 feet high; and (d) a 1,988-foot-long steel pipe penstock that varies from 158 to 129 inches in diameter and bifurcates into two 93-inch-diameter steel pipes just upstream of the powerhouse
- A conveyance from the Rock Creek diversion to the Mammoth Pool power tunnel that consists of a 434-foot-long, 20 to 30-inch-diameter steel pipe to a 20-inch-diameter vertical borehole into the tunnel

- A conveyance from the Ross Creek diversion to the Mammoth Pool power tunnel that consists of a 607-foot-long, 10 to 12-inch-diameter steel pipe to a 10-inch-diameter vertical borehole into the tunnel

Fishwater Generator

- A small generating unit located in the diversion tunnel

Construction Adits

- Two construction adits to the power tunnel

Transmission Lines

- One 230-kV transmission line that extends from the powerhouse to the non-project Big Creek No. 3 switchyard
- One 0.6-mile-long 12-kV line that connects the fishwater turbine to the non-project Stevenson 12-kV transmission line

Powerhouse

- A powerhouse containing two generating units

2.1.1.4 Big Creek No. 3 Hydroelectric Power Project

The Big Creek No. 3 Project was constructed from 1921 to 1923 and placed in service between 1923 and 1980 (Units 1 and 3 – 1923, Unit 4 – 1948, Unit 5 – 1980). The project is located in Fresno and Madera counties, California, along Big Creek, a tributary of the San Joaquin River. The project's reservoir is capable of impounding about 933 acre-feet of water. There are no transmission lines associated with the project. The project features are all located on 508.14 acres within the Sierra National Forest. Reservoir and powerhouse characteristics are shown in tables 2-2 and 2-3.

The Big Creek No. 3 development consists of a dam, water conveyance penstocks, three construction adits, and a powerhouse. Relevant information about each feature is presented below.

Dam

- Dam 6, a constant-radius concrete arch dam that is 495 feet long and 155 feet high that includes six ungated spillway bays

Conveyances

- A conveyance that consists of: (a) a 28,191-foot-long, 21-foot by 21-foot unlined tunnel (Tunnel 3); (b) a 164-foot-tall underground surge chamber that varies in diameter from 60 inches at the base, 25 inches in the middle and 75 inches at the top ; (c) a 310-foot long, 18-foot-diameter riveted steel pipe that divides through two spherical manifolds into five penstocks

Penstocks

- Four 90-inch to 54-inch-diameter steel penstocks for Units 1, 2, 3, and 4
- One 90-inch to 63-inch diameter steel pipe penstock to Unit 5

Construction Adits

- Three construction adits to Tunnel 3

Powerhouse

- A powerhouse containing five generating units

2.1.1.5 Existing Project Boundaries

The current project boundaries for the Big Creek ALP Projects encompass project facilities including dams and diversions, impoundments, water conveyances and associated structures, access roads and trails, transmission, communication and control lines, powerhouses, gaging stations, and helicopter landing sites for access to project structures. The project boundaries include land adjacent to project features; the width of these zones varies depending on the feature. Table 2-3 describes the lands included in the project boundaries for the Big Creek ALP Projects considered in this final EIS.

Table 2-3. Lands included in the project boundaries for the Big Creek ALP Projects. (Source: SCE, 2007a, as modified by staff)

Feature	Associated Lands Included in the Current Project Boundary
Dams and diversion structures	Variable distance of at least 50 feet from the structures
Impoundments	Variable horizontal distance (near zero feet to several hundred feet) from the maximum normal water surface elevation
Water conveyances	Typically the conveyances are located along the center line of a 100-foot-wide right-of-way (ROW)
Water conveyance structures	Typically 50 feet from the structure
Access roads	Typically the roads are located along the center line of a 50- to 100-foot-wide ROW
Access trails	Typically the trails are located within a 10-foot-wide ROW
Transmission lines	Typically the lines are located along the center line of a 100- to 150-foot-wide ROW

Feature	Associated Lands Included in the Current Project Boundary
Communication and control lines	Typically the lines are located along the center line of a 10-foot-wide ROW
Gaging stations	Typically 50 feet from the structure
Helicopter landing sites	Typically a 70 to 400 foot diameter area around the landing site
Recreational sites	Includes the footprint of the recreational area in most cases (some recreational areas are currently located outside of the project boundary)

The land included within the project boundaries currently overlaps at some locations (i.e., land at specific points is within the project boundary of two different projects). Table 2-4 presents those overlapping areas for the Big Creek ALP Projects (and other adjacent projects).

Table 2-4. Project lands overlapping other project lands for the Big Creek ALP Projects. (Source: SCE, 2007a, as modified by staff)

Affected Projects	Location of overlapping project lands
Big Creek Nos. 2A, 8, and Eastwood and Big Creek Nos. 1 and 2	Near Powerhouses 1 and 2 At the outlet of Ward Tunnel on Huntington Lake
Big Creek Nos. 2A, 8, and Eastwood and Mammoth Pool	Where the Mammoth Pool transmission lines passes Powerhouse 8
Big Creek Nos. 2A, 8, and Eastwood and Big Creek No. 3	Near the Big Creek Dam 6
Big Creek Nos. 2A, 8, and Eastwood and the Portal Project	Near the Portal forebay and powerhouse
Big Creek Nos. 2A, 8, and Eastwood and Big Creek No. 4	Near Powerhouse 8 at Redinger reservoir

Affected Projects	Location of overlapping project lands
Mammoth Pool and Big Creek No. 3	Around the Big Creek No. 3 forebay and powerhouse Where the Mammoth Pool transmission lines connect to the Big Creek No. 3 switchyard

In addition, there are features included in the Big Creek ALP Projects that also serve other projects. For example, the Ward Tunnel (part of Big Creek Nos. 2A, 8, and Eastwood), feeds water from Florence Lake, and a series of small diversions on the South Fork San Joaquin River (Big Creek Nos. 2A, 8, and Eastwood) into Huntington Lake (Big Creek Nos. 1 and 2). Huntington Lake (Big Creek Nos. 1 and 2), which serves as the impoundment for the Big Creek No. 1 development, is also a source of water for the Big Creek Nos. 2A and Eastwood developments (Big Creek Nos. 2A, 8, and Eastwood) via the Huntington-Pitman-Shaver conduit.

2.1.2 Existing Project Operations

Operations of SCE's seven licensed projects in the Big Creek System are managed from both a watershed-wide perspective and on an individual project-by-project basis. The Big Creek System consists of six major reservoirs (Thomas A. Edison, Florence, Huntington, Shaver, Mammoth Pool, and Redinger), and nine powerhouses (Portal, Eastwood, Mammoth Pool and Big Creek Powerhouses 1, 2, 2A, 3, 4, and 8). Figure 2-1 presents a schematic of the seven projects and associated reservoirs, water conveyance tunnels, and powerhouse in the Big Creek System.

SCE operates the Big Creek ALP Projects within the Big Creek System in accordance with its current license conditions, which include minimum instream flow (MIF) release requirements that are made by SCE from diversions and impoundments. Stream reaches, including bypassed stream reaches, are discussed later in section 3.3.1 and elsewhere.

SCE manages water through the system in a manner that best meets the operational constraints that are imposed either by contractual operating agreements (i.e., licenses, permits) or by physical limitations of the generating equipment. The Big Creek System is subject to several operating constraints, including: (1) available water supply; (2) electrical system requirements; (3) both planned and unplanned maintenance outages; (4) storage limits (including both recreational minimums and year-end carryover maximums); (5) both minimum and maximum release limits (from storage); (6) various provisions contained in water rights agreements,[10] and (7) California Independent System Operator requirements.

2.1.2.1 Big Creek System Water Management

This section provides a general overview of how SCE manages the seven projects in the Big Creek System.

In all water year types, water released from project reservoirs and diverted from streams is used to generate power. There are subtle differences, however, in the way the system is operated during different water year. Generally, SCE operates the projects so that the Big Creek System generates around the clock in the spring run-off period, except in dry water years. Operational flexibility is limited during normal run-off because the amount of water run-off available exceeds the combined generation and storage capacity of the system, resulting in water flowing over spillways or "spill." When the reservoirs stop spilling, SCE is able to use available inflows and generate power to meet the electric supply requirements and provide both base load and peaking energy.

In the upper basin area, water diverted from the Upper South Fork San Joaquin River drainage is stored in Florence Lake and water from Mono Creek drainage is stored in Lake Thomas Edison. Water is diverted from these two lakes and various other small backcountry diversions into Huntington Lake via the Ward Tunnel and the Mono-Bear Siphon. The volumes of water that can pass through Ward Tunnel and the siphons are limited by the physical size and layout of these conduits.

The Big Creek System has three interlinked water chains or pathways through which water may be transported and used to produce power.

- Huntington Water Chain: Portal powerhouse and Powerhouses 1, 2, 8, 3, and 4.
- Shaver Water Chain: Portal powerhouse, Eastwood powerhouse, and Powerhouses 2A, 8, 3, and 4.
- Mammoth Water Chain: Mammoth Pool powerhouse and Powerhouses 3 and 4.

After passing through, or bypassing, the Portal powerhouse, water entering Huntington Lake is directed either to the Huntington or Shaver chain. Water from Powerhouses 1 and 2 in the Huntington Chain joins water from the Shaver Chain, which

[10] The most prominent water rights agreement is the Mammoth Pool Operating Agreement between SCE and the U.S. Bureau of Reclamation (Reclamation). It pertains to the storage and release of water from SCE's Big Creek reservoirs upstream of Reclamation-operated Friant dam (Millerton Lake) and the associated Central Valley Project water distribution system operated by Reclamation for downstream irrigators.

has already passed through Eastwood powerhouse and Powerhouse 2A. Water from these two chains is then diverted through Powerhouse 8, after which is joins the waters of the San Joaquin River coming from the Mammoth Chain. Water from all three chains then continues through Big Creek powerhouses 3 and 4.

Water from the Middle Fork and North Fork San Joaquin River drainages and the South Fork San Joaquin River that is not diverted at Florence Lake, Lake Thomas A. Edison, Bear Creek forebay, and the small backcountry diversions, is collected in Mammoth Pool reservoir and becomes part of the Mammoth Chain. Mammoth Pool powerhouse is usually run at maximum during the high flow or run-off period to prevent or delay spill at Mammoth Pool reservoir.

For the most part, Portal, Eastwood, and Big Creek No. 4 operate independently of the other powerhouses in the Big Creek System. Portal powerhouse opportunistically uses water passing through the Ward Tunnel for power generation, but only operates efficiently at moderate flows through Ward Tunnel. Ward Tunnel flows outside of the efficient flow range of Portal powerhouse bypass the powerhouse through a valve into Huntington Lake. Eastwood powerhouse generation normally occurs during the peak demand period of the day, unless water is being moved continuously from Huntington Lake to Shaver Lake for use during peak periods.

During the night, water is typically pumped from Shaver Lake through Eastwood power station into Balsam Meadows reservoir. During the day, the water then passes back through Eastwood power station in generate mode to Shaver Lake during peak demand hours. Maintaining water surface levels for recreational purposes at Huntington Lake and above pump-back minimum water surface elevations in Shaver Lake are important considerations when planning operations at Eastwood. Powerhouse 4 is the last power generation opportunity in the Big Creek System and therefore adjustments in the operation of that powerhouse will not affect the other upstream powerhouses.

Besides inflow, market constraints and pricing, transmission constraints, and weather will affect generation and operations at the Big Creek ALP Projects.

2.1.2.2 Water Management for the Big Creek ALP Projects

Here we describe how SCE operates the reservoirs and powerhouses that are part of or integrally related to the operation of the Big Creek ALP Projects.

Big Creek Project Reservoirs

Lake Thomas A. Edison

Lake Thomas A. Edison, a component of SCE’s Vermilion Project, is the highest elevation reservoir in the Big Creek System. The lake is located on, and stores water from, Mono Creek and its tributaries. Water released from storage at the lake is diverted about 1 mile downstream at Mono Creek diversion (part of the Big Creek Nos. 2A, 8, and Eastwood Project) into the Mono-Bear Siphon. Water can also be diverted from the Bear

Creek diversion into the Mono-Bear Siphon. Water from the Mono-Bear Siphon flows into Ward Tunnel. Lake Thomas A. Edison has a relatively large storage capacity compared to its drainage area. Thus, during the spring run-off period in non-spill years, the majority of inflow is stored and not released until late summer. In spill years, however, the inflow to the lake is stored until threat of spill at Florence Lake and Bear Creek diversion has passed, then releases from the lake begin to avoid using the emergency spillway. Peak storage normally occurs sometime during July and August.

Florence Lake

Florence Lake, a component of the Big Creek Nos. 2A, 8, and Eastwood Project, is a high elevation reservoir that stores water from the South Fork San Joaquin River and other small tributaries. Water at Florence Lake is diverted into Ward Tunnel, as is water from Bolsillo, Chinquapin, Camp 62, and Camp 61 creeks. Priority is given to water being diverted from Florence Lake if spill is imminent at that location. Water being diverted from Lake Thomas A. Edison is given last priority because it is the least likely to spill due to its large storage capacity. Water diverted into Ward Tunnel passes under and is hydrologically connected to Portal forebay. The water eventually exits Ward Tunnel through Portal powerhouse or the bypass valve, and is stored in Huntington Lake.

Florence Lake storage is kept near its minimum level (1,000 acre-feet) during the winter months to avoid damage due to freezing water on the dam face. Storage usually begins to increase in late April. After the peak storage level is reached in late spring/early summer, the reservoir elevation gradually declines until it again reaches its minimum storage level in late fall.

Huntington Lake

Huntington Lake, a component of the Big Creek Nos. 1 and 2 Project, is also a relatively high elevation reservoir that stores water from the backcountry lakes and diversions via the Ward Tunnel. Water from Huntington Lake may be sent to either Powerhouse 1 or Shaver Lake via Balsam forebay or North Fork Stevenson Creek. A good faith effort is made by SCE to keep Huntington Lake as full as practicable with minimum fluctuation from Memorial Day through Labor Day weekend, for recreational uses. However, during wet years, it becomes necessary to keep storage lower until after local uncontrolled peak inflows have passed. Spill could occur if local uncontrolled inflows exceed Huntington Lake water diversion capacities. Due to downstream safety issues and domestic water issues for the town of Big Creek, spill is avoided at Huntington Lake, if possible.

Shaver Lake

Shaver Lake, a component of the Big Creek Nos. 2A, 8, and Eastwood Project, is a moderate elevation reservoir that stores water from Huntington Lake via Eastwood or Tunnel 7 (through Gate 2) and local inflows from North Fork Stevenson Creek and other small tributaries. Water storage at Shaver Lake is not noticeably altered on a daily basis by pump-back operations at Eastwood powerhouse, which usually occur during the late-night/early-morning hours from spring through fall, depending on water availability. During this period, the reservoir is generally kept at a high surface elevation to enable the use of pump-back capability. In pump-back mode, the Eastwood powerhouse pumps water from Shaver Lake and returns it to Balsam forebay. This water is used again the following day, for generation through Eastwood powerhouse, and then returned to Shaver Lake. For pump-back generation to occur, Shaver Lake has to be above a minimum elevation of 5,342 feet, or 78,426 acre-feet of storage. During wet water years, Shaver Lake storage will be drawn down below this pump-back minimum elevation in the spring/early summer to create storage space for the upcoming run-off and to minimize the potential for spilling at Shaver dam. Water from Shaver Lake is diverted to Powerhouse 2A through Tunnel 2, and is also released to Stevenson Creek, which is a tributary to the San Joaquin River downstream of Dam 6.

Mammoth Pool

Mammoth Pool reservoir, a component of the Mammoth Pool Project, is a moderate elevation reservoir that stores water from the San Joaquin River and other small tributaries. The drainage area of Mammoth Pool reservoir is by far the largest of all of the system reservoirs, relative to the reservoir size. As a result, Mammoth Pool reservoir spills more often than the other system reservoirs. In most cases, spill at Mammoth Pool dam will also result in spill downstream of Dam 6 and Redinger reservoir. Ideally, minimum storage at Mammoth Pool reservoir will occur just prior to the beginning of spring run-off to maximize storage space availability. After the threat of spill has passed, storage at Mammoth Pool reservoir declines at a rate necessary to ensure compliance with the September 30th storage requirements of the Mammoth Pool Operating Agreement. Consideration is given to flood control issues when determining the optimal storage level at Mammoth Pool reservoir during the winter months.

Big Creek Project Powerhouses

Big Creek Nos. 2A, 8, and Eastwood Project

The Eastwood powerhouse receives water from Balsam Meadows forebay, which is filled via the Huntington-Pitman-Shaver Conduit from Huntington Lake or through water pumped back from Shaver Lake, and discharges to Shaver Lake. Eastwood may operate as a pumped storage project in all water year types after the run-off period has ended and SCE gains control of reservoir inflows in the Big Creek System. Powerhouse 2A receives water from Shaver Lake and discharges to the Dam 5 impoundment on Big Creek. Powerhouse 8 uses water from the Dam 5 impoundment and discharges to the Dam 6 impoundment on the San Joaquin River.

Big Creek Nos. 1 and 2 Project

Big Creek No. 1 uses water from Huntington Lake and discharges into the Dam 4 impoundment on Big Creek. No. 2 receives water from the Dam 4 impoundment and discharges to the Dam 5 impoundment on Big Creek.

Mammoth Pool Project

Mammoth Pool reservoir receives flow from a large watershed that includes: Chiquito, Jackass, Dalton, and Granite creeks, and the North, Middle and South forks of the San Joaquin River. Under existing operations, water from the Mammoth Pool Project is diverted at the Mammoth Pool reservoir on the San Joaquin River and from Rock and Ross creeks (tributaries to the San Joaquin River downstream of Mammoth Pool reservoir). Water passing through the powerhouse enters the San Joaquin River just upstream of the Dam 6 impoundment, also known as Big Creek No. 3 forebay.

Big Creek No. 3 Project

Big Creek No. 3 receives water from the Dam 6 impoundment. The powerhouse discharges into Redinger reservoir (Big Creek No. 4 Project, FERC No. 2017).

2.2 APPLICANT'S PROPOSAL

2.2.1 Proposed Project Facilities

SCE proposes the following modifications to project facilities. These modifications are discussed in more detail under specific resource sections.

Big Creek Nos. 2A, 8, and Eastwood Project

- Install new minimum flow devices and gaging equipment at Dam 5 and Mono Creek diversion.
- Decommission diversions at Crater Creek, Tombstone Creek, North Slide Creek, and South Slide Creek.
- Rehabilitate all existing recreational facilities over the life of the license.
- Construct a new accessible fishing platform at Jackass Meadows campground.
- Construct a new accessible boat landing platform at Florence Lake.
- Install interpretive signage at Florence Lake Store, Jackass Meadows Campground, Mono Campground, and Whitebark Vista.
- Enhance visual aesthetics by painting the Mono-Bear siphon pipeline.

Big Creek Nos. 1 and 2 Project

- Install new minimum flow devices and gaging equipment at Ely Creek diversion, Balsam Creek diversion and Dam 4.

- Decommission domestic diversions at Pitman and Snow Slide creeks.
- Rehabilitate all existing recreational facilities over the life of the license.
- Construct a new Dam 3 day-use area at Huntington Lake.
- Construct a new accessible fishing platform at Huntington Lake.
- Install interpretive signage at Bear Cove day-use picnic area, Dam 3 parking area, Dowville day-use picnic area, and Eastwood Visitor Center.
- Enhance visual aesthetics by painting the Big Creek No. 1 penstock and other structures and providing vegetative screening at the switchyard.

Mammoth Pool Project

- Install new minimum flow devices and gaging equipment at Mammoth Pool dam, Rock Creek diversion and Ross Creek diversion.
- Upgrading the fishwater generator.
- Rehabilitate all existing recreational facilities over the life of the license.
- Install interpretive signage in the Mammoth Pool vicinity and Redinger reservoir overlook.
- Enhance visual aesthetics by painting the Mammoth Pool penstock.

Big Creek No. 3 Project

- Install new minimum flow devices and gaging equipment at Dam 6.
- Rehabilitate all existing recreational facilities over the life of the license.
- Enhance visual aesthetics by painting the Big Creek No. 3 penstock.

2.2.2 Project Safety

The Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; Mammoth Pool; and Big Creek No 3 projects have been operating for 29, 48, 50, and 30 years, respectively under the existing licenses. During this time, Commission staff have conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the licenses, and proper maintenance. In addition, the Big Creek ALP Projects have been inspected and evaluated every 5 years by an independent consultant, and a consultant's safety report has been filed for Commission review. As part of the relicensing process, Commission staff would evaluate the adequacy of all proposed project facilities under a new license. Special articles would be included in any licenses issued, as appropriate. Commission staff would continue to inspect the project during the terms of the new licenses to assure continued adherence to Commission-approved plans relating to operation and maintenance, and accepted engineering practices and procedures.

In addition to the environmental measures proposed by SCE, it also proposes to move the Howell-Bunger valve and fishwater generator located in the Mammoth Pool diversion tunnel to an exterior location at the downstream end of the tunnel for more efficient and safer access, maintenance, and operation. The fishwater generator is used to provide MIFs downstream of Mammoth Pool dam. The Howell-Bunger valve is used to provide releases from the reservoir other than through the powerhouse. The generator and Howell-Bunger valve also would be automated to enable operation from the Big Creek dispatch control center at the Big Creek No. 3 powerhouse for better control, compliance, and operator safety. These modifications would improve overall project safety (SCE, 2006).

2.2.3 Proposed Project Operations

SCE proposes to provide or modify minimum flow releases from several dams and diversions, provide channel and riparian maintenance flows from some diversions, provide pre-spill whitewater flow releases from some diversions, and to eliminate some flow diversions through diversion decommissioning. These modifications to project operations are summarized in the following section and discussed in more detail under specific resource sections.

2.2.4 Proposed Environmental Measures under the Settlement Agreement

SCE proposes a comprehensive set of measures covering the full range of resources in the Upper San Joaquin River Basin. Table 2-5 summarizes those proposed measures under the Settlement Agreement.[11] The Settlement Agreement envisions that all measures listed in appendix A of the agreement would be included in new licenses for the Big Creek ALP Projects, whereas measures listed in appendix B of the agreement would be implemented by SCE, but not included as a condition of new licenses. We only list those measures from appendix A of the agreement with the exception of one measure included in appendix B of the agreement that has a nexus to project purposes.

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[11] The precise wording of the measure summaries in this table differs from the specific language of the Settlement Agreement. Individual measures (Proposed Articles in the Settlement Agreement) include programmatic elements for scheduling and developing plans, monitoring, evaluation, and reporting that are not listed in this table. Characterizations of these measures are primarily the result of our attempt to provide a concise summary of the measures for this draft EIS and are not intended to modify any of the terms of the Settlement Agreement.

Table 2-5. Proposed environmental measures for the Big Creek ALP Projects under the Settlement Agreement. (Source: SCE, 2007b)

Article	Measure	Elements
1.1.1	**Streamflow Requirements**	As set forth in measures 1.1.1.1 through 1.1.1.22, maintain flows downstream of Project diversion dams. Measure instream flow releases as the 24-hour average of the flow and as an instantaneous flow. Instream flows would be the flow set forth below or the natural inflow into the point of diversion, whichever is less. Should the 24-hour average flow as measured, be less than the required 24-hour average flow, but more than the instantaneous flow (instantaneous floor); begin releasing the equivalent under-released volume of water within 7 days of discovery (based on SCE review of flow records) of the under-release. Water year types would be based on the April 1 forecast from the California Department of Water Resources (CDWR) Bulletin No. 120, San Joaquin Valley Water Year Index, or its successor index that is most representative of the Big Creek Watershed. Inform the Forest Service, Water Board, FWS, and the Commission which category of instream flows would be implemented based on the April 1 forecast.
	1.1.1.1 through 1.1.1.20 and 1.1.1.22	**Big Creek Nos. 2A, 8 and Eastwood Project** • Modify minimum flow releases at Stevenson Creek, Upper Balsam Creek (forebay to diversion), Lower Big Creek (Dam 5 to San Joaquin River), North Fork Stevenson Creek, Pitman Creek, Mono Creek (downstream of diversion), Bolsillo Creek, Chinquapin Creek, and Hooper Creek. **Big Creek Nos. 1 and 2 Project** • Provide minimum flows to Lower Balsam Creek (diversion to Big Creek), Middle Big Creek (Dam 4 to Dam 5), and Ely Creek and modify minimum flow releases to Upper Big Creek (Huntington Lake to Dam 4).

Article	Measure	Elements
		Mammoth Pool Project • Provide minimum flows to Rock Creek and Ross Creek and modify minimum flows to the San Joaquin River (Mammoth Pool dam to Dam 6). **Big Creek No. 3 Project** • Modify minimum flows to the San Joaquin River (Dam 6 to Redinger reservoir).
	1.1.1.21 Crater Creek /1.1.1.23 North Slide Creek/ 1.1.1.24 South Slide Creek/1.1.1.25 Tombstone Creek and 1.6 Small Diversions Decommissioning Plan	Remove from Service. The Licensee would implement the Small Diversions Decommissioning Plan (Crater Creek diversion, Tombstone Creek diversion, South Slide Creek diversion, North Slide Creek diversion, Pitman Creek domestic diversion, and Snow Slide Creek domestic diversion), included as appendix G in the Settlement Agreement.
	1.1.2/1.12 Flow Monitoring and Reservoir Water Level Measurement Plan	Measure and document all instream flow releases in publicly available and readily accessible formats. For the purposes of measuring and documenting compliance with the required instream flows in Project bypassed reaches, the Licensee would implement the Flow Monitoring and Reservoir Water Level Measurement Plan included as appendix L in the Settlement Agreement.
1.2	**Channel Riparian Maintenance Flow Plans**	By March 15 of each year, use March 1 preliminary water year forecast to inform the Forest Service, Water Board, FWS, Cal Fish & Game, and the Commission which category of instream flows would be implemented on April 1, with the option to adjust flows based on the April 1 and May 1 DWR Water Year forecast updates, if those updates are revised.

Article	Measure	Elements
	1.2.1 Bear Creek	Starting between May 15 and June 30 in Wet Years, do not divert water at the Bear Creek diversion for 10 consecutive days.
	1.2.2 Bolsillo Creek	Between April 1 and June 30 in Wet Years, do not divert water at the Bolsillo Creek diversion.
	1.2.3 Camp 62 Creek	Between April 1 and June 30 in Wet Years, do not divert water at the Camp 62 Creek diversion.
	1.2.4 Chinquapin Creek	Between April 1 and June 30 in Wet Years, do not divert water at the Chinquapin Creek diversion.
1.3	**Mono Creek Channel Riparian Maintenance Flow Plan**	Implement the Mono Creek Channel Riparian Maintenance Flow Plan, included as appendix D in the Settlement Agreement.
1.4	**Camp 61 Creek Channel Riparian Maintenance Flow Plan**	Implement the Camp 61 Creek Channel Riparian Maintenance Flow Plan, included as Settlement Agreement, appendix E. The objective of this Camp 61 Creek Channel Riparian Maintenance Flow Plan is to determine an appropriate channel and riparian maintenance flow regime to maintain reduced accumulations of fine sediment in Camp 61 Creek downstream of Portal forebay to the confluence with the South Fork San Joaquin River.
1.5	**Channel and Riparian Maintenance Flows for the South Fork San Joaquin River Downstream of Florence Reservoir**	Implement the channel and riparian maintenance flows for the South Fork San Joaquin River downstream of Florence reservoir, included as appendix F in the Settlement Agreement.

Article	Measure	Elements
1.7	**Large Woody Debris Management**	Return large wood to Bear Creek by allowing large woody debris to pass over the Bear Creek diversion dam spillway during spill.
1.8	**Temperature Monitoring and Management Plan**	Implement the Temperature Monitoring and Management Plan, included as appendix H in the Settlement Agreement.
1.9	**Fish Monitoring Plan**	Implement the Fish Monitoring Plan, included as appendix I in the Settlement Agreement.
1.10	**Sediment Management Prescriptions**	Implement the Sediment Management Prescriptions for certain small, moderate, and large diversions, included in Settlement Agreement, appendix J.
1.11	**Riparian Monitoring Plan** **(Camp 61 Creek, Mono Creek, and South Fork San Joaquin River)**	Implement the Riparian Monitoring Plan, included as appendix K in the Settlement Agreement.
2.1	**Historic Properties Management Plan**	Complete the draft HPMP filed with the Commission on November 29, 2005, pursuant to section 106 of the National Historic Preservation Act. To the extent required by the Commission or applicable law, consult with the Commission, interested governmental agencies, the Settlement Parties, and the Tribal Community for the completion of the draft HPMP. The final HPMP would include: • Provisions for coordination with the Vegetation Management Plan, Recreation Management Plan, Riparian Monitoring Plan, and any other plan referenced in the HPMP. • Provisions for including a Forest Service representative on the Big Creek Heritage Advisory Committee. Provisions to consult with the

Article	Measure	Elements
		Advisory Committee on the development of management and monitoring plans for cultural resources, review and evaluation of cultural resource data, the development of cultural resource protection measures, implementation of protection measures, or other recommendations as required by any Programmatic Agreement developed for the HPMP. The Advisory Committee would address specific issues or concerns that arise during the implementation of the licenses. • Provisions for continued management of National Register ineligible sites as important sites, as per the draft HPMP. Provide geographic information system (GIS) compatible electronic data through "Arc GIS coverage/shapefiles" whereby archaeological survey coverage and site locations can be entered into the Forest Service database. Implement the HPMP upon execution of a Programmatic Agreement.
3.1	**Visual Resources Plan**	Implement the Visual Resources Plan, included as appendix M in the Settlement Agreement.
3.2	**Transportation System Management Plan**	Implement the Transportation System Management Plan, included appendix N in the Settlement Agreement.
4.1	**Recreation Management Plan**	Implement the Recreation Management Plan, included as appendix O in the Settlement Agreement.
5.1	**Special-Status Bat Species Protection**	Prior to conducting any non-routine maintenance activities that could result in harm to special status bat species or their habitat, in structures that are known to support maternal or roosting bat species (including but not limited to, reconstruction and painting) (Settlement Agreement, table 5.1-1), consult with the Forest

Article	Measure	Elements
		Service, Cal Fish & Game, and FWS. Based on the consultation, implement appropriate avoidance and protection measures if necessary to minimize disturbance of special status bat species or habitat.
5.2	**Mule Deer Protection** **1. Mammoth Pool Reservoir**	To protect deer crossing Mammoth Pool reservoir during spring migration, maintain (i) the fences around the Mammoth Pool dam spillway; (ii) the Daulton Creek bridge; and (iii) a device to discourage deer from crossing the reservoir near the spillway. During the peak migration period (May 1 through June 15), ensure sand is present on the dam road to encourage deer to use the dam road to cross, and close the road during the peak migration period to reduce any adverse effects from recreation. Additionally, to ensure that the presence of debris that may impede deer migration across Mammoth Pool reservoir is monitored and that any build up of debris is removed in a timely manner, provide annual photo documentation to the Forest Service, Cal Fish & Game, and FWS of the area at the floating boom above the spillway (i.e., area of concern) along with an estimate of the extent of any debris present. This is especially important in years when Mammoth Pool reservoir spills. If agencies determine—based on review of the photograph and the estimate of the aerial extent of debris buildup—that the debris would impede deer migration, remove sufficient levels of debris to allow deer to migrate without impediment.
	2. Eastwood (Balsam Meadows)	Implement road closures within Big Creek Nos. 2A, 8, and Eastwood Project to prevent the disturbance of mule deer and other wildlife. Specific roads and road closure requirements are provided in appendix A in the Settlement Agreement, table 5.2-1.

Article	Measure	Elements
5.3	**Special-Status Species Protection**	Prior to construction of new project features on National Forest Service land that may affect Forest Service special-status species and their habitat (i.e., Forest Service sensitive and/or management indicator species), prepare a Biological Evaluation to describe the potential effect of the action on the species or its habitat. For state or federally listed species, federal candidate species, California species of special concern, and California fully protected species, prepare a Biological Assessment or other required document and obtain any necessary permits or approvals.
5.4	**Bald Eagle Management Plan**	Implement the Bald Eagle Management Plan, included as appendix P in the Settlement Agreement.
5.5	**Valley Elderberry Longhorn Beetle Management Plan**	Implement the VELB Management Plan, included as appendix Q in the Settlement Agreement.
5.6	**Vegetation And Integrated Pest Management Plan**	Implement the Vegetation and Integrated Pest Management Plan, included as appendix R in the Settlement Agreement.
5.7	**Bear/Human Interaction License Article**	Install and maintain bear-proof dumpsters at the Big Creek No. 1 administrative offices and company housing, and other project facilities where food waste may be disposed of or stored. The Forest Service, Cal Fish & Game, and FWS would review and approve dumpster design prior to installation. Implement a program to educate SCE personnel about proper food storage and garbage disposal to reduce bear/human incidents. The education program would consist of written materials (educational pamphlet) and employee training.
	Appendix B - (Non-FERC Settlement Agreement Provisions) – 1.2.2	During reconstruction and modification of the flow release structures for the Mammoth Pool dam, in consultation with agencies named above, assess the feasibility of adding gravel into or immediately below

Article	Measure	Elements
	Gravel Augmentation Feasibility Assessment	the spillway channel. Provide a written explanation of its determination to the Forest Service, FWS, Cal Fish & Game, and the Water Board. Schedule a meeting with these agencies, and any other interested government agencies to discuss the determination. The assessment would determine whether gravel augmentation in or below the spillway channel would: 1. impair the Mammoth Pool dam spillway function; 2. result in erosion and undermining of the access road to Mammoth dam; or 3. result in dam instability, impair operation of the release structures or hinder inspections to the dam and the release structures.

2.2.5 Proposed Project Boundary

2.2.5.1 Big Creek Nos. 2A, 8, and Eastwood

SCE proposes to add some lands to the area within the project boundary and to remove other lands from the project area. The exhibit G drawings have been revised to show these changes. Project boundary changes are summarized below.

SCE proposes to expand the area within the project boundary to include the following lands:

- The trail to the gage on Big Creek below Dam 5 from FS Road No. 8S05;
- The segment of FS Road No. 8S08A, leading to the upper penstock valves for Tunnel 5 from Railroad Grade Road (FS Road No. 8S08);
- The helicopter landing sites at: the summit at Shaver Hill near the junction of FS Road Nos. 2710 and 9S32; Tiffany Pines at Camp Edison; Mount Givens telecom site near the terminus of FS Road No. 7S32, near the Bear Creek diversion used to access the Bear Creek diversion and stream gage; Mono Creek diversion near FS No. 5S80Z, used to access the Mono Creek diversion and forebay; Mono Creek below Lake Thomas A. Edison, used to access the stream gage SCE gage no. 119; and the South Fork San Joaquin River below Hooper Creek, used to access SCE stream No. 129 at the

South Fork San Joaquin River at Florence Spill Station that provides access to SCE stream gage No. 128S, and to access the Florence Lake dam;

- The access road FS Road No. 9S58 to the North Fork Stevenson Creek gage from State Highway 168;
- The access road from FS Road No. 9S58 to the Eagle Point boat-in day-use area;
- The access road FS Road No. 9S17 to the Eastwood-Big Creek 1 Transmission Line tower M0-T3 from State Highway 168;
- The access road FS Road No. 9S312 to the Eastwood powerhouse from State Highway 168;
- The access road FS Road No. 9S58K from FS Road No. 9S58 to the Eastwood powerhouse entrance tunnel;
- The access roads FS Road Nos. 8S02 and 8S02B from State Highway 168 to the Huntington-Pitman-Shaver Tunnel Adit;
- The segment of FS Road No. 8S83 that accesses the Huntington-Pitman-Shaver Siphon from the junction of FS Road No. 8S83A;
- The Pitman Creek diversion access road (FS No. 8S94) from State Highway 168;
- The Bolsillo Creek diversion and Stream Gage Trail from FS Road No. 5S80H to the Bolsillo Creek diversion;
- The Chinquapin Creek diversion and Stream Gage Trail from FS Road No. 7S01 (Florence Lake Road) to the Chinquapin Creek diversion;
- The Bear Creek Stream Gage Trail from the Bear Creek diversion pool to the instream gage located upstream on Bear Creek;
- The land associated with the gaging station on Hooper Creek below Hooper Creek diversion (SCE gage no. 114) and the Hooper Creek diversion helicopter landing site;
- The land surrounding the gaging station on the South Fork San Joaquin River below the Hooper Creek confluence (SCE gage No. 129), increasing the existing diameter of project lands around the stream gage from 20 feet to 100 feet;
- The gaging station and ancillary equipment (cable way and housing structure) on the South Fork San Joaquin River above Hooper Creek confluence (SCE gage no. 128S;

- The access road FS Road No. 9S32C and associated spur roads to the Eastwood-Big Creek No. 1 Transmission Line towers M1-T2, M1-T3, M1-T4, M1-T5, M1-T6, M2-T1 and M2-T2; and
- The access road FS Road No. 8S47 from the gate to the Eastwood-Big Creek No. 1 Transmission Line towers M3-T1 and M2-T5.

SCE proposes to reduce the project area by removing:

- Excess land located southwest of Powerhouses 2 and 2A;
- A segment of FS Road No. 9S311 from the State Highway 168 to the Eastwood Switchyard;
- Excess land located along the southern side of Rancheria Creek from approximately 500 feet upstream of Portal powerhouse downstream to Huntington Lake;
- The Eastwood Overflow Campground located east of the Portal powerhouse;
- The Eastwood Overlook located along Rancheria Creek upstream of the confluence with Huntington Lake;
- The access road FS Road No. 5S80H to the Bolsillo Creek diversion from FS Road No. 5S80;
- The Chinquapin diversion piping near Camp 62 along a co-aligned segment of FS Road No. 7S01;
- The Florence Lake day-use area.

The net change in area would be a reduction of 24.79 acres, revising the total federal land acreage to 2,364.01 acres.

2.2.5.2 Big Creek Nos. 1 and 2

SCE proposes to add some lands to the area within the project boundary and to remove other lands from the project area. Specifically, SCE proposes to expand the area within the project boundary to include the following lands:

- The Eastwood Overflow Campground located east of Portal powerhouse;
- The Eastwood Overlook along Rancheria Creek upstream of the confluence with Huntington Lake;
- The access road beginning from the gate located at the terminus of Fresno County Road 3380 (Huntington Lodge Road) to the west end of Dam 2 (FS Road No. 8S66);
- The segment of FS Road No. 8S83 from the junction with FS Road No. 8S83A to the current project boundary.

SCE proposes to reduce the project area by removing:

- The area surrounding Rancheria Creek from Portal powerhouse to the high water line of Huntington Lake (Portal Tailrace);
- A portion of the right-of-way along the access road to the gaging station located on Big Creek below Huntington Lake (FS Road Nos. 8S66 and 8S66A), narrowing it from 100 feet to 50 feet (25 feet from the centerline along both sides of the road);
- The former company housing area near Powerhouses 2 and 2A;
- The segment of FS Road No. 8S13 between the gate near the top of the penstocks for Powerhouses 2 and 2A and FS Road No. 8S08 (Railroad Grade Road);
- Excess land located southwest of Powerhouses 2 and 2A; and
- The communication line ROW from the dispatcher's office near Powerhouse 3 to Powerhouse 2 and the Northern Hydro offices near Powerhouse 1.

The net change in project area would be a reduction of 118.63 acres, revising the total federal land acreage to 1,899.15 acres.

2.2.5.3 Mammoth Pool

SCE proposes to expand the existing project boundary to include 0.7 acres of federal lands associated with Shakeflat Trail to provide access to the San Joaquin River gaging station upstream of Shakeflat Creek and to include 2.90 acres of federal land for the helicopter landing site adjacent to the San Joaquin River above Shakeflat Creek. The revised total federal land acreage would be 2,033.28 acres.

2.2.5.4 Big Creek No. 3

SCE proposes to remove 44.17 acres of federal land above the high water line around the Dam 6 forebay that are not needed for access to the forebay or for the operation and maintenance of the project or other specified project purposes. The revised total federal land acreage would be 377.16 acres.

2.2.6 Proposed Action with Modifications

Section 4(e) Federal Land Management Conditions

Section 4(e) of the FPA states that the Commission may issue a license for a project on a federal reservation only if it finds that the license will not interfere or be inconsistent with the purpose for which the reservation was created or acquired. Such a reservation includes, without limitation, Forest Service-administered land. Section 4(e) of the FPA requires that a Commission license for a project located on a reservation include the conditions that the Secretary of the department under whose supervision the reservation falls deems necessary for the adequate protection and use of such reservation.

The Forest Service filed preliminary 4(e) conditions on February 5, 2007, for the Mammoth Pool Project and final conditions on February 27, 2008, for the remaining three projects. The measures proposed in the Settlement Agreement are consistent with the 4(e) conditions with the exception of minor variations in wording in the 4(e) conditions and the inclusion of standard general conditions by the Forest Service. Because the preliminary and final conditions filed by the Forest Service are consistent with the provisions of the Settlement Agreement, we discuss these terms and conditions in the context of our discussions of the Settlement Agreement measures throughout this final EIS.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the Big Creek ALP Projects would include SCE's proposal, including the Settlement Agreement and the terms and conditions filed pursuant to sections 4(e) and 10(j) of the FPA. Additional measures that we recommend for inclusion in any licenses that may be issued for the Big Creek ALP Projects are detailed below (in its comments on the draft EIS, SCE stated that it supports the staff alternative):

Aquatic Resources

Spawning Gravel Embeddedness Assessment Following Release of Flushing Flows–Assess gravel embeddedness in association with pool depth assessments following flushing flow releases from Dams 4, 5, and 6.

Sediment Management–Include the gravel augmentation feasibility assessment specified in section B.1.2.2 of the Settlement Agreement (measures not to be included in a new license) as a condition of a new license because this assessment pertains to Mammoth Pool dam spillway functions and maintenance of a project access road.

Terrestrial Resources

Bald Eagles–Specify in SCE's Avian Protection Plan that as follow-up to any documented bald eagle mortality at project transmission lines, the most recent APLIC guidelines would be used to assess appropriate corrective actions (the most recent guidance was issued in 2006 and it is likely to be updated during the life of the project).

Recreation

Funding Rehabilitation of Campgrounds–SCE would not be required to fund rehabilitation of five campgrounds that are located outside the existing and proposed project boundaries.

Report on Recreational Resources–SCE would provide reservoir elevation, boat ramp accessibility information, and parking and campsite capacity as a component of the Form 80 Recreation Report.

Land Use

Fire Management Plan–Include a Fire Management Plan in the Land Resource Plans that are approved by the Forest Service.

Sign Plan–Include a Sign Plan in the Land Resource Plans that are approved by the Forest Service.

Spill Prevention and Countermeasure Plan–Include a Spill Prevention and Countermeasure Plan in the Land Resource Plans approved by the Forest Service.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

2.4.1 Issuing a Non-Power License

A non-power license is a temporary license that the Commission terminates when it determines that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered by the license. At this point, no agency has suggested a willingness or ability to do so. No party has sought non-power licenses, and we have no basis for concluding that the Big Creek ALP Projects should no longer be used to produce power. Thus, we do not consider a non-power license a realistic alternative to relicensing in this circumstance.

2.4.2 Federal Government Takeover of the Projects

We do not consider federal takeover to be a reasonable alternative. Federal takeover and operation of the Big Creek ALP Projects would require Congressional approval. Although that fact alone would not preclude further consideration of this alternative, there is no evidence to indicate that federal takeover should be recommended to Congress. No party has suggested federal takeover would be appropriate, and no federal agency has expressed an interest in operating the projects.

2.4.3 Project Retirement

Retiring the Big Creek ALP Projects would require denying SCE’s license applications and require the surrender and termination of the existing licenses with any necessary conditions. The projects would no longer be authorized to generate power. Retiring the projects would involve significant cost and would foreclose any opportunity to add environmental enhancements to the existing Big Creek ALP Projects. For these reasons, we do not consider project retirement to be a reasonable alternative.

COVER SHEET

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSES

BIG CREEK ALP PROJECTS
Docket Nos. P-67, 2175, 2085, and 120

Chapter 3
Environmental Analysis
Pages 3-1 to 3-272
FEIS

3.0 ENVIRONMENTAL ANALYSIS

In this section, we first describe the general environmental setting in the project vicinity and any environmental resources that could be cumulatively affected by relicensing the Big Creek ALP Projects. Then, we address each affected environmental resource. For each resource, we first describe the affected environment—the existing condition and the baseline against which to measure the effects of the proposed project and any alternative actions—and then the environmental effects of the proposed projects, including the proposed measures in section 2.2.4. We have not identified any substantive issues related to geology and soils, beyond sediment management in project-related waterways (addressed in section 3.3.1, *Aquatic Resources*), and socioeconomics associated with the proposed action; therefore, these topics are not assessed in separate sections of this final EIS. Unless otherwise identified, the sources of our information are the license applications for the Big Creek ALP Projects (SCE, 2005; 2007a) and the Settlement Agreement (SCE, 2007b). We provide citations for information obtained from subsequent filings related to the projects.

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The Big Creek ALP Projects are located in the Upper San Joaquin River Watershed, which drains a 1,600-square-mile area situated between the Sierra Nevada crest to the east and the Central Valley foothills to the west. The San Joaquin River Watershed in the area of the projects is bordered generally by the Merced River Watershed to the north and the Kings River Watershed to the south. The San Joaquin River headwaters are in John Muir Wilderness area at elevations greater than 14,000 feet mean sea level (msl), and the river flows in a general southwesterly direction through the Sierra Nevada and foothills to the Central Valley region. Precipitation within the Upper San Joaquin River Watershed occurs mostly during the late fall, winter, and early spring and is mostly in the form of snow above elevation 5,000 feet msl. Average yearly precipitation varies greatly with elevation with about 50 inches at 5,000 feet msl. Streamflow normally peaks during the late spring and/or early summer from snowmelt runoff. Low flows within this watershed typically occur in late summer or early fall, after the snowmelt and before the runoff from the fall storms moving in from the Pacific.

3.2 CUMULATIVELY AFFECTED RESOURCES

According to the Council on Environmental Quality's regulations for implementing NEPA (50 CFR §1508.7), an action may cause cumulative effects on the environment if its effects overlap in space or time with the effects of other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time, including hydropower and other land and water development activities.

Based on information in the license applications, agency comments, other filings related to the Big Creek ALP Projects, and preliminary staff analysis, we identified the following resources that have the potential to be cumulatively affected by the continued operation of the projects, in combination with other activities: aquatic resources (water quantity, water temperature, sediment transport, and resident fish), native amphibians, and recreation.

Anadromous fish may have historically ascended the San Joaquin River to at least portions of the lower elevation reaches of some of the Big Creek ALP Projects, but currently Friant and Kerckhoff dams represent impassable barriers to anadromous fish access to the project area.[12] The timing and magnitude of flows passing through the Big Creek System would not influence anadromous fish downstream of Friant dam because Millerton Lake has the capacity to store nearly all releases from upstream projects, and the commitment of nearly all releases from Friant dam to irrigation and other consumptive uses would make any possible shift in Big Creek System operations irrelevant to anadromous fish downstream of Friant dam. Consequently, we conclude that the proposed action would have no cumulative effect on anadromous fish.

Relicensing the Big Creek ALP Projects would have effects on other resources, including vegetation, wildlife other than native amphibians, land use, aesthetics, and cultural resources. However, we consider those effects, both positive and negative, to be project-specific in nature and not influenced by other past, present, or reasonably foreseeable actions at other projects or by other parties.

3.2.1 Geographic Scope

The geographic scope of the analysis defines the physical limits or boundaries of the proposed action's effects on the resources. Because the proposed action would affect resources differently, the geographic scope for each resource may vary. We consider the geographic scope for water temperature and sediment transport to be the San Joaquin Watershed upstream of Redinger reservoir. Redinger reservoir has a total capacity of 35,033 acre-feet and is relatively narrow and over 200 feet deep. Therefore, any changes in the temperature and sediment transport of water entering Redinger reservoir from the proposed action at upstream projects would be overcome by influences in Redinger reservoir. For water quantity, resident fish, and recreation, we consider the geographic scope of cumulative effects to be the San Joaquin Watershed upstream of Friant dam. Changes in flow related to any modifications of project operations would be muted by the large storage capacity of Millerton Lake and releases for irrigation and other consumptive uses. Increases or decreases in resident fish (either native or introduced) in project waters can influence aquatic community dynamics in downstream waters, but the large volume

[12] Kerckhoff dam is located about 9 river miles downstream of the dam at Redinger reservoir, and Friant dam (which creates Millerton Lake) is located about 26 river miles downstream of the dam at Redinger reservoir.

of Millerton Lake would make further downstream cumulative effects of resident fish unlikely. Recreational enhancements at the Big Creek ALP Projects could serve to attract recreational users, thus deflecting overcrowding conditions that may occur elsewhere in the San Joaquin Watershed.

3.2.2 Temporal Scope

The temporal scope of our cumulative analysis in the final EIS includes a discussion of past, present, and future actions and their effects on each resource that could be cumulatively affected. Based on the terms of new licenses, the temporal scope looks 30 to 50 years into the future, concentrating on the effects on the resources from reasonable foreseeable future actions. The historical discussion, by necessity, is limited by the amount of available information for each resource.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

3.3.1 Aquatic Resources

3.3.1.1 Affected Environment

Water Resources

Water Quantity

Table 2-2, in section 2.1.1, *Existing Project Facilities*, gives characteristics of the Big Creek ALP Project reservoirs. Figure 3-1 provides a general schematic of the projects' key storage reservoirs, diversions, powerhouses, and gage locations. The most downstream point on figure 3-1 is Redinger reservoir which is part of the Big Creek No. 4 Project. Downstream of Redinger reservoir, the San Joaquin River flows to the small Kerckhoff reservoir with 4,140 acre-feet of storage operated by the Pacific Gas and Electric Company. Millerton Lake, operated by the U.S. Bureau of Reclamation, has more than 500,000 acre-feet of storage and is located downstream of Kerckhoff reservoir.

<u>Reservoirs</u>

Florence Lake – The highest elevation storage reservoir in the Big Creek ALP Projects[13] is Florence Lake located on the South Fork San Joaquin River about 28 miles upstream of the confluence with the San Joaquin River. From Florence Lake, water is diverted into Ward Tunnel (capacity 1,760 cubic feet per second [cfs]) which leads to Portal powerhouse and then to Huntington Lake. However, before Ward Tunnel reaches Portal powerhouse, it also receives diverted water from a series of small diversion dams on Chinquapin, Camp 62, and Bolsillo creeks. MIFs from Florence Lake are measured at

[13] Lake Thomas A. Edison, part of the Vermilion Valley Project (Project No. 2086), is at a slightly higher elevation than Florence Lake.

U.S. Geological Survey (USGS) gage no. 11230215 South Fork San Joaquin River below Hooper Creek, located about 3.5 miles downstream from Florence Lake, and range between 11 and 27 cfs depending on the water year type and month (tables 3-1 and 3-2). Table 3-3 shows historical flows at this gage.

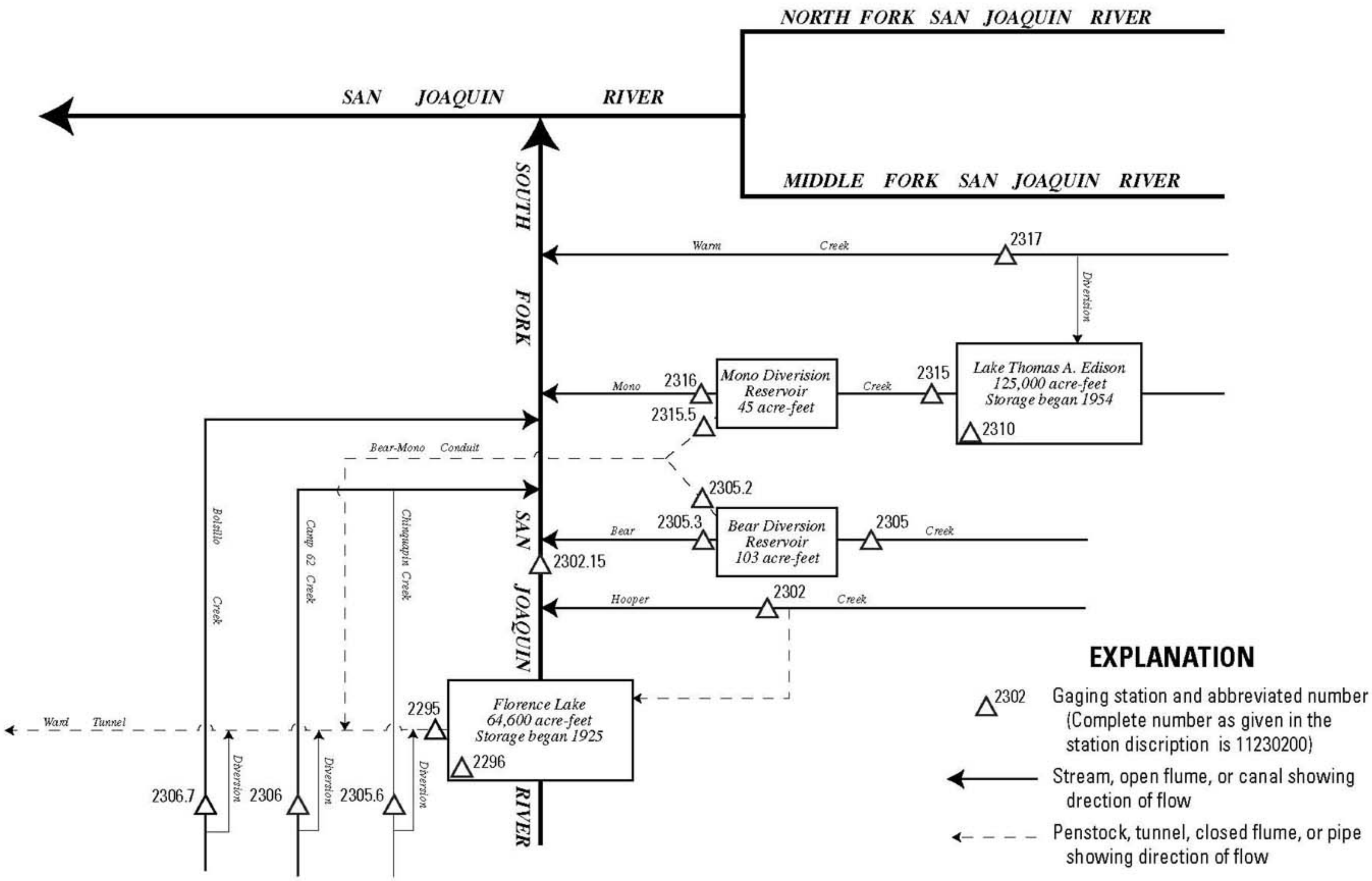

Figure 3-1. Schematic of the San Joaquin River Watershed area (page 1 of 2). (Source: USGS, 2004)

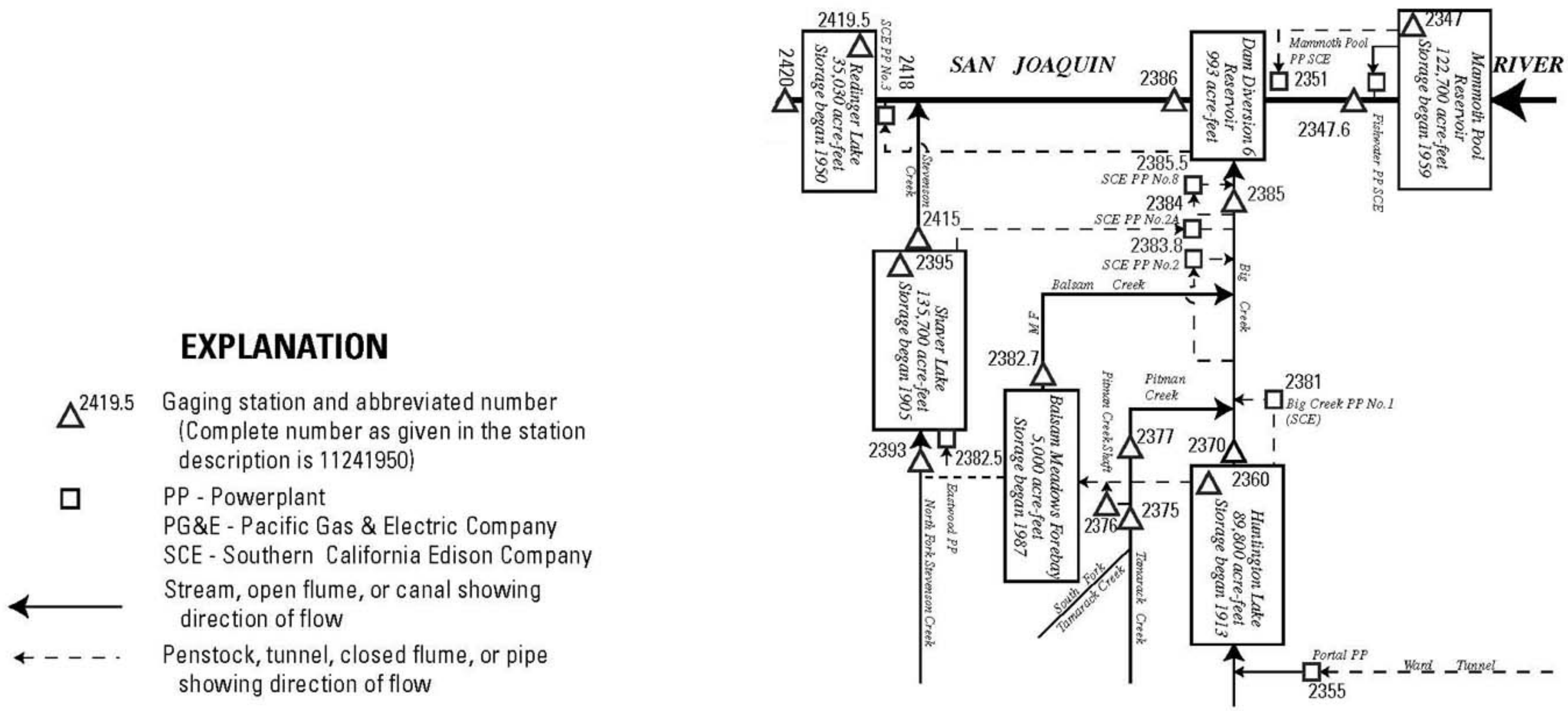

Figure 3-1. Schematic of the San Joaquin River Watershed area (page 2 of 2). (Source: USGS, 2004)

Table 3-1. Existing instream flow requirements for normal water year. (Source: SCE, 2007a; 2005)

USGS Gage	Stream Reach	Existing Instream Flow Release Requirement (cfs)											
		Oct	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Big Creek Nos. 2A, 8, and Eastwood (FERC No. 67)													
11230530	Bear Creek below diversion	2	2	2	2	2	2	2	3	3	3	3	3
11231600	Mono Creek below diversion	9	7.5	7.5	7.5	7.5	7.5	7.5	13	13	13	13	13
11230215	South Fork San Joaquin River below Hopper Creek	17	15	15	15	15	15	15	27	27	27	27	27
11237700	Pitman Creek near Tamarack Mountain[a]	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
11241500	Stevenson Creek below Shaver Lake	3	3 , 2	2	2	2	2	3	3	3	3	3	3
11238500	Lower Big Creek near mouth (below Dam 5)	3	3 , 2	2	2	2	2	3	3	3	3	3	3
11230600	Camp 62 Creek below diversion	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
11230560	Chinquapin Creek below diversion	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	1	1
11230670	Bolsillo Creek below diversion	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
11230120	North Slide Creek below diversion[b]	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
11230100	South Slide Creek below diversion[b]	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
11230200	Hooper Creek below diversion[c]	2	2	2	2	2	2	2	2	2	2	2	2
11239300	North Fork Stevenson Creek above Shaver Lake[d]	4	4	4	3.5	3.5	3.5	5	5	5	4.5	4.5	4.5

USGS Gage	Stream Reach	Existing Instream Flow Release Requirement (cfs)											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
11238270	Upper Balsam Creek below Balsam Meadows Forebay[e]	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	1
Big Creek No. 3 (FERC No. 120)													
11238600	San Joaquin River Stevenson reach (below Dam 6 above Stevenson Creek)	3	3	3	3	3	3	3	3	3	3	3	3
Mammoth Pool (FERC No. 2085)													
11234760	San Joaquin River Mammoth reach above Shakeflat Creek	25	10	10	10	10	10	10 , 25	25	25	30	30	30 , 25
Big Creek Nos. 1 and 2 (FERC No. 2175)													
11237000	Upper Big Creek 0.9-mile below Huntington Lake	2	2	2 , -	-	-	-	- , 2	2	2	2	2	2

Notes: When natural flow is at or below the MIF requirement, the diversions are turned out. Therefore, flows in a diverted reach may drop below the MIF requirement when SCE is not diverting.

When two values are listed for a specific month, the first value is for the first half of the month and the second value is for the second half of the month.

[a] When gaging is not possible due to freezing water (Dec 15 to Apr 15), record daily at downstream weir.

[b] Stream gages on North Slide and South Slide creeks have been inactive for more than 25 years.

[c] Included in South Fork San Joaquin River below Hooper.

[d] Intersection of North Fork Stevenson Creek and Shaver perimeter road.

[e] West Fork Balsam Creek. As measured in downstream channel immediately below project boundary.

Table 3-2. Existing instream flow requirements for dry water year. (Source: SCE, 2007a; 2005)

		Existing Instream Flow Release Requirement (cfs)											
USGS Gage	**Stream Reach**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Big Creek Nos. 2A, 8, and Eastwood (FERC No. 67)													
11230530	Bear Creek below diversion	1	1	1	1	1	1	1	2	2	2	2	2
11231600	Mono Creek below diversion	6	5	5	5	5	5	5	9	9	9	9	9
11230215	South Fork San Joaquin River below Hopper Creek	13	11	11	11	11	11	11	20	20	20	20	20
11237700	Pitman Creek near Tamarack Mountain[a]	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
11241500	Stevenson Creek below Shaver Lake	3	3 , 2	2	2	2	2	3	3	3	3	3	3
11238500	Lower Big Creek near mouth (below Dam 5)	2	2 , 1	1	1	1	1	2	2	2	2	2	2
11230600	Camp 62 Creek below diversion	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
11230560	Chinquapin Creek below diversion	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	1	1
11230670	Bolsillo Creek below diversion	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
11230120	North Slide Creek below diversion[b]	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
11230100	South Slide Creek below diversion[b]	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
11230200	Hooper Creek below diversion[c]	2	2	2	2	2	2	2	2	2	2	2	2
11239300	North Fork Stevenson Creek above Shaver Lake[d]	3	3	3	3	3	3	4	4	4	3.5	3.5	3.5

USGS Gage	Stream Reach	Existing Instream Flow Release Requirement (cfs)											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
11238270	Upper Balsam Creek below Balsam Meadows Forebay[e]	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	1
Big Creek No. 3 (FERC No. 120)													
11238600	San Joaquin River Stevenson reach (below Dam 6 above Stevenson Creek)	3	3	3	3	3	3	3	3	3	3	3	3
Mammoth Pool (FERC No. 2085)													
11234760	San Joaquin River Mammoth reach above Shakeflat Creek	12.5	10	10	10	10	10	10, 12.5	12.5	12.5	30	30	30, 12.5
Big Creek Nos. 1 and 2 (FERC No. 2175)													
11237000	Upper Big Creek below Huntington Lake	2	2	2 , -	-	-	-	- , 2	2	2	2	2	2

Notes: When natural flow is at or below the MIF requirement, the diversions are turned out. Therefore, flows in a diverted reach may drop below the MIF requirement when SCE is not diverting.

A value of 10, 25 indicates a flow of 10 cfs in the first half of the month and 25 cfs in the last half of the month.

[a] When gaging is not possible due to freezing water (Dec 15 to Apr 15), record daily at downstream weir.

[b] Stream gages on North Slide and South Slide creeks have been inactive for more than 25 years.

[c] Included in South Fork San Joaquin River below Hooper.

[d] Intersection of North Fork Stevenson Creek and Shaver perimeter road.

[e] West Fork Balsam Creek. As measured in downstream channel immediately below project boundary.

Table 3-3. Monthly discharge (cfs) statistics for gaging stations downstream of reservoirs. (Source: USGS, 2008; SCE, 2005, 2007a, 01CAWG-06)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
South Fork San Joaquin River below Hooper Creek (11230215) Period of record: 10/1/1982 to 9/30/2002. Drainage area: 184 square miles.												
Mean	20.3	17.7	16.7	18.6	20.3	26.5	28.3	45	322.4	244.4	69.3	28.1
Median	18	16	16	17	18	23	25	29	28	28	27	27
Max.	123	79	141	366	153	202	116	2,190	4,010	5,020	1,650	118
Min.	8.1	7.4	11	7.5	11	11	12	20	19	19	7.3	21
10% Exceed.	29	28	20	22	27	39	44	68	1180	717	46	32
90% Exceed.	14	13	13	13	13	17	17	23	23	23	23	22
Stevenson Creek below Shaver Lake (11241500) Period of Record: 10/1/1986 to 9/30/2002. Drainage area: 29.4 square miles.												
Mean	12.6	3.3	2.8	18.4	27.1	42.1	44.4	75.8	120.1	78.3	14.1	3.6
Median	3.5	3.5	2.6	2.6	2.8	3.0	3.8	3.6	3.6	3.5	3.4	3.5
Max.	278	11.0	10.0	340	305	317	307	650	688	672	434	37.0
Min.	3.1	1.6	1.2	1.9	2.1	2.1	3.0	3.1	3.0	3.0	3.0	3.0
10% Exceed.	4.5	3.8	3.8	4.1	51.0	203	256	317	350	441	4.7	4.0
90% Exceed.	3.3	2.5	2.2	2.2	2.4	2.5	3.3	3.3	3.2	3.1	3.1	3.1

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Big Creek below Huntington Lake (11237000) Period of Record: 10/1/1986 to 9/30/2002. Drainage area: 81.1 square miles.												
Mean	3.3	3.2	3.1	3.0	2.5	3.0	4.1	6.3	8.7	4.0	3.9	3.7
Median	2.9	2.9	2.9	2.6	2.4	2.6	4.0	4.5	4.2	3.8	3.6	3.4
Max.	5.7	6.6	5.9	29.0	5.4	13.0	19.0	51.0	115.0	8.6	13.0	8.5
Min.	2.1	2.1	2.0	1.2	0.8	1.2	1.6	2.5	2.5	2.2	2.1	2.1
10% Exceed.	4.6	4.2	4.1	4.1	3.5	4.0	6.1	11.0	12.0	5.2	5.2	4.8
90% Exceed.	2.4	2.4	2.4	2.0	1.8	2.0	2.6	2.7	2.8	2.5	2.4	2.7
San Joaquin River above Shakeflat Creek (11234760) Period of Record: 10/1/1982 to 9/30/2002. Drainage area: 1,003 square miles/												
Mean	24.3	13.5	15.0	159.6	66.5	126.0	223.0	1,210.5	2,066.5	1,074.9	119.5	25.2
Median	27.0	13.0	12.0	13.0	14.0	14.0	17.0	32.0	31.0	29.0	29.0	28.0
Max.	62.0	53.0	106	26,000	2,350	10,100	12,900	18,100	15,500	13,500	3,830	50.0
Min.	7.0	10.0	4.9	9.2	4.4	4.2	10.0	14.0	14.0	13.0	14.0	13.0
10% Exceed.	32.0	16.0	19.0	56.0	64.0	57.0	59.0	4,500	8,020	4,510	52.0	35.0
90% Exceed.	14.0	11.0	11.0	11.0	12.0	12.0	12.0	14.0	14.0	14.0	14.0	14.0

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Balsam Creek below Balsam Meadows Forebay (11238270) Period of Record: 1/24/1989 to 9/30/2002												
Mean	0.8	0.7	0.8	0.8	0.8	0.9	1.0	0.8	1.2	1.3	1.3	1.3
Median	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	1.2	1.3	1.3	1.3
Max.	1.6	2.1	2.2	1.3	1.5	3.2	3.4	1.4	2.1	1.5	1.6	1.7
Min.	0.5	0.5	0.6	0.5	0.3	0.5	0.5	0.5	0.8	1.1	1.0	1.0
10% Exceed.	1.2	1.0	1.2	1.1	1.1	1.3	1.3	1.2	1.4	1.4	1.5	1.4
90% Exceed.	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	1.1	1.1	1.1	1.2

Notes: The period of record indicated in this table was the time period used to develop the table, not the complete period of record at a specific gage.
Because daily data were used to develop this table, the minimum and maximum values shown are the daily minimum and maximum values within each month for the stated period of record, not the minimum and maximum monthly values.

The average maximum yearly storage was 60,096 acre-feet and the average minimum yearly storage was 1,008 acre-feet over a 21-year period (1980 to 2001) (SCE, 2003c). These averages correspond to the range of water levels shown in figure 3-2 (water levels within Florence Lake for water years 1981 to 2007). Due to snowmelt runoff in spring and early summer, Florence Lake normally begins to refill in April and May, reaches its maximum water level and storage in late June or July, then falls to its minimum level by December. Under the existing license, SCE is required to maintain a minimum reservoir elevation of 7,276.6 feet msl from July 1 until August 31 and a minimum reservoir elevation of 7,232.6 feet msl during the reminder of the year. These elevations have usually been met as shown in figure 3-2. Historically, during the July 1 to August time period, the decrease in the reservoir level is less than 1 foot per day.

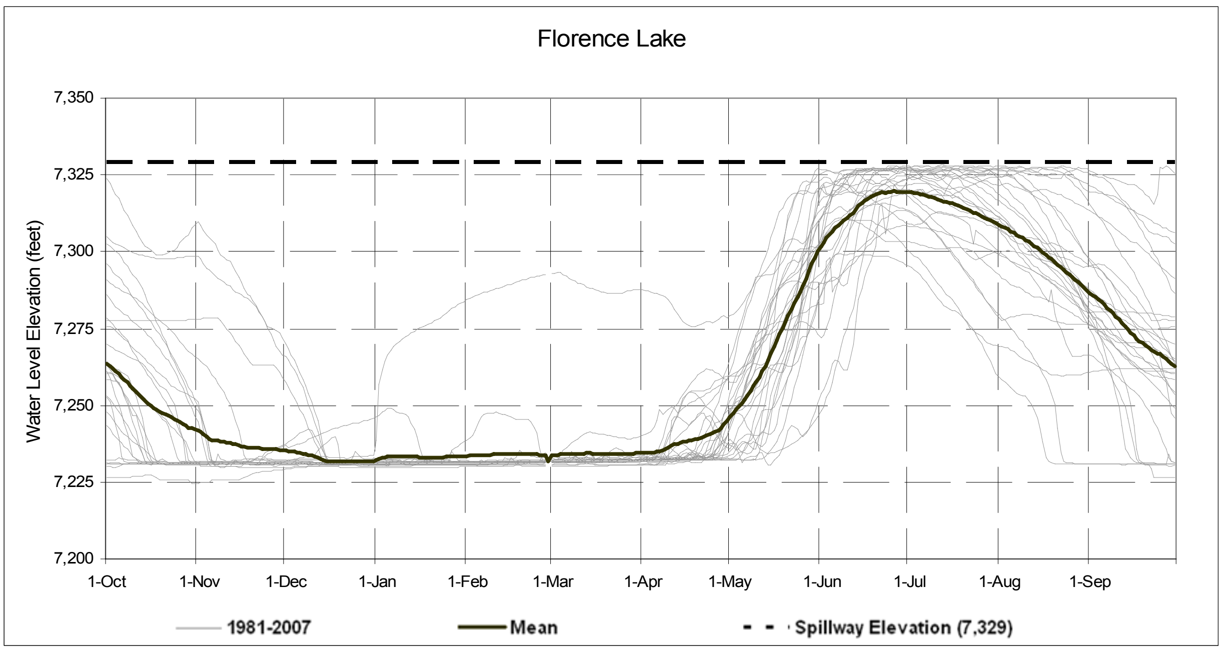

Figure 3-2. Florence Lake reservoir water levels 1981 to 2007. (Source: SCE, 2007a; USGS, 2008)

Shaver Lake – Shaver dam, which creates Shaver Lake, is located on Stevenson Creek about 4 miles upstream of its confluence with the San Joaquin River. Natural inflow occurs from Stevenson and North Fork Stevenson creeks. However, most inflow is from Huntington Lake via the Balsam Meadows forebay and Eastwood powerhouse. Inflow from the Eastwood powerhouse normally peaks in June in the 900 cfs range (table 3-4) and in the 200 cfs range during winter. From Shaver Lake, water passes through Tunnel 5 (capacity 650 cfs) to Powerhouse 2A, or during pump-back operations, is pumped to Balsam Meadows forebay via Eastwood powerhouse. Minimum flow releases to Stevenson Creek are made from near the bottom of Shaver dam, measured 0.3 mile downstream of the dam at USGS gage no. 11241500 Stevenson Creek below Shaver Lake, and range between 2 and 3 cfs for both normal and dry water year types (see tables 3-1 and 3-2). Table 3-3 shows historical flows at this gage.

Table 3-4. Monthly discharge statistics (cfs) for powerhouses. (Source: USGS, 2008)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Big Creek Powerhouse 2A near Big Creek (11238400) Period of record 10/1/1980 to 9/30/2007 missing water year 1984												
Mean	287	235	236	227	253	299	312	390	439	464	447	420
Median	269	197	211	215	214	256	269	371	470	463	449	436
Max.	731	655	655	655	656	706	669	721	716	671	825	677
Min.	0	0	0	0	0	0	0	0	0	0	0	0
10% Exceed.	597	563	536	475	608	628	642	645	649	646	640	632
90% Exceed.	14	0	0	0	0	0	1	91	150	234	232	198
Big Creek Powerhouse 8 near Big Creek (11238550) Period of record: 10/1/1980 to 9/30/2007 missing water year 1984												
Mean	572	487	498	502	541	659	757	898	953	986	915	836
Median	526	471	479	481	486	597	645	867	1,030	1,005	930	856
Max.	1,210	1,200	1,220	1,280	1,370	1,390	1,450	1,430	1,410	1,400	1,440	1,320
Min.	0	0	0	0	0	0	0	30	47	1	17	0
10% Exceed.	996	918	867	906	1,170	1,180	1,330	1,370	1,370	1,335	1,245	1,200
90% Exceed.	203	101	190	125	86	220	279	425	529	618	522	404

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Eastwood Powerhouse above Shaver Lake near Big Creek (11238250) Period of record: 10/1/1987 to 9/30/2007												
Mean	304	256	281	266	242	240	380	780	931	700	557	469
Median	322	239	285	267	204	187	317	769	879	644	565	484
Max.	913	972	812	1,210	1,260	996	1,560	1,910	1,900	1,720	1,370	1,160
Min.	0	0	0	0	0	0	0	0	0	0	0	0
10% Exceed.	606	574	553	543	523	587	913	1,410	1,540	1,190	896	771
90% Exceed.	0	0	0	0	0	0	0	134	378	304	196	143
Big Creek Powerhouse 3 near Shaver Lake (11241800) Period of record: 10/1/1980 to 9/30/2007 missing water year 1984												
Mean	962	826	970	1,069	1,301	1,968	2,509	2,687	2,471	2,197	1,824	1,486
Median	914	732	793	943	1,210	1,770	2,585	2,880	2,690	2,010	1,690	1,265
Max.	3,300	2,670	3,270	3,250	3,280	3,490	3,460	4,890	3,660	3,420	3,520	3,340
Min.	0	0	0	0	0	328	394	166	444	235	330	198
10% Exceed.	1,620	1,440	1,870	2,190	2,668	3,240	3,321	3,350	3,330	3,315	3,055	2,600
90% Exceed.	348	227	339	244	342	989	1,560	1,725	1,370	1,255	1,040	728

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mammoth Pool Powerhouse near Big Creek (11235100) Period of record: 10/1/1980 to 9/30/2007 missing water year 1984												
Mean	355	310	391	573	776	1,297	1,737	1,852	1,678	1,286	917	631
Median	288	236	247	411	602	1,135	1,920	2,070	1,935	1,030	752	496
Max.	2,080	1,590	2,510	2,510	2,550	2,650	2,580	2,660	2,630	2,600	2,500	2,090
Min.	0	0	0	0	0	0	49	0	27	0	8	0
10% Exceed.	754	726	971	1,190	2,026	2,340	2,450	2,490	2,470	2,440	1,855	1,401
90% Exceed.	26	0	11	38	43	498	900	1,000	655	514	365	74
Big Creek Powerhouse 1 at Big Creek (11238100) Period of record: 10/1/1980 to 9/30/2007 missing water year 1984												
Mean	306	258	292	287	273	339	406	489	503	518	473	418
Median	310	218	270	230	226	323	421	559	575	565	510	447
Max.	617	594	605	736	723	722	756	797	731	728	736	711
Min.	0	0	0	0	0	0	0	3	1	101	9	9
10% Exceed.	578	569	573	580	575	599	690	696	695	687	620	587
90% Exceed.	52	2	79	35	3	40	126	228	275	323	259	178

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Big Creek Powerhouse 2 near Big Creek (11238380) Period of record: 10/1/1980 to 9/30/2007 missing water years 1984 and 1995												
Mean	311	281	312	286	266	335	383	455	462	485	454	409
Median	314	254	282	222	210	317	386	490	529	531	487	429
Max.	639	636	653	666	639	621	621	650	638	655	696	727
Min.	0	0	0	0	0	0	0	10	0	99	10	0
10% Exceed.	602	600	602	606	601	606	605	608	610	607	605	605
90% Exceed.	42	63	94	36	12	66	127	228	271	315	250	175

Note: The period of record indicated in this table was the time period used to develop the table, not the complete period of record at a specific gage.

Because daily data were used to develop this table, the minimum and maximum values shown are the daily minimum and maximum values within each month for the stated period of record, not the minimum and maximum monthly values.

Figure 3-3 shows water levels within Shaver Lake for water years 1981 to 2007. Due to snowmelt runoff in the spring and early summer and the rate of inflow from the Eastwood powerhouse, Shaver Lake normally reaches its maximum water levels in July, and its lowest levels are normally in the winter and early spring. Under the existing license, SCE maintains a minimum reservoir elevation of 5,268.73 feet msl from September 1 to June 15. During the remainder of the year, the existing license specifies a reservoir level dependent on the April 1 forecast for the natural runoff of the San Joaquin River at Friant dam from April through July as shown in table 3-5. Historically, from June 15 through September 1, the decrease in the reservoir level is less than about 0.25 foot per day.

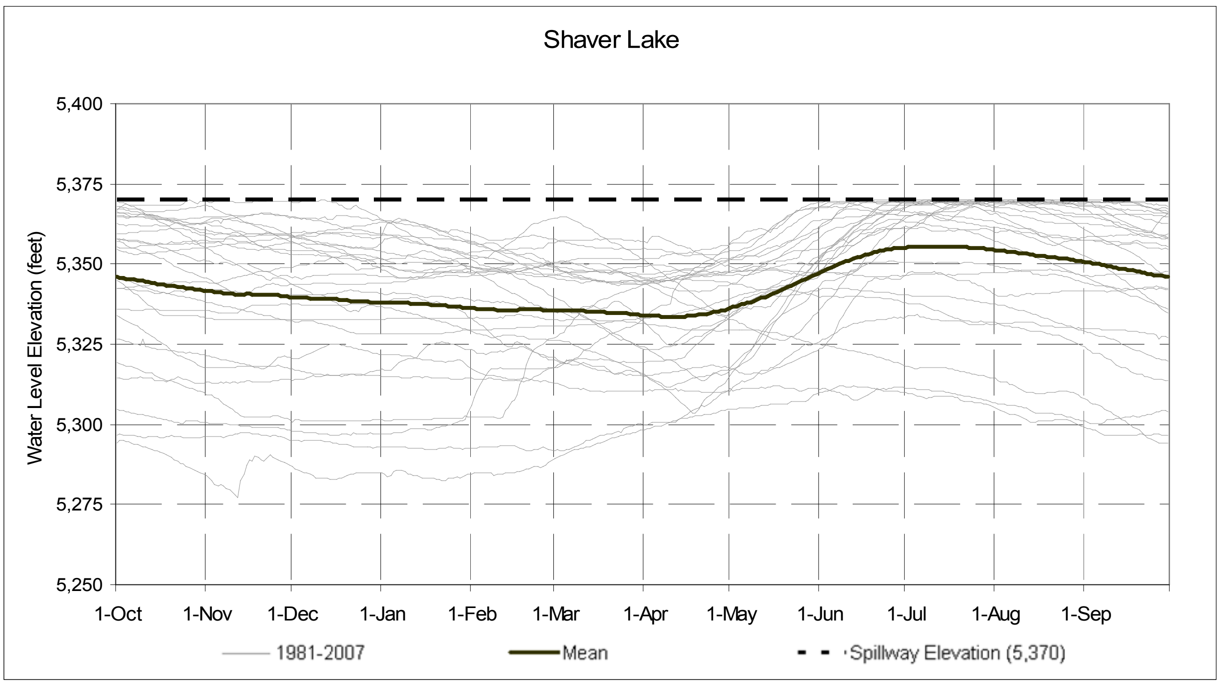

Figure 3-3. Shaver Lake reservoir water levels 1981 to 2007. (SCE, 2007a; USGS, 2008)

Table 3-5. Shaver Lake minimum reservoir elevations under the existing license from June 15 through September 1. (Source: FERC, 1978)

Forecast Runoff (acre-feet)	Minimum reservoir elevation (feet)
Above 900,000	5,348.56
700,000 to 900,000	5,330.37
550,000 to 700,000	5,306.97
Less than 550,000	5,268.73

Huntington Lake – Huntington Lake is on Big Creek about 10 miles upstream from its confluence with the San Joaquin River. Huntington Lake receives most of its inflow from the Portal powerhouse and Big Creek. Water is diverted to Powerhouse 1 via Tunnel 1 (capacity 690 cfs), and to Shaver Lake via Balsam Meadows forebay. Minimum flow releases to Big Creek are measured about 1 mile downstream of Huntington Lake dam at USGS gage no. 11237000 Big Creek below Huntington Lake. The existing release requirement is 2 cfs (see tables 3-1 and 3-2) from late April to mid December and 0 the rest of the year for both normal and dry water year types. Table 3-3 shows historical flows at this gage. Figure 3-4 shows water levels within Huntington Lake for water years 1981 to 2007. Due to snowmelt runoff and inflow from Portal powerhouse, Huntington Lake normally reaches its maximum elevation by the end of June (figure 3-4) and is held at near its spillway elevation of 6,950 feet msl until slightly after Labor Day for recreational use. Water levels then normally drop to an annual low by April 1. Under the existing license, SCE is required to make every reasonable effort to maintain the water surface of Huntington Lake as high as possible and with as little fluctuation as possible during May 1 to September 10. Historically, other than the refill of the reservoir in May and June, as figure 3-4 shows, the water levels remain stable from July through early September.

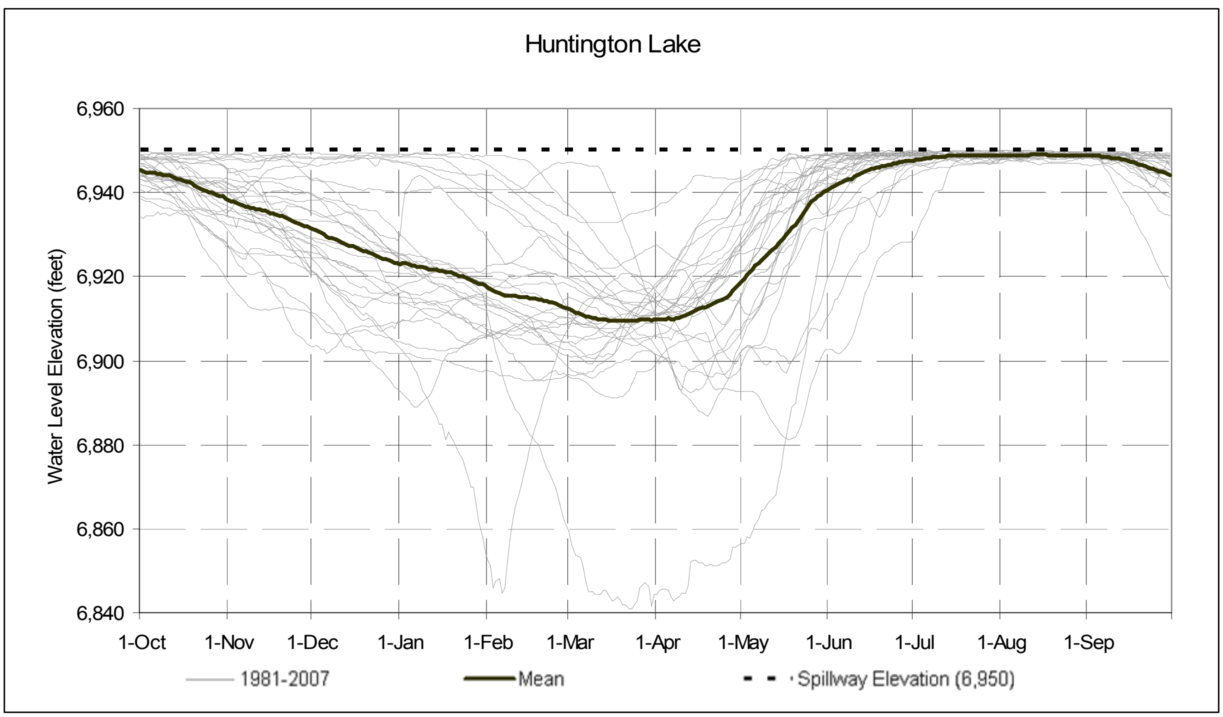

Figure 3-4. Huntington Lake reservoir water levels 1981 to 2007. (Source: SCE, 2007a; USGS, 2008)

Balsam Meadows Forebay – Balsam Meadows forebay is a small reservoir with a usable storage capacity of 1,570 acre-feet on Balsam Creek, 2.75 miles upstream from its confluence with Big Creek. This reservoir receives diverted flows from Huntington Lake and Pitman Creek with the water then diverted via a tunnel (capacity 1,500 cfs) to the Eastwood powerhouse. However, to add to generation capacity during peak demand periods, water is pumped via the Eastwood powerhouse to Balsam Meadows forebay during low electric demand periods and then released back to Eastwood powerhouse during higher electric demand periods. Minimum flow releases downstream of Balsam Meadows forebay are measured about 80 feet below at the dam at USGS gage no. 11238270 on Upper Balsam Creek below Balsam Meadows forebay and are 0.5 to 1.0 cfs during normal and dry water year types (see tables 3-1 and 3-2). Table 3-3 shows historical flows at this gage.

Mammoth Pool Reservoir – Mammoth Pool reservoir is located on the San Joaquin River about 10 miles downstream of the confluence of the South and Middle Forks of the San Joaquin River. A large portion of the watershed at Mammoth Pool reservoir is from the undeveloped Middle Fork of the San Joaquin River. Jackass and Chiquito creeks flow directly into the Mammoth Pool reservoir area. During normal operations, the majority of the flow from the reservoir is diverted via the Mammoth tunnel (capacity 2,100 cfs) to the Mammoth Pool powerhouse. Additional flows are released via the fishwater turbine at the base of the dam and by a Howell-Bunger valve with a capacity of 1,800 cfs. The minimum flow releases are measured about 1 mile below Mammoth Pool dam at USGS gage no. 11234760 San Joaquin River upstream of Shakeflat Creek. The existing MIF (see tables 3-1 and 3-2) ranges between 10 and 30 cfs for this location depending on the water year type and month. Table 3-3 shows historical flows at this gage.

Mammoth Pool reservoir typically fills during April and May (figure 3-5) and reaches its maximum water level by early June. Afterwards the water level normally decreases to its lowest level by November 1 where it generally remains until early April. However, with the lower elevation than the other main storage reservoirs, fluctuations during the winter months are much more common in Mammoth Pool reservoir due to inflow from rain events or melting snow at lower elevations. Due to the large drainage area and lack of storage facilities on a substantial portion of its watershed, Mammoth Pool reservoir spills more often than the other project reservoirs. In most cases, spill at Mammoth Pool dam also results in spill downstream of Dam 6 and Redinger reservoir. SCE attempts to have the minimum storage at Mammoth Pool reservoir occur just prior to the beginning of spring runoff to maximize storage space availability. After the threat of spill has passed, storage at Mammoth Pool reservoir and other reservoirs within the Big Creek System declines at a rate necessary to ensure compliance with the September 30th storage requirement in the Mammoth Pool Operating Agreement (table 3-6). SCE states that it also considers flood control issues when determining the optimal storage level at Mammoth Pool reservoir during the winter months. The existing license requires SCE to make every effort to maintain the water surface elevation at the maximum level and with a minimum amount of fluctuation from June 1 to September 1. According to historical records, the average decrease in water levels during the last half of the summer is between 1 and 1.5 feet per day.

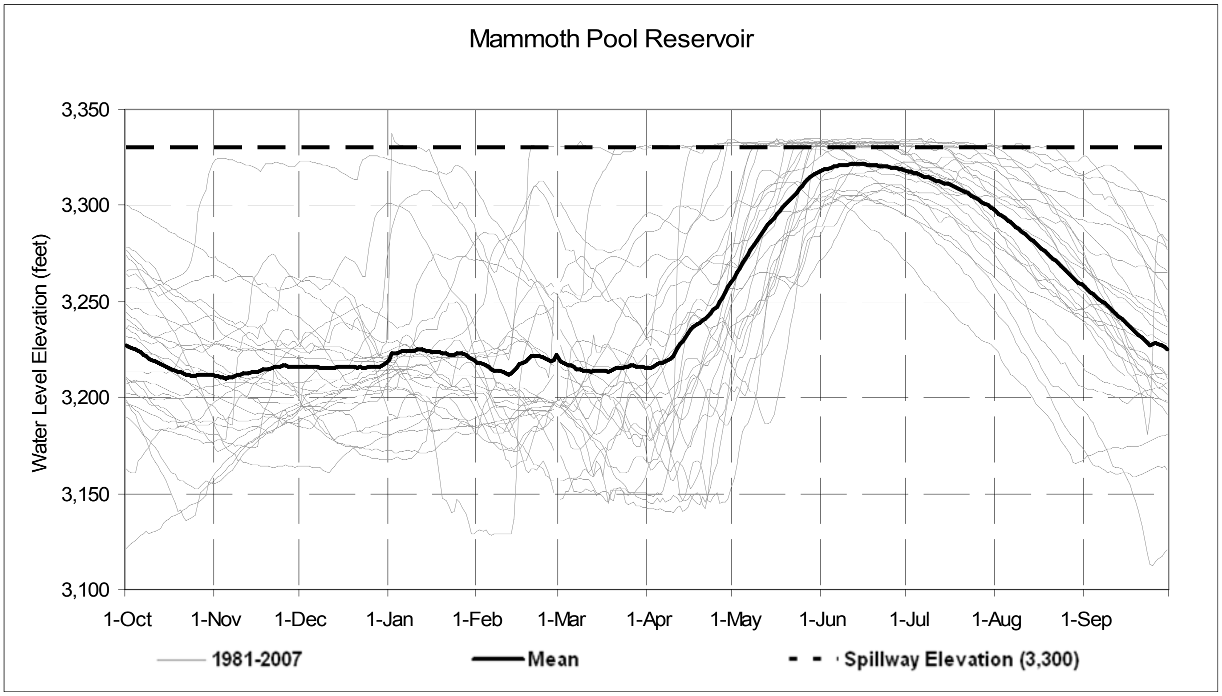

Figure 3-5. Mammoth Pool reservoir water levels 1981 to 2007. (Source: SCE, 2005; USGS, 2008)

Table 3-6. Mammoth Pool Operating Agreement summary September 30 storage constraints and minimum flow constraints. (Source: SCE, 2005)

Computed Natural Runoff at Friant dam (acre-feet)	**Oct 1 Beginning Storage (acre-feet)**	**September 30 Maximum Allowable Year-ending Storage (acre-feet)[a]**	**Minimum Allowable Flow Past Dam 7 (acre-feet)[a]**
A-J = April to June FWY = Full Water Year			
A-J < 650,000	(1st year)	< 152,500	-
A-J < 650,000	(2nd sequential year)	Not to exceed beginning storage	-
A-J > 650,000 FWY < 1,200,000	>202,500 & <325,000	Equal as nearly as possible to beginning storage	-
A-J > 650,000 FWY <	>325,000	Not more than	-

Computed Natural Runoff at Friant dam (acre-feet)	Oct 1 Beginning Storage (acre-feet)	September 30 Maximum Allowable Year-ending Storage (acre-feet)[a]	Minimum Allowable Flow Past Dam 7 (acre-feet)[a]
1,200,000		beginning storage and not less than 325,000	
A-J > 650,000 FWY < 1,200,000	<202,500	Not more than beginning storage (plus amount computed A-J runoff at Friant exceeds 750,000) but not to exceed 202,500	-
FWY > 1,200,000 FWY < 1,600,000	>202,500	Not less than beginning storage plus amount of FWY computed run-off at Friant less 1,200,000	> 615,000 Jun 1 - Sep 30 > 450,000 Jul 1 - Sep 30 (shall be reduced if necessary to meet storage criteria)
FWY > 1,200,000 FWY < 1,600,000	< 202,500	Not less than 202,500 but may exceed beginning storage by up to 50,000 but total cannot exceed 325,000	> 615,000 Jun 1 - Sep 30 > 450,000 Jul 1 - Sep 30 (shall be reduced if necessary to meet storage criteria)
FWY > 1,600,000		>350,000	> 465,000 Jul 1 - Sep 30 (shall be reduced if necessary to meet storage criteria)

[a] The storage volumes listed in columns two and three are for Mammoth Pool and the other reservoirs within the Big Creek System upstream of Friant dam.

Bypassed Reaches

In this section we describe flow in reaches affected by project operations, in the following order: (1) the South Fork San Joaquin River and its tributaries; (2) the San Joaquin River and its tributaries with the exception of Big Creek; and (3) Big Creek and its tributaries.

South Fork San Joaquin River – The South Fork San Joaquin River bypassed reach extends about 28 miles from Florence Lake dam to its confluence with the middle fork of the San Joaquin River, with elevations ranging from 7,218 to 3,721 feet msl (see figure 3-1). The north side of the upper part of this reach receives inflow from four small tributaries: Tombstone, North Slide, South Slide, and Hooper creeks. There are small diversions that lead to Florence Lake on each of these creeks, but none are currently in operation except the Hooper Creek diversion which has a capacity of 85 cfs. The diversions are at elevations greater than 7,500 feet msl, and the creeks are generally very steep with a combination of boulder and bedrock channels. The MIFs for Hooper Creek downstream of the diversion dam (see tables 3-1 and 3-2) are measured about 300 feet below the diversion dam at USGS gage no. 11230200, and table 3-7 provides a summary of the historical monthly flow regime. Hooper Creek enters the South Fork San Joaquin River upstream of USGS gage no. 11230215 located about 3.5 miles downstream of Florence Lake. The MIFs for North Slide and South Slide creeks are shown in tables 3-1 and 3-2. Stream gages on North Slide and South Slide creeks have been inactive for more than 25 years.

The south side of the Upper South Fork San Joaquin River bypassed reach receives inflow from these small high elevation tributaries: Crater, Camp 61, Camp 62, Chinquapin, and Bolsillo creeks (see figure 3-1). The Crater Creek diversion channel (capacity 80 cfs) carries flows to Florence Lake, and Chinquapin, Camp 62, and Bolsillo creeks are diverted (each diversion has a capacity of 30 cfs) directly into the Ward Tunnel. The Camp 61 Creek diversion dam (part of SCE's Portal Project) also diverts up to approximately 84 cfs to the Ward Tunnel which goes to Portal powerhouse. There are no MIF requirements in Crater or Camp 61 creeks in the current license, but seepage from the diversion provides flow to the creek when the diversion is in operation. The MIFs for Chinquapin, Camp 62, and Bolsillo creeks downstream of their diversion dams are shown in tables 3-1 and 3-2. A summary of the historical monthly flow regimes downstream of these three diversions is provided in table 3-7. Chinquapin Creek enters Camp 62 Creek about 1 mile upstream from its confluence with the South Fork San Joaquin River, which is 7.7 miles downstream of Florence Lake. Bolsillo Creek enters the South Fork San Joaquin River about 8.3 miles downstream of Florence Lake.

Table 3-7. Monthly discharge (cfs) statistics for gaging stations downstream of diversion structures. (Source: USGS, 2008; SCE, 2007a, 01CAWG-06)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Bear Creek below diversion (11230530) Period of Record: 10/1/1983 to 9/30/2002. Drainage area 52.8 square miles.												
Mean	2.8	2.4	2.6	5	3.2	5.3	9.3	31.4	119.8	91.4	11	3.7
Median	2.1	2.1	2.1	2.2	2.2	2.3	2.4	3.2	3.2	3	3	3
Max.	88	19	36	603	24	122	228	923	1,250	1,420	490	37
Min.	0.9	1	1	1.1	1.1	1.2	1.2	2.2	2.2	2.1	2.1	2.1
10% Exceed.	5	3.1	3.3	4	4.4	4.8	4.8	86	537	493	4.5	4.5
90% Exceed.	1.4	1.3	1.3	1.4	1.4	1.5	1.5	2.4	2.4	2.3	2.3	2.3
Mono Creek below diversion (11231600) Period of Record: 10/1/1983 to 9/30/2002. Drainage area 92.8 square miles.												
Mean	10.3	9.4	9.1	8.5	8.7	8.3	9.2	12.9	36.9	65.8	20.6	12.9
Median	9.5	7.7	7.7	7.7	7.7	7.4	8.1	13.0	13.0	14.0	13.0	13.0
Max.	68.0	56.0	45.0	26.0	26.0	25.0	115	62.0	604	1,300	1,070	46.0
Min.	6.0	5.2	4.1	4.4	5.4	2.6	5.4	7.9	9.1	8.8	8.9	8.1
10% Exceed.	14.0	13.0	13.0	13.0	12.0	12.0	14.0	15.0	24.0	113.0	16.0	16.0
90% Exceed.	6.7	5.7	5.6	5.7	5.8	5.7	5.8	9.5	9.9	9.9	9.8	9.6

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Pitman Creek near Tamarack Mountain below diversion (11237700) Period of Record: 10/1/1986 to 9/30/2002. Drainage area 23.0 square miles.												
Mean	0.7	1.3	1.5	1.6	2.9	5.1	17.6	33.7	44.1	14.1	1.0	0.7
Median	0.6	0.9	0.9	1.1	1.2	1.6	1.7	1.7	1.3	1.1	0.5	0.4
Max.	4.5	56.0	205	40.0	418	100	297	762	746	384	18.0	5.1
Min.	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.1
10% Exceed.	1.5	2.0	1.8	2.5	3.4	13.0	75.0	143	137	17.0	1.7	1.5
90% Exceed.	0.2	0.3	0.3	0.3	0.1	0.1	0.2	0.8	0.6	0.6	0.2	0.1
Big Creek near Mouth near Big Creek (11238500) Period of Record: 10/1/1982 to 9/30/2002. Drainage area 131 square miles.												
Mean	9.0	41.3	57.9	54.9	25.6	41.2	11.7	34.0	58.7	26.0	5.4	5.2
Median	3.5	3.3	2.6	3.6	3.0	4.2	4.3	4.8	3.9	3.9	3.9	3.6
Max.	516	800	871	3540	972	1,430	578	1,030	999	886	222	298
Min.	2.3	1.3	1.0	1.2	1.4	1.3	2.0	2.1	2.1	2.1	2.1	2.2
10% Exceed.	5.7	13.0	6.6	8.5	12.0	35.0	15.0	78.0	106.0	26.0	6.3	6.1
90% Exceed.	2.5	1.9	1.5	1.6	1.7	1.7	2.3	2.5	2.5	2.4	2.4	2.4

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Camp 62 Creek below diversion (11230600) Period of Record: 10/1/1983 to 7/15/2002. Drainage area 1.97 square miles.												
Mean	0.6	0.6	1	0.9	0.8	0.8	0.9	1.8	0.9	0.4	0.4	0.3
Median	0.4	0.3	1	0.8	0.8	0.8	0.5	0.5	0.5	0.4	0.4	0.3
Max.	2.7	2	1	1	0.8	1	8.1	27	18	1	0.6	0.5
Min.	0.1	0.2	1	0.8	0.8	0.5	0	0	0	0	0	0
10% Exceed.	1.5	1.5	1	1	0.8	1	2	3.7	0.9	0.6	0.6	0.5
90% Exceed.	0.3	0.2	1	0.8	0.8	0.5	0.2	0.3	0.4	0.2	0.1	0
Chinquapin Creek below diversion (11230560) Period of Record: 5/12/1986 to 6/26/2002. Drainage area 1.65 square miles.												
Mean	0	0	0	0	0	0.7	1.2	3.3	3.7	1.9	0.9	0.4
Median	0	0	0	0	0	0	0.7	1.3	1.3	1.2	1.1	0.4
Max.	0	0	0	0	0	0.8	13	40	34	8	1.5	1
Min.	0	0	0	0	0	0	0.2	0.9	0.7	0.3	0.5	0
10% Exceed.	0	0	0	0	0	0	1.4	4.3	12	3	1.2	0.6
90% Exceed.	0	0	0	0	0	0	0.6	1.1	1.2	1	0.5	0.1
Bolsillo Creek below diversion (11230670) Period of Record: 10/1/1985 to 9/30/2002. Drainage area 1.4 square miles.												
Mean	0.2	0.2	0.2	2.2	0.9	1.2	1.1	2.4	2.7	2.1	0.5	0.3
Median	0.2	0.2	0.2	0.9	0.7	1.1	0.3	0.6	0.6	0.5	0.5	0.3

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Max.	0.3	0.5	0.4	27.0	4.9	4.8	8.4	16.0	15.0	14.0	0.6	0.6
Min.	0.1	0.2	0.2	0.1	0.1	0.3	0.2	0.4	0.3	0.4	0.3	0.1
10% Exceed.	0.2	0.2	0.3	4.3	1.3	2.2	2.8	9.6	10.0	8.7	0.6	0.6
90% Exceed.	0.1	0.2	0.2	0.1	0.1	0.4	0.5	0.5	0.5	0.4	0.3	0.1
Hooper Creek below diversion (11230200) Period of record: 10/1/1986 to 9/30/2002. Drainage area 7.22 square miles.												
Mean	2.7	2.6	2.4	2.8	2.6	3.7	6.6	10.7	13	12.3	4.7	2.8
Median	2.5	2.5	2.1	2.2	2.3	3	4.6	3.6	4	4	3.2	2.4
Max.	6.2	5	8.4	43	7.7	15	52	86	110	112	57	11
Min.	1.3	1.4	1.4	1.4	1.4	1.5	1.2	2.1	1.6	2.2	1.9	1.7
10% Exceed.	4.5	3.7	3.3	3.3	4.2	6.5	12	27	42	46	5.3	4
90% Exceed.	1.7	1.8	1.7	1.6	1.6	2.1	2.7	2.5	2.5	2.6	2.4	1.9
North Fork Stevenson Creek near Perimeter Road (11239300) Period of Record: 1/25/1989 to 9/30/2002. Drainage area 4.42 square miles.												
Mean	5.7	7.4	6.8	11.7	10.8	15.1	26.7	28.7	24.9	9.0	6.1	5.8
Median	4.8	4.7	5.2	5.9	7.2	9.6	16.0	16.0	7.3	5.9	5.4	5.3
Max.	167	87.0	45.0	836	107	151	209	1,750	1,300	603	79.0	57.0
Min.	1.9	2.1	3.5	3.5	1.6	2.6	6.0	4.3	4.0	3.7	3.8	3.8
10%	7.2	8.9	10.0	15.0	14.0	28.0	45.0	51.0	54.0	12.0	7.7	7.3

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Exceed.												
90% Exceed.	3.8	3.8	4.2	4.5	4.8	6.1	9.3	6.0	4.9	4.2	4.1	4.1
San Joaquin River above Stevenson Creek (11238600) Period of Record: 10/1/1982 to 9/30/2002. Drainage area 1,197 square miles.												
Mean	5.9	5.9	39.4	509.5	379.4	398.8	299.7	1,503.2	2,593.7	884.0	136.2	4.5
Median	3.5	3.5	3.5	3.5	3.5	4.1	4.3	211.0	531.0	3.5	3.5	3.5
Max.	60.0	598	4,400	32,000	5,570	12,000	3,620	20,500	16,000	13,300	4,320	109
Min.	3.0	3.1	3.0	3.1	3.0	3.1	3.1	3.2	3.3	3.2	3.3	3.1
10% Exceed.	4.6	4.3	7.3	402	1,510	1,470	870	4,330	9,310	3,350	89.0	4.1
90% Exceed.	3.3	3.2	3.2	3.3	3.3	3.3	3.4	3.4	3.4	3.3	3.3	3.3

Notes: The period of record indicated in this table was the time period used to develop the table, not the complete period of record at a specific gage.

Because daily data were used to develop this table, the minimum and maximum values shown are the minimum and maximum daily values within each month for the stated period of record, not the minimum and maximum monthly values.

During some winter months, data for gaging stations on Camp 62 Creek (11230600), Bolsillo Creek (11230670), and Chinquapin Creek below the diversion dam (11230560) were based on data synthesized for the SCE license application, since the diversions and gages were not always in operation.

Bear Creek is part of a large watershed located on the northeast side of the South Fork San Joaquin River between Florence Lake and Lake Edison (part of the Vermilion Valley Project). Bear Creek diversion (capacity 450 cfs) is located 1.6 miles upstream of the confluence with the South Fork San Joaquin River. The Mono diversion (capacity 450 cfs) is located 5.9 miles upstream of the confluence of Mono Creek with the South Fork San Joaquin River (see figure 3-1). The MIFs for Bear and Mono creeks downstream of their diversion dams are shown in tables 3-1 and 3-2. A summary of the historical monthly flow regimes downstream of these diversions as recorded at USGS gage no. 11230530 Bear Creek below diversion and USGS gage no. 11231600 Mono Creek below diversion are is provided in table 3-7. Both of these stream gages are located 60 feet or less downstream of the diversion dams. Water diverted from the Bear and Mono Creek diversions is routed through the Bear-Mono conduit to the Ward Tunnel to the Portal powerhouse and then Huntington Lake.

San Joaquin River – The San Joaquin River Mammoth reach extends 8.4 miles from Mammoth Pool dam downstream to Mammoth Pool powerhouse at the head of the Dam 6 impoundment (see figure 3-1). The MIF for this reach is measured at USGS gage no. 11234760 which is about 0.5 mile downstream of Mammoth Pool dam (see tables 3-1 and 3-2). Table 3-3 shows a summary of the historical monthly flow regimes downstream this diversion.

Rock Creek enters the San Joaquin River thereabout 3 miles downstream from Mammoth Pool dam. The Rock Creek bypassed reach extends about 0.4 mile from the Rock Creek diversion to the creek's confluence with the San Joaquin River. Ross Creek enters the San Joaquin River about 7 miles downstream of Mammoth Pool dam. The bypassed reach extends about 0.85 mile from the Ross Creek diversion to its confluence with the San Joaquin River. Neither the Rock nor Ross Creek bypassed reaches are currently gaged or have MIFs.

Dam 6 impounds the Powerhouse 3 forebay, which inundates the confluence of Big Creek with the San Joaquin River (see figure 3-1). In addition to flows from the San Joaquin River and Big Creek, the forebay receives outflows from Powerhouse 8 and the Mammoth Pool powerhouse. Flow is then diverted through Tunnel 3 (capacity 2,431 cfs) to Powerhouse 3 at the upper end of Redinger reservoir. Flow from Redinger reservoir is diverted to Powerhouse 4 (part of Big Creek No. 4 Project).

The Stevenson reach of the San Joaquin River extends 5.7 miles from Dam 6 downstream to Powerhouse 3 at the upper end of Redinger reservoir (see figure 3-1). Stevenson Creek enters the bypassed reach 3.45 miles downstream of Dam 6 and below USGS gage no. 11238600 which measures the MIF downstream of Dam 6 (tables 3-1 and 3-2). Table 3-7 summarizes the historical monthly flow regime for this gage.

The natural flow in the North Fork Stevenson Creek bypassed reach is augmented by instream flow releases from Tunnel 7 at river mile 3.55. Prior to construction of the Eastwood powerhouse, this reach was used to transport water to Shaver Lake. The MIFs for this reach are shown in tables 3-1 and 3-2. The MIF for North Fork Stevenson Creek is measured at USGS gage no. 11239300. Table 3-7 shows a summary of the historical monthly flow regime for this gage.

The Stevenson Creek bypassed reach extends 4.3 miles downstream from Shaver dam to the confluence with the San Joaquin River (see figure 3-1). Flow at Shaver Lake is diverted to Powerhouse 2A. The MIF for the Stevenson Creek bypassed reach is measured at USGS gage no. 11241500 (see tables 3-1 and 3-2). Table 3-3 summarizes the historical monthly flow regime for this gage.

Big Creek – The Upper Big Creek bypassed reach extends 3.6 miles from Huntington Lake to Dam 4. The MIF for the reach downstream of Huntington Lake is measured at USGS gage no. 11237000 (see tables 3-1 and 3-2). Table 3-3 shows a summary of the historical monthly flow regime for this gage. Dam 4 forms a small 3.2-acre impoundment at the downstream end of the bypassed reach, and the impoundment also receives inflow from Upper Big Creek, Powerhouse 1, and Pitman Creek. Water in the impoundment is diverted through Tunnel 2 (capacity 600 cfs) to Powerhouse 2, upstream of Dam 5 on Big Creek. Additional flow is diverted into Tunnel 2 from Balsam and Ely creeks.

The Middle Big Creek bypassed reach extends 4.3 miles from Dam 4 downstream to Powerhouses 2 and 2A, both of which discharge into the 3.3-acre (surface area) Dam 5 forebay on Big Creek. There is no MIF requirement from Dam 4 in the current license, and it is not currently gaged. Dam 5 serves as the forebay for the tunnel diversion (capacity 600 cfs) to Powerhouse 8.

The Lower Big Creek bypassed reach extends from Dam 5, 1.65 miles to the Big Creek confluence with the San Joaquin River (see figure 3-1) at an impoundment created by Dam 6. Powerhouse 8 also discharges into the Dam 6 impoundment. The current MIF requirements downstream of Dam 5 are shown in tables 3-1 and 3-2. USGS gage no. 1238500 Big Creek near mouth (historical data shown in table 3-7) is located 0.6 mile upstream of the confluence and about 1 mile downstream of Dam 5.

The diversion (capacity 800 cfs) on Pitman Creek is located about 1.5 miles upstream of the stream's confluence with Big Creek (see figure 3-1). Flow is diverted through Tunnel 7 (capacity 1,480 cfs), which conveys water from Huntington Lake to Balsam forebay and North Fork Stevenson Creek. The MIFs for this reach are measured at USGS gage no. 11237700 (see tables 3-1 and 3-2). Table 3-7 shows a summary of the historical monthly flow regime for this gage.

The very small natural flow in Upper Balsam Creek is augmented by releases from the Balsam Meadows forebay, which is located 2.75 miles upstream of the confluence with Big Creek. Balsam Creek enters Big Creek 1 mile downstream of Dam 4. The bypassed reach, or Lower Balsam Creek, extends 0.74 mile from the Balsam Creek diversion downstream to the confluence with Big Creek. Water diverted from Balsam Creek is conveyed through Tunnel 2 to Powerhouse 2 on Big Creek at the impoundment behind Dam 5. There are no MIFs or gages on Lower Balsam Creek.

Ely Creek flows into Big Creek about 2.6 miles downstream of Dam 4. The Ely Creek diversion (capacity 9 cfs) is located less than 1 mile upstream of the confluence with Big Creek. Diverted water is conveyed to Tunnel 2, which it enters through Adit 6. Flows are intermittent upstream of the diversion. There is no MIF release requirement below the diversion in the current license, and no gages downstream of this diversion.

SCE has a diversion on Adit 8 Creek that can be used to transfer water from Tunnel 5 to Tunnel 2 in the event of an outage at Powerhouse 2A, but this diversion has not been used since about 1980.

Water Use

Water rights in the state of California are administered by the Water Board. Each of the four Big Creek ALP Projects either has a separate water right or shares one or more water rights with the other hydroelectric projects for the diversion, use, and storage of water. The vast majority of the water rights are for nonconsumptive uses associated with power generation. To protect the rights of downstream water rights holders, SCE entered into agreements that restrict the use of water within the area of the four Big Creek ALP Projects to non-consumptive purposes, i.e., hydroelectric generation. Certain agreements limit the length of time and amount of water that SCE can store in its project reservoirs. A few locations, such as SCE's administrative offices and company housing near Powerhouse 1, have minor consumptive water rights. SCE does not hold water rights for the consumptive use of water by any party other than SCE, nor does SCE sell any water rights associated with the Big Creek ALP Projects to others. SCE states that certain water rights were acquired under state law, prior to the formation of the Water Board's predecessor in 1914, which are not documented by licenses or permits. Additional water rights were obtained through appropriation of water prior to the implementation of the Water Commission Act of 1914, and by prescriptive use against other parties. SCE also holds other water rights as a riparian land owner, which authorizes it to divert and use water on its own land.

Water Quality

This section describes the water quality in the vicinity of the Big Creek ALP Projects. Project surface waters are naturally low in mineral and nutrient content, which is characteristic of regions composed of granitic bedrock with shallow infertile granitic soils of the western Sierra Nevada. The waters tend to be clear, with high water quality.

Project reservoirs are oligotrophic (limited primary productivity) due to their size and depth, and the relatively infertile granitic soils of their drainage area. Reservoir stratification is generally weak to moderate with temperatures ranging from 6 to 25ºC, depending on water depth and season.

SCE conducted water quality studies in 2002 to characterize the physical and chemical properties of water upstream, within, and downstream of project reservoirs, forebays, and diversions. The study included a review of existing data, in situ water quality measurements, and field collection and laboratory analysis of water quality samples. The water quality sampling and laboratory analysis portion of the study included three programs: spring (runoff flow) and fall (baseflow) stream sampling, fecal coliform sampling, and reservoir/forebay sampling.

Spring Runoff and Fall Baseflow Stream Sampling Program

Water quality sampling was conducted during spring, summer, and fall of 2002 to assess water quality in project area streams during the snowmelt runoff period and baseflow period. Spring sampling was conducted at 78 stream locations from May 20 to June 14, 2002. Three locations, Tombstone diversion channel (dry), Ross Creek upstream of the San Joaquin River confluence (dry), and the South Fork San Joaquin River upstream of the confluence of the San Joaquin River (inaccessible due to high flows), were not sampled.

Fall sampling was conducted at 78 stream locations from June 12 through September 6, 2002. Three locations, Tombstone diversion channel, Ross Creek upstream of the San Joaquin River confluence, and Ely Creek downstream of the diversion, were dry and could not be sampled. Forty of the 78 sampling stations that were located on 13 small tributary streams with small diversions were sampled during mid-summer in order to obtain data prior to the end of their diversion periods. Water quality sampling stations were established at locations upstream and downstream of the diversion structures. The remaining 38 stream stations were sampled during late summer/early fall.

Water quality conditions at each surface water sampling location were evaluated by collecting in-situ measurements of temperature, pH, dissolved oxygen (DO), turbidity, and specific conductance. Samples were submitted for laboratory analysis of 34 chemical and/or physical constituents. Several parameters/constituents could not be evaluated due to analytical laboratory detection limits that were too high to allow comparison to the regulatory standard. Laboratory analysis indicated that some samples did not meet California Central Valley Region Water Quality Control Board Basin Plan (Basin Plan) (CVRWQCB, 1998) objectives for some parameters (SCE, 2003h).

The laboratory results indicate that the concentrations of mercury, copper, lead, silver, and zinc in all of the water samples are below the Basin Plan objectives [(copper (1 milligram per liter [mg/L]), lead (15 micrograms per liter [μg/L]), mercury (2 μg/L), silver (100 μg/L), and zinc (5 mg/L)]. However, the California Toxics Rule (CTR) and National Toxics Rule (NTR) have established more stringent criteria for these metals to protect freshwater aquatic life. The CTR and NTR set acute and chronic criteria that are hardness-dependent[14] and must be calculated on a station-by-station basis. Due to the naturally low hardness of water in the project area (hardness as $CaCo_3$ concentrations were 2.2 to 25 mg/L), the calculated standards for the five metals were extremely low and were below the laboratory detection limits for reporting (SCE, 2003h).

[14] The water quality criterion decreases with decreasing water hardness.

To allow comparison to the regulatory standard, SCE requested that the laboratory review the raw data files and report concentrations down to the minimum detection limits, which would be low enough to enable a comparison to the CTR and NTR standards. The laboratory reports these results as J-qualified trace values, which are considered estimated values. These estimated values exceeded the hardness-based CTR and NTR criteria for these metals in some instances both upstream and downstream of project facilities. Estimated lead concentrations exceeded hardness-based criteria in five samples, silver exceeded hardness-based criteria in two samples, and zinc exceeded hardness-based criteria in one sample. SCE reported that the source of lead and silver contamination is not known, but these low concentrations do not adversely influence water quality and neither of these contaminants are project-related.

Estimated concentrations (J-qualified trace values) of mercury exceeded hardness-based criteria at a majority of the study sites in the project area, including locations both upstream and downstream of project facilities. SCE reported that the widespread, low level mercury concentrations found in much of the Upper San Joaquin River Watershed are not project-related and do not adversely influence aquatic resources.

All parameters in project area streams during the spring and fall sampling program met Basin Plan, CTR, and NTR objectives with the exception of pH, DO, ammonia, nitrate/nitrite, arsenic, total iron, and total manganese. Location and timing of exceptions varied with each parameter. Only the water quality results that did not meet water quality criteria are reported below.[15]

Values of pH lower than 6.5 (the Basin Plan objective) were recorded at locations both upstream and downstream of active diversions, indicating that the low pH conditions are generally not project-related. The low pH in streams that flow from the base of reservoirs and forebays appears to reflect the lower pH values observed in the lower water column of these waterbodies.

Three locations had pH values slightly greater than 8.5 (the Basin Plan objective) in the spring, but the high pH values were observed both upstream and downstream of project facilities indicating that they are generally not project-related. Alkalinity, dissolved carbon dioxide reactions, oxidation of dissolved ferrous iron, dissolved organic matter, and acidic snowmelt can influence natural pH values. Alkalinity is usually the primary factor that controls pH values, and surface waters within igneous rock basins typically contain low alkalinity values (low buffering capacity), resulting in more acidic pH values (usually <7.0). The alkalinity of project area surface waters are generally very low and can be quickly modified by acidic water, such as rapidly melting snow that has accumulated acidity from atmospheric sources or organic acids that are produced in coniferous forests (Wetzel, 2001, in SCE, 2003h). The pH values were particularly low

[15] Detailed water quality results are available in SCE, 2003h.

during the spring snowmelt period, suggesting that slight acidity of the runoff may be influencing pH values.

According to the Basin Plan objectives, DO concentrations shall not be reduced below a minimum level of 7.0 mg/L for waters designated as Cold at any time. DO concentrations below the Basin Plan objective were observed at one Ely Creek station in the spring (6.57 mg/L) and at 10 stations in the fall (5.29 to 6.97 mg/L) (SCE, 2003h). DO concentrations below the Basin Plan objective were observed in Ely, Bear, and South Slide creeks upstream of the diversions, and in Ross Creek downstream of the diversion (SCE, 2003h). Ross Creek is an ephemeral stream[16] and has low DO levels upstream of the diversion during the summer months. This is a naturally occurring condition in Ross Creek and is not a project-related effect. DO concentrations below Basin Plan objectives occurred in the South Fork San Joaquin River and Pitman, Stevenson, Mono, and Bear creeks in 2002 (SCE, 2003h).

The Basin Plan does not specify an objective for ammonia (NH_3), but the NTR has set criteria, which must be calculated using ambient pH and temperature specific to each site. During the spring and summer/fall sampling periods, ammonia concentrations were all non-detectable at a detection limit of reporting of 1.0 mg/L (SCE, 2003h, tables CAWG-4-6 and CAWG-4-7). One hundred forty-six of the 153 stream samples had an ammonia criterion greater than 1 mg/L. The remaining seven samples (five spring and two fall samples) had calculated criteria less than 1.0 mg/L. Five of these samples were from natural waters located upstream of any project facilities. It could not be determined if these seven samples met the criteria because the laboratory method detection limit is greater than the calculated criterion.

The Basin Plan nitrate/nitrite (NO_3/NO_2) objective (10 mg/L) is based on a secondary maximum contaminant level derived for the protection of drinking water sources (CCR, 1996, in SCE, 2003h). EPA has recommended a value of 1.0 mg/L for the protection of freshwater aquatic life. The EPA value was not exceeded during the spring and summer/fall sampling periods. All spring concentrations were below the Basin Plan objective (SCE, 2003h, table CAWG-4-6). Two results exceeded the Basin Plan objective during the August sampling period. There is no known project-related source that could contribute nitrates in these stream reaches, and the observed exceedances were not considered project-related.

The Basin Plan specifies an objective for arsenic (10 ug/L) based on a primary maximum contaminant level for drinking water. In the spring 2002, three samples exceeded the arsenic objective. The arsenic objective was exceeded in five samples during the late summer-fall sampling period. Arsenic is a naturally occurring, widely

[16] Ephemeral streams flow only for short-durations in response to seasonal or storm runoff.

distributed metallic element; although the sources of arsenic at these locations are unknown it is unlikely they are project-related.

The Basin Plan specifies an objective for iron of 0.3 mg/L, based on secondary maximum contaminant levels for drinking water. This objective is of aesthetic (taste and staining) rather than toxicological significance and does not pertain to levels that will protect freshwater aquatic organisms. EPA has recommended a value of 1.0 mg/L for the protection of freshwater aquatic life. During the 2002 spring and fall sampling periods, the 0.3 mg/L objective was exceeded at 11 locations (SCE, 2003h). None of the 11 samples exceeded the EPA-recommended iron value for the protection of freshwater aquatic life (1.0 mg/L). Iron occurs in project area rocks and is commonly found in surface water so that at least some of the iron content is attributable to background sources and is not project-related.

The Basin Plan specifies a manganese objective of 0.05 mg/L, based on secondary maximum contaminant levels for drinking water. This objective is of aesthetic (taste and odor) significance rather than toxicological. No aquatic life objective has been developed for manganese. In the spring of 2002, one sample from Ely Creek upstream of the diversion exceeded the drinking water objective, and another single sample from Stevenson Creek downstream of Shaver Lake dam exceeded the objective during the late summer-fall. Manganese occurs in project area rocks and is commonly found in surface water so that at least some of the manganese content is attributable to background sources and is not project-related.

The Basin Plan objective for turbidity is based on increases above the natural turbidity that are attributable to controllable water quality factors.[17] To determine compliance with this objective, comparisons of turbidity measurements downstream of project features were compared to those obtained upstream of project features. Turbidity was above the Basin Plan objective in Hooper Creek downstream of the diversion, in Camp 62 Creek downstream of the diversion, and in Balsam Creek downstream of the forebay. Turbidity exceedances in Camp 62 Creek and Balsam Creek occurred only once and are not considered project-related.

Fish Tissue Sampling for Silver and Mercury

EPA and the Centers for Disease Control both report that silver does not cause toxic effects in humans; and the Basin Plan does not specify an objective for silver in fish tissue. Filets from ten fish (three brown trout and seven rainbow trout) collected from Mammoth Pool reservoir were evaluated for silver content, and no samples had silver concentrations at detectable levels (>0.02 milligrams per kilogram [mg/kg]). Three

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[17] Where natural turbidity is between: 0-5 NTUs (nephelometric turbidity units) increases shall not exceed 1 NTU; 5-50 NTUs increases shall not exceed 20 percent; 50-100 NTUs increases shall not exceed 10 NTUs; and greater than 100 NTUs increases shall not exceed 100 percent.

composite liver samples obtained from two groups of six rainbow trout and one group of three brown trout sampled from Mammoth Pool reservoir had silver concentrations ranging between 0.491 and 2.346 mg/kg. Subsamples sent to a second laboratory for verification had concentrations ranging from 0.047 to 1.99 mg/kg.

The Basin Plan does not specify an objective for methylmercury in fish tissue, but EPA has established a screening level criterion of 0.3 mg/kg. Two out of ten fish sampled and analyzed from Mammoth Pool reservoir contained mercury concentrations in fish filets that exceeded the screening level (one of three brown trout sampled and one of seven rainbow trout sampled). SCE reported that the source of mercury in Mammoth Pool reservoir is not known, but it is likely not project-related. It also reported that the existing mercury levels at Mammoth Pool reservoir do not warrant issuance of a public health advisory (personal communication from B. Brodberg, (California) Office of Environmental Health Hazard Assessment, as cited by SCE, 2007a).

Fecal Coliform Sampling Program

The fecal coliform sampling program consisted of a screening level assessment and a 30-day, five-sample assessment. A threshold of 200/100 milliliters was used as a screening level criterion for all water samples obtained during the stream-sampling program. Any sample that exceeded this value would have been included in the more rigorous 30-day, five-sample program. None of the screening level samples exceeded the 200/100 milliliter threshold and were not incorporated into the more rigorous 30-day, five sample fecal coliform sampling program (SCE, 2003h).

The 30-day, five sample fecal coliform sampling program was conducted at locations that were approved by the Combined Aquatics Working Group during the development of the study plan, including Shaver and Huntington lakes that receive significant amounts of contact recreation. The remaining large reservoirs and moderate-sized impoundments were only sampled monthly. None of the monthly reservoir samples contained concentrations greater than the screening level concentration of 200/100 MPN,[18] and were not added to the more rigorous sampling program (SCE, 2003h).

The 30-day, five-sample fecal coliform sampling was conducted between June 26 and July 24, 2002, in the nearshore areas of Huntington and Shaver lakes and in associated creeks. The Fourth of July period was chosen to characterize fecal coliform concentrations before, during, and after a heavy recreational use period. The results of this study show that both the geometric mean of all values and the highest values obtained from all study locations were well below Basin Plan thresholds (SCE, 2003h).

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[18] MPN is a measurement of the most probable number of bacterial colonies per 100 ml of water.

Monthly Reservoir and Forebay Profile Program

The 2002 monthly reservoir and forebay profile program sampling was conducted at 19 stations in Florence, Huntington, and Shaver lakes, Mammoth Pool reservoir, and Mono, Balsam, Bear, Dam 4, Dam 5, and Dam 6 forebays.[19]

Depth profiles were performed in each reservoir of five in-situ measurements - pH, DO, temperature, specific conductance, and turbidity. Water quality samples were collected at each location for laboratory analysis of 34 chemical and/or biological tests. Six additional analyses were performed on samples collected from reservoirs where motorized craft are allowed, to test for the occurrence of methyl tertiary butyl ether, total petroleum hydrocarbons as gasoline and diesel, benzene, toluene, ethylbenzene, and xylene. Field and laboratory results indicate that pH values and DO, methyl tertiary butyl ether, and total petroleum hydrocarbons-diesel were occasionally detected at values that did not meet Basin Plan objectives (SCE, 2003h). Benzene, toluene, ethylbenzene, and total xylene occasionally were also detected, but at concentrations that did not exceed Basin Plan objectives (SCE, 2003h).

Water Temperature

A number of bypassed stream reaches had occurrences when the mean daily water temperature exceeded the evaluation objective for trout, and/or downstream stream water temperatures increased by more than 2.8 degrees Celsius (°C) and exceeded the evaluation objective for trout (table 3-8). The water temperatures in these bypassed reaches are described later in *Bypassed Reaches*.

[19] The CAWG-4 Chemical Water Quality Study Plan identifies Lake Thomas A. Edison, Redinger reservoir, and Portal forebay as water bodies that have or are currently undergoing the Traditional Licensing Process and are not included in the ALP sampling program.

Table 3-8. Number of days that thermal warming exceeded 2.8°C in bypassed reaches when daily mean temperatures exceeded 18, 19, and 20°C. (Source: SCE, 2007a, as modified by staff)

Downstream Site	2000			Days Temperature Increase is >2.8°C (5°F) and Daily Mean is				2001			Days Temperature Increase is >2.8°C (5°F) and Daily Mean is			
	Days >2.8°C (5°F)	No. Days Monitored	% Days >2.8°C (5°F)	≤15°C and ≤18°C	>18°C and ≤19°C	>19°C and ≤20°C	>20°C	Days >2.8°C (5°F)	No. Days Monitored	% Days >2.8°C (5°F)	≤15°C and ≤18°C	>18°C and ≤19°C	>19°C and ≤20°C	>20°C
Mammoth Pool Project (FERC Project No. 2085)														
SJR Mammoth Pool Reach Downstream of Mammoth Pool Dam	37	46	80%	21	16	0	0	34	133	26%	10	5	7	12
SJR Mammoth Pool Reach Upstream of Rock Creek	33	46	72%	33	0	0	0	21	132	16%	4	6	9	2
SJR Mammoth Pool Reach Upstream of Ross Creek	28	46	61%	25	1	2	0	34	133	26%	1	2	8	23
SJR Mammoth Pool Reach Upstream of Mammoth Pool Powerhouse	22	41	54%	22	0	0	0	33	133	25%	1	3	8	21
Rock Creek Upstream of SJR Confluence	0	138	0%	0	0	0	0	17	103	17%	0	1	0	16
Ross Creek Upstream of SJR Confluence	0	11	0%	0	0	0	0	47	73	64%	8	9	9	21
Big Creek Nos.1 and 2 (FERC Project No. 2175)														
Big Creek Downstream of Dam 1	37	108	34%	37	0	0	0	32	149	21%	32	0	0	0
Big Creek Canyon Site	3	102	3%	3	0	0	0	7	149	5%	7	0	0	0
Big Creek Upstream of Powerhouse 1	1	108	1%	1	0	0	0	21	177	12%	21	0	0	0
Big Creek Downstream of Dam 4	24	101	24%	24	0	0	0	66	177	37%	66	0	0	0
Big Creek Downstream of Dam 4	41	128	32%	41	0	0	0	135	183	74%	134	1	0	0
Big Creek Upstream of Balsam Creek	33	129	26%	29	4	0	0	166	183	91%	87	17	23	39
Big Creek Upstream of Powerhouse 2	80	154	52%	70	8	2	0	171	183	93%	130	24	15	2
Ely Creek Upstream of Big Creek Confluence [a]	1	121	1%	1	0	0	0	0	94	0%	0	0	0	0
Balsam Creek Upstream of Big Creek Confluence [a]	0	127	0%	0	0	0	0	10	183	5%	10	0	0	0
Big Creek Nos. 2A, 8, and Eastwood (FERC Project No. 67)														
SFSJR Downstream of Florence Lake Dam	4	77	5%	4	0	0	0	7	50	14%	7	0	0	0
SFSJR Downstream of Jackass Meadow	42	113	37%	42	0	0	0	4	57	7%	4	0	0	0
SFSJR Upstream of Hooper Creek	30	107	28%	30	0	0	0	1	57	2%	1	0	0	0
SFSJR Upstream of Crater Creek	34	109	31%	34	0	0	0	25	76	33%	25	0	0	0
SFSJR Upstream of Bear Creek	15	85	18%	15	0	0	0	30	76	39%	30	0	0	0
SFSJR Upstream of Mono Hot Spring	27	114	24%	27	0	0	0	5	37	14%	5	0	0	0
SFSJR Upstream of Camp 62 Creek	35	114	31%	35	0	0	0	52	74	70%	44	8	0	0
SFSJR Upstream of Bolsillo Creek	37	114	32%	37	0	0	0	56	74	76%	47	7	2	0
SFSJR Upstream of Camp 61 Creek	41	95	43%	35	5	1	0	54	67	81%	34	11	7	2

Downstream Site	2000			Days Temperature Increase is >2.8°C (5°F) and Daily Mean is				2001			Days Temperature Increase is >2.8°C (5°F) and Daily Mean is			
	Days >2.8°C (5°F)	No. Days Monitored	% Days >2.8°C (5°F)	≤15°C and ≤18°C	>18°C and ≤19°C	>19°C and ≤20°C	>20°C	Days >2.8°C (5°F)	No. Days Monitored	% Days >2.8°C (5°F)	≤15°C and ≤18°C	>18°C and ≤19°C	>19°C and ≤20°C	>20°C
SFSJR Upstream of Mono Creek	45	95	47%	39	4	2	0	60	73	82%	35	14	8	3
SFSJR Upstream of Warm Creek	-	0	-	-	-	-	-	35	52	67%	30	5	0	0
SFSJR Upstream of Rattlesnake Creek	23	51	45%	22	1	0	0	62	76	82%	49	10	3	0
SFSJR Upstream of Hoffman Creek	22	78	28%	21	1	0	0	61	76	80%	52	8	1	0
SFSJR Upstream of SJR Confluence	74	76	97%	59	9	6	0	76	76	100%	44	10	15	7
Pitman Creek Upstream of Big Creek Confluence	0	44	0%	0	0	0	0	8	61	13%	8	0	0	0
NF Stevenson Creek Upstream of Shaver Lake	42	147	29%	42	0	0	0	59	150	39%	59	0	0	0
Crater Creek Upstream of SFSJR Confluence	30	41	73%	30	0	0	0	8	38	21%	8	0	0	0
Crater Creek Diversion Inflow to Florence Lake	5	41	12%	5	0	0	0	14	38	37%	14	0	0	0
Bear Creek Downstream of Diversion	0	74	0%	0	0	0	0	0	107	0%	0	0	0	0
Bear Creek Upstream of SFSJR Confluence	2	116	2%	2	0	0	0	5	108	5%	5	0	0	0
Mono Creek Downstream of Diversion	0	128	0%	0	0	0	0	0	85	0%	0	0	0	0
Mono Creek Upstream of SFSJR	60	108	56%	60	0	0	0	71	122	58%	71	0	0	0
Camp 62 Creek Upstream of SFSJR Confluence	-	-	-	-	-	-	-	54	54	100%	54	0	0	0
Camp 62 Creek Upstream of SFSJR Confluence	-	-	-	-	-	-	-	27	27	100%	27	0	0	0
Bolsillo Creek Upstream of SFSJR Confluence[2]	21	152	14%	21	0	0	0	0	116	0%	0	0	0	0
Big Creek Downstream of Dam 5	37	94	39%	37	0	0	0	55	177	31%	55	0	0	0
Big Creek Upstream of Powerhouse 8	31	68	46%	22	5	4	0	112	177	63%	92	10	6	4
Big Creek Downstream of Dam 5	26	121	21%	26	0	0	0	5	184	3%	5	0	0	0
Big Creek Upstream of Powerhouse 8	14	94	15%	5	5	4	0	12	184	7%	10	2	0	0
Stevenson Creek Downstream of Shaver Lake Dam	43	128	34%	43	0	0	0	44	108	41%	44	0	0	0
Stevenson Creek at Railroad Grade	36	106	34%	36	0	0	0	47	122	39%	47	0	0	0
Stevenson Creek Upstream of SJR	68	127	54%	62	3	3	0	115	113	102%	112	3	0	0

	2000			Days Temperature Increase is >2.8°C (5°F) and Daily Mean is				2001			Days Temperature Increase is >2.8°C (5°F) and Daily Mean is			
Downstream Site	**Days >2.8°C (5°F)**	**No. Days Monitored**	**% Days >2.8°C (5°F)**	**≤15°C and ≤18°C**	**>18°C and ≤19°C**	**>19°C and ≤20°C**	**>20°C**	**Days >2.8°C (5°F)**	**No. Days Monitored**	**% Days >2.8°C (5°F)**	**≤15°C and ≤18°C**	**>18°C and ≤19°C**	**>19°C and ≤20°C**	**>20°C**
Stevenson Creek Downstream of Shaver Lake Dam	18	147	12%	18	0	0	0	21	179	12%	21	0	0	0
Stevenson Creek at Railroad Grade	0	117	0%	0	0	0	0	15	179	8%	15	0	0	0
Stevenson Creek Upstream of SJR	1	127	1%	0	0	1	0	34	179	19%	29	0	5	0
Big Creek No. 3 (FERC Project No. 120)														
SJR Downstream of Dam 6	-	0	-	-	-	-	-	0	184	0%	0	0	0	0
SJR Upstream of Stevenson Creek	0	61	0%	0	0	0	0	0	184	0%	0	0	0	0
SJR Downstream of Big Creek Powerhouse 3	1	64	2%	1	0	0	0	6	163	4%	6	0	0	0

Notes: SJR=San Joaquin River; SFSJR=South Fork San Joaquin River; °C=degrees Celsius; °F=degrees Fahrenheit

[a] Water temperature monitoring was conducted when diversions were not diverting.

Fishery Resources

This section describes the fisheries resources in the vicinity of the Big Creek ALP Projects, including special status fishes, historic and current fish assemblages, and current aquatic habitat conditions.

Special Status Fishes

No state or federally listed threatened or endangered fish species have been documented in the project area. Hardhead is the only aquatic species known to occur in the project area with a special management status. Hardhead is a Forest Service Region 5 sensitive species and a Cal Fish & Game species of concern (Class 3 Watch List).

Historical Fish Assemblages

Historically, most of the streams above 5,000 feet msl were fishless due to steep gradients that prevented upstream fish passage (Moyle, 2002; Yoshiyama et al., 1998). This includes most of the project area, with the exception of the San Joaquin River downstream of Mammoth Pool and the lower sections of several tributary streams, including Big Creek and Stevenson Creek. In the past, the San Joaquin River supported runs of anadromous salmonids and a native rainbow trout assemblage (Moyle, 2002). Central Valley spring-run Chinook salmon and Central Valley steelhead[20] both occurred in the San Joaquin Basin as far upstream as the vicinity of the present-day Mammoth Pool dam (Yoshiyama et al., 1998). Dams that prevented upstream fish passage were constructed on the San Joaquin River downstream of the project area prior to the construction of Mammoth Pool dam, including Friant dam (river mile 267) and Kerckhoff dam (river mile 292). As a result, these ESA-listed species no longer occur in the project area.

Similar to current conditions, the San Joaquin River in the vicinity of Redinger reservoir was likely a transition zone between species adapted to warm water and those adapted to colder water prior to construction of the Big Creek ALP Projects. In the San Joaquin River, the pikeminnow-hardhead-sucker assemblage generally occurs in lower elevation streams than the rainbow trout assemblage, although rainbow trout can occur in the upper limits of the native transition zone. Sacramento pikeminnow, Sacramento sucker, hardhead, rainbow trout, brown trout and prickly sculpin were found in project bypassed reaches within the transition zone. Moyle (2002) reports that this native California assemblage of the Sacramento-San Joaquin rivers is currently in decline, especially in the San Joaquin River Valley. However, this assemblage has been relatively

[20] Steelhead are the anadromous form of rainbow trout.

stable over a number of years in both Redinger reservoir and in the San Joaquin River reach downstream.[21]

The species composition in the San Joaquin River in the vicinity of Redinger reservoir most likely shifted both seasonally and annually depending on water supply and water temperature. The San Joaquin River downstream of Mammoth reach was probably dominated by native Sacramento sucker, Sacramento pikeminnow, hardhead, and prickly sculpin with some rainbow trout, similar to the pikeminnow-hardhead-sucker assemblage described by Moyle (2002). The pikeminnow-hardhead-sucker assemblage currently occupies a narrow altitude range in the Sierra Nevada foothill streams of the San Joaquin Basin (Moyle, 2002).

Rainbow and Non-native Trout

Beginning in the 1800s, native and non-native trout were stocked in many of the upper reaches of the basin by settlers, soldiers, fishermen, and government agencies, with the intent to establish consumptive use and sport fisheries (SCE, 2003b). As a result, there are wide-spread, established populations of rainbow trout and non-native brown, brook, and golden trout in previously fishless areas of the basin (Moyle, 2002). Some remote reaches of the basin are still naturally fishless.

Currently, depending on the stream reach, the project area streams are dominated by combinations of four species of trout: rainbow, brown, brook, and rainbow x golden trout hybrids. Brook trout are among the most cold-tolerant of the trout species, and are often the only species in the small, high elevation project area streams.

Rainbow trout and rainbow x golden trout hybrids are spring spawners. Most wild rainbow trout reach sexual maturity in their second or third year and usually spawn between February and June, depending on water temperature and strain (McAfee, 1966, in SCE, 2003c). In colder waters at high altitudes, spawning may occur as late as July or early August. Rainbow trout in other similar South Fork San Joaquin River tributary streams have been found to spawn from April through June (Loudermilk, 2001, in SCE, 2003c). The eggs hatch in 15 weeks at 3.5ºC and 11 weeks at 5ºC (Stickney, 1991, in SCE, 2003c). The fry emerge from the gravel beginning 2 to 3 weeks later, depending upon temperature. Juvenile and adult rainbow trout may migrate into a lake or other downstream areas or remain in the stream defending a small home range (Moyle, 2002).

Golden trout spawn when water temperatures reach 7 to 10ºC, or as early as May in the project area. It is not known whether the spawning period of rainbow x golden trout hybrids is similar to that of rainbow trout or golden trout (SCE, 2003c). Golden trout eggs hatch in about 20 days at 14ºC (Moyle, 2002).

[21] Redinger reservoir is located downstream of Big Creek Powerhouse 3, and is not part of the four Big Creek ALP Projects.

Brown trout spawn in the fall or winter and may begin spawning migration as soon as early September, depending on water levels and stream temperature in the project area (SCE, 2003c). Spawning sites are not chosen until stream temperatures begin to significantly cool; peak spawning activity generally does not occur until October and November and tapers off in December (Moyle, 2002). Eggs hatch after 11 to 16 weeks (Loudermilk, 2001, in SCE, 2003c). Large brown trout are highly piscivorous and can prey on young of their own or of other trout species.

Brook trout may begin their spawning migration in mid-September, depending on water temperatures; peak spawning period lasts from October to December (SCE, 2003c). Eggs hatch after 12 to 16 weeks at water temperatures of 2 to 5°C. Brook trout may also spawn in lakes if there is suitable habitat.

Native Transition Zone Fishes

Within the project area, the Stevenson reach of the San Joaquin River (Dam 6 downstream to Redinger reservoir) typically has warmer summer water temperatures than streams in the upper basin, and supports a native transition-zone fish community (also called a pikeminnow-hardhead-sucker assemblage), and low numbers of trout. The native transition-zone community exists between the native cyprinid-catostomid zone community on the San Joaquin River valley floor and the rainbow trout zone community in the higher elevations (Moyle, 2002).

In 1995, native species comprised about 91 percent of the fish collected in Redinger reservoir, and hardhead comprised 46 percent of the total catch (SCE, 2003b). Adult hardhead probably migrate into the Stevenson reach of the San Joaquin River to spawn, and utilize stream habitat for fry and juvenile rearing. Hardhead spawn mainly in April and May (Reeves, 1964, and Grant, 1992, in SCE, 2003c). However, hardhead spawning is reported to occur from May through August in the upper San Joaquin River (Wang, 1986, in SCE, 2003c). Fish from larger rivers or reservoirs may migrate 30 to 75 kilometers or more upstream in April and May, usually into smaller tributary streams (Reeves, 1964, in SCE, 2003c). Hardhead usually occur in the same habitats as Sacramento suckers and Sacramento pikeminnow, and are almost never found in areas where pikeminnow are absent (Moyle and Nichols, 1973; Moyle, 1995 and 2002, in SCE, 2003c). They are rarely found in reservoirs, with the exception of Redinger and Kerckhoff reservoirs in Fresno County, and in reservoirs of the Pit River system in Shasta County (Moyle, 2002).

Sacramento suckers are found in the lower elevation project streams and in tributaries to Huntington Lake, as well as Huntington Lake and Shaver Lake (SCE, 2003c). Larval suckers concentrate in the warm, quiet, protected stream margins (Moyle, 2002). Juvenile suckers were more commonly found in the tributary streams where they hatched, than in reservoirs and downstream areas. Sub-adult and adult suckers are usually found in the deep water of pools, in runs, or beneath undercut banks near riffles during the day. Adult suckers prefer water greater than 3 feet deep where they are relatively safe from avian predators such as herons, osprey, and bald eagles. Spawning generally takes place in February through June, depending on water temperatures, and may continue into July or August in some systems (Moyle, 2002). The spawning migration is triggered when water temperatures warm to 5.6 to 10.6°C (SCE, 2003c). Adults swim up to 20 kilometers upstream to spawn, and a sudden cooling of the water can stop the run until warmer temperatures return (Moyle, 2002).

Sacramento pikeminnow prefer water temperatures ranging from 18 to 28ºC (Moyle, 2002). Adults migrate to spawning areas in April and May, generally when water temperatures reach 14°C (SCE, 2003c). Spawning occurs when water temperatures rise to 15 to 20°C (Moyle, 2002). The presence of small larvae found in some streams indicates that spawning may occur through June (Wang, 1986; Mulligan, 1975, in SCE, 2003c). Pikeminnow migrate upstream to spawn in gravel riffles in streams or on gravel areas near shore, in lakes or reservoirs. The eggs of Northern pikeminnow, a closely related species, hatch in four to seven days at 18°C (Burns, 1966, in SCE, 2003c).

Reservoir Fishes

Reservoir fish in the project area include trout, Sacramento sucker, and prickly sculpin, as well as non-native kokanee salmon,[22] smallmouth bass, bluegill, crappie and carp, among others. Project reservoirs occur at a wide range of elevations, and include alpine lakes, such as Florence Lake and Huntington Lake, that support coldwater trout and kokanee (in Huntington Lake).

Other project reservoirs, such as Shaver Lake and Mammoth Pool reservoir, are characterized by Moyle (2002) as mid-elevation, Central Valley reservoirs. Moyle describes these reservoirs as often supporting warmwater fish species near the surface and in edgewater habitat, and coldwater species (trout and kokanee) in deeper, colder water. Warmwater species include smallmouth bass and other centrarchids such as bluegill and crappie. Coldwater species found in Mammoth Pool and Shaver Lake include trout and kokanee (in Shaver Lake).

Kokanee spawn between September and February, depending on the genetic stock and lake and stream temperatures. Kokanee require water temperatures between 6 and 13°C to spawn, and may spawn in streams or lakes with suitable gravel substrate. Spawning kokanee attempt to return to the stream in which they were hatched; spawners congregate at the mouths of streams or in the vicinity of suitable lake spawning areas. The fry emerge in April through June and immediately migrate downstream and generally do not start feeding until they reach a lake.

Smallmouth bass are normally found in water approximately 20 to 27°C, and prefer pools with abundant cover (SCE, 2003c). In rivers and streams, they are usually found in the same habitat as the pikeminnow-hardhead-sucker native transition zone fish

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[22] Kokanee are the land-locked, resident form of sockeye salmon.

community (Moyle, 2002). Hardhead are almost never found in areas that have well-established centrarchid populations such as smallmouth bass (Moyle and Nichols, 1973; and Moyle, 1995 and 2002, in SCE, 2003c). In the project area, smallmouth bass are generally found in Shaver Lake. Spawning occurs when water temperatures reach 13 to 16°C, usually in April (SCE, 2003c). Young fry are typically present during early summer (Moyle, 2002).

Benthic Macroinvertebrates

The project area streams support diverse communities of benthic macroinvertebrates. A few taxa are abundant, regardless of site location or stream; many of these are members of families within the order Diptera (flies) including Orthocladiinae, Tanytarsini, and Simuliidae (SCE, 2003c). The most common family of Ephemeroptera (mayflies) is Baetidae; of Plecoptera (stoneflies) is Nemouridae; and of Trichoptera (caddisflies) is Hydropsychidae. Other families and genera of these groups are abundant in some streams. Based on fish condition factors measured in the applicant's studies, productivity does not appear to be a limiting factor for trout populations in the project area.

Visual surveys for mollusks located a few individuals, generally small in size, at a limited number of locations downstream of the project area. The results of crayfish trapping in Shaver Lake and Mammoth Pool reservoir suggest that crayfish are well distributed in these reservoirs (SCE, 2003c).

Bypassed Reaches

In this section we describe aquatic habitats and fish populations in reaches affected by project operations, in the following order: (1) South Fork San Joaquin River and its tributaries; (2) San Joaquin River and its tributaries with the exception of Big Creek; and (3) Big Creek and its tributaries.

South Fork San Joaquin River

The South Fork San Joaquin River bypassed reach extends 28 miles from Florence Lake dam to South Fork San Joaquin River's confluence with the middle fork of the San Joaquin River, with elevations ranging from 7,218 to 3,721 feet msl over the length of the reach (figure 3-6). The upstream half of this reach is a mix of small canyon and open channel types. The lower half is in a deep, bedrock dominated canyon. There are several potential barriers to upstream fish migration in this reach, including a 36-foot high waterfall located 6.9 miles upstream of the confluence with the San Joaquin River.

Historically, Cal Fish & Game and other entities have stocked or introduced several species of fish to the South Fork San Joaquin River, including brown trout, brook trout, rainbow trout/steelhead, cutthroat trout, and golden trout (SCE, 2003c). Cal Fish & Game currently manages the river as a put-and-take rainbow trout fishery to supplement the wild trout population. During the period 1998 through 2002, Cal Fish & Game stocked an average of 4,798 adult rainbow trout per year.

Fish sampling conducted in 2002 indicated that the South Fork San Joaquin River, downstream of Florence Lake, also supports abundant, self-sustaining populations of brown and rainbow trout (SCE, 2003c). Multiple age classes of brown and rainbow trout were present, including young-of-the-year although densities and age class structure varied by geomorphic reach type. Brown trout densities were greater in the bypassed reach than they were in a reference site[23] sampled upstream of Florence Lake (see appendix C). In the bypassed reach, higher densities of brown trout occurred upstream of Bear Creek, while the furthest sites downstream were dominated by rainbow trout (see appendix C). The lowest rainbow trout densities were in the confined, canyon between Bear Creek and Mono Crossing.

The rainbow trout age class structure was skewed toward young-of-the-year (54 percent) (SCE, 2003c). Only 9 percent of the brown trout population were young-of-the-year fish. Most of the rainbow trout collected in this area were presumed to be wild fish based on their appearance and scales (SCE, 2003c). Brown trout was the only species collected upstream of Florence Lake.

Small Tributaries on the North Side of the South Fork San Joaquin River – Tombstone, North Slide, South Slide, and Hooper Creeks

The small tributaries on the north side of the South Fork San Joaquin River include Tombstone, North Slide, South Slide, and Hooper creeks (figure 3-6). There are small diversions on each of these creeks, but only the Hooper Creek diversion is in operation. The diversions are at elevations between 7,502 and 7,673 feet msl. These creeks are very steep, headwater boulder/bedrock channels. Cascades and bedrock sheets, which provide little or no quality trout habitat, predominate (SCE, 2003b).

Tombstone Creek – There are smaller components of complex habitat types in Tombstone Creek, some spawning gravel, and deep pools downstream of the diversion (SCE, 2003b). Farther downstream where Tombstone Creek passes through Jackass Meadow, run and pool habitats predominate (stream length not available). The meadow segment has fine sediment and a well developed floodplain. These types of channels support productive fisheries when they are in good condition, and are relatively rare in headwater areas. No fish were found in Tombstone Creek upstream of the diversion during sampling conducted in 2002; although brown trout were found downstream of the diversion. Mean density and biomass for brown trout were relatively high (see appendix C). Multiple age classes were present including young-of-the-year (14 percent) (SCE, 2003c).

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[23] A reference site is a comparable stream that is unaffected by the project.

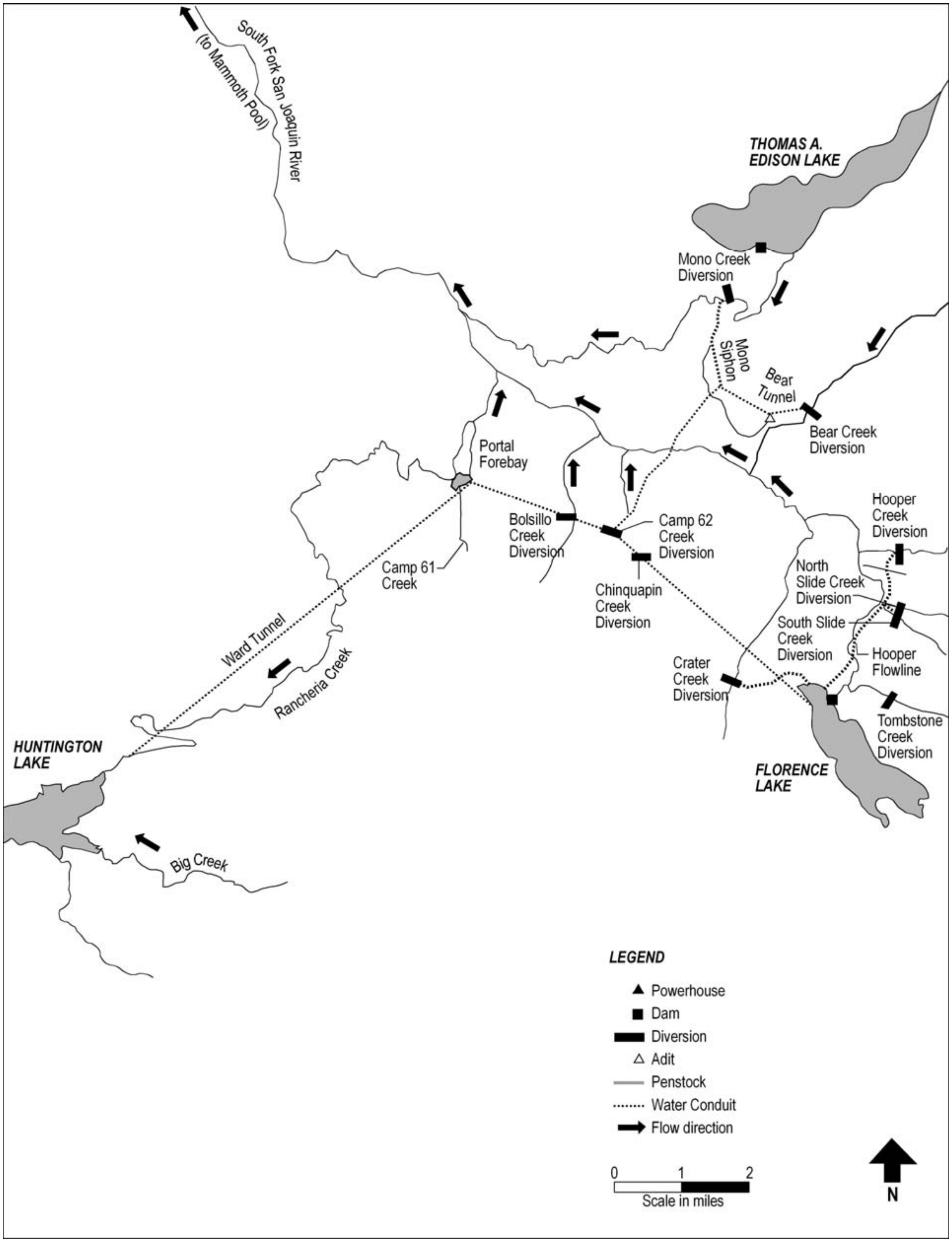

Figure 3-6. Big Creek System (page 1 of 2). (Source: SCE, 2007a, as modified by staff)

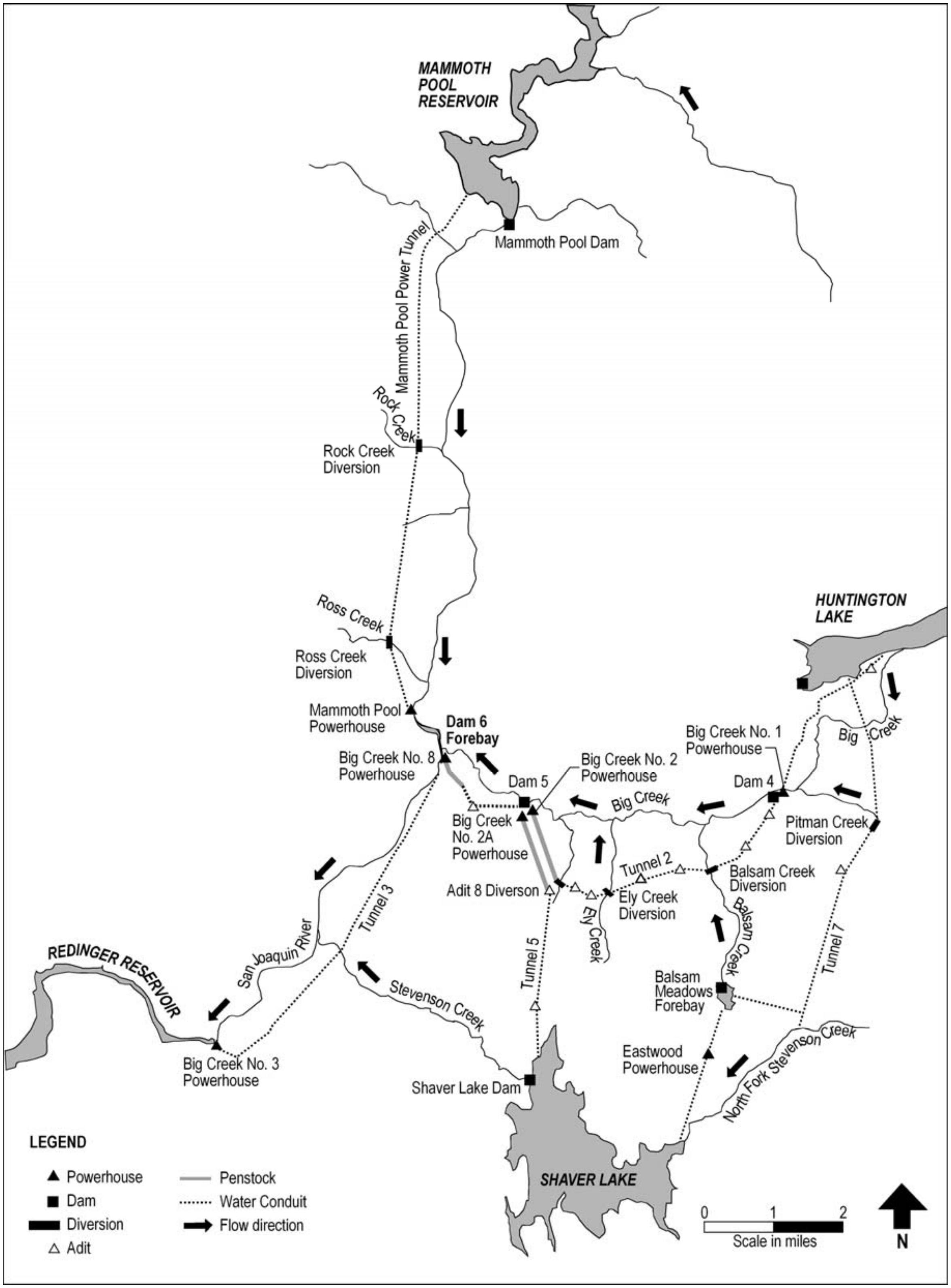

Figure 3-6. Big Creek System (page 2 of 2). (Source: SCE, 2007a, as modified by staff)

North Slide and South Slide Creeks – North Slide and South Slide creeks are fishless. The fisheries potential in these creeks is very limited in these 0.3 mile long bypassed reaches because (1) there are no pools in either creek; (2) there is no suitable spawning gravel in North Slide Creek; (3) a short stream segment downstream of the North Slide Creek diversion was dry during the survey; and (4) in North Slide Creek there is a 15-foot high waterfall in a cascade series about 17 feet upstream from its confluence with the South Fork San Joaquin River that is a total barrier to upstream fish migration (SCE, 2003d).

Hooper Creek –Hooper Creek bypassed reach is 0.6 miles long. Multiple natural fish migration barriers including cascades located 0.1 mile from the confluence of the South Fork San Joaquin River limit access to Hooper Creek (SCE, 2003d). These natural features limit the potential for brown and brook trout[24] to migrate past these barriers during their fall spawning period, but are less likely to be spawning migration barriers for rainbow trout and rainbow x golden trout hybrids, which spawn in higher spring flows.

Self-sustaining populations of rainbow x golden trout hybrids, including multiple age classes and young-of-the-year (24 percent) were found in Hooper Creek upstream and downstream of the diversion in 2002 (SCE, 2003c). Rainbow x golden trout density and biomass were higher downstream of the diversion than they were upstream of the diversion (see appendix C).

Small Tributaries on the South Side of the South Fork San Joaquin River – Crater, Camp 61, Camp 62, Chinquapin, and Bolsillo Creeks

The small headwater tributaries on the south side of the South Fork San Joaquin River are Crater, Camp 61, Camp 62, Chinquapin, and Bolsillo creeks (figure 3-6). The Crater Creek diversion channel carries flows to Florence Lake, and Chinquapin, Camp 61, Camp 62, and Bolsillo creeks are diverted directly into the Ward Tunnel.

Upper Crater, Chinquapin, Camp 61, Camp 62, and Bolsillo creeks are steep, boulder/bedrock streams, none of which are currently stocked (SCE, 2003c). Fish sampling conducted in 2002 indicated that Crater, Camp 62, Chinquapin, and Bolsillo creeks had self-sustaining populations of brook trout upstream and downstream of the diversions (SCE, 2003c). Mean brook trout densities and biomasses were high in all reaches except for Crater Creek upstream and downstream of the diversion (see appendix C). Camp 61 Creek had the highest estimated brown trout density among the Portal Project streams (SCE, 2003g).

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[24] Although these species were not collected in Hooper Creek during SCE's fish population surveys, brown trout do occur in the South Fork San Joaquin River, and brook trout occur in several of its tributaries near Hooper Creek.

Crater Creek and Crater Creek Diversion Channel – The 2.85 mile-long Crater Creek bypassed reach has an elevation of 8,762 feet msl at the diversion and 6,814 feet msl at the confluence with the South Fork San Joaquin River. Upper Crater Creek has mostly cascade and step-run habitats, and large amounts of spawning gravel. The numerous cascades upstream of the diversion provide relatively low quality fish habitat. Lower Crater Creek has a short segment of more complex habitat types and a substantial amount of shallow pool habitat where it passes through Hell Hole Meadow.

Crater Creek diversion channel, which extends 1.38 miles from Crater Creek diversion to Florence Lake, is a combination of ditch and natural channel. The Crater Creek diversion channel has an elevation of 8,762 feet msl at the diversion and 7,343 feet msl at the confluence with Florence Lake. It is a steep, bedrock channel dominated by cascade or bedrock sheet that has little or no fish habitat value, and small amounts of the more complex habitat types (SCE, 2003b).

There is no MIF requirement in Crater Creek in the current license, but seepage from the diversion provides flow to the creek when the diversion is in operation. There is flow in Crater Creek diversion channel during the spring when rainbow trout spawn, but there are few rainbow trout in Florence Lake. Channel flow declines when operation of the diversion ceases, so that Crater Creek diversion channel provides little or no spawning habitat for brown and brook trout in Florence Lake.

Total brook trout density and biomass in Crater Creek during 2002 were lower downstream of the diversion than upstream of the diversion (see appendix C). Higher trout densities were found in Crater Creek diversion channel than in Crater Creek. Multiple age classes including young-of-the-year were found in both the creek and the diversion channel (21 and 33 percent, respectively) (SCE, 2003c).

Camp 62 and Chinquapin Creeks – The 1.35 mile-long Camp 62 Creek bypassed reach has and elevation of 7,371 feet msl at the diversion and 6,523 feet msl at the confluence with the South Fork San Joaquin River. Lower Camp 62 Creek has two complete barriers to upstream fish migration in addition to the diversion. The lowest barrier is a 45-foot high waterfall about 400 feet upstream of the confluence with the South Fork San Joaquin River that limits recruitment from the river (SCE, 2003c). There is spawning gravel in the lowest reach, but the waterfall prevents migration from the river to relatively large amounts of good to excellent quality spawning gravel in the bypassed reach. Camp 62 Creek has fair amounts of complex habitat types. Large woody debris (LWD)[25] was observed in five of the nine habitat units in the reach upstream of the Camp 62 diversion (SCE, 2003d). One unit had 5 to 10 pieces of LWD and one unit had 15 to 20 pieces. The other units had zero to five pieces of LWD. Both creeks have MIF requirements under the current license (see tables 3-1 and 3-2).

[25] LWD is wood that is greater than 6 inches in diameter with approximately 33 percent or greater of the total length of the wood situated within the stream channel.

Chinquapin Creek enters Camp 62 Creek about 1 mile upstream from its confluence with the South Fork San Joaquin River, which is 7.7 miles downstream of Florence Lake. The 0.9 mile-long Chinquapin Creek bypassed reach has an elevation of 7,641 feet msl at the diversion and 6,976 msl at the confluence with Camp 62 Creek. Chinquapin Creek has a waterfall 785 feet upstream of the confluence with Camp 62 Creek that is a barrier to upstream fish passage. Chinquapin Creek has mostly step-pool, step-run, and cascade habitats. Total brook trout densities in both creeks were greater downstream of the diversions than upstream of the diversions in 2002, although catchable-sized brook trout density was lower downstream of the diversion at Camp 62 Creek (see appendix C). The age class structure of Chinquapin and Camp 62 creeks was skewed toward young-of-the-year (63 and 46 percent, respectively) (SCE, 2003c). Fair amounts of spawning gravel were found in both creeks (SCE, 2003d).

Bolsillo Creek – The 1.6 mile-long Bolsillo Creek bypassed reach has an elevation of 7,623 feet msl at the diversion and 6,521 feet msl at the confluence with the South Fork San Joaquin River. Bolsillo Creek enters the South Fork San Joaquin River about 8.3 miles downstream of Florence Lake. Bolsillo Creek has approximately equal amounts of steep to moderate gradient habitat downstream of the diversion. Step-pool, step-run, and cascade are the primary habitat types, and there is a fair amount of spawning gravel. Bolsillo Creek has a large waterfall 0.2 mile from the confluence with the South Fork San Joaquin River that is a complete upstream migration barrier and prevents recruitment from the river (SCE, 2003d). Brook trout densities were lower downstream of the diversion compared to upstream of the diversion (see appendix C). Multiple age classes, including young-of-the-year (27 percent), were present downstream of the diversion (SCE, 2003c).

Camp 61 Creek – Camp 61 Creek extends approximately 2 miles from Portal forebay dam (7,117 feet msl) to its confluence with the South Fork San Joaquin River (6,413 feet msl). Channel gradients range from 2 to 10 percent, and step runs, step pools, and lateral pools are the dominant habitat types. The majority of the pools in the reach are less than 2 feet deep. Substrates are mainly boulders (37 percent), sand (19 percent), and bedrock (12 percent), with lesser amounts of cobble, gravel, and fines. A moderate amount of spawning gravel is present in run, pool, and riffle habitats. Although quantitative data are limited, lower Camp 61 Creek (downstream of the confluence with Adit 2 Creek) was reported as having 90 to 100 percent embeddedness. In addition, accumulations of fine sediment in pools in Camp 61 Creek downstream of Portal forebay dam were nearly 2.5 times greater than that observed in East Fork Camp 61 and West Fork Camp 61 creeks.

LWD is only intermittent within the active channel, and, where present, has a minimal influence on channel morphology. In 2000, 2001, and 2003, the maximum water temperature in Camp 61 Creek, upstream from its confluence with Adit 2 Creek, was 19.3 °C (table 3-8). The maximum water temperate in Camp 61 Creek downstream of its confluence with Adit 2 Creek was 16.8 °C.

Four fish passage barriers are present in Camp 61 Creek downstream of Portal forebay. All four are complete barriers to upstream fish migration at low flows (SCE, 2003g). Three of the barriers are short waterfalls located 8,117, 7,040, and 5,247 feet upstream of the confluence with the South Fork San Joaquin River; the fourth barrier is a bedrock sheet located 5,194 feet upstream of the confluence with the South Fork San Joaquin River. The barrier at 7,040 feet is a barrier at all flows.

Under existing conditions, Camp 61 Creek has no MIF requirement. Flow downstream of the forebay is present as a result of seepage emanating from Portal forebay dam and from accretion and surface runoff during the spring snowmelt or precipitation events. Additional water is also provided to Camp 61 Creek from leakage from Adit 2 (via Adit 2 Creek). Adit 2 Creek converges with Camp 61 Creek approximately 1 mile downstream of Portal forebay dam; upstream from the Adit 2 Creek confluence. Camp 61 Creek is often completely dry. Based on limited weir data collected from 1997 through 2002, flows in Camp 61 Creek immediately downstream of Portal forebay dam are typically less than 0.123 cfs (SCE, 2003g).

Brown trout was the only fish species captured in Camp 61 Creek, and they were only present in the reach downstream of the confluence with Adit 2 Creek. Downstream of Adit 2 Creek, the density of brown trout was estimated to be 1,439 fish per mile in 2001 and 1,513 fish per mile in 2002 (SCE, 2003g). Several age classes of brown trout were captured during sampling in Camp 61 Creek; however, age 0+ fish were relatively rare, possibly indicating a lack of suitable spawning habitat or a lack of access to suitable spawning habitat due to low flows (SCE, 2003g).

Bear Creek

Bear Creek is part of a large watershed located on the northeast side of the South Fork San Joaquin River between Florence Lake and Lake Edison (figure 3-6). Bear Creek diversion is located 1.6 miles upstream of the confluence with the river. The bypassed reach drops from an elevation of 7,350 feet msl at the diversion to 6,715 feet msl at the confluence with the river. Bear Creek is a bedrock/boulder controlled stream (SCE, 2003b). The reach upstream of the diversion has a large amount of riffle, run, and shallow pool habitats. The reach downstream of the diversion is predominantly step-pool and high gradient riffle habitats. A fair amount of LWD and spawning gravel is present.

Bear Creek has self-sustaining populations of brown trout upstream and downstream of the diversion. Fish densities and biomass in 2002 were substantially higher in the reach downstream of the diversion compared to upstream of the diversion (see appendix C), and fish density in the bypassed reach was one of the highest of the project reaches (brown trout 1,406 fish/km). Multiple age classes including young-of-the-year (15 percent) were present downstream of the diversion (SCE, 2003c).

Mono Creek (Mono Diversion to the South Fork San Joaquin River)

The Mono diversion is located 5.8 miles upstream of the confluence of Mono Creek with the South Fork San Joaquin River (figure 3-6). Mono Creek has an elevation of 7,333 feet msl at the diversion and drops to an elevation of 6,313 feet msl at the confluence with the river. The reach is mostly a boulder/bedrock channel with pool, step-run, and cascade habitats, and lesser amounts of pocket water and riffle habitat (SCE, 2003b). Many pools are deeper than those found in other South Fork San Joaquin River tributaries and large amounts of spawning gravel are present in local concentrations.

Brown trout and catchable-sized hatchery rainbow trout were collected in the impoundment upstream of Mono Creek diversion in 2002. Cal Fish & Game has regularly stocked rainbow trout in Mono Creek upstream of the diversion for many years. It is likely that there is little to no recruitment of wild rainbow trout in or upstream of the impoundment, as indicated by the absence of young rainbow trout and only catchable-size rainbow trout of hatchery origin (SCE, 2003c). The presence of numerous young-of-the-year brown trout, despite the lack of stocking, indicates successful spawning of this species takes place upstream of the Mono diversion dam.

Cal Fish & Game does not stock trout in the Mono Creek bypassed reach. Five brown and one rainbow trout were collected in the bypassed reach during fish sampling conducted in 2002 (SCE, 2003c). Therefore, the mean density and biomass were low for both species and the populations are not self-sustaining (see appendix C). Mono Creek historically supported higher fish densities, even though MIFs have not changed (SCE, 2003c). At the time that SCE conducted its habitat and fisheries surveys in Mono Creek, habitat conditions were adversely affected by the abundance and distribution of fine sediments. SCE reported that fine sediments have been less abundant in pools since high flows occurred in 2005 and 2006.

The San Joaquin River Mammoth Reach

The San Joaquin River Mammoth reach extends 8.4 miles from Mammoth Pool dam downstream to Mammoth Pool powerhouse at the head of the Dam 6 impoundment (figure 3-6). The Mammoth reach has an elevation of 3,052 feet msl at the Mammoth Pool dam and 2,222 feet msl at the Mammoth Pool powerhouse.

Mammoth reach is moderate (2 to 4 percent) to low gradient (0 to 2 percent), with boulder/bedrock controlled and gully channel types in a deep, steep-walled bedrock canyon (SCE, 2003b). Habitats include large deep pools with long runs and complex habitats such as pocket water and riffles. Pools are the dominant habitat type in the reach. There are small amounts of spawning gravel and areas of finer substrate.

Fish sampling was conducted at two sites in the Mammoth reach during 2002. One site was in the vicinity of Rock Creek and the other was downstream of Ross Creek (SCE, 2003c). Sampling results indicated that the reach has self-sustaining populations of Sacramento sucker, rainbow trout, and brown trout (see appendix C), although the population densities of all three species were greater downstream of Ross Creek than they were near Rock Creek.[26] Rainbow trout had greater density in the lower site than brown trout and brown trout had greater density in the upper site. Multiple age classes were present for all three species, although there were few young-of-the-year of any species near Rock Creek (SCE, 2003c). The age class distributions of rainbow trout, brown trout, and Sacramento sucker were skewed toward young-of-the-year (37, 62, and 75 percent, respectively) downstream of Ross Creek (SCE, 2003c). Sacramento sucker was 76 percent of the total fish collected at both sites combined.

Dam 6 impounds Powerhouse 3 forebay, which inundates the confluence of Big Creek with the San Joaquin River (figure 3-6). In addition to flows from the San Joaquin River and Big Creek, the forebay receives outflows from Powerhouse 8 and the Mammoth Pool powerhouse, and it diverts flow through Tunnel 3 to Big Creek Powerhouse 3. The forebay has a volume of 993 acre-feet and a surface area of 23.2 acres at the spill elevation of 2,230 feet msl. The water level in the forebay rarely varies significantly but occasionally drops to elevations as low as 2,214 feet msl (587 acre-feet of storage) (SCE, 2003b). Sampling conducted in 2002 indicated that Sacramento sucker was the most abundant species (79 percent of the total catch). Brown trout comprised 15 percent of the catch and rainbow trout comprised 6 percent (SCE, 2003c).

The composition of the fish community in the forebay found during the 2002 sampling resembled that of the San Joaquin River upstream and immediately downstream of the forebay, with the exception of hardhead, which were only found downstream of Stevenson Creek. Mean condition factors for trout species were greater than 1 (see appendix C), indicating sufficient food sources, and multiple age classes were represented for all fish species.

The San Joaquin River Stevenson Reach

The Stevenson bypassed reach of the San Joaquin River extends 5.7 miles from Dam 6 downstream to Powerhouse 3 at Redinger reservoir (figure 3-6). Stevenson Creek enters the bypassed reach 3.45 miles downstream of Dam 6. The Stevenson reach has an elevation of 2,222 feet msl at Dam 6 and 1,432 feet msl at Powerhouse 3.

The Stevenson bypassed reach is a moderate gradient (2 to 4 percent) stream with a gully channel (SCE, 2003b). Substrate in the reach is composed primarily of boulder, bedrock and sand, and small amounts of widely distributed spawning gravels. Habitat surveys revealed moderately to very deep pools, complex pocket water, and small riffle areas. Canopy cover was low and there was no LWD.

The Stevenson bypassed reach has a native fish assemblage of hardhead, Sacramento pikeminnow, and Sacramento sucker, in addition to low densities of rainbow trout and brown trout (see appendix C). Fish communities differed between sampling sites in the upper and lower portion of the reach (see appendix C). The upper site,

[26] Only 10 brown trout and 10 rainbow trout were collected near Rock Creek.

located 1.6 miles downstream of Dam 6, was dominated by Sacramento sucker (76 percent of the total catch). Rainbow trout comprised 9 percent of the catch, brown trout and Sacramento pikeminnow each comprised 2 percent, and prickly sculpin comprised 11 percent. There were multiple age classes of Sacramento sucker including young-of-the-year (36 percent); one juvenile Sacramento pikeminnow; and no hardhead collected at the upper site (SCE, 2003c).

Sampling conducted at the lower site, 0.7 mile upstream of the Powerhouse 3, indicated that this section supports populations of Sacramento pikeminnow and hardhead, as well as small numbers of Sacramento sucker, all representing components of the native transition zone community. One brown trout also was collected. The lower site was dominated by a single age class of juvenile Sacramento pikeminnow (18 of 19 fish collected) (SCE, 2003c). There were only two adult Sacramento sucker at the lower site. Hardhead comprised 40 percent of the fish collected in the lower site and there were multiple age classes including young-of-the-year (7 percent) (SCE, 2003c). This is the only reach in the project area that has a population of hardhead.

Large numbers of small unidentified cyprinids[27] were also found in the margins of the pool habitats. Based on their morphological features, the cyprinids are thought to be juvenile Sacramento pikeminnow or hardhead. Hardhead and other members of the native transition zone assemblage in Redinger reservoir probably spawn in the Stevenson reach of the San Joaquin River, and potentially in other tributaries. Hardhead also occur downstream of the project area in Redinger reservoir, and in the reach downstream from Redinger reservoir. It is likely that the adult fish from the Stevenson bypassed reach return to Redinger reservoir after spawning.

Rock Creek

Rock Creek enters San Joaquin River approximately 3 miles downstream from Mammoth Pool dam (figure 3-6). The bypassed reach extends approximately 0.4 mile from the Rock Creek diversion to the creek's confluence with the San Joaquin River. Rock Creek is a steep gradient (>10 percent), bedrock/boulder controlled channel (SCE, 2003b). The stream drops steeply from an elevation of 3,336 feet msl at the diversion to 2,670 feet msl at its confluence with the San Joaquin River.

Habitat in the bypassed reach is mostly step-pools, cascades, and bedrock sheets with small amounts of other pool habitats. The cascades provide low quality habitat and bedrock sheets have no habitat value. No spawning gravel was found during habitat surveys conducted in 2000 and 2001, which indicates reproduction may occur in upstream locations or in tributaries.

Cal Fish & Game manages Rock Creek as a put-and-take fishery for rainbow trout, which have been stocked every year from 1956 to the present. An average of 2,688

[27] Unidentified minnow species.

catchable rainbow trout were stocked in Rock Creek from 1998 through 2002. Fish sampling conducted in 2002 indicated that Rock Creek also supported self-sustaining populations of rainbow and brown trout (SCE, 2003c). Brown trout density was higher upstream of the diversion, and rainbow trout density was higher downstream of the diversion (see appendix C). Rainbow and brown trout densities were relatively high for a stream of this size. There were multiple age classes of brown trout upstream and downstream of the diversion, indicating that successful recruitment occurs in Rock Creek or its tributaries. No young-of-the-year rainbow trout were collected upstream of the diversion and only three young-of-the-year rainbow trout were collected downstream of the diversion (SCE, 2003c). Young-of-the-year brown trout were 26 percent of the age class structure upstream of the diversion. Only one young-of-the-year brown trout was collected downstream of the diversion.

Ross Creek

Ross Creek enters San Joaquin River about 7 miles downstream of Mammoth Pool dam (figure 3-6). The bypassed reach extends approximately 0.85 mile from the Ross Creek diversion to its confluence with the San Joaquin River. Ross Creek was probably also historically fishless due to steep stream gradients (>20 percent) that prevent the upstream migration of fish from the San Joaquin River (SCE, 2003b). The bedrock/boulder controlled channel drops steeply from an elevation of 3,359 feet msl at the diversion to 2,289 feet msl at its confluence with the San Joaquin River.

Habitat in the bypassed reach is composed mostly of shallow step-pools upstream and downstream of the diversion with substantial components of cascades and bedrock sheets, with little or no spawning gravel. Ross Creek has a relatively small drainage area, and the creek was dry upstream of the diversion by mid-June or early July in 2000 and 2001. Flows in Ross Creek are affected by upstream, non-project diversions.

Rainbow and brown trout have been planted in Ross Creek historically, and both species are reported to persist (SCE, 2003b). Ross Creek was not sampled for fish because the reach upstream of the diversion and a large segment downstream of the diversion were dry during the summer of 2002, when fisheries sampling was conducted.

North Fork Stevenson Creek

The natural flow in the North Fork Stevenson Creek bypassed reach is augmented by instream flow releases from Tunnel 7 at river mile 3.55 (figure 3-6). Prior to construction of the Eastwood power station, this reach was used to transport water to Shaver Lake. Approximately 16,081 feet upstream of the confluence with Shaver Lake, North Fork Stevenson Creek has an elevation of 7,082 feet msl. At the confluence with Shaver Lake the creek elevation is 5,434 feet msl.

North Fork Stevenson Creek has steep gradient (>10 percent), high gradient (4 to 10 percent), moderate gradient (2 to 4 percent), low gradient (0 to 2 percent), and moderate gradient gully channel types (SCE, 2003b). The reach upstream of the Tunnel

7 outlet is a narrow channel, primarily composed of cascade and bedrock sheet, with smaller components of shallow pools, limiting the habitat value of this reach. Much of the reach downstream of the outlet is step-pool and cascade or step-run with small riffles and other pool habitat. The reach downstream of the outlet contains distinct sections of either steep or lower gradient habitats, and many pools downstream of the outlet are up to three feet deep. Small amounts of fair to good quality spawning gravels are distributed downstream of the outlet and there is a small amount of poor quality gravel upstream.

Fish population monitoring studies were conducted downstream of the Tunnel 7 outlet beginning in October 2000, after a gate failure resulted in higher than normal streamflows. Sampling indicated that fish populations were reduced following this high flow event, but populations of rainbow trout began to recover in 2001. In 2002 the dominant species were brown trout, rainbow trout, and rainbow x golden trout hybrids; and the overall density and biomass of trout species were high (see appendix C). Young-of-the-year were 55 percent of the brown trout population and 20 percent of the rainbow trout population (SCE, 2003c). No young-of-the-year rainbow x golden trout hybrids were collected. Sacramento sucker was a small component of the catch (3 percent) and all four fish were 4+ years of age.

Stevenson Creek

The Stevenson Creek bypassed reach extends 4.3 miles downstream from Shaver dam to the confluence with the San Joaquin River (figure 3-6). Stevenson Creek has an elevation of 5,252 feet msl at Shaver dam and 1,638 feet msl at its confluence with the San Joaquin River. More than half of the bypassed reach is steep gradient (>10 percent); the rest is high gradient (4 to 10 percent) and moderate gradient (2 to 4 percent), (SCE, 2003b). Cascades and pools are the dominant habitat types. Some pools are moderately to very deep, many areas have LWD, and pools have small amounts of spawning gravel. Stevenson Creek Falls and a series of other waterfalls create 13 natural migration barriers within the first 0.5 mile upstream of the San Joaquin River confluence (SCE, 2003d). No spawning gravels were found in this stream section.

Rainbow trout was the only species collected in 2002. Multiple age classes of rainbow trout were collected including young-of-the-year (17 percent) (SCE, 2003c). The mean rainbow trout density and biomass were high (see appendix C).

Upper Big Creek

The Upper Big Creek bypassed reach extends 3.6 miles from Huntington Lake to Dam 4 (figure 3-6). Upper Big Creek has an elevation of 6,950 feet msl at the release point downstream of Dam 1 and 4,836 feet msl at the confluence with the Big Creek Powerhouse 1 tailrace. Upper Big Creek lies in a deep, steep-walled bedrock canyon and has long step-pool and step-run habitats (SCE, 2003b). The channel types are primarily steep gradient (>10 percent) with lesser amounts of high gradient (4 to 10 percent), moderate gradient (2 to 4 percent), and moderate gradient gully channel. Big Creek has a mixture of habitat types, including some that are fairly complex, and there is a considerable amount of riparian vegetation encroachment in the lower gradient areas. Pools are mostly shallow and there are small amounts of spawning gravel (SCE, 2003b). There are many waterfalls located in the steep gradient channel upstream of Powerhouse 1 that form barriers to upstream fish migration at all flows (SCE, 2003d). Fish sampling conducted in 2002 indicated Upper Big Creek supports self-sustaining populations of brown trout and prickly sculpin, including multiple age classes and young-of-the-year (brown trout young-of-the-year, 17 percent) (SCE, 2003c). There were no rainbow trout in Upper Big Creek. Mean brown trout density and biomass were high (see appendix C).

Dam 4 forms a 3.2 acre impoundment at the downstream end of the bypassed reach (figure 3-6). The impoundment receives inflow from Upper Big Creek, No. 1 tailrace, and Pitman Creek. Water in the impoundment is diverted through Tunnel 2 to Powerhouse 2, upstream of Dam 5 on Big Creek. Additional flow is diverted into Tunnel 2 from Balsam and Ely creeks. Sampling conducted in 2002 indicated that the forebay had self-sustaining populations of rainbow and brown trout and prickly sculpin (SCE, 2003c). Multiple age classes were present, including young-of-the-year rainbow and brown trout.

Middle Big Creek

The Middle Big Creek bypassed reach extends 4.3 miles from Dam 4 downstream to Powerhouse 2/2A, which discharges into the Dam 5 forebay on Big Creek (figure 3-6). Middle Big Creek has an elevation of 4,811 feet msl downstream of Dam 4 and 2,972 feet msl at Big Creek Powerhouse 2. There is no MIF requirement from Dam 4 in the current license. Flow in the reach derives from dam seepage, local run-off, tributaries, and accretion.

The Middle Big Creek bypassed reach is a high gradient (4 to 10 percent), bedrock/boulder channel, with a small segment of moderate gradient (2 to 4 percent) channel (SCE, 2003b). The primary habitats are step-pools and cascades. There are also substantial amounts of pool, riffle, and flatwater habitats. Generally, the pools are moderately deep to very deep, but fine sediments affect pool depth. A small amount of spawning-sized gravel is present, mostly located in the step-pools and plunge pools. Relatively small amounts of gravel are found in the high gradient riffles that are often used by spawning trout.

Fish sampling conducted in 2002 indicated that there were equal densities of rainbow and brown trout in the Middle Big Creek bypassed reach (see appendix C). The brown trout young-of the-year age class (12 percent) and density were lower in Middle Big Creek compared to the brown trout population in Upper Big Creek. However, the total trout density (brown and rainbow trout combined) was comparable to the brown trout density in Upper Big Creek; the total average adult trout density was lower than Upper Big Creek (see appendix C). Young-of-the-year were 12 percent of the rainbow trout population.

Dam 5 forms a 3.3-acre impoundment at the downstream end of the reach. The impoundment receives water from Upper Big Creek and from Powerhouse 2/2A, and serves as the forebay for the diversion to Big Creek Powerhouse 8. Water surface elevation in the forebay rarely varies by more than 5 feet. During fish sampling conducted in 2002, brown trout comprised 84 percent of the total catch and rainbow trout and prickly sculpin each comprised 8 percent in the impoundment.

Lower Big Creek

Dam 5 is 1.65 miles upstream of the confluence with the San Joaquin River (figure 3-6). The Lower Big Creek bypassed reach extends 1.65 miles from Dam 5 to its confluence with the San Joaquin River, in the impoundment formed by Dam 6. The reach drops from an elevation of 2,910 feet msl at the release point downstream of Dam 5 to 2,284 feet msl at Powerhouse 8.

The Lower Big Creek bypassed reach is moderately steep and bedrock/boulder controlled. Most of the reach is high gradient (4 to10 percent) and the lower end of the reach is very steep (>10 percent) (SCE, 2003b). The primary habitat is step-pool and other pool types, with small amounts of riffle and flatwater habitats. Most of the pools are shallow, but many pools are moderately to very deep. There are small amounts of spawning gravel in the pools. Transient fine sediments are generally associated with material discharged during tunnel inspections. A tall, vertical waterfall located 0.1 mile upstream of the confluence with the San Joaquin River prevents upstream migration from the San Joaquin River into Big Creek (SCE, 2003d).

Multiple age classes of brown and rainbow trout were collected in the Lower Big Creek bypassed reach in 2002 (SCE, 2003c). Mean rainbow and brown trout densities were high (see appendix C). There was a higher abundance of rainbow trout than brown trout, and numerous young-of-the-year rainbow trout (54 percent) were collected in the high gradient channel, which suggests reproduction occurs in or near this reach. Young-of-the-year fish made up 23 percent of the brown trout population.

Pitman Creek

The diversion on Pitman Creek is located about 1.5 miles upstream of the stream's confluence with Big Creek (figure 3-6). Flow is diverted through Tunnel 7, which transports water from Huntington Lake to Balsam forebay and North Fork Stevenson Creek. The Pitman diversion has a spill elevation of 6,998 feet msl. Pitman Creek drops steeply to an elevation of 4,843 feet msl at its confluence with Big Creek.

Pitman Creek is bedrock/boulder controlled and has a moderate gradient (2 to 4 percent) channel upstream of the diversion and a very steep channel downstream of the diversion (SCE, 2003b). The most common habitat types upstream of the diversion are step-pools and flatwater habitats (runs and glides), and there are small components of complex habitats such as pocket water and riffles. The steep gradient (>10 percent) and moderate gradient channels downstream of the diversion are almost entirely step-pool, cascade, and bedrock sheet habitats, with small components of other pool types and pocket water. Many of the pools are moderately to very deep. The only spawning gravels are small amounts upstream of the diversion, mostly in runs (SCE, 2003c). A non-project weir 0.16 mile upstream of the confluence with Big Creek blocks upstream fish migration from Big Creek (SCE, 2003d).

Catchable-sized rainbow trout have been stocked in Pitman Creek almost every year since 1956 (SCE, 2003c). In 2002 brook, rainbow, and brown trout were collected upstream of the diversion (6, 73, and 21 percent of the catch respectively). Rainbow trout comprised 94 percent of the total catch downstream of the diversion, brown trout and brook trout were each 3 percent (SCE, 2003c). The rainbow trout population may be self-sustaining, based on the presence of young-of-the-year (15 percent) and older fish. Only two brown trout and two brook trout were collected downstream of the diversion (see appendix C).

Upper Balsam Creek

The natural flow in Upper Balsam Creek is augmented by releases from the Balsam Meadows forebay, which is located 2.75 miles upstream of the confluence with Big Creek (figure 3-6). Only a small, ephemeral stream flows into the forebay. Upper Balsam Creek drops from an elevation of 6,517 feet msl at the forebay to an elevation of 4,865 feet msl at the Balsam Creek diversion.

The 2.05 mile-long Upper Balsam Creek bypassed reach is a predominantly steep, bedrock channel with some moderate gradient channels (SCE, 2003b). The predominant habitats are step-pools and high gradient riffles. There also is a substantial amount of run, step-run, and trench chute habitat. Bedrock sheets and cascades are also common, and there are small amounts of spawning gravel. There are numerous natural migration barriers throughout Balsam Creek (SCE, 2003d).

Multiple age classes of rainbow trout, including young-of-the-year (15 percent), were collected upstream of the diversion in 2002, indicating the population is self-sustaining (SCE, 2003c). Fish density and biomass were high (see appendix C).

Lower Balsam Creek

Balsam Creek enters Big Creek 1 mile downstream of Dam 4. The bypassed reach extends 0.74 mile from the Balsam Creek diversion, downstream to the confluence with Big Creek (figure 3-6). Balsam Creek has an elevation of 4,872 feet msl at the base of the diversion dam and 4,140 feet msl at the confluence with Big Creek. Water diverted from Balsam Creek is conveyed through Tunnel 2 to Powerhouse 2 on Big Creek.

Lower Balsam Creek is a steep, bedrock controlled channel (SCE, 2003b). It is mostly composed of step-pool, bedrock sheet, and high gradient riffle habitats with some cascade, step-run, run, trench chute, and other pool habitats. Nearly all of the pools are shallow. Numerous natural barriers to upstream migration fragment fish habitat in the creek. Low quality habitat, migration barriers, and small amounts of spawning gravel probably limit reproduction in the reach downstream of the diversion. Only one rainbow trout (age 2+) was collected downstream of the diversion during 2002 sampling.

Ely Creek

Ely Creek flows into Big Creek about 2.6 miles downstream of Dam 4 (figure 3-6). The Ely Creek diversion is located less than 1 mile upstream of the confluence with Big Creek. Diverted water is conveyed to Tunnel 2, which it enters through Adit 6. The diversion spill elevation is 4,844 feet msl, and the elevation of Ely Creek at its confluence with Big Creek is 3,454 feet msl. Flows are intermittent upstream of the diversion, and there is no MIF release requirement downstream of the diversion in the current license.

Ely Creek is a very steep gradient (>10 percent), granitic channel (SCE, 2003b). The reach upstream of the diversion is dominated by cascade and bedrock sheet habitats that provide low quality or no habitat and a small amount of plunge pool and flatwater habitats. The reach downstream of the diversion was dry when the stream was surveyed in 2001. The wetted segments were primarily step-runs, shallow step-pools, and high gradient riffles. Small amounts of spawning gravel were present downstream of the diversion in flatwater habitats and pools.

Rainbow trout age 3+ and greater were the only fish collected upstream of the diversion during sampling conducted in 2002 (SCE, 2003c). Multiple age classes of rainbow trout, including young-of-the-year (15 percent), and rainbow x golden trout hybrids age 1+ or greater were collected downstream of the diversion. Total rainbow and hybrid trout and adult trout densities were higher downstream of the diversion than upstream of the diversion (see appendix C). Total rainbow and hybrid trout biomass was slightly lower downstream of the diversion.

Adit 8 Creek

Adit 8 Creek is a small, intermittent and fishless stream that enters middle Big Creek downstream of Ely Creek (figure 3-6). SCE has a diversion on Adit 8 Creek that can be used to transfer water from Tunnel 5 to Tunnel 2 in the event of an outage at Powerhouse 2A. This diversion structure has not been used in since 1980. Adit 8 Creek has an elevation of 4,825 feet msl at the diversion and an elevation of 3,242 feet msl at the confluence with Big Creek.

Adit 8 Creek has a very steep gradient (>10 percent), boulder channel (SCE, 2003b). A substantial component of the habitat is cascade that has relatively low habitat value. The perennial reaches contain some components of more complex habitat (e.g. riffles) and some shallow pools. Canopy cover is high and there is a fair amount of spawning gravel. The creek is dry most of the year upstream of the diversion. The flow in Adit 8 Creek downstream of the diversion results from minor leakage from Tunnel 2.

Reservoirs

Florence Lake

The intake in Florence Lake is connected to Ward Tunnel, which carries water from Florence Lake and diverted flow from tributaries to the South Fork San Joaquin River. Flow from Ward Tunnel is discharged through either a Howell-Bunger valve or Portal powerhouse to Huntington Lake. The intake is near the bottom of the lake at an elevation of 7,200 feet msl. The intake is in a depth of 107 feet of water when the lake is full, and discharges relatively cool water during the summer months when the lake is thermally stratified.

There is no powerhouse or other source of turbine mortality upstream of Portal powerhouse. Therefore, Portal powerhouse represents the potential entrainment mortality for the Upper Basin, and was studied in support of the Portal Project. A large surface area at the intake structure (3,325.5 square feet) results in low approach velocities. Based on flow records at the Ward Tunnel intake (USGS gage no. 11229500) between 1982 and 2002, the maximum monthly, 50 percent exceedance value of associated intake approach velocity was 0.17 foot per second in July. Monthly 20 percent exceedance values also were far below the maximum swimming capability of juvenile trout (SCE, 2003g).

The relatively small amount of shallow habitat available in Florence Lake is indicative of the steep sides of the reservoir, typical of most alpine reservoirs. Sampling conducted in 2002 indicated there were abundant, self-sustaining populations of brown trout in Florence Lake and its tributaries. Rainbow trout were not collected in 2002. The ability to sample Florence Lake was limited during fall because of low lake level. The Ward Tunnel intake in Florence Lake was not submerged within the lake in the late fall. There was very little flow from the South Fork San Joaquin River upstream and the residual lake was located well upstream of the intake. Flow to the intake during October is through a shallow, slow moving stream and must pass over a weir to reach the intake. A hydroacoustic survey conducted in Florence Lake near the Ward Tunnel intake in August of 2002 showed that most fish were concentrated above a depth of 50 feet, and that substantially lower densities were found near the depth of the intake (invert elevation 7,220 feet msl) (SCE, 2003b). Therefore, entrainment mortality is low due to low intake velocities (less than 1 foot per second) and low density of trout near the Ward Tunnel intake (SCE, 2003g).

Shaver Lake

Shaver Lake has a relatively large amount of shallow habitat available at most reservoir elevations. Shallow, reef-like areas that become islands at lowered lake elevations are scattered around the edges of the reservoir. SCE has also constructed shallow water reefs and spawning terraces near the lake margin to provide additional habitat for smallmouth bass (SCE, 2003b).

Relatively cool water is released to Stevenson Creek during the summer when there are thermal gradients (SCE, 2004a). Water from Shaver Lake that is not released to Stevenson Creek is diverted through Tunnel 5 to Big Creek Powerhouse 2A. Powerhouse 2A has a Pelton Impulse turbine and a high head of 2,418 feet. The intake to Powerhouse 2A is at the bottom of the dam, with an invert elevation of 5,225 feet msl. If fish were entrained, the potential for turbine mortality would be high due to pressure changes alone (Franke et al., 1997).

The large surface area of the intake results in low approach velocities. Based on flow records at Powerhouse 2A near Big Creek gage (USGS gage no. 11238400) between 1982 and 2002 (discontinuous record), the maximum monthly intake approach velocity associated with the 50 percent exceedance flow was calculated to be 0.11 feet per/second in June through August (SCE, 2004a). Twenty percent exceedance values did not exceed 0.14 foot per second. These low approach velocities put this intake in the category of very low risk for vulnerability to entrainment because most trout have sustained swimming speeds of between five and seven body lengths per second (Bell, 1991).

A hydroacoustic survey conducted in July of 2002 showed fish at the dam end, which is the deepest portion of the lake, concentrated in the upper layers of the lake, above a depth of 71 feet. Low fish densities were found at greater depths near the intake, which has an invert elevation of 5,225 feet msl, was at a depth of 136 feet at the time of sampling, and is at a depth of 96.5 feet when the reservoir is at minimum pool. Another hydroacoustic survey conducted in October 2002 showed all fish at depths shallower than the intake (SCE, 2003a). Therefore, fish vulnerability to entrainment at the intake is low because calculated intake velocities are low (less than 1 foot per second) and fish presence near the intake face is low (SCE, 2004a).

Cal Fish & Game manages Shaver Lake as a put-and-take catchable rainbow trout fishery and a stock-and-grow fingerling and sub-catchable rainbow trout and kokanee fishery, and the populations of these species are largely of hatchery origin. Cal Fish & Game stocked an average of 35,383 catchable-sized rainbow trout, 26,082 fingerling rainbow trout, and 50,133 fingerling kokanee per year in Shaver Lake between 1998 and 2002. In addition, Shaver Lake supports a warmwater fishery for smallmouth bass, bluegill, and crappie.

During surveys conducted in 2002, rainbow trout comprised 37 percent, smallmouth bass comprised 27 percent, kokanee comprised 19 percent, and Sacramento sucker comprised 3 percent of the total catch. Small numbers of bluegill, crappie, unidentified centrarchids, and carp were also collected (SCE, 2003c). A hydroacoustic survey conducted in July of 2002 showed fish at the dam end, which is the deepest portion of the lake, concentrated in the upper layers of the lake, above a depth of 71 feet. Low fish densities were found at greater depths near the intake, which has an invert elevation of 5,225 feet msl, was at a depth of 136 feet at the time of sampling, and is at a depth of 96.5 feet when the reservoir is at minimum pool. Another hydroacoustic survey conducted in October 2002 showed all fish at depths shallower than the intake (SCE, 2003c; 2003e).

Huntington Lake

A relatively large amount of shallow habitat is available at most reservoir elevations (SCE, 2003b). Huntington Lake has two major intakes, the Tunnel 7 intake and the Powerhouse 1 intake. Powerhouse 1 is the only powerhouse directly connected to the intakes in Huntington Lake. The Tunnel 7 intake can divert water to Balsam Meadows forebay and Shaver Lake via North Fork Stevenson Creek.

During the summer when the lake is thermally stratified, the instream flow releases to Big Creek and diversions to Powerhouse 1 are from cool water deep in the reservoir. Powerhouse 1 has a Pelton Impulse turbine and a high head of 2,131 feet. The intake to the powerhouse is on the bottom of Huntington Lake with an invert elevation of 6,821 feet msl and the calculated approach velocities were low (SCE, 2004a). If fish were entrained to the intake, the potential for turbine mortality would be high due to pressure changes alone (Franke et al., 1997).

Based on flow records at Powerhouse 1 at Big Creek gage (USGS gage no. 11238100) between 1982 and 2002 (discontinuous record), the maximum monthly, 50 percent exceedance value of associated intake approach velocity was 0.45 foot per second in June and July. Calculated intake velocities in October were generally lower than during the summer months. Monthly 20 percent exceedance values over the period of record were near 0.5 foot per second during months of peak diversion. These calculated approach velocities indicate the intake has a low risk for vulnerability to entrainment because most trout have sustained swimming speeds of between five and seven body lengths per second (Bell, 1991). Therefore, despite the relatively large numbers of fish in the lake, fish vulnerability to entrainment at the Tunnel 1 intake is low because intake velocities are generally low (less than 1 foot per second) and fish presence near the intake face is low.

The Tunnel 7 intake is shallower than the intake to Tunnel 1 (invert elevation 6,885 feet msl) (SCE, 2004a). Hydroacoustic surveys conducted in 2002 showed that most fish were concentrated at depths shallower than the intake in June. In October, when calculated approach velocities were lower, a higher density of fish was found at depths similar to the intake. The calculated approach velocities at the Tunnel 7 intake were also low, based on flow records at the Huntington-Shaver Conduit at Huntington Lake gage (USGS gage no. 11236080) for the period between 1974 and 1983 (SCE, 2004a). The maximum, monthly intake approach velocity associated with the 50 percent exceedance flow was 0.32 foot per second in June. The 50 percent exceedance flow intake approach velocity in October was 0 foot per second. Twenty percent exceedance flow intake velocities did not exceed 0.58 foot per second. These velocities indicate that vulnerability to entrainment is also low (less than 1 foot per second). Fish entrained into Tunnel 7 from Huntington Lake to Balsam Meadows forebay would not experience turbine passage, but subsequent entrainment to the Eastwood power station intake in Balsam Meadows forebay potentially may result in turbine passage (SCE, 2004a).

Cal Fish & Game manages Huntington Lake as a put-and-take fishery for catchable rainbow trout, and as a stock-and-grow fishery for fingerling and sub-catchable rainbow trout. A stock-and-grow fishery for kokanee also is maintained. From 1998 through 2002, Cal Fish & Game stocked an average of 30,320 catchable-sized rainbow trout and 18,407 rainbow fingerlings per year, and an average of 4,103 fingerling kokanee. Huntington Lake also has a self-sustaining population of brown trout and some naturally-produced rainbow trout.

During fisheries surveys in 2002, prickly sculpin comprised 40 percent of the catch, Sacramento sucker comprised 39 percent, brown trout comprised 11 percent, and rainbow trout and kokanee comprised 5 percent each (SCE, 2003c). Mean condition factors were greater than 1 for trout and 2.94 for kokanee (see appendix C).

Balsam Meadows Forebay

Water is diverted to the forebay by the Balsam Meadows diversion conduit, a shunt of Tunnel 7 that carries water from Huntington Lake and Pitman diversion to the forebay and to North Fork Stevenson Creek. The majority of flow from Balsam Meadows forebay is routed through Eastwood power station and discharged to Shaver Lake. Eastwood power station also may operate in pumpback mode at night to supplement peak generation during the day. The water pumped from Shaver Lake passes through Eastwood power station tunnel, the same conduit that draws water from Balsam Meadows forebay. The intake has an invert elevation of 6,600 feet msl.

The Eastwood power station has a Francis reaction/pump turbine and a high head of 1,338 feet. These turbines have a lower potential for turbine mortality than Pelton Impulse turbines; however, head at this location is relatively high and potential turbine mortality would be low to high if fish were entrained due to pressure changes alone (Franke et al., 1997).

Based on flow records at the Eastwood power station between 1987 and 2002, the monthly, 50 percent exceedance value flows have associated intake approach velocities of 0.15 to 0.67 foot per second. These velocities indicate that vulnerability to entrainment would be low because most trout have sustained swimming speeds of between five and seven body lengths per second (Bell, 1991). The highest monthly value occurred in June when velocities resulting from 20 percent exceedance flows were 1.06 feet per second (June) or less. Therefore, fish vulnerability to entrainment at the intake is low to medium because intake velocities are low (less than 1 foot per second), fish presence near the intake face is low, and fish near the intake are likely to be larger adults.

The Eastwood power station intake is located on the north side of the forebay and contains suitable habitat for fish, but the shallow water habitat is limited by the small size and relatively steep shoreline (SCE, 2004a). Only a small ephemeral stream flows into the forebay. The reservoir can be thermally stratified during the summer, although thermal stratification does not occur often and does not persist.

The forebay is not currently stocked. During fisheries surveys conducted in the forebay in 2002, prickly sculpin comprised 41 percent of the catch, kokanee comprised 28 percent of the catch, and Sacramento sucker comprised 19 percent of the catch. Rainbow trout, smallmouth bass, and brown trout comprised 7, 3, and 2 percent of the catch, respectively (SCE, 2003c). Multiple age classes including younger fish were represented for most species, except for brown trout. Only age 6+ and older brown trout were identified in this location.

Mammoth Pool Reservoir

The reservoir has steep sides and shallow water habitat is relatively rare at all reservoir elevations. The amount of deep water habitat is relatively unchanged by changes in reservoir elevation.

Water from Mammoth Pool that is not released to the San Joaquin River is diverted through a water conduit, consisting of the Mammoth Pool power tunnel and a penstock that connects Mammoth Pool to Mammoth Pool powerhouse. The intakes for the Howell-Bunger valve, the fishwater turbine, and the diversion to the Mammoth Pool powerhouse are at considerable depth near the dam, where the coolest water is found during periods of thermal stratification. The intake to the Mammoth Pool powerhouse is near the bottom of the reservoir, with an invert elevation of 3,100 feet msl. The powerhouse has two Francis reaction turbines and high head of 1,100 feet. Potential turbine mortality would be low to high if fish were entrained due to pressure changes alone (Franke et al., 1997).

Based on flow records at the Mammoth Pool power plant near Big Creek (USGS gage no. 11235100) between 1982 and 2002 (discontinuous record), intake approach velocity associated with the maximum, monthly, 50 percent exceedance flow value was calculated as 0.73 foot per second in May (SCE, 2004a). Twenty percent exceedance values did not exceed 0.81 foot per second. This suggests that when fish are near the intake, vulnerability to entrainment would be low (Bell, 1991).

Very few fish were found near the powerhouse intake during hydroacoustic surveys, indicating that there is little potential for fish to encounter the intakes (SCE, 2004a). The reservoir trout population is primarily composed of larger fish (most juveniles rear in accessible tributaries) and the powerhouse intake approach velocities are well within the swimming capabilities of adult fish. Therefore, fish vulnerability to entrainment at the intake is low due to low intake velocities (less than 1 foot per second) and low fish presence near the intake face.

Cal Fish & Game manages Mammoth Pool reservoir as a put-and-take fishery for catchable rainbow trout, and as a stock-and-grow fishery for fingerling and sub-catchable rainbow trout. From 1998 to 2002, Cal Fish & Game stocked an average of 7,975 catchable-sized rainbow trout, 4,002 sub-catchable rainbow, and 12,070 rainbow fingerlings per year in Mammoth Pool reservoir (SCE, 2003c).

Mammoth Pool reservoir also supports a self-sustaining population of brown trout (SCE, 2003c). Brown trout comprised 71 percent of the fish sampled in 2002, and rainbow trout, probably of hatchery origin, comprised 29 percent (SCE, 2003c). The brown trout collected were all age 3+ or older. No other species were collected. The rainbow trout appeared to be of hatchery origin, based on physical appearance and scale analysis (SCE, 2003c).

3.3.1.2 Environmental Effects

This section discusses the effects of relicensing the Big Creek ALP Projects under the terms of the Settlement Agreement, with additional measures specified or recommended by the Forest Service or Interior. Proposed and recommended measures are discussed in the order they are presented in the Settlement Agreement.

General Streamflow Requirements

Under Settlement Agreement measure A1.1.1, SCE would maintain MIFs in the bypassed reaches downstream of project diversion dams. Instream flows would be the flows set forth below or the natural inflow into the point of diversion, whichever is less.

Rock Creek (A1.1.1.1)

All water year types

- August 1-December 31: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs[28]
- January 1-March 31: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs
- April 1-June 30: 24-hour average of 2 cfs with an instantaneous floor of 1.5 cfs
- July 1-July 31: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs

Ross Creek (A1.1.1.2)

Wet, above normal, below normal water year types

- October 1-September 30: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs

Dry, critical water year types

[28] The instantaneous flow is the flow value used to construct the average daily flow value and would be measured in time increments that SCE has proposed of at least once every 15 minutes. The 24-hour average flow is the average of the incremental readings from midnight of one day to midnight of the next day.

- July 1-November 30: Not diverting
- December 1-June 30: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs

San Joaquin River (Dam 6 to Redinger reservoir – "Stevenson Reach") (A 1.1.1.3)

All water year types

- August 1-October 31: 24-hour average of 50 cfs with an instantaneous floor of 45 cfs
- November 1-November 30: 24-hour average of 25 cfs with an instantaneous floor of 22 cfs
- December 1-February 28: 24-hour average of 20 cfs with an instantaneous floor of 18 cfs
- March 1- March 31: 24-hour average of 50 cfs with an instantaneous floor of 45 cfs
- April 1-June 30: 24-hour average of 80 cfs with an instantaneous floor of 72 cfs
- July 1-July 31: 24-hour average of 60 cfs with an instantaneous floor of 54 cfs

San Joaquin River (Mammoth Pool Dam to Dam 6) (A1.1.1.4)

All water year types

- September 1-November 30: 24-hour average of 80 cfs with an instantaneous floor of 72 cfs
- December 1-February 28: 24-hour average of 55 cfs with an instantaneous floor of 50 cfs
- March 1-March 31: 24-hour average of 80 cfs with an instantaneous floor of 72 cfs
- April 1-June 30: 24-hour average of 125 cfs with an instantaneous floor of 112 cfs
- July 1-August 31: 24-hour average of 100 cfs with an instantaneous floor of 90 cfs

Lower Stevenson Creek (A1.1.1.5)

All water year types

- October 1-March 31: 24-hour average of 5 cfs with an instantaneous floor of 4 cfs
- April 1-June 30: 24-hour average of 10 cfs with an instantaneous floor of 8 cfs
- July 1-September 30: 24-hour average of 8 cfs with an instantaneous floor of 6 cfs

Lower Balsam Creek (Diversion to Big Creek) (A1.1.1.6)

All water year types

- October 1-June 30: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs
- July 1-September 30: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs

Upper Balsam Creek (Forebay to Diversion) (A1.1.1.7)

All water year types

- July 1-March 31: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs
- April 1-June 30: 24-hour average of 2 cfs with an instantaneous floor of 1.5 cfs

Middle Big Creek (Dam 4 to Dam 5) (A1.1.1.8)

All water year types

- October 1-October 31: 24-hour average of 8 cfs with an instantaneous floor of 6 cfs
- November 1-March 31: 24-hour average of 7 cfs with an instantaneous floor of 5 cfs
- April 1-September 30: 24-hour average of 12 cfs with an instantaneous floor of 10 cfs

Lower Big Creek (Dam 5 to San Joaquin River) (A1.1.1.9)

All water year types

- October 1-October 31: 24-hour average of 8 cfs with an instantaneous floor of 6 cfs
- November 1-March 31: 24-hour average of 7 cfs with an instantaneous floor of 5 cfs
- April 1-September 30: 24-hour average of 12 cfs with an instantaneous floor of 10 cfs

Upper Big Creek (Huntington Lake to Dam 4) (A1.1.1.10)

All water year types

- October 1-March 31: 24-hour average of 2 cfs with an instantaneous floor of 1.5 cfs
- April 1-June 30: MIF release valve to be fully open
- July 1-September 30: 24-hour average of 3 cfs with an instantaneous floor of 2 cfs

Ely Creek (A1.1.1.11)

All water year types

- June 1-February 28: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs
- March 1-March 31: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs
- April 1-May 31: 24-hour average of 2 cfs with an instantaneous floor of 1.5 cfs

North Fork Stevenson Creek (A1.1.1.12)

All water year types

- October 1-September 30: The minimum release would be 12 cfs, or the flow through the instream flow valve when that valve is wide open

Pitman Creek (A1.1.1.13)

All water year types

- July 1-March 31: 24-hour average of 0.8 cfs with an instantaneous floor of 0.5 cfs
- April 1-June 30: 24-hour average of 2.5 cfs with an instantaneous floor of 2.0 cfs

Bear Creek (A1.1.1.14)

All water year types

- July 1-November 30: 24-hour average of 7 cfs with an instantaneous floor of 5 cfs
- December 1-December 31: 24-hour average of 6 cfs with an instantaneous floor of 4 cfs
- January 1-March 31: 24-hour average of 4 cfs with an instantaneous floor of 3 cfs
- April 1-Jun 30: 24-hour average of 10 cfs with an instantaneous floor of 8 cfs

Mono Creek (Downstream of Mono Diversion) (A1.1.1.15)

All water year types

- September 1-December 31: 24-hour average of 25 cfs with an instantaneous floor of 22 cfs
- January 1-March 31: 24-hour average of 18 cfs with an instantaneous floor of 16 cfs
- April 1-June 30: 24-hour average of 25 cfs with an instantaneous floor of 22 cfs

- July 1-August 31: 24-hour average of 30 cfs with an instantaneous floor of 27 cfs

South Fork San Joaquin River (A1.1.1.16)

All water year types

- October 1-October 31: 24-hour average of 30 cfs with an instantaneous floor of 27 cfs
- November 1-March 31: 24-hour average of 25 cfs with an instantaneous floor of 22 cfs
- April 1-June 30: 24-hour average of 40 cfs with an instantaneous floor of 36 cfs
- July 1-September 30: 24-hour average of 35 cfs with an instantaneous floor of 32 cfs

Bolsillo Creek (A1.1.1.17)

All water year types

- July 1-March 31: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs
- April 1-June 30: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs

Camp 61 Creek (A1.1.1.18)

Wet, above normal, below normal water year types

- October 1-March 31: 24-hour average of 2 cfs with an instantaneous floor of 1.5 cfs
- April 1-June 30: 24-hour average of 4 cfs with an instantaneous floor of 3 cfs
- July 1-September 30: 24-hour average of 3 cfs with an instantaneous floor of 2 cfs

Dry, critical water year types

- October 1-September 30: 24-hour average of 1.25 cfs with an instantaneous floor of 0.75 cfs

Camp 62 Creek (A1.1.1.19)

All water year types

- July 1-March 31: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs
- April 1-June 30: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs

Chinquapin Creek (A1.1.1.20)

All water year types

- July 1-March 31: 24-hour average of 0.5 cfs with an instantaneous floor of 0.35 cfs
- April 1-June 30: 24-hour average of 1 cfs with an instantaneous floor of 0.75 cfs

Hooper Creek (A1.1.1.22)

All water year types

- October 1-March 31: 24-hour average of 2 cfs with an instantaneous floor of 1.5 cfs
- April 1-June 30: 24-hour average of 4 cfs with an instantaneous floor of 3 cfs
- July 1-September 30: 24-hour average of 3 cfs with an instantaneous floor of 2 cfs

Crater Creek (A1.1.1.21), North Slide Creek (A1.1.1.23), South Slide Creek (A1.1.1.24), and *Tombstone Creek (A1.1.1.25)*

All water year types

- Removed from service

Other Recommendations

The Forest Service filed a 4(e) condition and Interior filed a 10(j) recommendation for all the Big Creek ALP Projects that are consistent with Settlement Agreement measure A1.1.1, General Instream Flow Requirements. For Big Creek Nos. 1 and 2, the Forest Service also filed a 4(e) condition and Interior filed a 10(j) recommendation that suggest that Adit 8 and Rancheria creeks be removed from license.

Our Analysis

In this section, we evaluate the effects of MIF provisions included in Settlement Agreement measure A1.1.1 for each reach, based on fish population and habitat assessments conducted by SCE and presented in the amended PDEA (SCE, 2007a). Many bypassed reaches were naturally fishless, but most currently support self-sustaining populations of introduced rainbow, brown, and/or brook trout. The results of SCE's fisheries surveys, conducted in coordination with the Combined Aquatics Working Group, found that fish condition factors in bypassed reaches were consistently greater than or equal to 1 (see appendix C), indicating that stream productivity is generally not a limiting factor. In a number of reaches, a lack of high quality spawning gravel and LWD was observed, which may be attributed to trapped materials in project reservoirs. A scarcity of these features may limit trout productivity and recruitment. Proposed and recommended measures designed to address these factors are discussed in sections 3.3.1.2, *Sediment Management and Large Wood Debris Management*.

In some of the project reaches, low flows from project operations create barriers to fish passage, limit available fish habitat, reduce DO levels, and contribute to daily mean and maximum water temperatures that exceed optimal levels for trout growth. The objectives of the Basin Plan (CVRWQCB, 1998) include maintaining temperatures that do not impair beneficial uses and limiting thermal warming to ≤2.8 ºC above the natural receiving water temperature. The Water Board considers temperatures needed to protect cold freshwater habitat to be met when daily mean water temperatures are 20ºC or less and daily maximum temperatures are 22ºC or less. These conditions are considered sufficient to protect the beneficial use (J. Canaday, Water Board, cited from SCE, 2007a, attachment C). A review of water temperature requirements of Central Valley rainbow trout included in the amended PDEA supported a conclusion that daily mean summer water temperatures of 20ºC or less would be suitable for rainbow trout growth. The review also indicated that the incipient upper lethal temperature for rainbow trout is in the range of 25 to 30ºC. Moyle (2002) reports preferred temperatures ranges of 12 to 20ºC for brown trout and 14 to 19 ºC for brook trout. He also reports that brown trout can survive for short periods of time at temperatures up to 28 to 29°C, and that brook trout can survive at temperatures of up to 26°C, but that growth is poor at temperatures much above 19°C.

Water temperature data collected by SCE in 2000 and 2001 indicated that the 20ºC daily average and ≤2.8ºC thermal warming criteria were only rarely exceeded in 2000, but that the thermal warming and the daily mean temperature criteria were frequently exceeded in 2001 in (1) Mammoth Pool reach; (2) Ross and Rock creek bypassed reaches; and (3) Big Creek bypassed reach upstream of Balsam Creek (table 3-8). Although condition factors indicated that thermal stress was not having a pronounced adverse effect on trout growth rates in most reaches, it is likely that maintaining mean daily water temperatures ≤20ºC would improve trout growth and survival.

The bypassed reaches have numerous barriers to upstream fish migration, including some natural barriers (e.g., waterfalls and cascades) that may be passable at higher flows (SCE, 2003d). Natural seasonal runoff conditions affect passage of migrating fish, particularly prior to or during spawning periods. Native rainbow trout spawning migrations occur in April through June during the spring runoff period, and therefore are less likely to be affected by flow-related passage barriers than brown and brook trout, which spawn in the fall, during low flow conditions.

The proposed increases in MIFs would generally meet the Forest Service's aquatic management goals, objectives, and direction and Interior's general resource objectives for improving aquatic habitat and conserving aquatic species. They would also improve compliance with the Basin Plan objectives for coldwater beneficial uses in many of the bypassed reaches by decreasing the prevailing seasonal water temperatures. The environmental effects of the proposed MIFs in specific bypassed reaches (table 3-9), and attainment of the Forest Service and Interior's specific resource objectives (SROs), are discussed below. The Forest Service and Interior identified SROs for the project reaches with the specified and recommended terms and conditions they filed for each project. Identification of both daily average and instantaneous minimum flows, as SCE does for most reaches, would provide some allowance for variations in the accuracy of flow releases and measurements, while avoiding the potential for adverse effects from large variations in flow.

Table 3-9. Miles of project stream affected by the proposed MIFs. (Source: SCE, 2007, PDEA table 5.2.3-1)

Bypassed Stream Reach	Miles of Increased MIF	Reaches with Temperatures >20°C
Rock Creek	0.4	0.4
Ross Creek	0.85	0.85
San Joaquin River Stevenson reach	5.7	5.7
San Joaquin River Mammoth reach	8.4	8.4
Stevenson Creek	4.3	
Lower Balsam Creek	0.74	
Upper Balsam	2.05	
Middle Big Creek	4.3	
Lower Big Creek	1.65	1.65
Upper Big Creek	3.6	3.6
Ely Creek	1.0	
North Fork Stevenson Creek	3.6	
Pitman Creek	1.5	
Bear Creek	1.6	
Mono Creek	5.8	
South Fork San Joaquin River	28.0	28.0
Bolsillo Creek	1.6	
Camp 61 Creek	2.0	
Camp 62 Creek	1.35	
Chinquapin Creek	0.9	

Bypassed Stream Reach	Miles of Increased MIF	Reaches with Temperatures >20ºC
Crater Creek	2.85	
Crater Creek Diversion Channel	1.38	
Hooper Creek	0.6	
North Slide Creek	0.3	
South Slide Creek	0.3	
Tombstone Creek	1.0	
Total Stream Miles	**85.77**	**48.60**

Rock Creek (A1.1.1.1)[29]

Historically, Rock Creek was most likely fishless, due to steep stream gradients (>20 percent), and three waterfalls that form a complete barrier to fish migration at all flows (two of them are located only several hundred feet upstream of the confluence with the San Joaquin River) that prevent the upstream migration of fish from the San Joaquin River. Rainbow, brown, and brook trout have been planted in Rock Creek in the past, and Cal Fish & Game continues to stock rainbow trout. The fishery downstream of the diversion dam has less fish density, biomass, and habitat compared to upstream of the dam. Recruitment to early life stages appears to be limited both upstream and downstream of the dam. Habitat downstream of the dam is limited by topography, lack of spawning sites (no spawning gravel observed), and low flow. A large segment (37 percent; about 1,000 feet) of the reach downstream of the diversion was not surveyed because of difficult access and safety concerns. This section is dominated by cascades and waterfalls.

There is no MIF requirement for the Rock Creek bypassed reach under the current license and it is probable that the magnitude of peak flows has decreased substantially because of diversions during the spring. Daily mean and maximum water temperatures measured in 2000 and 2001 were >20ºC in the bypassed reach in the summer and early fall months. Excessive thermal warming (>2.8ºC) occurred downstream of the dam (see table 3-8), which was likely attributable to project operations, although air temperatures were also warmer than normal during much of the monitoring period in both years. Review of modeled data for mid-August to mid-September indicates that the unregulated 30-day minimum flow was about 0.1 cfs.

[29] The bypassed reaches downstream of project diversion dams are discussed in the order in which they appear in the Settlement Agreement.

Although the Forest Service did not provide SROs for Rock Creek, it did state that increased flows from Rock Creek may assist with providing cooler water temperatures in Mammoth reach. Interior contends there are no fish in Rock Creek downstream of FS Road No. 4S81. Interior's applicable fisheries SROs for Rock Creek bypassed reach are listed below.[30]

- Provide a MIF in Rock Creek bypassed reach that is greater than the 30-day minimum flow.
- Improve habitat for trout species in terms of water temperature and flow.
- Emphasize habitat improvements for harvest species.

There is currently no MIF for Rock Creek. The proposed MIF of 0.5 to 2 cfs (24-hour average) and 0.35 to 1.5 cfs (instantaneous), depending on water year type and season, would be substantially higher than the unregulated 30-day minimum flow (0.1 cfs). The proposed MIF would reduce thermal warming in 0.4 mile of stream (see table 3-9),consistent with Interior's SRO to emphasize habitat improvements for harvest species (hatchery rainbow trout, naturally reproducing rainbow, and brown trout). A weighted usable area (WUA[31]) analysis was not completed for this reach due to extremely low amounts of riffle habitat. However, the proposed MIFs would provide year-round wetted habitat, and increase habitat connectivity and pool depths. The proposed MIFs would have little effect on existing spawning habitat, recruitment, and productivity that are naturally limited due to steep gradients and lack of spawning gravel.

Ross Creek (A1.1.1.2)

Ross Creek was historically fishless due to steep stream gradients (>20 percent) that prevent the upstream migration of fish from the San Joaquin River. Rainbow and brown trout have been planted in Ross Creek, and both species are reported to persist, although fish populations were not sampled by SCE because the reach was dry in 2002 when sampling occurred.

There is no MIF requirement for the Ross Creek bypassed reach under the current license, and Ross Creek is dry upstream and downstream of the diversion during most of the summer and fall, due in part to an upstream non-project diversion. The synthetic unregulated hydrograph also indicates a 30-day minimum of 0 cfs between mid-August to mid-September. Daily mean and maximum water temperatures were >20ºC in the bypassed reach during the summer and early fall months of 2000 and 2001, and excessive thermal warming (>2.8ºC) occurred downstream of the dam (table 3-8).

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[30] Interior's additional SROs for Rock Creek pertain to western pond turtle habitat.

[31] WUA is an index of fish habitat generated by the Physical Habitat Simulation Model (PHABSIM).

Although the Forest Service did not provide SROs for Ross Creek, it did state that increased flows from tributary streams may assist with providing cooler water temperatures in the Mammoth reach. Interior contends there are no fish in Ross Creek downstream of FS Road No. 4S81. Interior's only fisheries SROs for Ross Creek are to provide an MIF that is greater than the 30-day minimum flow and to emphasize habitat improvements for harvest species.[32]

The proposed MIF of 0.5 cfs (24-hour average) and 0.35 cfs (instantaneous) except July through November of critically dry water years (not diverting) is higher than the unregulated 30-day minimum flow (0 cfs) and would reduce thermal warming in 0.85 mile of Ross Creek (see table 3-9) and in the lower 4 miles of the Mammoth reach (the San Joaquin River from Mammoth Pool dam to Dam 6) (A1.1.1.4)

Stevenson Reach (the San Joaquin River from Dam 6 to Redinger) (A1.1.1.3)

All fish species found in the Stevenson reach were in good condition (see appendix C); however, the fish communities differed between the upper and lower portions of the reach. The upper portion of the reach was dominated by Sacramento sucker, but also included smaller numbers of rainbow and brown trout, Sacramento pikeminnow, and prickly sculpin. The lower portion of the reach supported more species associated with the native transition zone fish community including Sacramento pikeminnow, hardhead, and Sacramento sucker, with almost no trout.

The native transition zone species found in the Stevenson reach are also found in Redinger reservoir, and it is likely adults of these species spawn in the Stevenson reach and then return to the lake after spawning. Interior reports that hardhead numbers, particularly adults, were lower in this reach than in other locations in the system where they occur.

Indicators of hydraulic alteration (IHA)[33] analysis estimates the 30-day minimum unregulated flow during dry water years was 69 cfs and during wet water years was 192 cfs. The current year-round MIF for the Stevenson bypassed reach is 3 cfs (see tables 3-1 and 3-2), indicating the current flow regime is substantially lower than historic drought conditions. Daily mean water temperatures were >20ºC and exceeded Basin Plan objectives during the summer and early fall months of 2000 and 2001.

SCE's studies indicated that the difference in fish communities between the Upper and Lower Stevenson reach was largely due to differences in water temperatures (SCE, 2003f). Cool water released from Dam 6 resulted in daily maximum water temperatures ≤20ºC in the upper end of the Stevenson reach in 2000 and 2001 (see table 3-8).

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[32] Interior's additional SROs for Ross Creek pertain to western pond turtle habitat.

[33] IHA is an analysis technique that evaluates the effect of a project on flow levels and recurrence intervals.

Water temperatures increased rapidly downstream to the next monitoring site just upstream of the Stevenson Creek confluence. Summer daily mean temperatures were >20ºC at this site in both 2000 and 2001 (see table 3-8). Inflow from Stevenson Creek and the Powerhouse 3 tailrace provide relatively cool water to the lower section of the Stevenson reach in the summer months (see table 3-8).

Summer water temperatures in the reach are frequently above the optimal ranges for rainbow and brown trout, but are close to or within the reported optimal ranges identified for hardhead.[34] Water temperatures near the Big Creek Powerhouse 3 tailrace were generally more favorable for trout growth than temperatures in the lowermost portion of the Stevenson reach, which were more suitable for hardhead.

Forest Service and Interior's SROs for the Stevenson reach are as follows.

- Provide cooler water temperatures during July and August.
- Provide more habitat for hardhead and Sacramento pikeminnow.
- Provide more habitat for adult rainbow and brown trout.

The proposed MIF would range seasonally[35] from 20 to 80 cfs (24-hour average) and 18 to 72 cfs (instantaneous). The proposed MIF also would increase the physical habitat (WUA) that is available for all life stages of rainbow and brown trout, Sacramento pikeminnow, and adult hardhead in Stevenson reach. The existing adult rainbow trout habitat under the current MIF is 44 percent WUA[36] and brown trout habitat is 56 percent WUA during normal and dry water years. The proposed MIF would increase adult rainbow trout habitat to 75 to 84 percent WUA and brown trout habitat to 86 to 93 percent WUA during the spring and summer months (April through September) when habitat is most likely limiting trout production.

The existing rainbow and brown trout spawning habitat is 18 and 15 percent WUA, respectively. The proposed MIF would increase rainbow trout spawning habitat to 100 percent WUA and brown trout spawning habitat to 72 to 91 percent WUA.

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[34] Moyle (2002) notes hardhead prefer water temperature 24 to 28°C. Preliminary work by Cech suggests that adult hardhead acclimated to water temperatures below 20°C prefer temperatures at or above 20°C (J. Cech, University of California at Davis, personal communication 2006, cited in SCE, 2007c).

[35] Proposed MIFs in some reaches vary by season and water year type. For specific MIFs proposed for each season and water year type, refer to the comprehensive listing of proposed MIF requirements provided at the beginning of this section.

[36] WUA percentages presented in this EIS are the percentage of the maximum WUA over the entire range of flows that were modeled.

The existing adult hardhead habitat is 58 percent WUA; juvenile hardhead habitat is 78 percent. The proposed MIF would increase adult hardhead habitat to 70 to 87 percent WUA and juvenile hardhead habitat to 90 to 100 percent WUA.

The existing adult Sacramento sucker habitat is 48 percent WUA; juvenile Sacramento sucker habitat is 90 percent. The proposed MIF would increase adult Sacramento sucker habitat to 61 to 81 percent WUA, and juvenile Sacramento sucker habitat to 95 to 100 percent WUA.

The existing adult Sacramento pikeminnow habitat is 76 percent WUA; juvenile Sacramento pikeminnow habitat is 90 percent. The proposed MIF would increase adult Sacramento pikeminnow habitat to 90 to 100 percent WUA and juvenile Sacramento pikeminnow habitat to 94 to 100 percent WUA.

Increased flow should also provide a more consistent water temperature regime that would benefit all trout life stages and reduce thermal warming in 5.7 miles of stream (see table 3-9). Although increased flows may contribute to water temperatures that are lower than optimal for hardhead growth, reduced daily fluctuations may be beneficial to this species as well. Water temperature monitoring would determine if the proposed MIFs bring Stevenson reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*). Fish monitoring would determine if the Stevenson reach is an important transitional zone habitat and whether it would be more appropriately classified as warmwater habitat (see section 3.3.1.2, *Fish Monitoring*).

Mammoth Reach (the San Joaquin River from Mammoth Pool Dam to Dam 6) (A1.1.1.4)

Mammoth reach currently supports self-sustaining populations of Sacramento sucker, rainbow and brown trout. Recruitment appears to be occurring, but there are low numbers of young trout.

The current MIFs range seasonally and by water year from 10 to 30 cfs (tables 3-1 and 3-2) and are substantially lower than historic drought conditions (30-day minimum flow 67 cfs). Temperature monitoring conducted by SCE indicated that daily mean and maximum water temperatures upstream of Ross Creek exceeded 20ºC in 23 days in 2001, and excessive thermal warming (>2.8 ºC) occurred during the summer and early fall months of 2001 (see table 3-8).

Forest Service and Interior's SROs for Mammoth reach are as follows.

- Ensure that the MIF in Mammoth reach is sufficient to enhance trout life stages and maintain adult trout populations (≥ 6 inches in length) where a coldwater fishery is the designated beneficial use and surveys indicate the presence of trout (Interior).

- Enhance habitat in Mammoth reach. Provide 80 percent of maximum WUA for spawning and 90 percent of maximum WUA for adult trout during the summer (Interior). Provide 95 percent of maximum summer WUA for adult rainbow and brown trout (Forest Service).
- Ensure that the MIF in Mammoth reach is sufficient to maintain preferable stream temperatures defined as mean daily temperature of 17ºC and daily maximum of ≤20ºC from May 1 through October 31 in stream reaches where a coldwater fishery is the designated beneficial use (Interior).
- Ensure that the MIF in Mammoth reach during July and August is no lower than the 30-day minimum flow identified for the reach by IHA analysis (Interior).
- Provide cooler water temperatures within Mammoth reach during July and August.
- Provide more spawning gravels within Mammoth reach.

The proposed MIFs, which range seasonally from 55 to 125 cfs (24-hour average) and from 50 to 112 cfs (instantaneous) would reduce thermal warming in 8.4 miles of stream and provide cooler water temperatures in July and August (see table 3-9). However, the proposed MIF would be lower than 30-day unregulated minimum flows (67 cfs in dry water years and 182 cfs in wet water years) in July and August. Water temperature monitoring would determine if the proposed MIF for Mammoth reach complies with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

The existing adult rainbow trout spring-summer habitat (April through September) in Mammoth reach, under current flows, is 53 to 70 percent WUA, and adult brown trout is 69 to 84 percent WUA during normal and dry water years. The proposed MIF would increase adult rainbow trout habitat to 89 to 95 percent WUA and adult brown trout to 98 to 100 percent during the spring and summer months when habitat is most likely limiting trout production. These increases essentially would meet the Forest Service and Interior’s SROs to provide 90 to 95 percent maximum summer WUA for adult trout.

The existing rainbow trout spawning habitat is 22 to 38 percent WUA, under current flows; brown trout spawning habitat is 26 to 40 percent. The proposed MIF would increase rainbow trout spawning habitat to 63 percent and brown trout spawning habitat to 60 to 66 percent WUA. The proposed MIF substantially would increase spawning habitat for rainbow and brown trout, although it would not meet the Forest Service and Interior’s SROs to provide 80 percent of maximum spawning habitat for rainbow and brown trout.

Fish monitoring would determine if trout life stages are enhanced and adult trout populations (≥ 6 inches in length) are maintained where a coldwater fishery is the designated beneficial use and surveys indicate the presence of trout in the Mammoth reach (see section 3.3.1.2, *Fish Monitoring*).

The need for spawning gravel supplementation within the Mammoth reach is discussed later in this section, in *Sediment Management, Mammoth Pool*, and addressed again in the staff alternative (see section 5.2.4, *Comprehensive Development and Recommended Alternative, Mammoth Pool Project*).

Stevenson Creek (A1.1.1.5)

Stevenson Creek bypassed reach supports a self-sustaining rainbow trout fishery despite the presence of an estimated 13 natural barriers to upstream fish migration. Current flows are greater during summer and early fall than the 30-day historic drought conditions as a result of minimum flows released from Shaver Lake. Cold water is released when Shaver Lake stratifies in summer. By the end of summer, when the lake begins to lose its thermal stratification, warmer mixed water is released. Summer water temperatures are within the desired range for rainbow trout.

Mean daily water temperatures were ≤20ºC in 2000 and 2001, although thermal heating >2.8ºC occurred during early fall (see table 3-8). Water warms over the length of the reach during summer months and then cools starting in October.

The MIF requirement under the current license is 2 to 3 cfs, which provides less than 50 percent of the maximum WUA for adult rainbow trout. The instream flow transect data indicates that 5 to 6 cfs is necessary for fish passage where passage is not restricted by total barriers.

Forest Service and Interior's SROs for Stevenson Creek bypassed reach are as follows.

- Provide more spawning and adult habitat for rainbow trout.
- Provide for fish passage.
- Provide a sufficient MIF such that water temperatures do not exceed 2.8ºC thermal warming through the reach during the summer and fall.

The proposed MIF of 5 to 10 cfs (24-hour average) and 4 to 8 cfs (instantaneous) would be substantially larger than the 30-day unregulated minimum flow (0.2 dry water years and 0.8 wet water years). The proposed MIFs would also reduce thermal warming in 4.3 miles of stream (see table 3-9), and maintain consistency with water temperature objectives in the Basin Plan. Water temperature monitoring would determine if the proposed MIFs for Stevenson Creek reach comply with Basin Plan objectives for coldwater beneficial uses (section 3.3.1.2, *Temperature Monitoring and Management*).

The proposed MIF would increase adult rainbow trout spring-summer habitat (April through September) from an existing condition of 41 percent WUA to 64 to 71 percent WUA during normal and dry water years. Rainbow trout spawning habitat would increase from 18 to 88 percent WUA. The proposed April 1 to June 30 MIF of 10 cfs (24-hour average) would also improve passage during spawning.

DO concentrations that did not meet the state water quality objectives occurred in Stevenson Creek bypassed reach in 2002 (SCE, 2003h). Increased MIFs would lower instream water temperatures and increase DO concentrations in this reach. Implementation of the proposed *Temperature Monitoring and Management Plan* in appendix H of the Settlement Agreement would help determine if the water temperature and the related DO levels associated with the proposed flow increases meet Basin Plan DO objectives (see section 3.3.1.2, *Temperature Monitoring and Management*).

Lower Balsam Creek (Diversion to Big Creek) (A1.1.1.6) and Upper Balsam Creek (Forebay to Diversion) (A1.1.1.7)

Upper Balsam Creek bypassed reach has a self-supporting rainbow trout population that offers a better fishing opportunity than Lower Balsam Creek bypassed reach. Only one rainbow trout was collected in Lower Balsam Creek bypassed reach during sampling conducted in 2002. Ten natural barriers to upstream migration, including a 27-foot waterfall, 0.02 mile upstream of the reach's confluence with Big Creek, prevent upstream recruitment of fish from Big Creek and fragment fish habitat in this small creek. Steep stream gradients and a small amount of spawning gravel (4 percent) also limit trout populations in both bypassed reaches (SCE, 2003b).

There is no MIF release requirement downstream of the diversion in the current license, and there is little or no instream flow in Lower Balsam Creek bypassed reach other than leakage or seasonal overflow at the Lower Balsam Creek diversion. Water temperatures measured in the upper bypassed reach did not exceed Basin Plan objectives. Daily mean water temperatures in the lower bypassed reach exceeded 18°C for only three days in 2002, although excessive thermal warming (>2.8°C) did occur (see table 3-8). Daily maximum water temperatures in the lower bypassed reach were <22°C.

Forest Service and Interior's SROs for Upper and Lower Balsam Creek bypassed reaches follow. The SROs apply mainly to Upper Balsam Creek, which has more consistent instream flows than Lower Balsam Creek.

- Provide a MIF.
- Improve spawning habitat for rainbow trout during spring.
- Provide more habitat and fish passage for adults during the remainder of the year.
- Provide a higher flow during the spring and summer to correspond with expected peak flows that would occur if the project were not in place and to provide cold water to assist cooling of Middle Big Creek (Forest Service).

The current MIF in Upper Balsam Creek downstream of the forebay is 0.5 cfs from October through May and 1 cfs from June through September. Lower Balsam

Creek does not have an MIF. Upper Balsam Creek would have a proposed 1 to 2 cfs MIF (24-hour average) all year and Lower Balsam Creek would have a proposed 0.5 to 1 cfs MIF (24-hour average) all year. No IHA or WUA analyses were done for the Upper or Lower Balsam Creek bypassed reaches; however, the proposed MIFs would improve fish passage and likely provide more spawning and adult habitat for rainbow trout.

The proposed MIF would also decrease thermal warming in 2.75 miles of stream (see table 3-9). Water temperature monitoring would determine if the proposed Balsam Creek MIF helps to decrease water temperature in Middle Big Creek (see section 3.3.1.2, *Temperature Monitoring and Management*).

Middle Big Creek (Dam 4 to Dam 5) (A1.1.1.8)

Middle Big Creek bypassed reach has a self-sustaining fishery for rainbow and brown trout; however, recruitment seems to be limited and populations of all life stages appear to be very low.

Water temperatures were suitable for trout growth in the upper portion of the bypassed reach. However, mean daily temperatures in some sections of the bypassed reach were >20°C; particularly during summer months in 2001 (see table 3-8). Summer water temperatures upstream of the confluence with Balsam Creek (1 mile downstream of Dam 4) were often >20ºC, and occasionally reached stressful levels in 2001. Thermal warming in excess of 2.8 ºC occurred.

Water temperatures upstream of Powerhouse 2/2A reflected the influence of cooler inflows from Balsam and Ely creeks. Cool inflows from Balsam and Ely creeks were beneficial when they were present and temperatures in Middle Big Creek upstream of Powerhouse 2/2A were cooler than upstream of Balsam Creek (see table 3-8).

There is no MIF for Middle Big Creek in the current license; the only flow into this reach is provided from leakage at Dam 4 (estimated at less than 1 cfs), local runoff, and tributary inflows. The results of SCE's instream flow studies indicated that 1.75 cfs would be necessary for fish passage (where passage is not restricted by total barriers), and would also provide increased habitat.

Forest Service and Interior's SROs for Middle Big Creek bypassed reach are as follows.

- Provide a new MIF to enhance fish habitat.
- Reduce effects of thermal warming within the bypassed reach due to project operations.
- Provide more habitat for adult rainbow trout.
- Provide enhanced flow during spawning periods for both rainbow and brown trout.

The proposed MIFs, which range seasonally from 7 to 12 cfs (24-hour average) and 5-10 cfs (instantaneous), would be substantially higher than the 30-day minimum unregulated flow that was less than 1 cfs in dry water years and approximately 4 cfs in wet water years. The proposed MIF would also enhance fish habitat and provide more adult rainbow trout habitat. The existing adult rainbow trout spring-summer habitat (April through September) in the Middle Big Creek reach is 18 percent WUA, and adult brown trout is 29 percent WUA during normal and dry water years. The proposed MIF would increase adult rainbow trout habitat to 54 percent WUA and adult brown trout to 76 WUA percent during the spring and summer months when habitat is most likely limiting trout production.

The existing rainbow trout spawning habitat is 4 percent WUA and brown trout spawning habitat is 13 percent WUA. The proposed MIF would increase rainbow trout spawning habitat to 87 percent WUA and brown trout spawning habitat to 83 to 89 percent WUA. The proposed MIFs would also exceed the 1.75 cfs that SCE flow studies determined would be necessary for fish passage during trout spawning periods.

The proposed MIF would also reduce thermal warming in 4.3 miles of stream (see table 3-9). Water temperature monitoring would determine if the proposed Middle Big Creek, Pitman Creek, Balsam Creek, and Ely Creek MIFs bring Middle Big Creek bypassed reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

Lower Big Creek (Dam 5 to San Joaquin River) (A1.1.1.9)

Lower Big Creek bypassed reach supports a self-sustaining fishery for brown and rainbow trout. Recruitment seems to be occurring, although less successfully in the upstream, higher gradient portion of the reach. A vertical waterfall 475 feet upstream from its confluence the San Joaquin River prevents upstream passage and recruitment from downstream areas. There are numerous other natural passage barriers that prevent upstream migration under some flow conditions. Trout density per acre is high, which may be an indication of overcrowding in the limited amount of accessible habitat. Overwintering habitat may also be an issue in dry water years due to low flows and the dominance of shallow habitats.

Water temperatures in Lower Big Creek bypassed reach directly downstream of Dam 5 are affected by releases of cooler water from Powerhouse 2/2A. Water temperatures were <20ºC in the upper portion of the bypassed reach, but sometimes exceeded 20ºC during summer low flows in the lower end of the reach (see table 3-8).

The current MIF (2 to 3 cfs) is higher than the 30-day unregulated minimum flows during dry water years (0.9 cfs) and slightly lower during wet water years (3.7 cfs). The instream flow transect data indicate that 1.5 to 3.5 cfs is necessary for fish passage, where passage is not restricted by total barriers.

Forest Service and Interior's SROs for Lower Big Creek bypassed reach are as follows:

- Provide more habitat for adult rainbow and brown trout.
- Provide MIFs sufficient to maintain water temperatures within the desired range for coldwater trout species.

The proposed MIFs, which range seasonally from 7 to 12 cfs (24-hour average) and 5 to 10 cfs (instantaneous), would be substantially higher than the historic 30-day unregulated minimum flow (0.9 to 3.7 cfs) and the existing MIF (2 to 3 cfs). The proposed MIF would provide more adult trout habitat and fish passage where passage is not restricted by total barriers. The existing adult rainbow and brown trout spring-summer habitat (April through September) in the Lower Big Creek bypassed reach are 46 to 50 percent WUA and 63 to 67 percent WUA, respectively during normal and dry water years. The proposed MIF would increase adult rainbow trout habitat to 73 percent WUA and adult brown trout habitat to 89 percent WUA during the spring and summer months when habitat is most likely limiting trout production.

The existing rainbow trout spawning habitat is 24 to 34 percent WUA and brown trout spawning habitat is 28 to 55 percent WUA. The proposed MIF would increase rainbow trout spawning habitat to 90 percent WUA and brown trout spawning habitat to 83 to 88 percent WUA.

The proposed MIF would also reduce thermal warming in 1.65 miles of stream (see table 3-9) to help meet Basin Plan objectives for coldwater beneficial uses. Water temperature monitoring would determine if the proposed MIFs bring Lower Big Creek bypassed reach into consistency with the Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

Upper Big Creek (Huntington Lake to Dam 4) (A 1.1.1.10)

Upper Big Creek bypassed reach has self-sustaining populations of brown trout and prickly sculpin. The brown trout population is dominated by adult fish, indicating limited recruitment. Channel morphology and a reduction in habitat due to current MIFs are the probable causal factors.

Releases from the deep strata of Huntington Lake to Upper Big Creek bypassed reach are very cool for most of the summer; but water temperatures warm downstream of the release point (SCE, 2003f). In September and October when the lake mixes, release temperatures are warmer but are still relatively cool, and temperatures cool over the length of the bypassed reach.

Air temperatures heavily influence water temperatures in this reach. Water temperatures were ≤20°C in 2000 and 2001; however, some excessive thermal warming (>2.8ºC) occurred in the lower sections of the bypassed reach (see table 3-8). There is no winter MIF requirement in Upper Big Creek bypassed reach under the current license although SCE releases some flow during that period. A 2 cfs MIF is required the rest of the year. The existing MIF (0 to 2 cfs) is less than the historic 30-day unregulated minimum flow, which ranged from 0.4 to 3.5 cfs in dry and wet water years, respectively.

Historic bankfull flows would have exceeded 800 cfs, while existing bankfull flows are only 6.1 cfs due to constriction of the stream channel caused by substantial reduction from historic flow levels. As a result, the stream rarely overtops its original banks and is constrained to a much narrower low-flow channel.

Forest Service and Interior's SROs for Upper Big Creek bypassed reach are as follows.

- Provide a new year-round MIF.
- Provide spawning passage for brown trout.
- Contribute to spring runoff in Upper Big Creek bypassed reach to provide environmental cues for the aquatic and riparian ecosystem.
- Contribute to spring runoff in Upper Big Creek bypassed reach to provide channel maintenance and sediment transport (Forest Service).

The proposed MIF (2 to 5 cfs) typically would be higher than the 30-day unregulated minimum flow (0.4 to 3.5 cfs). The April 1 to June 30 MIF (release valve fully open) would improve the amount and quality of trout rearing habitat and meet Interior's 10(j) recommendation for a 5-cfs MIF (the current capacity of the Huntington Lake MIF pipe) during this period. The increased MIF would also improve environmental cues, channel maintenance, and sediment transport in the Upper Big Creek bypassed reach.

Fish passage was not evaluated, but fish population monitoring would determine whether the proposed MIFs are sufficient to improve passage during brown trout spawning migrations and increase recruitment (see section 3.3.1.2, *Fish Monitoring*).

Ely Creek (A1.1.1.11)

Rainbow trout and rainbow x golden trout hybrid occur in Ely Creek bypassed reach. The rainbow trout density was higher and biomass was lower downstream of the diversion dam compared to the reference populations upstream of the dam (see appendix C). There are no hybrid trout upstream of the diversion. The channel morphology naturally limits trout populations, and a lack of MIF also reduces trout habitat and restricts trout spawning migrations.

There is no MIF requirement for Ely Creek. The bypassed reach has little or no instream flow other than leakage or seasonal overflow at the dam, and intermittent flow may occur in some years. The diversion was not in operation during 2000 and 2001 when water temperature monitoring was conducted. Water temperatures appeared suitable for trout (≤20ºC) and there was no excessive warming downstream of the dam (see table 3-8).

Forest Service and Interior's SROs for Ely Creek bypassed reach are as follows.

- Provide a MIF.
- Provide better spawning passage for rainbow trout.
- Contribute to spring runoff in Middle Big Creek bypassed reach to provide channel maintenance, sediment transport, and environmental cues for aquatic and riparian ecosystem.

IHA and WUA analyses were not done for the Ely Creek bypassed reach. However, a wetted perimeter analysis was completed which indicated that the amount of wetted streambed increased most rapidly as flows increased up to 0.5 cfs, indicating that the proposed MIF of 0.5 to 2 cfs (24-hour average) would improve habitat conditions and invertebrate production in Ely Creek downstream of the diversion. In addition, increased flows also would contribute to environmental cues downstream in Middle Big Creek bypassed reach.

The proposed MIF would also reduce thermal warming in 1 mile of Ely Creek bypassed reach (see table 3-9). Water temperature monitoring would determine if the proposed Ely Creek MIF cumulatively helps bring Middle Big Creek bypassed reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

North Fork Stevenson Creek (A1.1.1.12)

North Fork Stevenson Creek has self-sustaining rainbow, rainbow x golden hybrid, and brown trout fisheries. The stream is only accessible to fish from Shaver Lake when the reservoir is at maximum elevation. There is a complete upstream migration barrier 457 feet upstream from the lake. Trout population densities are low, and habitat and recruitment are limited in the steeper stream segments. There are small amounts of fair to good quality spawning gravels in the bypassed reach.

Prior to the construction of Eastwood power station, this reach was used to transport water to Shaver Lake. The current stream channel was severely altered and is oversized as a result of much higher flows that were released from Tunnel 7 prior to completion of the Eastwood portion of the project.

Natural flow in North Fork Stevenson Creek bypassed reach is augmented by instream flow releases from Tunnel 7, so that inflow from Huntington Lake controls water temperatures in the bypassed reach downstream from the tunnel outlet. Meteorological conditions have more influence on water temperature near the confluence with Shaver Lake (SCE, 2003f). As a result of exposure to warm air temperatures, water temperatures are warmer from May through August near Shaver Lake than they are below the Tunnel 7 outlet, while cooling occurs later in the season, starting between mid-August and mid-September. Average daily water temperatures in North Fork Stevenson Creek bypassed reach were <20ºC in 2000 and 2001 (SCE, 2003f).

IHA analysis was not done for the North Fork Stevenson Creek bypassed reach; however, review of the unregulated historic data indicates the current MIF (5 cfs) is greater than the 30-day historic low flows. The current flows are greater during the summer and early fall than the historic unregulated conditions. The modeled unregulated data indicates that 30-day minimum flows would have been less than 0.1 cfs historically.

Forest Service and Interior's SROs for North Fork Stevenson Creek bypassed reach are as follows.

- Provide a MIF that provides more habitat for adult rainbow trout.
- Provide a MIF that occupies the oversized channel that was created by past project operations.

The proposed MIF (12 cfs year-round, or flow with the instream flow valve wide open) would be substantially larger than the historic unregulated 30-day minimum flow (<0.1 cfs). The proposed MIF would also increase the existing adult rainbow trout habitat from 41 to 47 percent WUA to 68 percent WUA and the adult brown trout habitat from 58 to 65 percent WUA to 85 percent WUA, respectively, during the spring and summer months (April through September) of normal and dry water years. Rainbow trout spawning habitat would increase from 75 to 84 percent WUA to 99 percent WUA, and brown trout spawning habitat would increase from 79 to 90 percent WUA to 95 percent WUA. The higher MIFs would also improve passage conditions during the rainbow and brown trout spawning periods. The proposed MIF would increase the wetted perimeter of the stream by approximately 15 percent during the summer low flow season, wetting more of the stream channel and increasing the amount of habitat that is available for invertebrate production.

The proposed MIF would reduce thermal warming and increase DO levels in 3.6 miles of North Fork Stevenson Creek (see table 3-9) and contribute flow to enhance environmental cues in the South Fork San Joaquin River bypassed reach.

Pitman Creek (A1.1.1.13)

Pitman Creek bypassed reach has self-sustaining rainbow, brown, and brook trout fisheries. There is very limited spawning gravel, all of which appears to be upstream of the diversion dam. An abundance of young-of-the-year trout downstream of the dam indicates successful recruitment is occurring in Pitman Creek (presumably from upstream of the dam), although fish populations and biomass are lower downstream of the dam. The steep channel morphology combined with low instream flow are impairing trout habitat, and the low instream flow does not provide fish passage during either spring or fall spawning periods. Recruitment into Pitman Creek bypassed reach from Big Creek may be affected by a non-project weir that is 0.16 mile upstream of the confluence.

The MIF required under the current license is 0.3 cfs. The unregulated hydrographs compared to the current hydrographs indicate that substantial changes occurred in the magnitude of flows, especially during the spring runoff period. The IHA analysis suggests that bankfull flows rarely occur under current operations.

Daily mean water temperatures were ≤19ºC in both 2000 and 2001, but excessive thermal warming >2.8°C occurred in 2001 (see table 3-8).

Forest Service and Interior's SROs for the Pitman Creek bypassed reach are as follows.

- Provide an increased MIF.
- Provide better passage for spawning rainbow trout.
- Contribute to spring runoff in Middle Big Creek bypassed reach to provide environmental cues for the aquatic and riparian ecosystems.

WUA analyses were not conducted for the Pitman Creek bypassed reach. However, wetted perimeter analysis indicated that the amount of wetted streambed increased most rapidly as flows increased up to 0.5 cfs, indicating that the proposed MIF of 0.8 cfs July through March and 2.5 cfs (24-hour average) April through June would increase invertebrate production and trout habitat, and improve upstream passage of rainbow trout during spring.

The proposed MIF would also reduce thermal warming in 1.5 miles of Pitman Creek (see table 3-9) and contribute flow to enhance seasonal environmental cues in Middle Big Creek bypassed reach.

Non-compliant DO concentrations occurred in Pitman Creek bypassed reach in 2002 (SCE, 2003h). Lower instream water temperatures would increase oxygen concentrations in this reach. Implementation of the proposed Temperature Monitoring and Management Plan in appendix H of the Settlement Agreement would help determine if the water temperature and related DO levels associated with the proposed flow increases meet Basin Plan DO objectives (see section 3.3.1.2, *Temperature Monitoring and Management*).

Bear Creek (A1.1.1.14)

Bear Creek bypassed reach supports a self-sustaining brown trout fishery. Population numbers are comparable to or greater than reference sites upstream of the diversion, and there is annual recruitment. The limiting factors analysis conducted for this reach in the amended PDEA suggests that adult rearing and spawning habitat is heavily used by an abundant trout population, and physical habitat may be approaching limiting values.

Instream flow study results for this reach indicate that available habitat for brown trout never exceeds 36 percent of the maximum habitat under existing MIFs. The 2 to 3 cfs MIFs under the current license is less than half of the 30-day historic low flow, indicating a flow regime less than was historically available during drought conditions.

The highest mean monthly temperatures were 14.2°C in August 2000, and 18.2°C in August 2001, although some thermal warming >2.8°C occurred (see table 3-8). Daily maximum temperatures did not exceed 22°C (SCE, 2003f).

Forest Service and Interior's SROs for Bear Creek bypassed reach are as follows.

- Provide an increased MIF to provide more rearing habitat for juvenile and adult brown trout and more spawning habitat for brown trout.
- Reduce water temperatures in Bear Creek bypassed reach.
- Provide cool water to the South Fork San Joaquin River bypassed reach.
- Provide a portion of cooler water to Mammoth reach.

The proposed MIF of 4 to 10 cfs (24-hour average) would be larger than existing conditions (2 to 3 cfs), and less than historic unregulated flow (6.1 cfs dry water years; 19 cfs wet water years).

The proposed MIF would increase brown trout carrying capacity, and improve brown trout spawning, rearing, and overwintering habitats. Adult brown trout habitat would increase from 23 to 36 percent WUA under the existing flow regime to 54 to 63 percent WUA under the proposed flow regime during the spring-summer months (April through September) of normal and dry water years. Brown trout spawning habitat would increase from 53 to 62 percent WUA under the existing flow regime to 74 to 77 percent WUA under the proposed flow regime. WUA would also be increased for fry and juvenile brown trout. This would meet Interior's objective to provide more rearing habitat for juvenile and adult brown trout and more spawning habitat for brown trout.

The proposed MIFs would also reduce thermal heating in 1.6 miles of Bear Creek and provide cool water to the South Fork San Joaquin River bypassed reach (28 miles) (see table 3-9). In turn this would cumulatively provide additional water to Mammoth Pool reservoir and help provide cooler water to Mammoth reach (8.4 miles). Water temperature monitoring would determine if the proposed Bear Creek MIF helps bring the South Fork San Joaquin River bypassed reach and Mammoth reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

Non-compliant DO concentrations occurred in Bear Creek bypassed reach in 2002 (SCE, 2003h). Lower instream water temperatures would result in increased oxygen concentrations in this reach. Implementation of the proposed Temperature Monitoring and Management Plan in appendix H of the Settlement Agreement would help determine if the water temperature and related DO levels associated with the proposed flow increases meet Basin Plan DO objectives (see section 3.3.1.2, *Temperature Monitoring and Management*).

Mono Creek (Downstream of Mono Diversion) (A1.1.1.15)

Mono Creek bypassed reach has a self-sustaining brown trout fishery and a small rainbow trout population. Fish population densities and biomass are very low for all trout life stages. Large amounts of spawning gravel are present in a few local concentrations. The abundance and widespread distribution of sand reduces the habitat value for trout and macroinvertebrates. Sedimentation, including loss of pool depth and embeddedness of spawning gravels, likely cause adverse effects on trout habitat, recruitment, and overwinter survival in this reach.

The current MIF (5 to 13 cfs) is less than the 30-day historic low flows, suggesting a flow regime that is lower than historic drought conditions. The current summer MIF is providing moderate levels of adult brown trout habitat (78 percent of maximum WUA); however, the instream flow study results indicate that this bypassed reach has the ability to provide more habitat for all trout life stages.

Monthly mean stream temperatures ranged from 9 to 14.8°C in 2000 and 10.6 to 16°C in 2001. Daily maximum temperatures were ≤18.7°C and daily mean temperatures were <17°C. Thermal warming in excess of 2.8°C occurred in 2000 and 2001 (table 3-8).

Forest Service and Interior's SROs for Mono Creek bypassed reach are as follows.

- Provide more habitat for adult brown trout, specifically >90 percent of maximum WUA during summer and ≥80 percent of maximum WUA throughout the year.
- Provide sufficient MIF such that warming does not exceed 2.8ºC in the Mono Creek bypassed reach during the summer.
- Improve the availability of spawning gravels.
- Provide higher flows during fall for brown trout spawning.
- Provide cool water to South Fork San Joaquin River.
- Provide a portion of cooler water to Mammoth reach.

The proposed MIFs, which range seasonally from 18 to 30 cfs (24-hour average all water year types) and 16 to 27 cfs (instantaneous) would be similar to the historic 30-day unregulated minimum flow (11 cfs in dry years, 34 cfs in wet years), and substantially higher than the existing MIF (5-13 cfs). The proposed MIF would increase adult brown trout habitat from 53 to 78 percent WUA to 90 to 92 percent WUA. Adult brown trout winter habitat would be a minimum of 85 percent of maximum WUA. These habitat increases would meet the Forest Service and Interior's SRO for adult brown trout habitat.

The proposed MIF would increase adult rainbow trout habitat from 32 to 56 percent WUA to 77 to 83 percent WUA during the spring-summer months (April through September) of normal and dry water years. The proposed MIF would increase rainbow trout spawning habitat from 44 to 80 percent WUA to 99 percent WUA in normal and dry water years.

Mono Creek derives most of its flow from Lake Edison, and has the potential to provide cool water to the South Fork San Joaquin River bypassed reach. The proposed MIFs would reduce thermal heating in 5.8 miles of Mono Creek and should provide additional cool water to the South Fork San Joaquin River bypassed reach (28 miles), that in turn would cumulatively provide additional water to Mammoth Pool and help provide cooler water to Mammoth reach (8.4 miles) (see table 3-9). Water temperature monitoring would determine if the proposed Mono Creek MIF helps bring the South Fork San Joaquin River bypassed reach and Mammoth reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

Non-compliant DO concentrations occurred in Mono Creek bypassed reach in 2002 (SCE, 2003h). Lower instream water temperatures would result in increased oxygen concentrations in this reach. Implementation of the proposed Temperature Monitoring and Management Plan in appendix H of the Settlement Agreement would help determine if the water temperature and related DO levels associated with the proposed flow increases meet Basin Plan DO objectives (see section 3.3.1.2, *Temperature Monitoring and Management*).

South Fork San Joaquin River (A1.1.1.16)

The 28-mile long South Fork San Joaquin River bypassed reach is the longest bypassed reach in the project area and receives inflow from 11 tributaries downstream of Florence dam, that have flows reduced by hydroelectric diversions and from other tributaries which are undiverted. Flows are diverted from nine tributaries by the Big Creek ALP Projects. In addition, flows from Warm Creek are diverted by the Vermilion Valley Project and flows are diverted from Camp 61 Creek by the Portal Project.

There is a 36-foot high waterfall approximately 6.9 miles upstream of the confluence with the San Joaquin River, which isolates the Upper South Fork San Joaquin River Subbasin from the San Joaquin River Basin. Five more natural barriers occur downstream of Mono Creek, only one of which is a complete barrier at all flows.

The South Fork San Joaquin River bypassed reach has self-sustaining rainbow and brown trout fisheries. Brown trout dominate the fish composition in the upper two subreaches from Florence Lake to Mono Creek. Downstream of Mono Creek, rainbow trout become the dominant species in the lower three subreaches. Across all subreaches, trout population numbers are low. Populations are unbalanced by lifestage, recruitment appears to be low, little spawning gravel is present, and water temperatures are not favorable to trout due to downstream thermal warming.

Water is released from near the bottom of Florence Lake, which means that relatively cool water is released during the summer when the lake is thermally stratified. Mixing of cool water from deeper strata and warmer surface water occurs by late August or mid-September; after which water temperatures in the South Fork San Joaquin River downstream of Florence Lake equal or exceed temperatures upstream of the lake due to the release of mixed water from the reservoir.

During summer months, water temperatures observed in 2000 and 2001 increased fairly rapidly in the first 12 miles downstream of Florence Lake, then stabilized or decreased slightly between Warm and Hoffman creeks (SCE, 2003f). The cooling trend in this segment of the South Fork San Joaquin River may be due in part to constriction of the river in a deep, narrow canyon, where it is less subject to warming from solar radiation and summer air temperatures. Coldwater additions from tributaries to this reach also may contribute to cool water temperatures. A less dramatic trend of temperature increase was apparent from downstream of the canyon reach, between Hoffman Creek and the San Joaquin River confluence. Water temperatures decreased substantially in September and October throughout the South Fork San Joaquin River.

The current MIF (11 to 27 cfs) is less than half of the 30-day historic low flows, indicating the current flow regime is lower than historic drought conditions. Low flows result in summer water temperatures that were >20ºC and thermal warming >2.8ºC that occurred in the South Fork San Joaquin River bypassed reach (see table 3-8).

The current MIF generally provides high levels of adult brown trout habitat in the upper subreaches during the summer (>90 percent of maximum WUA); but there is less habitat for adult rainbow trout in the lower subreaches (≤74 percent of maximum WUA).

Forest Service and Interior's SROs for the South Fork San Joaquin River bypassed reach are as follows.

- Provide cooler water temperatures during July and August.
- Provide a new MIF to increase habitat for adult rainbow and brown trout within the South Fork San Joaquin River bypassed reach.
- Provide 95 percent adult trout summer WUA (Forest Service).
- Provide more spawning gravel.
- Provide more inflow to Mammoth Pool (Interior).

The proposed MIFs to be released from Florence Lake, which range seasonally from 25 to 40 cfs (24-hour average all water year types) and 22 to 36 cfs (instantaneous), would be similar to the historic 30-day unregulated minimum flow (25 to 37 cfs in dry years; 56 to 77 cfs in wet years) and the existing MIF (11 to 27 cfs). The proposed MIF would provide more adult rainbow and brown trout habitat. The existing adult rainbow and brown trout spring-summer habitat (April through September) are 56 to 83 and 77 to 97 percent WUA, respectively in normal and dry water years. The proposed MIF would increase adult rainbow trout habitat to 90 to 93 percent WUA and adult brown trout habitat to 99 to 100 percent WUA during the spring and summer months, when habitat is most likely limiting production.

The existing rainbow trout spawning habitat is 59 to 97 percent WUA. The proposed April through June MIF (40 cfs) would increase rainbow trout spawning habitat to 100 percent WUA. The existing brown trout spawning habitat is 70 to 91 percent WUA, and the proposed MIF would increase brown trout spawning habitat to 99 to 100 percent WUA.

Temperature modeling shows that during July of a dry water year with warm air temperatures, maximum daily water temperatures frequently approach those that may be stressful for trout, and daily mean temperatures are occasionally warmer than is suitable for trout growth in the 2.5 mile reach upstream of Mono Creek (see table 3-8). The proposed tributary MIFs would increase flows into and through the South Fork San Joaquin River bypassed reach from the 12 impoundments that affect this reach (particularly Bear, Mono, and Camp 61 creeks), and would enhance trout habitat and provide a water temperature regime more suitable for trout because the Bear, Mono, and Camp 61 creek bypassed reaches have reservoirs that would provide cool water to the South Fork San Joaquin River bypassed reach. The proposed South Fork San Joaquin River MIF in conjunction with the increased tributary MIFs would cumulatively reduce thermal warming in the South Fork San Joaquin bypassed reach (28 miles), and would provide more water to Mammoth Pool reservoir, which would in turn provide cooler water to Mammoth reach (8.4 miles) (see table 3-9).

Water temperature monitoring downstream of Florence dam would determine if the proposed MIFs would achieve consistency with the Basin Plan objectives for coldwater beneficial uses and achieve Forest Service and Interior's SRO to provide cooler water temperatures in the South Fork San Joaquin River bypassed reach and Mammoth reach during July and August (see section 3.3.1.2, *Temperature Monitoring and Management*).

Non-compliant DO concentrations occurred in South Fork San Joaquin River bypassed reach in 2002 (SCE, 2003h). Lower instream water temperatures would increase oxygen concentrations in this reach. Implementation of the proposed Temperature Monitoring and Management Plan in appendix H of the Settlement Agreement would help determine if the water temperature and related DO levels associated with the proposed flow increases meet Basin Plan DO objectives (see section 3.3.1.2, *Temperature Monitoring and Management*).

Bolsillo Creek (A1.1.1.17)

Bolsillo Creek bypassed reach has a self-sustaining brook trout fishery. There is a large waterfall approximately 0.2 miles upstream from the confluence of Bolsillo Creek with the South Fork San Joaquin River that is a fish passage barrier and prevents upstream recruitment of fish past the falls. There is no spawning gravel downstream of the waterfall. An abundance of young-of-the-year trout downstream of the diversion dam indicates that successful recruitment is occurring in Bolsillo Creek.

The year-round MIF under the current license is 0.4 cfs. Water is diverted from the peak of the hydrograph, but it appears that 30-day minimums are not affected by project operation (both are 0 cfs). IHA analysis indicates the timing and magnitude of the maximum 1-day flow is unchanged because this diversion is not operated during wet water years when peak flows occur, although diversion of spring runoff does occur during other water year types. The IHA suggests that bankfull 2-year recurrence flows of 18 cfs are not occurring (currently 3.7 cfs), and 5-year recurrence flows of 27 cfs are even more diminished (currently 11 cfs) under current operations.

Daily mean temperatures were ≤16°C, and daily maximum temperatures were ≤18.4° in 2000 and 2001, although excess thermal warming >2.8°C occurred in the bypassed reach (see table 3-8). The diversion is not operated during the fall brook trout spawning period.

Forest Service and Interior's SROs for Bolsillo Creek bypassed reach are as follows.

- Provide an increased MIF.
- Contribute to spring runoff in the South Fork San Joaquin River to provide environmental cues for aquatic and riparian ecosystems.

The proposed MIF of 0.5 to 1 cfs (24-hour average) and 0.35 to 0.75 cfs (instantaneous) would be substantially greater than the 30-day unregulated minimum or the 30-day minimum existing, both 0 cfs.

The proposed MIF would decrease thermal warming in 1.6 miles of Bolsillo Creek (see table 3-9), and contribute flow to enhance seasonal environmental cues in the South Fork San Joaquin River.

Camp 61 Creek (A1.1.1.18)

Flows in Camp 61 Creek are diverted into Ward Tunnel by the Portal Project, and diverted flows are delivered into Huntington Lake via the Portal powerhouse. Camp 61 Creek has one of the highest densities of brown trout among streams in this part of the Portal Project area.

The current license for the Portal Project does not include a minimum flow release to Camp 61 Creek. The Settlement Agreement would provide the following MIFs in Camp 61 Creek, which are consistent with the final 4(e) conditions for the Portal Project filed by the Forest Service on October 29, 2006.

Wet, Above Normal, Below Normal Water Year Types

- October 1 through March 31: 24-hour average of 2 cfs, instantaneous floor of 1.5 cfs
- April 1 through June 30: 24-hour average of 4 cfs, instantaneous floor of 3 cfs

- July 1 through September 30: 24-hour average of 3 cfs, instantaneous floor of 2 cfs

Dry, Critical Water Year Types

- October 1 through September 30: 24-hour average of 1.25 cfs, instantaneous floor of 0.75 cfs

The Commission's Portal Project environmental assessment determined that the availability of aquatic habitat in this reach is limited by the lack of an instream flow release. In 2000 and 2001, the estimated trout densities (all ages) in Camp 61 Creek downstream of the Adit 2 Creek confluence were substantially lower than estimated trout densities observed in both the unregulated East and West forks of Camp 61 Creek (FERC, 2006). In addition to higher trout densities, the East and West forks also support three species of trout (rainbow, brook, and brown trout), while brown trout was the only species captured in Camp 61 Creek. Although brown trout were fairly abundant in Camp 61 Creek downstream of the confluence with Adit 2 Creek and exhibited several age classes, age 0+ fish were relatively rare, possibly indicating a lack of suitable spawning habitat. In addition, the extent of upstream movement of brown trout likely is limited because of low-flow related migration barriers within the stream channel.

The proposed MIFs, plus leakage from the dam, would; substantially increase the amount of wetted area in Camp 61 Creek compared to existing conditions; (2) provide perennial flow and fish passage throughout the creek; and (3) decrease thermal warming in 2 miles of Camp 61 Creek (see table 3-9). This increase in instream flow over existing conditions would likely increase the distribution and abundance of brown trout, expand the abundance and diversity of important benthic macroinvertebrate species, and provide cold-water refugia for native aquatic species residing in the South Fork San Joaquin River (28 miles). The increase in flow may also facilitate rainbow trout colonization of Lower Camp 61 Creek. Water temperatures in Camp 61 Creek immediately downstream of Portal forebay dam would be frequently reduced during the summer, compared to existing conditions, and would remain well within the preferred range for brown and rainbow trout.

Increased MIFs also would enhance seasonal environmental cues and help meet Basin Plan temperature objectives in the South Fork San Joaquin River. Increased flows in the river also would provide additional water to Mammoth Pool reservoir that in turn would provide cooler water to Mammoth reach. Water temperature monitoring would determine if the proposed Camp 61 Creek MIF helps bring the South Fork San Joaquin River bypassed reach and Mammoth reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

Camp 62 Creek (A1.1.1.19)

Camp 62 Creek bypassed reach has a self-sustaining brook trout fishery with successful recruitment. A 45-foot-tall waterfall 370 feet upstream of its confluence with the South Fork San Joaquin River prevents fish passage to upstream areas, where there are relatively large amounts of good to excellent quality spawning gravel.

The MIF under the current license is 0.3 cfs. Water is diverted from the peak of the hydrograph, but it appears that 30-day minimums are not affected by project operation (both are 0 cfs). IHA analysis suggests the timing and magnitude of maximum 1-day flow is unchanged because the diversion is not operated during wet water years when peak flows occur. Diversion of spring runoff currently occurs during other water year types.

Daily mean temperatures were ≤17°C, and daily maximum temperatures were ≤18.2°C in 2000 and 2001. Some thermal warming >2.8°C occurred in 2001 (see table 3-8). The diversion is not operated in the fall during brook trout spawning.

Forest Service and Interior's SROs for Camp 62 Creek bypassed reach are as follow.

- Provide an increased MIF (Interior).
- Contribute to spring runoff in the South Fork San Joaquin River to provide environmental cues for aquatic and riparian ecosystem.
- Provide enhanced flows to dissipate arsenic, mercury, pH, and turbidity (Forest Service).
- Contribute to spring runoff in the South Fork San Joaquin River to provide channel maintenance and transport sediment (Forest Service).

The proposed MIF of 0.5 to 1.0 cfs (24-hour average) and 0.35 to 0.75 cfs (instantaneous) would be greater than the 30-day unregulated minimum or the 30-day minimum existing, both 0 cfs. The IHA analysis suggests that bankfull 2-year recurrence flows of 62 cfs are not occurring (currently 3.2 cfs), and 5-year recurrence flows of 95 cfs are even more diminished (currently 12 cfs) under current operations (MIF 0.3).

The proposed MIF would reduce thermal warming in 1.35 miles of Camp 62 Creek (see table 3-9) and contribute flow to enhance seasonal environmental cues in the South Fork San Joaquin River aquatic and riparian ecosystems. Flow would be measured at USGS gage no. 11230600, and water temperature monitoring would determine if the proposed Camp 62 Creek MIF helps bring the bypassed reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

The proposed MIF may also contribute to the cumulative increase of flow in the South Fork San Joaquin River to help provide channel maintenance and sediment transport, however Camp 62 Creek enters the river downstream of USGS gage no. 11230215, the compliance gage below Florence Lake.

It is unlikely that increased flows would affect any changes in the pH, arsenic, mercury, or turbidity values in Camp 62 Creek. Values of pH lower than 6.5 were recorded at surface water locations both above and below active diversions, including Camp 62 Creek, indicating that the low pH conditions are generally not project-related. The pH values were particularly low during the spring snowmelt period, suggesting that slight acidity of the runoff may be influencing pH values.

A number of project surface water samples exceeded the drinking water criteria for arsenic, including Camp 62 Creek. The sources of arsenic at these locations are unknown; however, arsenic is a naturally occurring, widely distributed metallic element and it is unlikely the occurrence of arsenic in Camp 62 Creek is project-related.

Low concentrations of mercury were found in many of the surface water samples both upstream and downstream of project facilities, including Camp 62 Creek (SCE, 2003h). The sources of mercury are unknown; however, mercury is a naturally occurring, widely distributed element. The low level mercury concentrations are not considered project-related, nor do they adversely affect aquatic resources.

Turbidity exceedances above the Basin Plan standard in Camp 62 Creek downstream of the diversion (11 NTUs) occurred only once and were not considered project-related.

Chinquapin Creek (A1.1.1.20)

Chinquapin bypassed reach, which is located on a tributary to Camp 62 Creek, has a self-sustaining brook trout fishery. A 45-foot high waterfall 370 feet upstream of the South Fork San Joaquin River and Camp 62 Creek confluence prevents recruitment from the river to Chinquapin Creek. Another waterfall approximately 785 feet upstream of the Camp 62 Creek and Chinquapin Creek confluence prevents recruitment to Upper Chinquapin Creek. Individual fish condition factors are lower in the bypassed reach than upstream of the diversion dam. Abundance of young-of-the-year trout downstream of the dam indicates successful recruitment is occurring in Chinquapin Creek.

There is no MIF requirement under the current license. Water is diverted from the peak of the hydrograph, but it appears that 30-day minimums are not affected by project operation (both are 0 cfs). Little spring runoff currently occurs except during wet water years. The IHA analysis notes that bankfull 2-year recurrence flows of 24 cfs are not occurring (currently 4 cfs), and 5-year recurrence flows of 45 cfs are even more diminished (currently 11 cfs) under current operations. Daily mean temperatures were ≤17°C in 2000 and 2001, although some thermal warming occurred in the bypassed reach.

Forest Service and Interior's SROs for Chinquapin Creek bypassed reach are as follows.

- Provide a MIF.
- Contribute to spring runoff in the South Fork San Joaquin River bypassed reach to provide environmental cues for aquatic and riparian ecosystems.

- Contribute to spring runoff in the South Fork San Joaquin River bypassed reach to provide channel maintenance and assist in transport of fine material (Forest Service).

There is no current MIF in Chinquapin Creek. The proposed MIFs of 0.5 to 1 cfs (24-hour average) and 0.35 to 0.75 (instantaneous) would be greater than the 30-day unregulated minimum or the 30-day minimum existing, both 0 cfs. The proposed fall MIF (0.5 cfs) would improve adult brook trout passage during the spawning season. The proposed summer MIF (1 cfs) would decrease thermal warming and provide more fish habitat in 0.9 mile of Chinquapin Creek and 1.35 miles of Camp 62 Creek[37] (table 3-9).

Increased spring-summer flows would also help meet Basin Plan objectives by reducing thermal warming in 28 miles of the South Fork San Joaquin River bypassed reach (see table 3-9). Water temperature monitoring would determine if the proposed Chinquapin Creek MIF cumulatively helps bring the South Fork San Joaquin River bypassed reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

Increased flows would help enhance seasonal environmental cues in the South Fork San Joaquin River aquatic and riparian ecosystems, and help provide channel maintenance and assist in the transport of fine material.

Hooper Creek (A1.1.1.22)

Hooper Creek bypassed reach has a relatively healthy, self-sustaining rainbow x golden trout fishery. Cascades located approximately 0.1 mile from the confluence of the South Fork San Joaquin River are barriers to brown and brook trout migrations during low flows that occur in the fall spawning season. The cascades would probably not be barriers to spring spawning rainbow trout and rainbow x golden trout hybrids; however, the current MIF does not provide passage during the spring spawning period.

The current MIF (2 cfs) is approximately the same as 30-day historic low flows during dry water years, indicating a flow regime that approximates what would be available during drought conditions. Little spring runoff currently occurs except during wet water years. The IHA analysis indicates that historically, bankfull flows of 58 cfs had a 1.5-year recurrence, overbank flows of 68 cfs had a 2-year recurrence, and flows of 18 cfs were exceeded 50 percent of the time. These flows would have provided fish passage on an annual basis. Daily mean water temperatures in the bypassed reach were ≤12.9°C in 2000 and 2001.

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[37] WUA analysis was not done for Chinquapin or Camp 62 creeks.

Forest Service and Interior's SROs for Hooper Creek bypassed reach are as follows.

- Provide a MIF that provides increased habitat and fish passage for spring spawning rainbow trout and rainbow x golden trout hybrids.
- Contribute to spring runoff in the South Fork San Joaquin River to provide environmental cues for aquatic and riparian ecosystems.
- Provide cool water to the South Fork San Joaquin River bypassed reach (Interior).
- Provide a portion of cooler water to Mammoth reach (Interior).
- Provide higher flows to help dissipate iron and turbidity (Forest Service).

The proposed MIFs of 2 to 4 cfs (24-hour average) and 1.5 to 3 cfs (instantaneous) would be greater than the 30-day unregulated minimum (1.8 cfs in dry water years and 4.1 cfs in wet water years). The proposed spring MIF (4 cfs) would provide rainbow trout and rainbow trout x golden trout passage during the spawning season. The proposed summer MIF (3 to 4 MIF) would decrease thermal warming and provide more fish habitat in 0.5 miles of Hooper Creek[38] (see table 3-9).

The proposed MIF would also help achieve consistency with the Basin Plan objectives for coldwater beneficial uses in the South Fork San Joaquin River and the Mammoth reach. Water temperature monitoring would determine if the proposed Hooper Creek MIF cumulatively helps bring the South Fork San Joaquin River bypassed reach and Mammoth reach into compliance with Basin Plan objectives for coldwater beneficial uses (see section 3.3.1.2, *Temperature Monitoring and Management*).

The non-compliant turbidity level in Hooper Creek was attributed to current sediment management practices. Implementation of the proposed *Sediment Management Prescriptions* in appendix J of the Settlement Agreement includes the operation of the Hooper diversion low level outlet during the spring run-off period in wet water years to allow sediment pass through and reduce the accumulation of sediment behind the diversion dam (see section 3.3.1.2, *Sediment Management*).

Crater Creek (A1.1.1.21), North Slide Creek (A1.1.1.23), South Slide Creek (A1.1.1.24), and Tombstone Creek (A1.1.1.25)

Under the Settlement Agreement, these four diversions and two domestic diversions (Pitman Creek and Snow Slide Creek domestic diversions) would be decommissioned because they (1) are currently not in service; (2) are no longer needed for the operation and maintenance of the project; or (3) have been requested to be removed by resource agencies participating in the ALP. Of these four diversions, only

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[38] WUA analysis was not done for Hooper Creek.

the Crater Creek diversion is currently in service. Decommissioning these diversions would ensure that the natural flow to the four affected bypassed reaches is maintained, which would provide cooler water temperatures to these streams and the South Fork San Joaquin River bypassed reach than would occur if water diversion was continued or resumed. We discuss other aspects of decommissioning these diversions later in section 3.3.1.2, *Small Diversions Decommissioning*.

Adit 8 Creek

The diversion on Adit 8 Creek has not been used for several decades, but this dam gives SCE the flexibility to divert water from Tunnel 5 to Tunnel 2 in the event of an outage at Powerhouse 2A. This short, very steep reach drops almost 1,600 feet in elevation from the base of the dam downstream to its confluence with Big Creek. Adit 8 Creek is intermittent and there is little or no instream flow other than leakage from Tunnel 2 or seasonal overflow at the dam. There is no MIF requirement under the current license, and Adit 8 Creek is dry upstream of the diversion dam for most of the year. No fisheries issues have been identified in Adit 8 Creek bypassed reach which is naturally intermittent and fishless.

The Forest Service suggests that Adit 8 Creek be removed from the license. The lack of identified aquatic issues in the reach and its infrequent use indicate that a decision to include or remove Adit 8 Creek and the diversion would have little if any effect on aquatic resources.

Rancheria Creek

Rancheria Creek conveys outflows from the Portal powerhouse and any flows that pass from the Portal surge chamber into Huntington Lake. Both of these facilities are part of the Portal Project. The stream supports self-sustaining populations of rainbow, brown, and brook trout and Sacramento sucker. Kokanee from Huntington Lake have been observed spawning in the Portal powerhouse tailrace and in the lower portion of Rancheria Creek upstream of the tailrace confluence (FERC, 2006).

The Forest Service suggests that Rancheria Creek be removed from the license. The Portal surge chamber and powerhouse are not part of the Big Creek ALP Projects, so removal of Rancheria Creek would not have any effect on the ability of the Commission to implement measures needed to protect aquatic and other resources in Rancheria Creek downstream of the Portal surge chamber and powerhouse.

Determination of Water Year Type

Under Settlement Agreement measure A1.1.1, SCE would base Water Year Types on the April 1 forecast for the California Department of Water Resources (CDWR), Bulletin No. 120, San Joaquin Valley Water Year Index, or its successor index that is most representative of the Big Creek Watershed. SCE would inform the Forest Service, the Water Board, Interior, and the Commission which category of instream flows would be implemented based on the April 1 water year forecast.

Under Settlement Agreement measure A1.2, by March 15 of each year, SCE would use the March 1 preliminary water year forecast to inform the Forest Service, the Water Board, Interior, Cal Fish & Game, and the Commission which category of instream flows would be implemented on April 1. SCE would have the option to adjust flows based on the April 1 and May 1 DWR water year forecast updates, if those updates are revised. SCE would notify the Forest Service, the Water Board, Interior, Cal Fish & Game, and the Commission if instream flows are to be modified to conform to the revised forecast water year type.

Other Recommendations

Interior filed 10 (j) recommendations and the Forest Service filed 4(e) conditions that are consistent with the Settlement Agreement.

Our Analysis

Currently, CDWR classifies water years for the San Joaquin Valley water year index by the following formula (CDWR, 2008):

- 0.6 x current April through July runoff forecast (in million acre-feet);
- plus 0.2 x current October through March runoff (in million acre-feet); and
- plus 0.2 x previous water year's index.

Resulting San Joaquin Valley water year classifications (million acre-feet) are:

- Wet $\geq$ 3.8
- Above normal > 3.1, and < 3.8
- Below normal > 2.5, and $\leq$ 3.1
- Dry > 2.1, and $\leq$ 2.5
- Critical $\leq$ 2.1

Table 3-10 shows the drainage areas and average annual unregulated inflows within the four drainage areas that make up the four subwatersheds within the San Joaquin Watershed.

Table 3-10. San Joaquin subwatershed information. (Source: EA Engineering, 1999)

Watershed	**Drainage area(square miles)**	**Annual average unregulated runoff (million acre-feet)**	**Drainage area to runoff ratio**
Tuolumne River inflow to New Don Pedro reservoir	1,540	1.8	856
Merced River inflow to Lake McClure	1,273	1.0	1,273
San Joaquin River inflow to Millerton Lake	1,676	1.7	986
Stanislaus River inflow to New Melones reservoir[a]	900	1.056	852
Total	5,389	5.6	962

[a] Interchangeably referred to as Stanislaus River below Goodwin reservoir in CDWR Bulletin 120 (as cited in EA Engineering, 1999).

The drainage area to Redinger reservoir, which acts as a forebay for Powerhouse 3, the furthest downstream powerhouse in the Big Creek System, has a drainage area of about 1,295 square miles. This drainage area makes up the majority of the drainage area to Millerton Lake shown in table 3-10. The drainage area to runoff ratio shown in table 3-10 for the inflow to the farther downstream Millerton Lake is also representative of the larger San Joaquin Watershed area used in the CDWR forecast.

Snowmelt within the Upper San Joaquin River Watershed produces roughly 90 percent of the yearly runoff, most of which (about 70 percent) occurs between April 1 and the end of July. For more than 50 years, CDWR has predicted yearly runoff based on a large number of snow pack measurements and other methods within the Sierra Nevada. CDWR's runoff predictions are highly reliable because of the snowmelt-based runoff of the Sierra Nevada and CDWR's extensive monitoring, analysis, and records. This forecast is already used for water management purposes on other watersheds within the San Joaquin Watershed. Incorporating the water year classification for the project facilities would help ensure that project operations meet important resource objectives, such as enhancing aquatic and riparian habitat, and maintaining reservoir levels at a reasonable level for recreational use.

Use of the March 1 forecast for the initial determination of water year type is necessary to determine minimum flows and channel and riparian maintenance flows that would begin on April 1. SCE would have the ability to adjust the water year type based on the April 1 and May 1 forecast if the water year forecast is revised which would be useful during years of unexpected precipitation or snowmelt during the months of March and April.

Instream Flow and Water Level Monitoring

SCE proposes to implement the Flow Monitoring and Reservoir Water Level Measurement Plan in appendix L of the Settlement Agreement to monitor compliance with streamflows and water levels that may be required in a new license. This plan contains the following components:

- location and design of flow monitoring equipment;
- instream flow monitoring, and recording of flow data;
- operation, maintenance, and calibration of flow monitoring equipment;
- schedule for designing, permitting and installing infrastructure changes and associated flow monitoring equipment;
- flow data dissemination to resource agencies; and
- reservoir water surface elevation measurement.

Consistent with the Settlement Agreement, SCE plans to add or upgrade gages within the project area to ensure compliance with MIFs and other flow requirements that may be part of the license conditions. Table 3-11 provides information for the gages within the project area that would be used for compliance where the MIF is expected to change and or areas where gages are proposed to be constructed. Table 3-12 provides a summary of the existing water-stage recording gages on the major reservoirs (SCE plans to continue this monitoring).

Table 3-11. Status of compliance gages for streams with proposed changes in MIF. (Source: SCE, 2007a)

	Current Status of Gaging				Proposed Flow Monitoring		Type of New Gage Proposed	
	Streams with proposed changes in infrastructure at diversion	**Currently Gaged**	**Not Currently Gaged**	**Existing USGS Gage Number**	**Current Gage**	**New Gage Proposed**	**Acoustic Velocity Meter**	**Float Type**
Mammoth Pool (No. 2085)								
San Joaquin River (Mammoth Pool to Dam 6)	X	X		11234760	X	X	X	
Rock Creek	X		X			X	X	
Ross Creek	X		X			X		X
Big Creek Nos. 1 and 2 (No. 2175)								
Upper Big Creek (Huntington Lake to Dam 4)		X		11237000	X			
Middle Big Creek (Dam 4 to Dam 5)	X		X			X	X	
Lower Balsam Creek (Diversion to Big Creek)	X		X			X		X

Ely Creek	X		X			X		X
Big Creek Nos. 2A, 8, and Eastwood (No. 67)								
South Fork San Joaquin River		X		11230215	X[a]			
Bear Creek		X		11230530	X		X	
Mono Creek (downstream of Mono Diversion)	X	X		11231600	X	X[b]	X	
Bolsillo Creek		X		11230670	X			
Camp 62 Creek		X		11230600	X			
Chinquapin Creek[c]		X		11230560	X			
Hooper Creek		X		11230200	X			
Lower Big Creek (Dam 5 to San Joaquin River)	X	X		11238500	X	X[d]	X	
Pitman Creek		X		11237700	X			
Upper Balsam Creek (forebay to diversion)		X		11238270	X			

North Fork Stevenson Creek		X	11239300	X
Stevenson Creek		X	11241500	X
Big Creek No. 3 (No. 120)				
San Joaquin River (Dam 6 to Redinger)	X	X	11238600	X

[a] A new gage has been installed and would be calibrated to better characterize high flow events.

[b] A new acoustic velocity meter gage would be installed to monitor increased MIFs under a new license.

[c] 24-hour average flows remain the same, but an instantaneous floor is added.

[d] An acoustic velocity gage would be installed at Dam 5 to monitor MIF releases. The existing downstream gage (USGS gage no. 11238500) would be operated to monitor higher flow events.

Table 3-12. Current reservoir water-stage recorders at the major reservoirs. (Source: SCE, 2007a)

Reservoir	USGS gage number
Mammoth Pool reservoir	11234700
Huntington Lake	11236000
Florence Lake	11229600
Shaver Lake	11239500

During operation of its facilities, SCE would need to monitor the required 24-hour average and instantaneous (instantaneous floor) instream flows at its compliance locations. The instantaneous flow is the flow value used to construct the average daily flow value and would be measured in time increments that SCE has proposed of at least once every 15 minutes. The 24-hour average flow is the average of the incremental readings from midnight of one day to midnight of the next day. Except for malfunctions or occurrences beyond SCE's control, 24-hour average, instantaneous flows would be measured at each site during the period the location is diverting water. SCE proposes in the Settlement Agreement to compensate for an unplanned under release by releasing the equivalent under-released volume of water within 7 days of discovery of the under-release. The 24-hour average flow values would be reported to the USGS on an annual basis. The 15-minute recordings used to construct the 24-hour average flows would be available from SCE upon request from the Commission, agencies, or other parties. Operational dates of the small diversions would also be available upon request.

SCE would consult with the USGS, at a minimum, during the development of the flow monitoring scheme for all locations to ensure accurate measurements would be recorded during the term of a new license. Calibration of the acoustic velocity meters would be performed by SCE biannually using a portable acoustic velocity meter. SCE calibration of the float level recorders or bubblers would include the collection of current meter measurements to verify the rating tables. Float level recorders and bubblers would be checked on a monthly basis by SCE by comparing the inside recorder reading to the outside permanent staff gage reading for any discrepancies.

SCE would use the March 1 preliminary water year forecast to inform the Forest Service, Water Board, Interior, Cal Fish & Game, and the Commission which category of MIF and channel and riparian maintenance flow would be implemented by March 15 of each year. SCE would have the option to adjust flows based on the April 1 and May 1 DWR water year forecast updates, if those updates are revised. SCE would notify the agencies and the Commission if changes to the MIFs and channel and riparian maintenance flows are to be modified to conform to the revised forecast water year type.

Our Analysis

Flow compliance monitoring for many of the new gages listed in table 3-11 would require development of new measuring schemes. We expect that infrastructure changes at Dam 4, Mammoth Pool dam, and Dam 6 may involve the most extensive engineering and construction work. Site access downstream of Dam 4 and Dam 6 is particularly difficult, and access is likely to necessitate additional construction, or, depending upon site-specific conditions, alternative design strategies. SCE plans to construct gaging weirs at the Ross, Balsam, and Ely creeks gaging locations, which would require in-channel construction. Installation of flow gaging stations in these locations would result in environmental effects associated with the construction of the gage station itself, the associated access, and provision of electricity to operate the gaging station instrumentation (e.g., potential erosion and sedimentation, destabilization of existing steep slopes, disturbance of aquatic habitat, and degradation of local visual quality).

The type and frequency of maintenance activity on the flow monitoring equipment, and the methods and frequency used to calibrate the flow measuring devices, would depend on the equipment chosen to monitor streamflows, and the quality assurance requirements of USGS would ensure the accurate measurements would be recorded during the term of a new license. Due to low flows, cold temperatures, and deep snowpack during the winter generally above 5,000 feet msl in the project area, it may not be feasible to operate flow measuring equipment in smaller streams during winter months, when SCE is not diverting flow from those streams.

The gaging and water level monitoring proposed by SCE would be sufficient to ensure compliance with MIFs and other flow and water level requirements proposed for the area of the Big Creek ALP Projects. The coordination of the collection and reporting of these data would ensure that compliance is continually checked and confirmed by the Commission and other agencies.

Channel and Riparian Maintenance Flows - Bear, Bolsillo, Camp 62, and Chinquapin Creeks

Habitat in these bypassed reaches has the potential to be affected by (1) disruption of natural geomorphic processes including sediment retention behind dams; and (2) flow regulation that alters the timing, magnitude, and duration of peak flows and base flows. Under Settlement Agreement measure A1.2, Channel Riparian Maintenance Flow Plan, SCE would implement the following channel and riparian maintenance flows for Bear, Bolsillo, Camp 62, and Chinquapin creeks.

Bear Creek (A1.2.1)

Starting between May 15 and June 30 in wet water years, SCE would not divert water at Bear Creek diversion for 10 consecutive days.

Bolsillo Creek (A1.2.2), Camp 62 Creek (A1.2.3), and Chinquapin Creek (A.1.2.4)

Between April 1 and June 30 in wet water years, SCE would not divert water at the Bolsillo, Camp 62, or Chinquapin creek diversions.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations consistent with Settlement Agreement measure A1.2, Channel Riparian Maintenance Flow Plan for Bear, Bolsillo, Camp 62, and Chinquapin creeks.

Our Analysis

No riparian resource issues were identified in these bypassed reaches in the amended PDEA. However, current project operations have decreased the duration, magnitude, and frequency of high spring flows in all four of these bypassed reaches. During the period of record, the maximum recorded discharge downstream of the Bear Creek diversion (gage no. 11230530) in May and June was 923 to 1,250 cfs; downstream of the Bolsillo Creek diversion (gage no. 11230670) in April through June was 8.4 to 16 cfs; downstream of the Camp 62 Creek diversion (gage no. 11230600) in April through June was 8.1 to 27 cfs; and downstream of the Chinquapin Creek diversion (gage no. 11230560) in April through June was 13 to 34 cfs (see table 3-9). The proposed channel and riparian maintenance flows (natural discharge) would increase the magnitude and duration of spring peak flows and ensure that overbank flows occur during most wet water years because water would not be diverted for 10 consecutive days between May 15 and June 30 in Bear Creek and no diversions would occur at Bolsillo, Camp 62, and Chinquapin creeks between April 1 and June 30 in wet water years. Overbank flows would benefit riparian vegetation that requires periodic scouring to regenerate and maintain a variety of age classes over time.

Fish would benefit from increased riparian vegetation because many aquatic and terrestrial macroinvertebrates that serve as the prey base depend on riparian vegetation during their life cycles. In addition, riparian vegetation provides streambank stability to reduce erosion which can be a large source of instream sediment. It also provides canopy cover to reduce thermal heating and moderate daily temperature fluctuations, structure and overhead cover from predators, a source for LWD recruitment, and velocity breaks for fish during high flow. Riparian vegetation also traps overland sediment before it enters waterways to replenish riparian vegetation and protect aquatic habitat. Therefore, the proposed channel and riparian maintenance flows would protect and benefit the riparian and fish, as well as riparian-dependent wildlife resources in the Bear, Bolsillo, Camp 62, and Chinquapin creeks bypassed reaches.

Channel and Riparian Maintenance Flows - Mono Creek

Mono Creek bypassed reach is primarily a moderate gradient, bedrock/boulder channel, although a lower gradient, depositional section occurs where the stream flows through Mono Meadow. Streambank erosion in Mono Meadow due to livestock results in large amounts of fine sediment deposition and degraded fish habitat.

Other riparian resource issues in the bypassed reach include the occurrence of non-riparian species on depositional bars; riparian encroachment into the formerly active channel; loss of age class structure (regeneration); and changes in the timing, duration, and magnitude of peak flows. Under current project operations, inundation of the channel bars and floodplains occurs infrequently, and riparian vegetation is encroaching on the formerly active stream channel.

Under Settlement Agreement measure A1.3, SCE would implement the Mono Creek Channel Riparian Maintenance Flow Plan included in Settlement Agreement appendix D. The plan would establish an appropriate channel and riparian maintenance flow to reduce accumulations of sand in Mono Creek bypassed reach. During wet water years, the peak flows would either be 450 or 800 cfs depending on the results of sediment monitoring. Total flow volume would be at least 10,800 acre-feet over 11 days (Schedule 1) or at least 7,700 acre-feet over 10 days (Schedule 2). The Schedule 1 flow would be ramped up to at least 400 cfs over 3 days from the MIF to 800 cfs, and down ramped over 5 days (2 days at 500 cfs, 2 days 300 cfs, and 1 day to MIF). The Schedule 2 flow would be ramped up over 1 day to at least 450 cfs and down ramped over 1 day to MIF.

The volume of wet water year channel and riparian maintenance flow releases to Mono Creek would be determined from pool monitoring results (Hilton and Lisle, 1993), or a similar peer-reviewed sediment monitoring tool approved by SCE, the Forest Service, Interior, Cal Fish & Game, and the Water Board. The monitoring locations for the pools in Mono Meadow would be approved by the Forest Service in consultation with other interested agencies.

During above normal water years flows would be ramped up from the MIF over 2 days to 450 cfs. The 450 cfs peak flow would be maintained for 2 days then flows would be ramped down to the MIF over 3 days to achieve a flow volume of at least 4,100 acre-feet over the 7-day period. The first day flow would be ramped down to 345 cfs; the second day 240 cfs; and ramped down to the MIF on the third day.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations consistent with Settlement Agreement measure A1.3, Mono Creek Channel Riparian Maintenance Flow Plan.

Our Analysis

The Mono Creek Channel Riparian Maintenance Flow Plan would use monitoring and adaptive management to establish a channel and riparian maintenance flow that would reduce the large accumulations of sand and fine sediment in Mono Creek bypassed reach and transport sediment downstream to the South Fork San Joaquin River bypassed reach, which has a sediment deficit. The proposed Mono Creek bypassed reach channel and riparian maintenance flows would increase the magnitude, duration, and frequency of peak flows.

Flows of at least 450 cfs would provide partial mobilization of particles on the bed and bars. Under current operations, flows exceeding 800 cfs occurred for 17 days during a single wet water year (1995). Flows greater than 450 cfs occurred in three out of seven wet water years between 1983 and 2002. A flow of 450 cfs never occurred in above normal water years. The maximum daily flow in the above normal water years was 443 cfs, and occurred for 1 day in 1984. Other maximum daily flows that were greater than 50 cfs only occurred three times, all in 1984.

The proposed maximum 800 cfs wet water year flows would increase the wetted width by an average of 130 feet. The proposed 450 cfs above normal water year flows would increase the wetted width by about 43 feet. As a result, the proposed channel and riparian maintenance flows would inundate areas adjacent to the channel in all wet and above normal water years and restore floodplain connectivity and processes.

The proposed channel and riparian maintenance flows would (1) scour encroaching upland and riparian vegetation in the formerly active channel and on the channel bars; (2) deposit fresh alluvium; (3) regenerate and establish riparian vegetation; (4) provide higher soil moisture and water table to support riparian vegetation; (5) transport excessive accumulations of sand and fine sediment downstream to the sediment deficit South Fork San Joaquin River bypassed reach; (6) discourage continued encroachment of upland species on the channel bars; (7) cause some localized bank erosion in response reaches, and (8) increase LWD recruitment to the stream channel. The banks damaged by livestock in Mono Meadow, however, may be susceptible to increased bank erosion under flows of this magnitude. Monitoring would allow a determination of the extent of bank erosion and the potential need to modify channel and riparian maintenance flows or implement bank stabilization measures. In addition, the monitoring results would establish follow-up actions and may establish the party responsible for implementation.

Channel and Riparian Maintenance Flows – Camp 61 Creek

Under Settlement Agreement measure A1.4, SCE would implement the Camp 61 Creek Channel Riparian Maintenance Flow Plan included as Settlement Agreement appendix E. The plan is consistent with the final 4(e) conditions for the Portal Project filed by the Forest Service on November 29, 2006.

The objective of the Camp 61 Creek Channel Riparian Maintenance Flow Plan is to determine an appropriate flow regime to reduce accumulations of fine sediment in the Camp 61 Creek bypassed reach from Portal forebay to the South Fork San Joaquin River. The pool monitoring locations would be approved by the Forest Service in consultation with other interested agencies. Pool monitoring would occur within 6 months following any wet water year channel and riparian maintenance flow release, except the following:

- If channel and riparian maintenance flows are released in consecutive wet years and the pool monitoring V*w[39] values after the first year's release are ≤0.25, no measurement would be required after the second wet year channel and riparian maintenance flow release.
- If pool monitoring V*w values following each wet year channel and riparian maintenance flow release for three successive years are ≤0.25, then the pool monitoring regime would be modified so that monitoring occurs after every third wet year release or at a lesser frequency agreed to by the interested resource agencies.
- No pool monitoring would be required following above normal water year channel and riparian maintenance flow releases.

The pool monitoring results, or a similar peer-reviewed sediment monitoring tool approved by SCE, the Forest Service, Interior, Cal Fish & Game, and the Water Board would be used to determine which channel and riparian maintenance flow schedule would be implemented. Channel and riparian maintenance flows would be within 90 percent of the 24-hour average flow identified in table 3-13. SCE would make up any deficiency in total channel and riparian maintenance flow release volume within the existing release period. To the extent feasible, SCE would release channel and riparian maintenance flows for a 10-day consecutive period between May 1 and June 30.

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[39] The weighted mean value of the level of fine sediments.

Table 3-13. Proposed Camp 61 Creek 24-hour average channel and riparian maintenance flows. (Source: SCE, 2007b)

Channel and Riparian Maintenance Flow Release Day	Above Normal Water Year (cfs)	Wet Water Year (cfs)
1	ramp up from MIF to 22	ramp up from MIF to 28
2-3	22	28
4-7	30	40
8-9	22	28
10	ramp back to MIF	Ramp back to MIF

If the pool monitoring V*w value is >0.25 following the release of two wet water year flows, SCE would increase the duration of the channel and riparian maintenance flows by adding two more days of channel and riparian maintenance flows at 30 cfs in above normal years and two days at 40 cfs in wet years.

If the V*w continues to be greater than 0.25 after at least two modified channel and riparian maintenance flows in wet water years, the licensee would consult with the above listed agencies on the need for additional flow modifications to reduce fine sediment recruitment.

Our Analysis

Channel and riparian maintenance flows would help to flush fine sediments out of the Camp 61 Creek system to improve aquatic habitat conditions. The channel and riparian maintenance flows included in Settlement Agreement measure A1.4 would be of a slightly higher magnitude (30 versus 28 cfs in above normal years; 40 versus 29 cfs in wet water years) and the same duration as channel and riparian maintenance flows that were recommended in the Commission's environmental assessment for the Portal Project (FERC, 2006). The proposed higher flows would have a somewhat greater capacity to mobilize and transport accumulated sediments and contribute to the formation of physical habitat features such as riffles, pools, runs, and point bars. The flows also would support dynamic geomorphic processes over time and decrease spawning gravel embeddedness.

The Camp 61 Creek channel and riparian maintenance flows would occur between May 1 and June 30. These releases would occur during the peak spring hydrograph to maximize the channel's ability to mobilize and transport sediment and increase riparian vegetation regeneration. Spring releases would also contribute flow to the South Fork San Joaquin River to benefit spring spawning trout.

The channel and riparian maintenance flows would include specific ramping rates to be implemented over the 10-day release period that would better enable juvenile brown trout to seek cover from high flows and reduce the possibility of stranding following releases. As spawning and substrate conditions improve over time, brown trout recruitment and benthic macroinvertebrate productivity would increase and young-of-the-year trout would have increased access to interstitial spaces, which provide cover and refugia from high velocity flows, within the substrate.

Channel and Riparian Maintenance Flows – South Fork San Joaquin River downstream of Florence Reservoir

Riparian resource issues along the South Fork San Joaquin River bypassed reach and specifically in the Jackass Meadow complex and other low gradient response reaches include age class structure (low regeneration), community composition, encroachment of upland species, stress (high willow decadence, livestock, and recreational effects), loss of floodplain connectivity, and infrequent channel bar, floodplain, and meadow inundation.

Under Settlement Agreement measure A1.5, SCE would implement the proposed channel and riparian maintenance flows for the South Fork San Joaquin River downstream of Florence reservoir, included as Settlement Agreement appendix F. Wet year and above normal water year types would be based on the April 1 forecast.[40] During wet years, SCE would, within the extent of its control, release sufficient flow or augment a natural spill event which meets all of the following characteristics:

- Gradually ramp flows from the base flow to 1,600 cfs over 3 days, in as even increments as feasible.
- Maintain an average daily flow of at least 1,600 cfs for 3 consecutive days.
- Decrease flow from 1,600 cfs to the MIF over the next 8 days according to the schedule below:
    1. decrease flow to approximately 1,000 cfs for 1 day,
    2. decrease flow to approximately 750 cfs for 2 days,
    3. decrease flow to approximately 500 cfs for 3 days,
    4. decrease flow to approximately 150 cfs for 1 day, and
    5. decrease flow to the MIF over 1 day.
- Release a total flow volume of at least 22,000 acre-feet.

To the extent feasible, channel and riparian maintenance flows in wet years would be implemented starting between June 1 and July 7.

If the channel and riparian maintenance flow peak and volume release requirements are met by natural spill, then SCE would make a good faith effort to provide down ramping releases on the descending limb of the hydrograph to accommodate whitewater boating:

[40] Based on DWR, Bulletin No. 120, San Joaquin Valley Water Year Index, or its successor index that is most representative of the Big Creek watershed.

- Approximately 750 cfs for 3 days,
- Approximately 500 cfs for 2 days, and
- SCE would make a good faith effort to provide at least 1 day of flow between approximately 500 and 750 cfs during a weekend.

SCE would make a good faith effort to stabilize these flow releases between 10:00 a.m. and 4:00 p.m. for whitewater boating purposes, if the area is accessible to boaters.

During above normal water years,[41] to the extent within its control, SCE would release sufficient flow, augment a natural spill event, or document a natural spill event that meets all of the following characteristics:

- Gradually increase flow over 1 day from the base flow to a peak flow that would provide approximately 75 percent of the areal extent of inundation measured at 1,600 cfs.
- Maintain an average daily flow at the level of the peak flow for 2 consecutive days.
- Decrease flow from the peak flow to the MIF over the next 5 days according to the schedule below:
    1. maintain flow of approximately 700 cfs for 1 day,
    2. maintain flow of approximately 500 cfs for 3 consecutive days, and
    3. decrease flow to the MIF over 1 day.
- Release a total flow volume of at least 6,000 acre-feet plus the volume of the 2 day peak flow. In no event would SCE be required to increase the flow release volume above 13,000 acre-feet.
- SCE would make a good faith effort to provide at least 1 day of flow between approximately 500 and 700 cfs during a weekend.

To the extent feasible, above normal water year channel and riparian maintenance flows would be completed before Memorial Day weekend.

Within the first year after license issuance, SCE would implement the proposed Jackass Meadow Inundation Study described in the amended PDEA. The microtopography of the Jackass Meadow complex would be surveyed at a scale and in a level of detail sufficient to evaluate the areal extent of inundation that would occur based on the proposed channel and riparian maintenance flows. In the first 2 wet years that occur after issuance of the new license, SCE would map and calculate the areal extent of

[41] Beginning in the first above normal water year after SCE completes consultation with the Forest Service regarding the calculation of the channel and riparian maintenance flow necessary to inundate 75 percent of the areal extent inundated by 1,600 cfs.

inundation for at least three flow levels between and including 1,000 and 1,600 cfs. This information would be used to determine (1) whether a flow less than 1,600 cfs would provide the same level of inundation as provided at 1,600 cfs, and (2) the flow necessary to inundate approximately 75 percent of the area inundated at 1,600 cfs. If SCE and the Forest Service agree that a lower flow provides the same level of inundation provided by 1,600 cfs, the peak flow and amount of stored water released for the channel and riparian maintenance flow in future years may be reduced.

If above normal water years occur prior to completion of the Jackass Meadow Inundation Study, SCE would provide at least four consecutive days of flow between 500 and 750 cfs for whitewater boating purposes, including 2 weekend days.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations consistent with Settlement Agreement measure A1.5, Channel and Riparian Maintenance Flows for the South Fork San Joaquin River downstream of Florence Reservoir.

Our Analysis

The proposed South Fork San Joaquin River Channel Riparian Maintenance Flow Plan would use monitoring and adaptive management to establish a channel and riparian maintenance flow that would improve meadow and riparian ecosystems and floodplain function in the South Fork San Joaquin River bypassed reach. Historically, portions of the Jackass Meadow complex were probably inundated in most years. Under current operations, the meadow complex is inundated 4 out of 6 wet water years, and rarely during above normal water years. The current inundation flows are associated with spill events and recede very quickly. During uncontrolled wet water year spills, flows often exceeded 1,600 cfs. During above normal water years, spills occur only rarely.

The maximum average discharge in the South Fork San Joaquin River downstream of Hooper Creek (gage no. 11230215) for the period of record was 2,190 cfs in May; 4,010 cfs in June; and 5,020 cfs in July (see table 3-3). The proposed channel and riparian maintenance flows would increase the magnitude, duration, and frequency of peak flows above the current levels according to the above schedules. In wet years, a maximum of 1,600 cfs and total volume at least 22,000 acre-feet would be released over 14 days. In above average years, a maximum of 1,600 cfs and total volume not more than 13,000 acre-feet would be released over 8 days. The proposed wet water year channel and riparian maintenance flow would inundate channel bars, the meadow complex, and other floodplains for longer periods, and the recession rate would be slower than existing conditions. The proposed above normal water year channel and riparian maintenance flow would inundate about 75 percent of the area that would be inundated during wet water years. These more frequent, longer inundation periods would help recharge the underlying water table and saturate meadow soils to maintain moisture content for longer periods of time.

The proposed channel and riparian maintenance flows would (1) scour encroaching upland and riparian vegetation in the formerly active channel and on the channel bars; (2) deposit fresh alluvium; (3) regenerate and establish riparian vegetation; (4) provide higher soil moisture and water table to support riparian vegetation; (5) transport excessive accumulations of sand and fine sediment downstream to the sediment deficit South Fork San Joaquin River bypassed reach; (6) discourage continued encroachment of upland species on the channel bars; (7) cause some localized bank erosion in response reaches; and (8) increase LWD recruitment to the stream channel. The banks damaged by livestock and recreational users in the Jackass Meadow complex would be highly susceptible to increased bank erosion under flows of this magnitude.

Small Diversions Decommissioning

Under Settlement Agreement measure A1.6, SCE would implement the proposed Small Diversions Decommissioning Plan included as Settlement Agreement appendix G. SCE proposes to complete the decommissioning of the six small diversions within five years following issuance of the new licenses, assuming required permits are obtained. SCE identifies the following permits and approvals that may be required prior to beginning decommissioning work: (1) wilderness variance from the Forest Service (Carter and Tombstone diversion dams); (2) special-use permit from the Forest Service; (3) streambed alteration agreement from Cal Fish & Game; (4) water quality certification from the Water Board; and (5) a nationwide 404 permit from the U.S. Army Corps of Engineers. The small diversions that would be decommissioned include four backcountry hydroelectric generation diversions on North Slide, South Slide, Tombstone, and Crater creeks, and two domestic water diversions on Pitman and Snow Slide creeks.

All decommissioning work would be completed during the late summer and early fall months after the snow has melted to allow crews safe access to these back-country facilities after the peak recreational season.

The decommissioning would include the dismantling of five diversions and abandoning one diversion in place (South Slide Creek) that currently does not obstruct natural geomorphic processes. The diversions would be decommissioned because they are either: (1) currently not in service, (2) no longer needed for the operation and maintenance of the project, or (3) have been requested to be removed by resource agencies. Natural flow and sediment transport would be maintained or restored to the affected streams.

All above-ground facilities associated with the diversions (e.g., water conveyance pipes, support structures, stream gages) and other associated material would be removed. The decommissioning activities and removal of materials would be conducted in an appropriate manner depending on the location of the diversion (e.g., designated Wilderness, type of material).

A brief summary report would be prepared at the conclusion of each diversion decommissioning that includes pre- and post-decommissioning photographs to document the completed activities. The report would be provided to the Commission and appropriate regulatory agencies for their records.

Once the diversions have been decommissioned, SCE would provide notification to the Water Board that the diversions are no longer in service and no longer necessary for project operations. SCE would request the water rights associated with the diversions be transferred or cancelled.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations consistent with the Settlement Agreement measure A1.6, Small Diversion Decommissioning Plan.

Our Analysis

Crater Creek

Crater Creek diversion dam is located about 1 mile west of Florence Lake at an elevation of 8,765 feet msl in the John Muir Wilderness. The diversion is currently in service. There is no MIF requirement for Crater Creek in the current license, but seepage from the diversion provides flow to the creek when the diversion is in operation.

Explosives and hand tools would be used to break up the concrete diversion and the rock mortar walls along the diversion channel and stream gage control structure. The diversion structure would be broken into small rock and mortar pieces that would be distributed on the ground surface in the immediate area around the former diversion, diversion channel, and stream gage. A helicopter may be used to remove the gage house materials and large sections of pipe (if the Forest Service determines that use of a helicopter is consistent with the results of a Minimum Tools Analysis [required for work in designated wilderness]). All airlifted materials would be transported as external loads, limiting the need for the helicopter to land at the diversion, and taken to SCE's Florence Work Camp where the material would be staged for transport and disposal at an appropriate facility. The smaller debris (e.g., pipe, metal associated with the diversion, tools, remaining trash) would be packed out by the crews.

Removing the diversion in the late summer-fall during low flow conditions with hand tools would minimize the potential for short-term turbidity or sedimentation related to the decommissioning. The proposed decommissioning would remove a structural fish passage barrier and restore natural instream flow and sediment transport to the Crater Creek bypassed reach, and would benefit the population of brook trout in this reach. Restoration of natural flow and sediment transport would help reduce cumulative effects related to flow and sediment deficit in the South Fork San Joaquin River bypassed reach.

Tombstone Creek

Tombstone Creek diversion dam and its associated water conveyance pipe are approximately 0.5 mile northeast of Florence Lake at an elevation of 7,673 feet msl in the John Muir Wilderness. The diversion is currently out of service.

Explosives and hand tools would be used to break up the rock mortar wall diversion and concrete support piers associated with the pipe into small pieces that would be distributed on the ground. Small debris would be packed out by the crews. The steel support poles used to elevate the pipe off the ground would be cut flush with ground surface. The supports, pipe, and other large debris may be airlifted out using a helicopter (if the Forest Service determines that its use is consistent with the results of a Minimum Tools Analysis). All airlifted materials would be transported to SCE's Florence Work Camp where it would be staged for transport to an appropriate disposal facility.

The exterior of the pipe is covered with an asbestos-bearing material. A California State Certified Industrial Hygienist with the appropriate asbestos certification would develop a work plan for the handling and disposal requirements of the pipe.

Removal of the diversions with hand tools in the late summer-fall during low flow conditions would minimize the potential for short-term turbidity or sedimentation related to the decommissioning activities. The proposed decommissioning would remove a structural fish passage barrier, restore sediment transport, and maintain the current instream flow in the Tombstone Creek bypassed reach. Restoration of natural sediment transport in Tombstone Creek would help reduce cumulative effects related to sediment deficit in the South Fork San Joaquin River bypassed reach.

North Slide Creek

The North Slide Creek diversion dam is located approximately 1.5 miles north of Florence Lake at an elevation of 7,501.5 feet msl, outside the Wilderness boundary. The diversion is currently out of service and has not been operational for 21 years.

Explosives and hand tools would be used to break up the rock and mortar wall diversion structure into small rock and mortar pieces that would be distributed on the ground surface in the immediate area around the former diversion. Ancillary features would be unbolted or torch cut into smaller manageable pieces that can be packed and transported from the area. All of the diversion piping is buried, and would be left in place. The first 5 feet of the pipe would be plugged using concrete. The diversion would be visually monitored once every 5 years to ensure that the pipe remains buried and sealed. The above-ground pipe and all debris (other than the rock and mortar wall debris) would be packed out by the crews.

North Slide Creek is naturally fishless, so the proposed decommissioning to maintain natural instream flow and restore sediment transport would not directly adversely affect or benefit fish in the bypassed reach. However, approximately 20 cubic yards of sediment are stored behind the diversion. SCE's intent, if approved by regulatory agencies, is to allow the sediment to be naturally redistributed by high flows. We expect that any increase in turbidity associated with sediment dispersal during high flows would be of relatively short duration. The restoration of sediment transport would help reduce cumulative effects related to sediment deficit in the South Fork San Joaquin River bypassed reach.

South Slide Creek

The South Slide Creek diversion dam is located approximately 1.5 miles southeast of Florence Lake at an elevation of 7,501.5 feet msl, outside of the Wilderness boundary. The diversion structure has been breached and the former mortar rock wall diversion structure has been degraded by extreme weather and high flow events. As a result, the diversion has not been operational for 21 years. The immediate area surrounding the diversion is overgrown with dense riparian vegetation.

The water conveyance system consists of a buried pipe that would be sealed with concrete and abandoned in place. The diversion would be visually monitored once every 5 years to ensure that the piping remains buried and sealed.

The diversion structure would be abandoned in place to prevent unnecessary disturbance to the stream channel and the riparian vegetation. Natural instream flow and sediment transport would be maintained.

The proposed decommissioning would maintain current instream flow and sediment transport in South Slide Creek. This creek is naturally fishless, so the abandoned diversion would not be a passage barrier, and the proposed decommissioning would not directly adversely affect or benefit fish.

Pitman Creek and Snow Slide Creek Domestic Diversions

The Pitman Creek and Snow Slide Creek domestic diversion dams are located approximately 1 mile east of the community of Big Creek. The diversion dams are concrete structures that historically provided domestic water to SCE personnel and facilities in the community, but have not been in operation for approximately 30 years. Associated with the diversions are water conveyance systems consisting of above and below ground steel pipes.

Decommissioning the Pitman and Snow Slide creek facilities would include removal of existing above ground structures (diversions and piping). Removal activities would be limited to those necessary to return the area to a natural condition without causing significant adverse effects. Both diversion dams would be removed by using explosives and hand tools. Buried ancillary facilities would require significant ground disturbance to remove; therefore, these underground facilities would remain in place.

Decommissioning would maintain current instream flow conditions in Pitman and Snow Slide creeks. Snow Slide Creek is naturally fishless so the proposed decommissioning (abandoning the buried diversion in place) would not directly adversely affect or benefit fish.

Pitman Creek, downstream of the domestic diversion has self-sustaining populations of rainbow, brown, and brook trout. Decommissioning the domestic diversion would maintain the current instream flow and natural sediment transport downstream to Pitman Creek diversion.

Bear Creek Large Wood Debris Management

The Bear Creek diversion dam blocks the transport of LWD from the upper watershed to the Bear Creek bypassed reach. Under Settlement Agreement measure A1.7, SCE would return large wood to Bear Creek by allowing LWD to pass over Bear Creek diversion dam spillway during spill. SCE would also collect LWD from the impoundment in the vicinity of the intake gates and dam for placement in the bypassed reach. For purposes of this measure, LWD is defined as dead or dying wood 10-feet or longer and at least 4-inches in diameter. SCE may cut large pieces of wood that otherwise would not be feasible to collect and move from the Bear Creek forebay as long as the minimum dimensions for LWD, as defined above, are maintained.

LWD would be placed downstream of the USGS gaging weir to ensure there is no obstruction of the flow recording equipment at the gage. Individual pieces of LWD would be placed so at least a portion lies within the channel to help ensure the wood is captured during spill events and transported and redistributed downstream. LWD should be distributed, as access allows, for approximately 100 to 200 feet downstream of the gaging weir.

SCE would describe the past year's LWD placement at annual consultation meetings. SCE and the resource agencies would decide if the amount of LWD is sufficient and the LWD procedures are adequate to transport downstream during spill events. Future placement and procedures for placing and distributing LWD in the Bear Creek channel may be modified based on the annual consultation.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations consistent with Settlement Agreement measure A1.7, Large Wood Debris Management.

Our Analysis

In the reference reach upstream of Bear Creek diversion, more than half of the habitat units had 1 to 15 pieces of LWD. Most habitat units in the bypassed reach did not have LWD; six habitat units had 1 to 5 pieces of LWD and one unit had 5 to 10 pieces (SCE, 2003b). The limiting factors analysis of the bypassed reach suggests that adult rearing and spawning habitat is heavily utilized by an abundant trout population, and the physical habitat may be approaching limiting values.

LWD contributes to productive aquatic ecosystems, and is an important component in the formation of complex aquatic habitat units and channel maintenance. The proposed LWD supplementation in the bypassed reach would increase the amount of available trout habitat by creating deep pools that provide thermal refugia and increasing habitat complexity. LWD creates high flow velocity breaks and provides cover from predators, including other trout. Snorkel surveys conducted by the Sierra National Forest indicate that the highest trout densities are associated with LWD. The velocity breaks created by LWD also retain and sort substrate to create gravel bars and spawning habitat by salmonids.

Increased LWD would provide more substrate for macroinvertebrates that are part of the trout prey base, and would trap drift insects and terrestrial organic material that would increase stream productivity and carrying capacity. LWD decay products also provide organic carbon and energy sources for the food web of the aquatic ecosystem.

Temperature Monitoring and Management

The Settlement Agreement provides for the release of increased MIFs to project bypassed reaches (measures A1.1.1.1-A1.1.1.25). Under measure A1.8, SCE would implement the Temperature Monitoring and Management Plan, included as Settlement Agreement appendix H, to document the effects of proposed MIFs on water temperatures and allow for adaptive management where needed.

Under the Temperature Monitoring and Management Plan, SCE would monitor water temperatures during at least the first three to five years that new MIFs are released, including at least one dry or critically dry water year. Water temperature monitoring would focus on the summer months (June 1 through September 30) in the designated bypassed reaches downstream of project diversions (Settlement Agreement appendix H, table 1). The temperature monitoring sites would be in the South Fork San Joaquin River, the San Joaquin River Mammoth reach, Big Creek, North Fork Stevenson Creek, San Joaquin River Stevenson reach, Camp 61 Creek, Mono Creek, and Florence Lake. Data would be collected by SCE to assist in (1) documenting consistency with water temperature Basin Plan targets for daily mean and maximum water temperatures under the new MIFs, and (2) obtaining information about potential project controllable factors.

In the higher elevation bypassed reaches and other bypassed reaches except those on the mainstem San Joaquin River, water temperatures are expected to be cool and monitoring would have a nominal duration of three years or until at least one dry or critically dry water year is monitored. If water temperatures targets are maintained in these locations, monitoring would be discontinued after three years. If target water temperatures are not maintained during extreme conditions in a reach, SCE and the resource agencies would consult to determine if monitoring should be extended for that reach. The Water Board and the Commission would decide when the water temperature monitoring has shown consistency with maintaining target water temperatures and if the monitoring of that stream reach can be terminated. In the lower elevation Mammoth and Stevenson reaches, water temperatures would be monitored for no less than five years, including at least one dry or critically dry water year. To understand the influence of extreme meteorological conditions on water temperatures, meteorological data would be collected by SCE in selected locations within the Upper San Joaquin River Basin.

Monthly water temperature profiles would be collected in Florence and Mammoth Pool reservoirs to characterize temperature stratification and the controllability of downstream water temperatures. Mammoth Pool reservoir mixes in the late summer/fall during dry water years so that increased water releases from the reservoir may not reduce downstream water temperatures, and water temperature may not be a controllable factor at such times. Real-time telemetry would be used to monitor summer water temperatures in the Mammoth and Stevenson reaches and in the South Fork San Joaquin River downstream of Lake Florence to identify when target temperatures are exceeded. Temperature profiles measured in Mammoth Pool reservoir and telemetry of water temperatures in Mammoth reach near the point of release would identify if the water available for release into the reach is sufficiently cool to attain target temperatures or to prevent warming of daily mean water temperatures over 20°C by more than 2.7°C.

If water temperatures in Mammoth reach exceed target temperatures when Mammoth Pool reservoir is thermally stratified, cool water would be released at Mammoth Pool dam to reduce water temperatures. If water temperatures in the Stevenson reach exceed target temperatures when cool water is present in the Dam 6 impoundment, cool water would be released at Dam 6 to reduce water temperatures. Water temperature conditions would be considered project controllable within the capacity of the flow release structures, when cool water is available.

A supplemental study that includes fish, water temperature, and DO data collection would be implemented in the first, third, and fifth years after implementation of the new MIF to evaluate the use and importance of Stevenson reach for transitional zone species including hardhead, Sacramento pikeminnow, and Sacramento sucker. Sampling would take place in the same locations and use the same techniques as were used in the SCE 2002 CAWG-7 Characterize Fish Populations report. If the supplemental study concludes that Stevenson reach is an important native fish transition zone, and the consensus recommendation of SCE and the resource agencies is to change the beneficial use designation of the reach or the lower portion of the reach (downstream of the Stevenson Creek confluence), SCE would propose an amendment of the coldwater habitat designation in the Basin Plan.

The combined monitoring results would be used by SCE to prepare a long-term water temperature control program that would be approved by the Water Board and the Commission, and would be added to the plan. SCE would also prepare an interim water temperature control program within 1 year after license issuance. The interim program would contain measures (e.g., increased flow releases) that may be feasibly implemented by SCE to maintain water temperatures below target temperatures, when water temperature is a project controllable factor. The interim program would also include feasible measures to reduce water temperature increases when water temperatures are above target levels and cannot be reduced below target levels, when water temperature increases are a project controllable factor.

Other Recommendations

Interior filed 10(a) recommendations for all four Big Creek ALP Projects that are consistent with Settlement Agreement measure A1.8, Temperature Monitoring and Management Plan. Interior's 10(a) recommendation would expand the program to include temperature monitoring of all of the projects' affected reservoirs and affected stream reaches.

Our Analysis

The proposed Temperature Monitoring and Management Plan was developed to verify whether the Basin Plan designated coldwater beneficial use would be maintained in project bypassed reaches under the new MIFs, as defined by daily mean water temperatures $\leq$20°C and daily maximum water temperatures $\leq$22°C. The proposed Temperature Monitoring and Management Plan would benefit fish by documenting how project operations affect water temperatures so that flows may be adjusted where temperature criteria are not being achieved. Through the interim program and adaptive management based on the monitoring results, water temperatures beneficial to coldwater fishes could be achieved. Once the long-term water temperature control program has been approved, water temperature targets would be met by SCE, when water temperatures are a project controllable factor.

The Temperature Monitoring and Management Plan includes measurement of water temperatures at 19 sites in 6 stream reaches[42] where daily mean water temperatures exceeded 20°C or daily maximum water temperatures exceeded 22°C in 2000 or 2001, based on criteria supplied by the Water Board to protect coldwater beneficial uses. We find these criteria to be consistent with available literature on the preferred temperature ranges for rainbow and brown trout, which indicate that the preferred water temperature range extends up to at least 20°C, with no indication that short-term increases to temperatures as high as 22°C would impair growth. Although a daily average temperature of 20°C is slightly outside of the preferred range of 14 to 19ºC given by Moyle (2002) for brook trout, this is not a native species in California and is considered to be invasive in many areas that it has colonized.

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[42] Seven sites on the South Fork San Joaquin River and in two of its tributaries (Camp 61 and Mono creeks), at six sites in the Mammoth and Stevenson reaches of the San Joaquin River, at four sites in the middle and lower Big Creek reaches, and at two sites in North Fork Stevenson Creek.

Interior's 10(a) recommendation would expand the monitoring program to include eight additional bypassed stream reaches (Stevenson, Upper Balsam, Bear, Hooper, Pitman, Bolsillo, Chinquapin, and Camp 62 creeks) none of which exceeded a daily mean temperature of 20°C or a daily maximum water temperature of 22°C in 2000 or 2001. Short-term (3 year) water temperature monitoring is proposed for Mono Creek upstream of the San Joaquin River at RM 0.1 in the Temperature Monitoring and Management Plan due to thermal heating in the reach that exceeds the Basin Plan standard (>5ºF). Based on monitoring data collected in 2000 and 2001, these reaches currently support all beneficial uses, would continue to do so under the MIFs proposed in the Settlement Agreement, and the proposed Mono Creek MIF is expected to decrease thermal warming to meet Basin Plan standards. Therefore, it is unclear what environmental enhancements would be achieved by Interior's 10(a) recommendation.

The Temperature Monitoring and Management Plan also includes measurement of temperature profiles in two reservoirs (Mammoth Pool and Florence Lake) to assess the potential for using cold water in these reservoirs to reduce water temperatures downstream. Interior's 10(a) recommendation would expand the monitoring program to include all 15 affected reservoirs and impoundments. However, two project reservoirs (Shaver and Huntington) besides Mammoth Pool and Florence Lake have sufficient storage to suggest that they have the potential to be used to manage downstream water temperatures. Shaver Lake has a maximum storage of 135,568 acre-feet and likely could be used to manage water temperatures in the downstream reach of Stevenson Creek. SCE's temperature monitoring data from 2000 and 2001 indicate that the temperature in this reach already meets the objectives to support coldwater life, and would continue to do so under the increased flows proposed in the Settlement Agreement. Similarly, Huntington Lake has a substantial amount of usable storage capacity (89,166 acre-feet), but the Upper Big Creek reach downstream of the reservoir already meets the objectives to support coldwater life, and would also be expected to do so under the increased flows proposed in the Settlement Agreement.

Implementing the Temperature Monitoring and Management Plan would assist in meeting the Basin Plan objectives for coldwater beneficial uses and Interior's SROs for the project affected reaches through adaptive management based on monitoring results.

Fish Monitoring

Trout populations in a number of the bypassed reaches have low densities, fragmented distributions, and/or skewed age class distributions. In many cases, fish populations appear to be constrained by the effects of flow diversions and project structures on stream flows, water temperatures, fish passage, and the transport and supply of spawning gravel and LWD. The Settlement Agreement includes measures that are expected to enhance fish populations by addressing many of these project-related effects.

Under Settlement Agreement measure A1.9, SCE would implement the proposed Fish Monitoring Plan, included as Settlement Agreement appendix I. Fish monitoring would be implemented at years 3, 8, 18, 28 (and in year 38, if a 50-year license is granted) in nine stream reaches and in Mammoth Pool reservoir, Huntington Lake, Florence Lake and in Shaver Lake. Fish populations would be monitored in the following stream reaches: San Joaquin River downstream of Mammoth Pool and Dam 6, Big Creek downstream of Dams 4 and 5, South Fork San Joaquin River downstream of Florence dam, Mono Creek downstream of the Mono diversion, Bear Creek downstream of the diversion, North Fork Stevenson Creek, and Stevenson Creek downstream of Shaver Lake. The proposed Fish Monitoring Plan also calls for a minimal amount of night snorkeling in the Mammoth reach. Monitoring would not begin until the new MIFs have been implemented in each survey reach. If monitoring is scheduled for a wet water year it would be postponed until the next non-wet water year to prevent confounding the effect of high flows on fish recruitment and populations.

The Fish Monitoring Plan would evaluate the response of fish populations in selected reaches and major reservoirs to the instream flow and other enhancement measures (channel and riparian maintenance flows, LWD, and sediment) included in the new licenses. Species composition, relative abundance, size and age distribution, biomass, density, and condition factors would be monitored during the months of August and September. Population statistics for hatchery-origin and wild trout would be evaluated separately. Physical measurements and observations of stream and reservoir conditions would be made at each sampling site including water temperature, specific conductance, and DO.

In addition, fish and crayfish would be collected from Mammoth Pool reservoir and fish would be collected from Huntington Lake during the population sampling events for tissue analysis, to evaluate for the presence bioaccumulated silver. Ten wild fish would be collected from each reservoir, and an additional ten crayfish would be collected from Mammoth Pool reservoir. Samples would be analyzed for silver content in 1) fish muscle tissue; 2) fish livers; and 3) entire crayfish. None of the project surface water or reservoir water samples exceeded the secondary drinking water objective for silver (100 micrograms per liter [μg/L]) (SCE, 2003h). However, the CTR and NTR have established more stringent silver criteria for acute dissolved silver criteria that are hardness dependent and calculated on a sample-by-sample basis, for the protection of freshwater aquatic life. The dissolved silver criteria were exceeded at one station in Mono Creek (0.26 μg/L), and on one occasion in the San Joaquin River downstream of Stevenson Creek (0.34 μg/L). The source of silver at these locations is unknown but SCE reports that it is not project-related. Results of the reservoir tissue sampling and comparisons to appropriate criteria would be included in the monitoring report.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations for all four Big Creek ALP Projects that are consistent with Settlement Agreement measure A1.9, Fish Monitoring Plan.

Our Analysis

Project Bypassed Reaches

The Forest Service's fisheries management goals, objectives, and direction, and Interior's general resource objectives for project bypassed reaches include: (1) managing fish habitat to maintain viable populations of all resident or indigenous fish; (2) determining and recommending MIFs and habitat conditions that maintain, enhance, or restore all life stages of native aquatic species and fish passage; (3) providing hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic dependent species; and (4) managing habitat for Forest Service sensitive fish species in a manner that prevents any species from becoming a candidate for threatened or endangered status. Resource objectives developed by the Forest Service and Interior for specific reaches are presented in *General Streamflow Requirements*. These generally focused on (1) providing more adult trout habitat, (2) reducing water temperatures, (3) providing more trout spawning habitat, and (4) increasing fish passage during the spawning seasons.

Monitoring fish populations in these reaches would provide a means of assessing the effects of the new MIFs and other enhancement measures on fish populations and to apply adaptive management, as needed. Fish population monitoring also would help determine if the Forest Service, Interior, and Basin Plan objectives are being met in these reaches.

Project Reservoirs and Impoundments

Cal Fish & Game management objectives for the large project reservoirs are focused on maintaining adequate populations of coldwater game fish (rainbow trout, brown trout, and kokanee). Cal Fish & Game manages Mammoth Pool reservoir as a put-and-take fishery for catchable rainbow trout, and a stock-and-grow fishery for fingerling and sub-catchable rainbow trout. It manages Huntington and Shaver lakes as put-and-take fisheries for catchable rainbow trout and as stock-and-grow fisheries for fingerling and sub-catchable rainbow trout and kokanee. Shaver Lake also supports a warmwater fishery for smallmouth bass, bluegill, and crappie, and another Cal Fish & Game objective for Shaver Lake is to provide suitable habitat for warmwater sport fish. Florence Lake and its tributaries support a self-sustaining population of brown trout.

In the proposed reservoir monitoring studies, fish populations would be described by depth intervals along with corresponding measurements of physical habitat (temperature, specific conductance, and DO). Monitoring fish populations would provide a means of assessing the effects of the new MIFs on fish populations in the major reservoirs, including potential effects of earlier depletion of cool water in dry years on reservoir trout. This information would help determine if Cal Fish & Game's management objectives for these reservoirs are being met, and would guide adaptive management plans.

As part of reservoir sampling, fish and crayfish from Mammoth Pool reservoir and fish from Huntington Lake would be collected for tissue analysis to evaluate the presence of bioaccumulated silver. Elevated silver levels may be associated with application of silver iodide in the watershed by SCE to enhance rainfall in the Upper San Joaquin River Watershed as a means to increase water yields for project operations (letter from W.E. Loudermilk, Regional Manager, Cal Fish & Game, Fresno CA to J. McPheeters, Manager of Northern Hydro Region, SCE, Rosemond CA, dated October 17, 2005). The application of silver iodide in the San Joaquin Watershed to stimulate increased water supply for the projects in the Big Creek System represents a project-related activity. Although we have no means to identify whether silver that occurs in project waters and in the tissue of fish from project waters is from silver iodide applications or naturally occurring sources, the information on silver levels in fish tissue would help to determine the extent of silver bioaccumulation in aquatic biota.

Sediment Management

Accumulation of sediment behind project dams prevents the flow of sediment, spawning gravel, and other materials beneficial to fish and wildlife from continuing downstream through the project-affected stream reaches. Under Settlement Agreement measure A1.10, SCE would implement the sediment management measures described in Settlement Agreement appendix J. These include measures for passing accumulated sediment through project facilities followed by flushing flows to redistribute passed sediments, removing accumulated sediment from behind dams that may block low level outlets or intake structures if necessary for continued project operations and minimum flow releases, and monitoring turbidity or pool filling. Table 3-14 summarizes sediment and monitoring measures proposed in the Settlement Agreement for each reach. SCE commits to consult with the Forest Service, Cal Fish & Game, FWS, and other regulatory agencies regarding information needs and permitting requirements for sediment management activities. If additional information is needed to obtain necessary permits, SCE would provide that information. Turbidity monitoring results would be reported to the Forest Service, FWS, Cal Fish & Game, the Water Board, and other interested government agencies. SCE would consult with these agencies to determine if modifications to the sediment management measures are warranted.

Table 3-14. Summary of proposed sediment management measures. (Source: SCE 2007b, staff)

Dam	Sediment Pass-through	Sediment Removal	Flushing Flow	Monitoring	
				Pool-filling	Turbidity
Balsam Creek Bolsillo Creek Camp 62 Chinquapin Creek Hooper Creek Pitman Creek Ross Creek Rock Creek Ely Creek	yes	if needed	wet year spring runoff with no diversion	no	no
Dam 4	yes	no	600 cfs for 24 hrs	yes	yes
Dam 5	yes	if needed	600 cfs for 24 hrs	yes	yes
Dam 6	yes	if needed	3,000 cfs for 24 hrs	yes	yes
Mono Creek	no	if needed	Channel and riparian maintenance flow (450 or 800 cfs)	no	yes
Mammoth dam	yes	no	whitewater recreation pre-spill flows (350 to 850 cfs)	no	yes

Dam	Sediment Pass-through	Sediment Removal	Flushing Flow	Monitoring	
				Pool-filling	Turbidity
Portal dam	no	if needed	TBD	no	yes
Balsam Meadows dam	no	if needed	no[a]	no	yes

[a] In its comments on the draft EIS, SCE clarified that its intent was to commit to flushing flows, if needed, at Portal dam but not at Balsam Meadows dam.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations for all four Big Creek ALP Projects that are consistent with Settlement Agreement measure A1.10, Sediment Management Prescriptions.

Our Analysis

Sediment retention behind the project dams has resulted in depletion of spawning gravels in the bypassed reaches. The proposed sediment pass-through activities would restore sediment transport processes in the bypassed reaches by allowing sediments and gravels stored in project impoundments to be transported downstream. Likely benefits of restoring the passage of sediment into downstream reaches include: increasing the volume of spawning gravels, improving benthic macroinvertebrate production, creating greater quality and diversity of aquatic habitats to benefit native fishes, and creating point bar development to enhance riparian habitat.

The potential effects of sediment management measures proposed at specific locations are discussed individually below.

Balsam, Bolsillo, Camp 62, Chinquapin, Hooper, Pitman, Ross, Rock, and Ely Creek Diversions

The low level outlets in Balsam, Bolsillo, Camp 62, Chinquapin, Hooper, Pitman, Ross, Rock, and Ely creek diversions would be opened during each spring runoff period in wet years, when flow is not diverted, to facilitate the pass through of accumulated sediment. If necessary, physical removal of sediment from behind the diversions would be done by hand or equipment during the low flow period in the spring prior to runoff, or in the fall.

Spring sediment releases could potentially cause some short-term decreases in the quality of spawning gravels in areas where large amounts of fine sediments are deposited. However, implementing sediment pass-through activities in wet years would minimize the potential for deposition of fine sediments in spawning gravels. Furthermore, a long-term increase in the amount of gravel available in these reaches likely would improve the quantity and quality of available spawning habitat. Overall, pass-through releases would provide a relatively natural sediment cycle, prevent large volumes of sediment from accumulating, maintain the natural sediment budget, and facilitate sediment transport.

The sediment pass-through measures proposed for these creeks would also help address sediment deficits in the larger downstream reaches. Sediment pass-through measures proposed for Bolsillo, Camp 62, Chinquapin, and Hooper creeks would provide much needed sediment to the South Fork San Joaquin River bypassed reach. Pitman Creek (through the Dam 4 forebay), Balsam Creek, and Ely Creek would provide sediment to Middle Big Creek bypassed reach. Ross and Rock creeks would provide much needed sediment to Mammoth reach.

Big Creek Dams 4, 5, and 6

Sediment pass-through or sediment removal activities at Dams 4, 5, and 6 would be implemented within 5 years of approval of the sediment management measures and would be implemented at least every 5 years after the initial implementation. The proposed sediment pass-through activities would occur between January 1 and March 31, which may temporarily decrease the amount of suitable spawning gravel available to spring spawning rainbow trout. The earlier these activities are implemented within this timeframe, the less likely that spawning rainbow trout or eggs incubating in the gravel would be affected.

Big Creek Dam 4 Forebay – At Dam 4, the low level outlet valve would be opened and the water surface elevation repeatedly fluctuated between the elevation of the tunnel invert intake and the low level outlet to mobilize sediment from the banks of the forebay. A flow not less than the MIF would be maintained through the low level outlet. After sediment pass-through is completed and the low level outlet has been closed, a minimum of 600 cfs would be spilled over the dam for at least 24 hours to facilitate sediment transport.

Because Middle Big Creek bypassed reach is a high gradient reach (95 percent high gradient channel and 5 percent moderate), it has a high sediment transport capacity. As a result, we expect that the proposed 600 cfs flushing flow should be sufficient to facilitate sediment transport and reduce pool filling and sedimentation in the bypassed reach following the proposed sediment pass-through. Sediment transported through Middle Big Creek bypassed reach would be stored in Dam 5 forebay until passed through to Lower Big Creek bypassed reach.

Big Creek Dam 5 Forebay – Sediment pass-through would be conducted following the methods used at Dam 4. Equipment would be used to remove residual sediment if necessary and culverts would be installed in areas where heavy equipment must cross the forebay. The MIF would be maintained during sediment removal.

Under the current license, sedimentation of Lower Big Creek bypassed reach occurs every 7 years when the Dam 5 forebay is drained for tunnel inspections. The resulting sedimentation may cause pool filling and embed spawning gravels which may, in turn, adversely affect trout reproduction, until flows of sufficient magnitude and duration occur to move the sediment downstream into the San Joaquin River. Because Lower Big Creek bypassed reach is a high gradient channel with a natural capacity to transport sediment, we expect that the proposed 600 cfs flushing flow may be sufficient to facilitate sediment transport and stored sediment in the streambed and pools. The maximum discharge during the period of record between January and March was 972 to 3,540 cfs near the mouth of Big Creek (gage no. 11238500); minimum flows at this location were 1.2 to 1.4 cfs (see table 3-9). Sediment transported through Lower Big Creek bypassed reach would be stored behind Dam 6 until passed through the Dam 6 forebay to the Stevenson reach.

Big Creek Dam 6 Forebay – Sediment pass-through at Dam 6 would follow the same procedures used at Dams 4 and 5, with the following modifications. A flow not less than the MIF would be maintained through two low level outlets during sediment pass-through. During each forebay fluctuation, a different sequence of two of the four low level outlets will be opened. After the sediment pass-through is completed and the low level outlets have been closed, a minimum of 3,000 cfs would be spilled over the dam for at least 24 hours to facilitate sediment transport. Sediment removal, if required, would follow the same procedures proposed for Dam 5.

Sediment releases from Dam 6 would improve the diversity of habitat types that occur in the entrenched, gully type channel that comprises the entire length of the Stevenson reach downstream of Dam 6. Because the reach has a moderate gradient of 2 to 4 percent, the proposed spill flow of 3,000 cfs would likely be sufficient to transport sediments and sort gravels to provide quality spawning habitat. However, monitoring the quality of spawning gravels could be important to confirm whether the spill flow is sufficient to maintain and/or improve the quantity and quality of spawning habitat.

Mono Creek Diversion and Balsam Meadows and Portal Forebays

Sediment pass-through and sediment removal activities at Mono Creek diversion, Balsam Meadows forebay, and Portal forebay[43] would be implemented within 5 years of approval of the sediment management measures and then at least every 5 years after the initial implementation.

Mono Creek Diversion – Mono Creek diversion forebay sediment removal activities would occur in wet years prior to the implementation of channel and riparian maintenance flows. The forebay would be drawn down for no longer than two weeks between July 1 and August 31 to allow equipment to remove sediment. A trench would

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[43] Portal forebay is part of the Portal Project, and changes in the proposed environmental measures for that project would be addressed in the license order for that proceeding.

be created in the forebay from the confluence of Mono Creek and the forebay to the low level outlet to transport the 25-cfs MIF or maximum flow through the outlet valve, whichever is less. There would be no sediment pass-through activities. Following sediment removal, the low level outlet would be closed and the Mono Creek channel and riparian maintenance flow would be spilled over the dam.

Mono Creek bypassed reach has large accumulations of sand that limit fish and macroinvertebrate populations (SCE, 2003b). Fine sediment in spawning substrate has been shown to significantly decrease salmonid embryo survival when it exceeds 20 percent (Bjornn and Reiser, 1991). The proposed Mono Creek diversion sediment management would not include any pass-through activities. Mechanical removal of accumulated sediment would be used to reduce further effects by sand and fine sediment. The proposed Mono Creek channel and riparian maintenance flow would transport accumulated sediment out of Mono Creek, including sediment introduced during sediment removal activities, downstream to the sediment deficit South Fork San Joaquin River bypassed reach (see *Channel and Riparian Maintenance Flows-Mono Creek*).

Balsam Meadows and Portal Forebays – If sediment removal is determined to be necessary in either forebay, it would be conducted in late fall to allow the use of mechanical equipment. The forebay would be drawn down to allow equipment to remove sediment, and a trench would be created in the forebay from the point of inflow to the low level outlet to transport the required MIF around the sediment removal area. No sediment pass-through activities are proposed.

Any sediment that is conveyed into Balsam and Camp 61 creeks during the proposed sediment removal activities has the potential to adversely affect spawning habitat. However, given that work would be conducted in the fall when flows would be low, the amount of sediment that would be transported to areas downstream of the forebays would likely be small. Any adverse effects on spawning conditions likely would be very minor and would affect only fall-spawning, non-native brook and brown trout. As a result, there would be no need to implement flushing flows downstream from Balsam Meadows or Portal forebays. The sediment management measure in the Settlement Agreement, however, includes a provision specifying that if a flushing flow is implemented in Camp 61 Creek downstream of the Portal forebay, the time frames and peak flow magnitudes of flushing flows would be determined in consultation with the Forest Service and other interested resource agencies, which would minimize the potential for any adverse effects.

Mammoth Pool

In wet water years, SCE would provide a continuous release between approximately 350 and 850 cfs for recreational purposes until such time as Mammoth Pool dam spills. This whitewater release is targeted to begin on April 15. If Mammoth Pool dam is already spilling on April 15, SCE would have no further responsibilities to provide whitewater recreational flows for the year. If SCE determines conditions are suitable to provide pre-spill flows prior to April 15, SCE may initiate pre-spill releases at an earlier date. Pre-spill release flows would be provided by operation of the Howell-Bunger valve at Mammoth Pool dam. Operation of the valve may allow sediment accumulated at the intake structure to pass downstream.

Mammoth Pool reservoir likely traps all but fine (suspended) sediments, and as a result, the Mammoth reach has a sediment deficit. Use of the Howell-Bunger valve to pass pre-spill releases would likely supply some sediment to the reach and improve the entrenched, gully type channel that comprises nearly half of bypassed reach. The proposed whitewater release flows would facilitate sediment transport, distribution, and sorting throughout the length of Mammoth reach.

Monitoring

The Settlement Agreement calls for monitoring pools downstream of Dams 4, 5, and 6 prior to and after implementation of sediment pass-through measures, to determine whether deposition of fine sediments has caused pools to fill with sediments and their volume reduced. The weighted mean value of the level of fine sediments in a representative set of five pools downstream of the diversion would be measured according to procedures defined by Hilton and Lisle (1993). Monitoring measurement locations would be approved by the Forest Service, Cal Fish & Game, Interior, the Water Board, and other interested resource agencies.

Monitoring pool depth at reaches downstream of Big Creek Dams 4, 5, and 6 would allow effects of sediment pass-through on pool habitat to be assessed and provide information that could be used to alter the implementation of sediment pass-through measures if excessive pool filling occurs. Excessive pool filling would adversely affect habitat availability and thermal refugia for adult trout. Given the relatively steep gradient and large drainage upstream of these dams, the volume of sediments retained in the reservoirs may be large, and the amount of sediment stored in these impoundments could be substantial. Also, given the relatively small size of the reservoirs, much of the sediment may be deposited relatively close to the dams, and may be accessible for release during the sediment pass-through operations.

The Settlement Agreement does not require monitoring of pool depths for the other dams where sediment pass-through measures would be implemented, including Mammoth Pool and the nine smaller headwater diversions listed in table 3-14. Because of the large size of the Mammoth Pool impoundment (approximately 8 miles in length), we would expect that most of the sediment retained in this reservoir would be deposited in the upstream portion of the reservoir. Furthermore, we expect that only small amounts of fine sediments would be released when pre-spill whitewater flows are released via the Howell-Bunger valve, and that these sediments would be easily transported downstream and pose little threat of pool-filling. The nine headwater diversions are on high gradient streams with very small impoundments, all of which have a surface area of less than 1 acre and a volume of less than 1 acre-foot. Given the small amount of sediment that could be retained in these impoundments and the high transport capacity of these headwater streams, we conclude there is little risk of pool-filling on these tributaries.

At all but nine small headwater diversions, SCE would also monitor turbidity prior to and during implementation of sediment management measures. In each year prior to implementation, SCE would monitor turbidity during two storm events at the same locations. Following submittal of the monitoring results, SCE would consult with the agencies to determine if modifications to sediment management measures are warranted. Monitoring would be discontinued in subsequent years, upon approval of the Forest Service, Interior, Cal Fish & Game, and the Water Board. Expansion of this monitoring component to include an assessment of the surficial deposition of fine sediment in representative potential spawning sites would allow potential adverse effects on spawning gravel to be evaluated and included in the evaluation of whether modifications to the sediment management measures are warranted.

Gravel Augmentation

Appendix B of the Settlement Agreement includes measures that the parties to the settlement do not propose as conditions in the new license because these measures were determined not to be related to project operations. We include an evaluation of one aquatic measure from appendix B of the Settlement Agreement in this section which we consider to be related to project operations and that has the potential to affect dam safety.

To address project effects on the recruitment of spawning gravels in Mammoth reach, SCE proposes to implement the Gravel Augmentation Plan described in Settlement Agreement measure B.1.2. The Forest Service reserved authority to add the gravel augmentation plan to its 4(e) conditions if the Settlement Agreement was not executed before a new license was issued.

Under the proposed plan, SCE would coordinate with the Forest Service, FWS, Cal Fish & Game, the Water Board, and other interested resource agencies to implement a feasibility assessment to determine if placing gravel in or near the spillway channel at Mammoth Pool dam is feasible and whether gravel placed at this location would be moved and redistributed by spill flows.

The assessment would determine whether gravel augmentation in or below the spillway channel would:

- impair the Mammoth Pool dam spillway function;
- result in erosion and undermining of the access road to Mammoth dam;
- result in dam instability or impair operation of the release structures; or
- hinder inspections to the dam and the release structures.

If the assessment concludes that the placement of gravel in or below the spillway channel would lead to any of these problems or would create other reliability or operational problems, then SCE would seek alternative locations for gravel placement.

SCE would evaluate various alternative locations to determine if other resources would be adversely influenced by gravel augmentation and if the augmentation would likely increase spawning gravel in Mammoth reach. The alternative locations would have sufficient physical space and access for placement of gravels and be comparable in cost to the placement of gravels in or below the spillway. These alternative locations would include, but would not be limited to, a location below the confluence of Rock Creek.

Gravel augmentation would begin after the first Mammoth reach fish monitoring following the initiation of the new flow regime. SCE would place 300 tons of gravel into the Mammoth reach immediately below Mammoth dam spillway, or at alternative feasible location(s). SCE would monitor gravel transport and distribution and evaluate whether the next two above normal or wet water year spill events with a peak flow of at least 5,000 cfs would be capable of moving the gravel from the emplacement site.

SCE would prepare a report following the completion of gravel monitoring after the second spill event for agency review and comment. SCE and the agencies would meet and decide whether to continue or modify the gravel augmentation program or implement a fish stocking program instead.

If the pilot project is successful, gravel augmentation would be implemented over the life of the license. If not, then a supplemental fish stocking program in the Mammoth reach would be implemented by Cal Fish & Game.

Our Analysis

Mammoth Pool dam is a barrier to downstream gravel movement and as a result, the Mammoth reach has a gravel deficit, and spawning habitat is limited. If feasible, based on results of the feasibility assessment, implementing a long-term gravel augmentation program would improve spawning habitat and trout recruitment in Mammoth. Increased gravel would also increase productivity by providing more habitat for benthic macroinvertebrates. Although the gravel augmentation program is proposed as a non-license measure, the feasibility assessment would be needed to determine the potential effect of this measure on project facilities, including the Mammoth Pool dam, spillway, and access road.

3.3.1.3 Cumulative Effects

Past and present cumulative effects on aquatic resources in the Upper San Joaquin River Basin result from hydropower development and operations, irrigation withdrawals, agricultural and rural development, recreational use and development, timber harvesting, mining, road building and maintenance, sport fisheries, and hatchery management.

These actions have caused adverse water quality and aquatic habitat effects, such as increased erosion and sedimentation, chemical and metals contamination, decreased floodplain connectivity, decreased riparian zones and LWD recruitment potential, altered peak and base flows, altered sediment transport, wetland and side-channel filling, rip-rapping to control channel migration, decreased aquatic habitat complexity, creation of migration barriers, loss of anadromous Chinook salmon and steelhead runs and productivity (i.e., loss of marine derived nutrients), introduction of non-native fishes and fish diseases.

Ongoing project-related cumulative effects on aquatic resources include interruption of sediment transport processes, alteration of water temperatures, and reduction of streamflows during the summer/fall low flow season.

The Settlement Agreement includes conservation measures that would reduce each of these cumulative effects and improve coldwater fish habitat and increase trout populations in project bypassed reaches. These measures have been previously discussed (see section 3.3.1.2), and would reduce the cumulative effects associated with operation of Big Creek facilities and would benefit all native and non-native coldwater trout by improving the quality of coldwater habitat in the bypassed reaches.

3.3.2 Terrestrial Resources

3.3.2.1 Affected Environment

Vegetation

SCE mapped vegetation communities within 0.25 miles of project facilities, roads, transmission lines, bypassed and flow-augmented reaches, and recreational facilities at the Big Creek ALP Projects in 2001, 2002, and 2003. SCE mapped 17 community types in the Big Creek Nos. 2A, 8, and Eastwood Project; 14 types at the Big Creek Nos. 1 and 2 Project; 13 types at the Mammoth Pool Project; and 5 types at the Big Creek No. 3 Project (table 3-15).

Table 3-15. Vegetation communities and wildlife habitats within 0.25 mile of the Big Creek ALP Project facilities. (Source: SCE, 2007a)

Vegetation Community/ Wildlife Habitat	Big Creek Nos. 2A, 8, and Eastwood	Big Creek Nos. 1 and 2	Mammoth Pool	Big Creek No. 3
Gray Pine-Chaparral Woodland/ Mixed Chaparral	X	X	X	X
Gray Pine-Chaparral Woodland with Rock Substrate/Mixed Chaparral with Rock Substrate	X	X	X	X
Westside Ponderosa Pine Forest/ Ponderosa Pine Forest			X	
Westside Ponderosa Pine Forest with Rock Substrate/Ponderosa Pine Forest with Rock Substrate				

Vegetation Community/ Wildlife Habitat	Big Creek Nos. 2A, 8, and Eastwood	Big Creek Nos. 1 and 2	Mammoth Pool	Big Creek No. 3
Sierran Mixed Coniferous Forest/Sierran Mixed Coniferous Forest	X	X	X	X
Sierran Mixed Coniferous Forest with Rock Substrate/Sierran Mixed Coniferous Forest with Rock Substrate	X	X	X	X
Jeffrey Pine Forest/Jeffrey Pine Forest	X			
Jeffrey Pine Forest with Rock Substrate/Jeffrey Pine Forest with Rock Substrate	X			
Jeffrey Pine-Fir Forest/Jeffrey Pine Forest	X	X		
Jeffrey Pine-Fir Forest with Rock Substrate/Jeffrey Pine Forest with Rock Substrate	X	X		
Lodgepole Pine Forest/ Lodgepole Pine Forest	X			
Blue Oak Woodland/Blue Oak Woodland		X	X	X
Oak Woodland/Montane Hardwood	X	X	X	X
Oak Woodland with Rock Substrate/Montane Hardwood with Rock Substrate	X	X	X	
Mixed Montane Chaparral/ Mixed Chaparral or Montane Chaparral	X	X	X	X
Mixed Montane Chaparral with Rock Substrate/Mixed Chaparral or Montane Chaparral with Rock Substrate	X	X	X	
Riparian/Montane, Valley, and	X	X	X	X

Vegetation Community/ Wildlife Habitat	Big Creek Nos. 2A, 8, and Eastwood	Big Creek Nos. 1 and 2	Mammoth Pool	Big Creek No. 3
Foothill Riparian				
Wet Montane Meadow/Wet Meadow	X	X	X	
Dry Montane Meadow/ Perennial Grassland	X			
Montane Freshwater Marsh/ Fresh Emergent Wetland				
Ruderal/Ruderal	X	X	X	
Open Ground/Open Ground	X	X	X	
Water/Water	X	X	X	X
Developed/ Developed	X	X	X	X

Noxious Weeds

In 2001, 2002, and 2003 SCE mapped noxious weeds adjacent to project facilities, roads, transmission lines, and recreational facilities at all the Big Creek ALP Projects.

SCE identified 10 noxious weeds and invasive ornamental plant species in the Big Creek Nos. 2A, 8, and Eastwood Project vicinity: black mustard (*Brassica nigra*), cheatgrass (*Bromus tectorum*), bull thistle (*Cirsium vulgare*), English ivy (*Hedera helix*), Klamathweed (*Hypericum perforatum*), perennial pepperweed (*Lepidium latifolium*), Himalayan blackberry (*Rubus discolor*), black locust (*Robinia pseudoacacia*), common tansy (*Tanacetum vulgare*), and woolly mullein (*Verbascum thapsus*). SCE identified eight noxious weeds and invasive ornamental plant species in the vicinity of the Big Creek Nos. 1 and 2 Project: cheatgrass, bull thistle, Scotch broom (*Cytisus scoparius*), Klamathweed, black locust, Himalayan blackberry, Spanish broom (*Spartium junceum*), and periwinkle (*Vinca major*). SCE identified four noxious weeds and invasive ornamental plant species in the vicinity of the Mammoth Pool Project, including: black mustard, cheatgrass, tocalote (*Centaurea melitensis*), and bull thistle. SCE identified six noxious weeds and invasive ornamental plant species in the vicinity of the Big Creek No. 3 Project: tree of heaven (*Ailanthus altissima*), black mustard, cheatgrass, Klamathweed, Himalayan blackberry, and Spanish broom.

Special-status Plant Species

SCE mapped special-status plant adjacent to project facilities, roads, transmission lines, and recreational facilities at the Big Creek ALP Projects in 2002 and 2003. SCE did not locate any state or federally listed plant species in any of the project areas. Based on the results of the surveys, SCE identified four special-status plant species in the vicinity of Big Creek Nos. 2A, 8, and Eastwood Project: Mono Hot Springs evening primrose (*Camissonia sierrae ssp. alticola*), short-leaved hulsea (*Hulsea brevifolia*), madera linanthus (*Leptosiphon serrulatus*), and flat-leaved bladderwort (*Utricularia intermedia*). SCE mapped two special-status plant species in the vicinity of the Big Creek Nos. 1 and 2 Project: subalpine fireweed (*Epilobium howellii*) and madera linanthus. SCE located three special-status plant species in the vicinity of Mammoth Pool Project, including: Mono Hot Springs evening primrose, flaming trumpet (*Collomia rawsoniana*), and Yosemite lewisia (*Lewisia disepala*). Several more special-status plant species have the potential to occur within these three Big Creek projects (see table 3-16). There are no known special-status plant species in the Big Creek No. 3 Project.

Riparian Vegetation

SCE mapped riparian vegetation along all of the Big Creek ALP Projects in 2002 and 2003. Significant riparian habitat occurs along approximately 47 river miles or 54 percent of the total river miles along streams associated with the projects (see table 3-17). Wet montane meadows comprise approximately 1.6 river miles or 3.4 percent of the mapped area along these streams. SCE found wide corridors of riparian vegetation to be relatively uncommon in the vicinity of the projects due to the geology, steep hillslopes, narrow valley bottoms, coarse substrate, and/or entrenched stream channels with limited soil development and sediment deposition sites. These factors result in only limited areas for riparian habitat to become established. In addition, many of the larger streams are deeply entrenched in bedrock-boulder channels with few locations for riparian vegetation establishment. Five riparian community types were identified in streams associated with the Big Creek ALP Projects, varying with elevation. The understory is composed of grasses and forbs, with few non-native species.

Table 3-16. Special-status plant species known or potentially occurring in the vicinity of the Big Creek ALP Projects. (Source: SCE, 2007a)

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Allium yosemitense Yosemite onion	–	FSS	CR, CNPS 1B.3	April–July	Broad-leaved upland forest, chaparral, cismontane woodland, lower montane coniferous forest; rocky, metamorphic substrate. 1,755–7,200 feet.	Unlikely	Not detected	Not detected	Unlikely
Botrychium crenulatum Scalloped moonwort	–	FSS	CNPS 2.2	Fertile June to July	Lower montane coniferous forests, oak woodlands, and chaparral, open rocky slopes. 4,900–10,765 feet.	Unlikely	Potential	Potential	Unlikely
Botrychium lineare Slender moonwort	FC	FSS	CNPS 1B.3	Unknown fertility period	Lower montane coniferous forests, oak woodlands, and chaparral, open rocky slopes to 8,530 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Bruchia bolanderi Bolander's candle moss	–	FSS	CNPS 2.2	N/A	Lower montane coniferous forest, meadows and seeps, upper montane coniferous forest: damp soil. 5,575–9,190 feet.	Unlikely	Potential	Potential	Unlikely
Calyptridium pulchellum Mariposa pussypaws	FT	–	CNPS 1B.1	April–August	Cismontane woodland in shallow granite soils on granitic domes, restricted to exposed sites. 1,300–3,600 feet.	Unlikely	Unlikely	Not detected	Not detected

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Camissonia sierrae ssp. *Alticola* Mono Hot Springs evening primrose	–	FSS	CNPS 1B.2	May–August	Lower montane coniferous forest, upper montane coniferous forest: granitic, gravel and sand pans. 4,500–8,500 feet.	Known	Not detected	Known	Unlikely
Carlquistia muirii Muir's tarplant	–	FSS	CNPS 1B.3	July–August	Chaparral (montane), lower montane coniferous forest, upper montane coniferous forest. 3,605–8,205 feet.	Unlikely	Not detected	Not detected	Unlikely
Carpenteria californica Tree-anemone	–	FSS	CT, CNPS 1B.2	May–July	Cismontane woodland, chaparral. Endemic to Fresno County. Very localized on well-drained granitic soils, mostly on north-facing ravines and drainages. 1,500–4,000 feet.	Not detected	Not detected	Not detected	Not detected
Castilleja campestris ssp. *succulenta* Succulent owl's-clover	FT	–	CE, CNPS 1B.2	April–May	Vernal pools. 1,640–2,460 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Clarkia biloba ssp. *australis* Mariposa clarkia	–	FSS	CNPS 1B.2	May–July	Chaparral, cismontane woodland. 980–3,100 feet.	Not detected	Not detected	Not detected	Not detected

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Clarkia lingulata Merced clarkia	–	FSS	CE, CNPS 1B.1	May–June	Chaparral, cismontane woodland. 1,312—1,492 feet.	Unlikely	Unlikely	Not detected	Not detected
Collomia rawsoniana Flaming trumpet	–	FSS	CNPS 1B.2	July–August	Riparian forest, lower montane coniferous forest on stabilized alluvium in riparian zones, at mid elevations along perennial streams north of the San Joaquin River. 2,500–7,200 feet.	Known	Not detected	Not detected	Not detected
Cypripedium montanum Mountain lady's slipper	–	FSS	CNPS 4.2	March–August	Broad-leaved upland and lower montane coniferous forests, moist or dry shaded slopes. 700–7,200 feet.	Not detected	Not detected	Not detected	Not detected
Delphinium inopinum Unexpected larkspur	–	FSS	CNPS 4.3	May–July	Alpine boulder and rock fields at high elevations in rocky soil at the extreme southern boundary of the SNF. 7,200–9,200 feet.	Unlikely	Not detected	Not detected	Unlikely
Dicentra nevadensis Tulare County bleeding heart	–	FSS	CNPS 4.3	June–October	Subalpine coniferous forest in gravelly openings. 7,200–10,000 feet.	Unlikely	Not detected	Not detected	Unlikely
Epilobium howellii Subalpine fireweed	–	FSS	CNPS 1B.3	July–August	Meadows, subalpine coniferous forest, wet meadows, mossy seeps. 6,500–9,000 feet.	Unlikely	Known	Not detected	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Erigeron aequifolius Hall's daisy	–	FSS	CNPS 1B.3	July–August	Broad-leaved upland forest, lower and upper montane coniferous forest, pinyon-juniper woodland, rocky soils. 4,900–8,000 feet.	Unlikely	Not detected	Not detected	Unlikely
Eriogonum nudum var. *regirivum* King's River buckwheat	–	FSS	CNPS 1B.2	August–November	Cismontane woodland; carbonate, rocky substrate. 490–985 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Eriogonum prattenianum var. *avium* Kettle Dome buckwheat	–	FSS	CNPS 4.2	June–August	Upper montane coniferous forest on granitic soils. 3,900--8,500 feet.	Unlikely	Not detected	Not detected	Unlikely
Eriophyllum congdonii Congdon's woolly sunflower	–	FSS	CR,CNPS 1B.2	May–June	Chaparral, cismontane woodland, lower montane coniferous forest: on metamorphic soils. 1,600–6,200 feet.	Not detected	Not detected	Not detected	Not detected
Erythronium pluriflorum Shuteye Peak fawn lily	–	FSS	CNPS 1B.2	May–July	Upper montane coniferous forest, meadows, subalpine coniferous forest, rocky granitic outcrops and slopes. 6,758–8,366 feet.	Unlikely	Not detected	Not detected	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Heterotheca monarchensis Monarch golden-aster	–	FSS	CNPS 1B.3	May–October	Cismontane woodland; carbonate substrate. 3,590–6,070 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Hulsea brevifolia Short-leaved hulsea	–	FSS	CNPS 1B.2	May–August	Granitic or volcanic soils in openings and under canopy in mixed conifer and red fir forest. 4,900–8,900 feet.	Unlikely	Not detected	Known	Unlikely
Hydrothyria venosa Veined water lichen	–	FSS	–	N/A	Cold, clear, unpolluted streams in mixed conifer forests. 4,000–8,000 feet.	Unlikely	Potential	Potential	Unlikely
Lewisia congdonii Congdon's lewisia	–	FSS	CR,CNPS 1B.3	April–June	Chaparral, cismontane woodland, lower montane coniferous forest, upper montane coniferous forest, granitic, moist places on metamorphic soils. 1,600–9,200 feet	Unlikely	Unlikely	Unlikely	Unlikely
Lewisia disepala Yosemite lewisia	–	FSS	CNPS 1B.2	April–June	Lower montane coniferous forest, pinyon juniper woodland upper montane coniferous forest, fine gravel on rock outcrops or domes. 4,250–11,000 feet.	Known	Not detected	Not detected	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Leptosiphon serrulatus Madera linanthus	–	–	CNPS 1B.2	April–May	Cismontane woodland, lower montane coniferous forest, open areas, chaparral. 1,000–4,000 feet.	Not detected	Known	Known	Not detected
Lupinus citrinus var. *citrinus* Orange lupine	–	FSS	CNPS 1B.2	April–July	Chaparral, cismontane woodland, lower montane coniferous forest, rocky granitic outcrops, usually in open areas (i.e. forest openings), on flat to rolling terrain. 2,000–5,000 feet.	Not detected	Unlikely	Not detected	Not detected
Meesia triquetra Three-ranked hump moss	–	FSS	CNPS 2.2	N/A	In bogs and wet woods. 6,000–8,000 feet.	Unlikely	Potential	Potential	Unlikely
Meesia uliginosa Broad-nerved hump moss	–	FSS	CNPS 2.2	N/A	In bogs and rock fissures, usually in alpine or arctic regions, sometimes in the lowlands. 7,500–9,000 feet.	Unlikely	Potential	Potential	Unlikely
Mimulus filicaulis Slender-stemmed monkeyflower	–	FSS	CNPS 1B.2	April–August	Cismontane woodland, lower montane coniferous forest, meadows and seeps, upper montane coniferous forest; vernally mesic environments. 2,950–5,745 feet.	Not detected	Not detected	Not detected	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Mimulus gracilipes Slender-stalked monkeyflower	–	FSS	CNPS 1B.2	April–June	Lower and upper montane coniferous forest, pinyon-juniper woodlands; granitic sand substrate. 1,600–4,300 feet.	Not detected	Not detected	Not detected	Not detected
Mimulus pulchellus Pansy monkeyflower	–	FSS	CNPS 1B.2	May–July	Lower montane coniferous forest, meadows and seeps; vernally mesic environments. 1,965–6,565 feet.	Not detected	Not detected	Not detected	Unlikely
Orcuttia inaequalis San Joaquin Valley Orcutt grass	FT	–	CE, CNPS 1B.1	April–September	Vernal pools. 100–2,477 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Sidalcea keckii Keck's checkerbloom	FE	–	CNPS 1B.1	April–May	Cismontane woodland, valley and foothill grassland; serpentine and clay substrate. 393–1,394 feet.	Unlikely	Unlikely	Unlikely	Not detected
Streptanthus fenestratus Tehipite Valley jewel-flower	–	FSS	CNPS 1B.3	April–July	Lower montane coniferous forest, upper montane coniferous forest. 3,490–5,745 feet.	Unlikely	Not detected	Not detected	Unlikely
Trifolium bolanderi Bolander's clover	–	FSS	CNPS 1B.2	June–August	Lower montane coniferous forest, meadows and seeps, upper montane coniferous forest; mesic environments. 7,900–8,530 feet.	Unlikely	Unlikely	Not detected	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Blooming Period/Fertile	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Utricularia intermedia Flat-leaved bladderwort	–	–	CNPS 2.2	June–August	Bogs, fens, meadows, seeps, marshes and lake margins. 3,950–8,850 feet.	Unlikely	Potential	Known	Unlikely
Viola pinetorum ssp. *Grisea* Grey-leaved violet	–	FSS	CNPS 1B.3	April–July	Dry peaks and slopes in subalpine conifer forest and upper montane conifer forest. 4,875–11,050 feet.	Unlikely	Not detected	Not detected	Unlikely

State Status
CR = California Rare
CT = California Threatened
CE = California Endangered

CNPS = California Native Plant Society
1B = Rare, threatened or endangered in California and elsewhere
2 = Rare in California but more common elsewhere
3 = Need more information
4 = Plants of limited distribution; a watch list

_.1 = Seriously endangered in California (over 80% of occurrences threatened / high degree and immediacy of threat)
_.2 = Fairly endangered in California (20–80% occurrences threatened)
_.3 = Not very endangered in California (<20% of occurrences threatened or no current threats known)

Federal Status
FC = Candidate Species
FE = Federal Endangered
FPE = Federally proposed for listing as endangered
FT = Federal Threatened
FSS = Forest Service Sensitive

Known: Species identified either through literature review (Forest Service, CNDDB, CNPS) or during focused surveys completed in the vicinity of the Big Creek ALP Projects.
Potential: Surveys were completed only in representative habitat potentially supporting the species. Species could potentially occur in potential habitat in the vicinity of the Big Creek Projects that were not surveyed.
Not Detected: Species were not found during surveys completed in the vicinity of the Big Creek ALP Projects.
Unlikely: Regulatory agencies identified species as potentially occurring in the vicinity of the Big Creek ALP Projects. Upon further review, it was determined that the projects were outside the species known elevation range or that no appropriate habitat is present.

Table 3-17. Linear miles of riparian vegetation by project within the Big Creek ALP Project area. (Source: SCE, 2007a)

Project	Riparian community type	Dominant species	Total Linear Miles	Patchy Riparian (miles)	Discontinuous Corridor (miles)	Continuous Corridor (miles)
Big Creek Nos. 2, 8, and Eastwood Project			34.92	0.2	16.1	17.2
	Aspen Riparian Forest	*Populus Tremuloides*	3.73	0.00	1.11	2.61
	Montane Riparian Scrub	*Alnus incana* ssp. *tenuifolia*, and *Salix* spp.	6.38	0.00	1.01	5.37
	White Alder Riparian Scrub	*Alnus rhombifolia* and *Salix* spp.	4.49	0.12	1.92	2.34
	White Alder Riparian Scrub/Montane Riparian Scrub	*Alnus incana* ssp. *tenuifolia*, *Alnus rhombifolia*, and *Salix* spp.	18.96	0.04	12.08	6.85
	Montane Black Cottonwood Riparian Forest	*Populus balsamifera* spp. *trichocarpa*	0.08	0.00	0.00	0.00
	Wet Meadow		1.27	0.00	0.00	0.00

Project	Riparian community type	Dominant species	Total Linear Miles	Patchy Riparian (miles)	Discontinuous Corridor (miles)	Continuous Corridor (miles)
Big Creek Nos. 1 and 2 Project			8.91	0.0	4.7	1.6
	Montane Riparian Scrub	*Alnus incana* ssp. *tenuifolia*, and *Salix* spp.	1.37	0.00	0.00	1.37
	White Alder Riparian Scrub	*Alnus rhombifolia* and *Salix* spp.	4.89	0.00	4.63	0.26
	White Alder Riparian Scrub/Montane Riparian Scrub	*Alnus incana* ssp. *tenuifolia*, *Alnus rhombifolia*, and *Salix* spp.	2.35	0.01	0.10	0.00
	Wet Meadow		0.31	0.00	0.00	0.00

Project	Riparian community type	Dominant species	Total Linear Miles	Patchy Riparian (miles)	Discontinuous Corridor (miles)	Continuous Corridor (miles)
Mammoth Pool Project			1.55	0.07	1.48	0.00
	White Alder Riparian Scrub	*Alnus rhombifolia* and *Salix* spp.	1.55	0.07	1.48	0.00
Big Creek No. 3 Project			1.08	0.01	1.07	0.00
	White Alder Riparian Scrub	*Alnus rhombifolia* and *Salix* spp.	1.08	0.01	1.07	0.00

Wildlife

Game Species

Mule deer are a Sierra National Forest-Management Indicator Species. In the central Sierra, the San Joaquin deer herd ranges from about 2,000 feet along the San Joaquin River up to about 12,000 feet along the crest of the Sierra. The herd inhabits winter ranges at elevations up to 3,600 feet from early October through mid-May. The herd remains at its winter range until mid-May (depending on snow pack) and then begins a gradual upward migration. During the summer, mule deer may be found from 6,000 to 10,000 feet in elevation from late May to early November. They are most commonly found from 6,500 to 8,000 feet, where optimum habitat occurs. A large number of deer using the summer range in Fresno County winter on the north side of the San Joaquin River in Madera County, and thus must cross the river when migrating between summer and winter ranges.

The North Kings mule deer herd is known to occur in and migrate through the Big Creek Nos. 2A, 8, and Eastwood Project near Shaver Lake. Both summer and winter range and several migration corridors occur or cross the project vicinity. The San Joaquin deer herd—including the Huntington herd, which is part of the larger San Joaquin herd—is known to occur in the vicinity of the Big Creek ALP Projects. The Huntington Lake area is within mule deer summer and winter range and several migration corridors occur in the Big Creek Nos. 1 and 2 Project vicinity. The area around Mammoth Pool reservoir has been identified as a mule deer holding area and mule deer are known to migrate through the Mammoth Pool Project vicinity. Deer have been observed swimming the reservoir, as well as crossing the road on the dam. The Huntington mule deer herd also occurs in the vicinity of the Big Creek No. 3 Project.

Special Status Wildlife

SCE conducted numerous studies and surveys for special-status wildlife species. Table 3-18 identifies all special-status wildlife species known to occur or potentially occur in the vicinity of the Big Creek ALP Projects. Special-status species that are known to occur include bald eagle (*Haliaeetus leucocephalus*), American peregrine falcon (*Falco peregrinus anatum*), mountain yellow-legged frog (MYLF) (*Rana muscosa*), Yosemite toad (*Bufo canorus*), western pond turtle (*Actinemys marmorata*), Townsend’s western big-eared bat (*Corynorhinus townsendii*), pallid bat (*Antrozous pallidus*), and western red bat (*Lasiurus blossevilli*). Additionally, potential habitat for the foothill yellow-legged frog (FYLF) (*Rana boylii*) occurs.

Table 3-18. Special-status wildlife species known or potentially occurring in the vicinity of the Big Creek ALP Projects. (Source: SCE, 2007a)

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Desmocerus californicus dimorphus Valley elderberry longhorn beetle	FT, FPD	–	–	Elderberry shrubs throughout the Central Valley and foothills below 3,000 feet elevation.	Known	Not detected	Potential	Known
Ambystoma californiense California tiger salamander	FT (Central California), FE (Sonoma and Santa Barbara Cos. only)	–	CSC	Vernal pools, annual grassland, and the grassy understory of valley-foothill oak woodland habitats below 4,500 feet. Requires seasonal wetlands or slow moving stream courses for reproduction.	Unlikely	Unlikely	Unlikely	Unlikely
Batrachoseps relictus Relictual slender salamander	–	FSS	CSC	Habitat requirements are poorly understood. Have been found under rocks, bark, and downed woody debris. Known from the SNF at elevations ranging from 600 to 8,000 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Hydromantes brunus Limestone salamander	–	FSS	CT, CFP	Associated with limestone outcroppings in foothill woodland and chaparral habitats of Merced Canyon in Mariposa County from 836–2,624 feet.	Unlikely	Unlikely	Unlikely	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Rana aurora draytonii California red-legged frog	FT	–	CSC	Breeds in quiet streams and permanent, deep, cool ponds with overhanging and emergent vegetation below 4,000 feet elevation. Known to occur adjacent to breeding habitats in riparian areas and heavily vegetated streamside shorelines, and non-native grasslands. Sierran streams historically supported populations of red-legged frog; however, these populations have been eliminated.	Unlikely	Unlikely	Unlikely	Unlikely
Rana boylii Foothill yellow-legged frog	–	FSS	CSC	Breeds in rocky streams with cool, clear water in a variety of habitats, including valley and foothill oak woodland, riparian forest, ponderosa pine, mixed conifer, coastal scrub, mixed chaparral, and wet meadows; occurs at elevations ranging from 0 to 4,500 feet.	Potential	Potential	Potential	Potential
Rana muscosa Mountain yellow-legged frog	FC (Sierra Nevada), FE (San Gabriel, San Jacinto, and San Bernardino Mts. Only)	FSS	CSC	Occurs in the Sierras at elevations ranging from 4,500 to 12,000 feet; associated with streams, lakes, and ponds in montane riparian, lodgepole pine, subalpine conifer, and wet meadow habitats; breeds in shallow water in low gradient perennial streams and lakes. Known from the high elevations of the SNF.	Unlikely	Known	Potential	Unlikely
Bufo canorus Yosemite toad	FC	FSS	CSC	Occurs in montane meadows and forest borders; breeds in shallow pools, at lake margins, or in pools of quiet streams at elevations ranging 6,400 to 11,300 feet. Known from the SNF.	Unlikely	Known	Known	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Actinemys marmorata Western pond turtle	–	FSS	CSC	Perennial wetlands and slow moving creeks and ponds with overhanging vegetation up to 6,000 feet; suitable basking sites such as logs and rocks above the waterline.	Known	Potential	Known	Known
Gambelia silus Blunt-nosed leopard lizard	FE	–	CE, CFP	Scarce resident of sparsely vegetated alkali and desert scrub habitats in the San Joaquin Valley and adjacent foothills up to 3,000 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Pandion haliaetus Osprey	–	–	SNF MIS, CSC	Breeds in northern California, associated strictly with large fish-bearing waters, primarily in ponderosa pine and mixed conifer habitats.	Known	Known	Known	Known
Haliaeetus leucocephalus Bald eagle	Former FT	FSS	SNF MIS, CE, CFP	Local winter migrant to various California lakes. Most of the breeding population is restricted to more northern counties. Regular winter migrants to the region. Usually not found at high elevations in the Sierra.	Known	Known	Known	Known
Accipiter cooperi Cooper's hawk			CSC (nesting)	Breeding resident throughout most of the wooded portion of the state. Breeds in Sierra Nevada foothills, New York Mountains, Owens Valley, and other local areas in southern California. Dense stands of oak and riparian woodland for nesting and grassland for foraging up to 9,000 feet.	Potential	Potential	Known	Known
Accipiter gentilis Northern goshawk	–	FSS	SNF MIS, CSC (nesting)	Prefers middle to high elevation, mature, dense conifer forests for foraging and nesting. Casual in foothills during winter, northern deserts in pinyon-juniper woodland, and low elevation riparian habitats.	Known	Known	Known	Known

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Buteo swainsoni Swainson's hawk	–	FSS	CT (nesting)	Uncommon breeding resident and migrant in the Central Valley, Klamath Basin, Northeastern Plateau, Lassen County, and Mojave Desert. Riparian woodlands, juniper-sage flats, and oak woodlands for nesting. Grasslands and agricultural areas for foraging.	Unlikely	Unlikely	Unlikely	Unlikely
Falco peregrinus anatum American peregrine falcon	Former FE	FSS	SNF MIS, CE, CFP	Very uncommon breeding resident and uncommon as a migrant. Breeds in woodlands, forests, coastal habitats, and riparian areas near wetlands, lakes, rivers, or other water on high cliffs, banks, dunes, or mounds. Active nesting sites are known along the coast, in the Sierra Nevada, and in the mountains of northern California. Migrants occur along the coast and the western Sierra Nevada in spring and fall.	Potential	Known	Known	Known
Strix nebulosa Great gray owl	–	FSS	CE (nesting)	Nests in old-growth coniferous forests and forages in montane meadows. Distribution includes high elevations of the Sierra Nevada and Cascade Ranges from 4,500 to 7,500 feet.	Unlikely	Known	Known	Unlikely
Strix occidentalis occidentalis California spotted owl	–	FSS	SNF MIS, CSC	Resides in dense, old growth, multi-layered mixed conifer, redwood, Douglas fir, and oak woodland habitats, from sea level up to approximately 7,600 feet. Known from the SNF.	Known	Known	Known	Known
Empidonax traillii brewsteri Willow flycatcher	–	FSS	SNF MIS, CE (nesting)	Wet meadow and montane riparian habitats from 2,000 to 8,000 feet. Most often occurs in broad, open river valleys or large mountain meadows with lush growth of shrubby willows. Known from the SNF.	Potential	Potential	Known	Known

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Vireo bellii pusillus Least Bell's vireo	FE	–	CE (nesting)	Summer resident below 2,000 feet in Santa Barbara, Ventura, San Bernardino, Riverside, San Diego, Imperial, and Inyo counties. Prefers willows and other low, dense valley-foothill riparian habitat in the lower portion of canyons for breeding.	Unlikely	Unlikely	Unlikely	Unlikely
Dendroica petechia brewsteri Yellow warbler			CSC (nesting)	Breeds in riparian woodlands from coastal and desert lowlands up to 8,000 feet in the Sierra Nevada. Also breeds in montane chaparral, open ponderosa pine, and mixed conifer habitats with substantial amounts of brush.	Potential	Potential	Known	Potential
Lasiurus blossevilli Western red bat	–	FSS	–	Occurs from British Columbia to South America. In California, occurs from Shasta County to the Mexican border west of the Sierra crest. Roosts solitarily in foliage in forests and woodlands from sea level up through mixed coniferous forest. In California known to roost in cottonwood and willow.	Not detected	Known	Not detected	Not detected
Corynorhinus townsendii Townsend's western big-eared bat	–	FSS	CSC	Found in all but alpine and subalpine habitats; most abundant in mesic habitats. Requires caves, mines, tunnels, buildings, or other man-made structures for roosting. This species is extremely sensitive to disturbance and may abandon a roost if disturbed. Known from the SNF.	Not detected	Not detected	Known	Known
Antrozous pallidus Pallid bat	–	FSS	CSC	Inhabits grasslands, shrublands, woodlands, and forests from sea level up through mixed conifer forests. Typically roosts in caves, crevices, or mines. Requires open habitat for foraging.	Not detected	Not detected	Known	Known

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Aplodontia rufa Sierra Nevada mountain beaver	–	–	SNF MIS, CSC	Occurs in dense riparian and open brushy stages of most forest types. Deep, friable soils are required for burrowing along cool, moist microclimates. Line in burrows located in or near deep soils near streams and springs. Typical habitat in the Sierra is montane riparian.	Potential	Potential	Known	Potential
Dipodomys nitratoides exilis Fresno kangaroo rat	FE	–	CE	Alkali desert scrub habitat and herbaceous habitat with scattered shrubs. Found in the San Joaquin Valley up to 1,800 feet.	Unlikely	Unlikely	Unlikely	Unlikely
Vulpes vulpes necator Sierra Nevada red fox	–	FSS	CT	Occurs throughout the Sierra Nevada at elevations above 7,000 feet in forests interspersed with meadows or alpine forests. Open areas are used for hunting, forested habitats for cover and reproduction. Known from the higher elevations of the SNF.	Unlikely	Known	Known	Unlikely
Martes americana American (pine) marten	–	FSS		Within the SNF, martens are known from the high elevation forested plant communities. Optimal habitats are various mixed evergreen forests with more than 40% crown closure and large trees and snags for den sites. Most commonly found in red fir and lodgepole pine forests between 4,000 and 10,600 feet elevation.	Unlikely	Known	Known	Unlikely
Martes pennanti pacifica Pacific fisher	FC	FSS	CSC, SNF MIS	Suitable habitat consists of large areas of mature, dense forest red fir, lodgepole pine, ponderosa pine, mixed conifer, and Jeffery pine forests with snags and greater than 50% canopy closure. Known from 4,000 to 8,000 feet elevations in the SNF.	Potential	Known	Known	Unlikely

Scientific/Common Name	Federal Status	Forest Service Status	Other Status	Habitat	Mammoth Pool	Big Creek Nos. 1 and 2	Big Creek Nos. 2A, 8 & Eastwood	Big Creek No. 3
Gulo gulo luteus California wolverine	–	FSS	CT, CFP	Mixed conifer, red fir, and lodgepole habitats, and probably sub-alpine conifer, alpine dwarf shrub, wet meadow, and montane riparian habitats. Occurs in Sierra Nevada from 4,300 to 10,800 feet. Majority of recorded sightings are found above 8,000 feet elevation.	Unlikely	Known	Known	Unlikely
Ovis canadensis californiana Sierra Nevada (California) bighorn sheep	FE	FSS	CE, CFP	Southern Sierra Nevada from Fresno and Mono counties and south. Alpine dwarf–shrub, low sage, sagebrush, bitterbrush, pinyon-juniper, palm oasis, desert riparian, desert succulent shrub, desert scrub, subalpine conifer, perennial grassland, montane chaparral, and montane riparian habitats.	Unlikely	Unlikely	Unlikely	Unlikely

State Status
CFP = California Fully Protected
CSC = California Species of Special Concern
CE = California Endangered
CT = California Threatened

Federal Status:
FC = Candidate Species
FE = Federal Endangered
FPE = Federally proposed for listing as endangered
FT = Federal Threatened
FSS = Forest Service Sensitive
SNF MIS = Sierra National Forest Management Indicator Species

Known: Species identified either through literature review (USFS, CNDDB, CNPS) or during focused surveys completed in vicinity of the four Big Creek Projects.

Potential: Surveys were completed only in representative habitat potentially supporting the species. Species could potentially occur in other potential habitat in the vicinity of the four Big Creek Projects that were not surveyed. For birds, the potential for occurrence refers to the potential for the species to nest in the Project area.

Not Detected: Species were not found during surveys completed in the vicinity of the four Big Creek Projects.

Unlikely: Regulatory agencies identified species as potentially occurring in the vicinity of the four Big Creek Projects. Upon further review, it was determined that the projects were outside the species known elevation range or that no appropriate habitat is present.

Bald Eagle—Bald eagles were federally delisted from the ESA on June 28, 2007; they continue to be federally protected by both the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The breeding range of bald eagles formerly included most of the North American continent, but bald eagles now nest mainly in Alaska, Canada, the Pacific Northwest, the Great Lakes states, Florida, and Chesapeake Bay. The winter range of the bald eagle is similar to the breeding range, but extends mainly from southern Alaska and southern Canada southward. Bald eagles are permanent residents and uncommon winter migrants throughout the state of California. They breed primarily in Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties. The breeding range is primarily in mountainous habitats next to reservoirs, in the Central Coast Range, and on Santa Catalina Island. About half of the wintering population is found in the Klamath Basin. Bald eagles forage near large aquatic ecosystems such as lakes, reservoirs, or free flowing rivers. Bald eagle nests are usually located in uneven-aged stands with old-growth components. Nesting usually occurs in large trees along shorelines in relatively remote areas. Breeding occurs from February through July, with peak activity occurring between the months of March through June. Average clutch size is two eggs. Incubation lasts approximately 35 days and fledging takes place at 11 to 12 weeks of age. Parental care may extend to 11 weeks after fledging. Bald eagles become sexually mature at 4 to 5 years of age.

Within the Big Creek Nos. 2A, 8, and Eastwood Project area, SCE identified one active nest located just outside the project boundary about 0.1 mile from the shoreline of Shaver Lake (SCE, 2007d). In 2000, two chicks were reported, but both died. In 2001, two chicks successfully fledged. The nest was unsuccessful in 2002, but produced three young in 2003. In 2005, one chick fledged successfully and in 2006 the pair attempted to nest but was unsuccessful. At the Big Creek Nos. 1 and 2 Project, bald eagles are known to winter and forage at Huntington Lake. A bald eagle nest was identified at Huntington Lake in 2003 about 400-feet from the shoreline, just outside the project boundary (SCE, 2007d). In 2004, the nest produced one fledgling. In 2005, the nest produced two fledglings. One juvenile was observed on the nest in 2006, but it is not known if this bird fledged successfully. Bald eagles are known to winter at the Mammoth Pool and Big Creek No. 3 projects.

American Peregrine Falcon—In 1999, FWS removed the peregrine falcon in North America from the federal endangered species list. The American peregrine falcon breeds in woodlands, forests, coastal habitats, and riparian areas near wetlands, lakes, rivers, or other water bodies, situated near high cliffs, banks, dunes, or mounds. It is a very uncommon breeding resident and migrant in California, with active nesting areas along the coast north of Santa Barbara, in the Sierra Nevada, and in other mountains of northern California. Migrants occur along the coast and in the western Sierra Nevada in spring and fall. The nest is a scrape on a depression or ledge in an open area, on human-made structures, and occasionally in a tree or snag cavity or old nest of other raptors. Riparian areas and coastal and inland wetlands are important habitats yearlong, especially in non-breeding seasons. It feeds on a variety of birds and occasionally takes mammals, insects, and fish. Breeding occurs from early March to late August with a clutch size of three to seven eggs. Incubation is approximately 32 days. No peregrine falcon nests are known to occur in the Big Creek Nos. 2A, 8, and Eastwood, Mammoth Pool, and Big Creek No. 3 Project areas; however, potential habitat occurs. One pair of peregrine falcons is known to nest in the Big Creek Nos. 1 and 2 Project area, previously nesting on Powerhouse 1 and on Sunset Point.

Mountain Yellow-legged Frog—The MYLF is endemic to the Sierra Nevada and Transverse ranges in California. This species is highly aquatic and is closely associated with low-gradient streams, meadows, ponds, and lakes from 4,500 to 12,000 feet in elevation in the Sierra Nevada. Adults are most active during the day and often bask in open areas. The MYLF is most often found in lakes and streams with gently sloping banks that are moderately rocky and interspersed with sedges, grasses, and low clumps of willows. The MYLF is a pond-breeding species that associates primarily with lakes and ponds throughout its southern range and with streams throughout its northern range. Because of harsh winters and high spring run-off in the higher elevations of the MYLF's range, only large pools and ponds that maintain the low velocities required during metamorphosis are used for breeding. Tadpoles may transform after their second summer, thus the tadpoles require still, deep water with fine sediments for overwintering. Adults are commonly observed basking at the edge of pools and along shallow sloped stream margins. Like other pond-breeding frogs and toads, the MYLF is not well adapted to swift flowing water. However, individuals have been noted basking on open, sunny cobbles adjacent to gently flowing riffles during dispersal season.

There are no known occurrences of MYLF within the vicinity of the Big Creek Nos. 2A, 8, and Eastwood Project. However, potential MYLF habitat (i.e., that rated as good or moderate in survey results) was identified along Tombstone, Crater, Chinquapin, Camp 62, Bolsillo, Bear, Mono, Pitman, Stevenson, and Balsam creeks; the South Fork San Joaquin River, Florence Lake to Mammoth Pool, North Fork Stevenson Creek, Florence Lake dam arches, Bear diversion pool, Mono diversion pool, and Dam 5 forebay. Meadows associated with these stream reaches also represent potential habitat.

There are known occurrences of MYLF in the vicinity of the Big Creek Nos. 1 and 2 Project, at Huntington Lake. Potential MYLF habitat (i.e., that rated as good or moderate in habitat survey results) was also identified in the vicinity of the Big Creek Nos. 1 and 2 Project in the following areas: Big Creek to Huntington Lake and adjustable channel reach; Big Creek to Dam 4; Big Creek Dam 4 to Dam 5; and Dam 4 forebay. MYLF habitat does not occur within the Mammoth Pool or Big Creek No. 3 Project areas.

Yosemite Toad—The Yosemite toad associates with montane meadows, streams, ponds, and lakes in lodgepole pine forests in the Sierra Nevada from 6,400 to 11,300 feet. Along the western slope of the Sierra Nevada, the northernmost limit of this species is Heather Lake in El Dorado County, and the southernmost limit is approximately 5 miles south of Kaiser Pass in Fresno County. The preferred habitat of the Yosemite toad is high elevation montane meadows, although individuals do associate with slow flowing, low-gradient stream habitats, such as pools and flatwater, near or adjacent to meadows. Individuals are rarely, if ever, seen in swiftly flowing stream habitats like cascades or exposed habitats like bedrock sheets. The substrate in streams that meander through montane meadows is predominantly composed of fines occasionally interspersed with sand. Coarse material is rare and probably holds little value for the Yosemite toad, which breeds in shallow pools in meadows during spring and primarily uses stream habitats during the drier portions of the year. Because the toads have a high association with low gradient streams adjacent to meadows, cover types more typical to those habitats are considered to have higher importance in providing refuge sites. Specifically, aquatic and terrestrial vegetation, woody debris, and undercut banks would be more common in meadow-stream complexes and would provide crucial protection from predators. There are known populations of Yosemite toad in the vicinity of the Big Creek Nos. 2A, 8, and Eastwood Project. SCE identified potential Yosemite Toad habitat (i.e., that rated as good or moderate in survey results), at Tombstone Creek, and the South Fork San Joaquin River. There are known occurrences of Yosemite toad in the vicinity of the Big Creek Nos. 1 and 2 Project at Huntington Lake. Yosemite toad habitat does not occur within the Mammoth Pool or Big Creek No. 3 Project areas.

Foothill Yellow-legged Frog—The FYLF is a stream-dwelling frog native to California and Oregon. As a stream obligate species, adult and juvenile FYLF primarily associate with pool and riffle habitats with gently to moderately flowing water. Tadpoles are often found in shallow near-shore habitats such as eddies, backwaters, and other low velocity areas. In eastern California it ranges from the Sierra Nevada foothills to approximately 4,500 feet (SCE, 2007c). The FYLF is not known to occur in any of the Big Creek ALP Projects; however, SCE identified potential habitat in reaches at all four projects.

Western Pond Turtle—The western pond turtle ranges from Baja, California to Washington and inland into western Nevada. In the Sierra Nevada, it historically occurred in most of the major drainages along the western slope. Its elevational distribution is from sea level to approximately 6,000 feet, but most populations occur below 4,000 feet. Populations found between 4,500 and 6,000 are expected to be transplants. This turtle occurs in marshes, perennial and intermittent streams, rivers, canals, ponds, vernal pools, and reservoirs, but also can be found nesting or overwintering in adjacent upland habitats (SCE, 2007c). At the Big Creek Nos. 2A, 8, and Eastwood Project the western pond turtle is known to occur at Shaver Lake, Camp 62 Creek, Stevenson Creek, North Fork Stevenson Creek, Dam 5 forebay, and Dam 6 forebay. At the Big Creek Nos. 1 and 2 Project, the western pond turtle is not known to occur; however, potential habitat occurs. At the Mammoth Pool Project, the western pond turtle is known to occur in two stretches of Rock Creek, from the diversion to the San Joaquin River and along Ross Creek. There are known occurrences of western pond turtle in the vicinity of the Big Creek No. 3 Project at Adit 2, Tunnel 3 at Powerhouse 3, and at FS Road No. 8S05 (Canyon Road).

Townsend's Western Big-eared Bat—Townsend's big-eared bat is a year-round resident in California, occurring from low desert to mid-elevation montane habitats. It is found primarily in rural settings, from inland deserts to coastal redwoods, oak woodland of the inner Coast Ranges and Sierra Nevada foothills, and low to mid-elevation mixed coniferous-deciduous forests. It typically roosts during the day in caves and mines, but can roost in buildings that offer suitable conditions. Night roosts are in more open settings and include bridges. It hibernates in mixed sex aggregations of a few to several hundred individuals. Hibernation occurs for prolonged periods in colder areas and intermittently in non-freezing areas. Townsend's big-eared bat arouses periodically and moves to alternative roosts, and actively forages and drinks throughout the winter (SCE, 2007c). There are known occurrences of Townsend's western big-eared bat in the vicinity of the Big Creek Nos. 2A, 8, and Eastwood Project at Tombstone Creek diversion piping. There are known roosts at the 102-inch valve house at Powerhouse 2A and at the Eastwood School site.

Pallid Bat—This year-round California resident is found in arid desert areas, grasslands and oak savanna, coastal forested areas, and coniferous forests of the mountain regions of California. Roost sites are typically rock outcroppings, caves, hollow trees, mines, buildings, and bridges. Pallid bats make use of similar structures for night roosting and will use more open sites such as eaves, awnings, and open areas under bridges for feeding roosts. Pallid bats are largely inactive in the winter months, and there is evidence for both hibernation and migration. Hibernation aggregations tend to be much smaller than summer aggregations. There are known occurrences of pallid bat in the vicinity of the Big Creek Nos. 2A, 8, and Eastwood Project at Powerhouse 8; Tunnel 7, at the Huntington-Pitman-siphon water conveyance system; Florence and Shaver lakes; Bear diversion pool; and Dam 5 forebay. There are known occurrences of pallid bat in the vicinity of the Big Creek No. 3 Project, at the angler access stairway at Mammoth powerhouse, and the parking area near Mammoth powerhouse gate. There are pallid bat roosts at Tunnel 3, Adits 1, 2 and 3, and at Powerhouse 3.

Western Red Bat—The western red bat is a solitary, foliage-roosting bat. These bats are adapted for exposed roosting behavior. In California, this species is known to roost in cottonwood trees and willows, but is commonly detected in a variety of habitats, including chaparral. Roost heights range from 10 to 50 feet. The range of the western red bat is from British Columbia to Central and South America. Migration occurs throughout its range and bats of Canada move into the coastal lowlands of California, and the California population is thought to winter in Central America. There are known occurrences of western red bat in the vicinity of the Big Creek Nos. 1 and 2 Project at Huntington Lake.

3.3.2.2 Environmental Effects

Vegetation and Integrated Pest Management Plan

Vegetation management, including trimming of vegetation by hand or equipment and the use of herbicides, occurs at several locations within the Big Creek ALP Projects. This regularly occurring management could have both beneficial and adverse effects on special-status plants and wildlife and the proliferation of noxious weeds.

SCE proposes, in measure 5.6 of the Settlement Agreement, to implement a Vegetation and Integrated Pest Management Plan. As part of the plan, SCE proposes avoidance and protection measures including: (1) regulated pesticide use; (2) special-status plant protection; (3) VELB (*Desmocerus californicus dimorphus*) protection; (4) peregrine falcon protection; (5) osprey protection; (6) cultural resources protection; (7) measures to prevent the spread of noxious weeds; (8) treatment of new and established infestations; (9) prevention of the spread of invasive ornamental plants; (10) revegetation of disturbed sites; and (11) weed-free erosion control methods. Measures related to the VELB, a federally threatened species, are discussed in section 3.3.3.2, *Threatened and Endangered Species*.

In addition to the above avoidance and protection measures, SCE has also established several programs to train personnel on the recognition and avoidance of special-status species. SCE proposes to continue the following programs: (1) Endangered Species Alert Program which annually trains personnel in the identification and potential locations of legally protected plant and animal species within the project location; (2) Northern Hydro Special-Status Species Information Program which provides SCE with a means of identifying when they may be working within an area that could support a Forest Service sensitive species; (3) Avian Protection Program which includes training information for SCE personnel on raptor and avian protocols; (4) Cultural Resources Environmental Awareness Program, in conjunction with the Endangered Species Alert Program, which includes procedures for implementation of the HPMP and awareness of Native American traditional cultural values, including biological resources with Native American cultural significance ; (5) Environmental Training Program which includes SCE employees regularly attending training sessions including a review of background material, permit conditions, and instructions on how to avoid effects on biological resources; (6) Noxious Weed Training program which trains SCE personnel on noxious weed control; (7) Compliance Program which includes a process that SCE must follow prior to implementing specific operations and maintenance activities to track the activities and guide personnel in implementation of these activities in compliance with established avoidance and protection measures; (8) Northern Hydroelectric Environmental Compliance Database which SCE would integrate into its existing databases and would include tracking the training records of SCE personnel, operation and maintenance activities that SCE has planned and completed, and noxious weed populations that have been identified and treated; (9) Geographic Information System Database which would include the results of all the project studies, data obtained from the Forest Service Special-status Species Database, the California Natural Diversity Database, other biological studies, and annual updates with any new data.

In addition, SCE proposes as part of the plan, to mitigate for adverse effects on the VELB (discussed in section 3.3.3.2, *Threatened and Endangered Species*) and to monitor the effectiveness of the avoidance and protection measures on special-status plants, VELB, cultural resources (discussed in section 3.3.5.2, *Cultural Resources*), noxious weeds and invasive ornamentals, and erosion control and revegetation areas. SCE also would continue to consult annually with the Forest Service to inform it of proposed vegetation management activities and would review the plan every 5 years.

SCE also proposes in measure 5.3 of the Settlement Agreement to prepare a biological evaluation to describe the potential effect of the action on the species or its habitat prior to construction of new project features on Forest Service land that may affect Forest Service special-status species and their habitat (i.e., Forest Service sensitive and/or management indicator species). For state or federally listed species, federal candidate species, California species of special concern, and California fully protected species, SCE proposes to prepare a biological assessment or other required document and obtain any necessary permits or approvals.

Forest Service 4(e) condition 16 is consistent with proposed measure 5.6 with the addition of requiring SCE to provide the Forest Service with survey data and completion reports at the annual consultation meeting. Interior 10(j) recommendation 11 (Project No. 67), 8 (Project Nos. 120 and 2175), and 9 (Project No. 2085) also are consistent with the proposed measure.

Forest Service 4(e) condition 14 is consistent with proposed measure 5.3, with additional specific guidance regarding the contents of a biological evaluation. Interior 10(j) recommendations 8, 5, and 6 (for Project Nos. 67, 120, and 2175, and 2085, respectively) are consistent with proposed measure 5.3 as well.

Our Analysis

The Big Creek ALP Projects contain populations of both noxious weeds and special-status plants and wildlife. Several species of special-status upland plant species (federal species of special concern, Forest Service sensitive and watch list species, and California Native Plant Society listed species) occur in proximity to project facilities at the Big Creek Nos. 2A, 8, and Eastwood, the Big Creek Nos. 1 and 2, and the Mammoth Pool projects. Populations of aquatic, wetland, and riparian special-status species occur close to project facilities at the Big Creek Nos. 2A, 8, and Eastwood Project. Vegetation maintenance, in the form of hand and mechanical trimming and herbicide application occurring at all four Big Creek ALP Projects near project facilities, recreational facilities, roads, and trails, could affect populations of special-status plants occurring in areas where vegetation is maintained. The proposed Vegetation and Integrated Pest Management Project would protect special-status plants by implementing herbicide controls, marking special-status plant locations prior to management activities, and maintaining 5-foot buffers around populations where SCE would not allow mechanized trimming and herbicide use. SCE's proposed measure would further benefit special-status plant populations by controlling the spread and proliferation of noxious weeds, which can outcompete native species and eliminate special-status plant populations.

According to the Vegetation and Integrated Pest Management Plan, two peregrine falcon nests and two osprey nests are located in areas potentially disturbed by vegetation management. The two osprey nests are located along two access roads to Shaver dam in the Big Creek Nos. 2A, 8, and Eastwood Project. The two peregrine falcon nests are located near Big Creek Nos. 1 and 2 Project roads. Mechanized vegetation management close to these nests during nesting season (March through September and February 15 through August 31 for osprey and peregrine falcons, respectively) could disturb nesting birds and reduce nesting success. Implementing the measures in the Vegetation and Integrated Pest Management Plan would limit the duration of mechanized vegetation clearing during osprey nesting and either prohibit or limit the duration of mechanized vegetation management within one quarter mile of active peregrine falcon nests. Limiting the extent and duration of mechanized clearing during nesting season would minimize disturbance of these special-status birds.

Monitoring the effectiveness of the proposed avoidance and protection measures for special-status plants and wildlife, noxious weed locations and treatment areas, and erosion control and revegetation areas would allow SCE to ensure that its proposed measures are working. If monitoring determines that noxious weed treatments and revegetation are not successful, SCE would consult with the Forest Service to identify alternative or additional treatment, ultimately increasing the likelihood that noxious weed control would be successful. In addition, SCE proposes to conduct periodic surveys for special-status plants, peregrine falcons, osprey, and noxious weeds. As such, SCE would be able to update its training programs to include newly identified populations and would be able to implement its avoidance and protection measures in the newly identified areas as well. Providing the Forest Service with the results of these surveys at the annual coordination meetings, as specified by the Forest Service, would allow the Forest Service to more accurately provide guidance during annual consultation. Additionally, preparing a biological evaluation and assessment, as appropriate, prior to constructing any new project facilities would maintain or enhance the protection of special-status plants and wildlife within the Big Creek ALP Projects during the course of any new licenses.

Riparian Monitoring

Quantitative and qualitative riparian studies completed for the Big Creek ALP Projects identified potential riparian or meadow resource issues along certain bypassed streams. Under Settlement Agreement measure A1.11, SCE would implement the Riparian Monitoring Plan included as appendix K in the Settlement Agreement to determine the effectiveness of channel and riparian maintenance flows for maintaining channels and riparian and meadow ecosystems (see section 3.3.1.2, *Channel and Riparian Maintenance Flows*).

The Riparian Monitoring Plan would be designed to monitor the status and trends of the riparian resources along Mono Creek, South Fork San Joaquin River, and Camp 61 Creek bypassed reaches in response to the channel and riparian maintenance flows and MIFs required under the new licenses. The specific objectives for the monitoring include the following:

- Monitor riparian and meadow vegetation composition in selected reaches.
- Monitor riparian vegetation age class structure, including regeneration, in selected reaches.
- Monitor trends in riparian and meadow health in selected reaches over the length of the new license.

Riparian resources would be evaluated the first year after license issuance, 5 years following channel and riparian maintenance flow releases made in the first wet water year for Mono Creek and Camp 61 Creek and the second wet water year for the South Fork San Joaquin River, and at 10-year intervals for the remainder of the license term.

Other Recommendations

The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations for all four Big Creek ALP Projects that are consistent with Settlement Agreement measure A1.11, Riparian Monitoring Plan.

Our Analysis

The riparian issues in Mono Creek bypassed reach and Mono Meadow are: (1) channel encroachment and reduced regeneration success (age class structure); (2) change in community composition; (3) reduced floodplain connectivity and bar inundation along adjustable reaches; (4) bank erosion due to livestock grazing; and (5) altered frequency and timing of peak flows.

The riparian issues in the South Fork San Joaquin River bypassed reach, specifically the Jackass Meadow complex, are: (1) decreased flow and floodplain connectivity; (2) change in community composition; (3) upland species encroachment (lodgepole pine); and (4) stressed herbaceous vegetation and willows caused in part by grazing and recreation. The Forest Service also expressed an interest in the regeneration of sedge beds in certain locations along the meadow.

The monitoring data, including regeneration success, species coverage, species presence/absence, distribution of stem size classes, and percent decadence of species present, would provide information to determine whether or not the proposed channel and riparian maintenance flows and MIFs promote healthy riparian and meadow communities; result in successful establishment of native species' on alluvial surfaces in reaches with identified age class resource issues; support native riparian or meadow species; and discourage the establishment of mature woody vegetation and upland species on lower surfaces within the channel causing channel encroachment.

Adaptive management would be implemented based on pool monitoring (see section 3.3.1.2, *Channel and Riparian Maintenance Flows*) and riparian monitoring results to ensure the channel and riparian management goals are met in Mono, Camp 61, and the South Fork San Joaquin River bypassed reaches.

Special-Status Wildlife Species

Numerous special-status wildlife species, such as bald eagles, western red bat, Townsend's western big-eared bat, and pallid bat, occur at the Big Creek ALP Projects. Project operations, maintenance, and recreation all have the potential to disturb bald eagles and special-status bats, decreasing their productivity or reducing the quality of their habitat. Additionally, electrocution or collisions with project transmission lines could injure or kill bald eagles.

SCE proposes, in measure 5.1 of the Settlement Agreement, to consult with Cal Fish & Game, the Forest Service, and FWS prior to conducting any non-routine maintenance activities that could result in harm to special-status bat species or their habitat, in structures that are known to support maternal or roosting bat species (including but not limited to, reconstruction and painting), as identified in table 5.1-1 of the Settlement Agreement. Based on the consultation, SCE would implement appropriate avoidance and protection measures if necessary to minimize disturbance of special-status bat species or their habitat.

SCE proposes, in measure 5.4 of the Settlement Agreement, to implement its Bald Eagle Management Plan. The Bald Eagle Management Plan contains avoidance and protection measures including implementing the Avian Protection Plan to minimize the potential for bald eagles to be electrocuted on project transmission lines, protecting active and inactive bald eagle nests, implementing the SCE training programs described above under the Vegetation and Integrated Pest Management Plan, monitoring known nests and surveying for new nests annually or every 5 years as needed, and surveying wintering eagles and for winter roost sites every 5 years. SCE would report on the results of the surveys and provide the reports to Cal Fish & Game, the Forest Service, and FWS.

Forest Service 4(e) condition 15 and Interior conditions 7 and 9 (for Project No. 67) and 4 and 6 (for Project Nos. 120 and 2175), and 7 (for Project No. 2085) are consistent with the measures proposed in the Settlement Agreement. In addition, Forest Service 4(e) condition 15 specifies that SCE notify the Forest Service of project related bald eagle mortality.

Our Analysis

Bald Eagle—There are two known bald eagle nests located within the Big Creek ALP Projects area: one about 400-feet from Huntington Lake just outside of the Big Creek Nos. 1 and 2 Project boundary and about 0.1 mile from Shaver Lake just outside of the Big Creek Nos. 2A, 8, and Eastwood Project boundary. Wintering bald eagles are known to occur at all Big Creek ALP Projects. Although bald eagles were federally delisted from the ESA on June 28, 2007, they continue to be federally protected by both the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Bald eagles are sensitive to a variety of human activities, especially during the nesting season. If bald eagles are disturbed during nesting or foraging, they have to expend additional energy and time being flushed from their nest or locating a different foraging area. If the disturbance is great enough, bald eagles may abandon their nests, reducing the productivity of that nest territory. Project activities that could disturb bald eagles include helicopter flights for inspection and maintenance and project recreation, such as boating, fishing, hiking, and camping. Each nesting bald eagle pair has a different sensitivity to disturbance, based on such factors as acclimation and nest tree screening.

In its November 27, 2007 response to a Commission AIR, SCE identified project-related activities that could disturb nesting bald eagles that occur within a 660-foot buffer surrounding the nests and assessed the activities' consistency with FWS National Bald Eagle Management Guidelines (FWS, 2007). SCE does not conduct operation and maintenance activities within the 660-foot buffer around either known nest site. Water-based recreation activities (boating, kayaking, angling, water skiing, etc.) occur on both lakes; however, there are no recreational facilities within the buffer at Shaver Lake and only a portion of the Rancheria Campground (owned and operated by the Forest Service) is within the buffer at Huntington Lake. These activities do not occur within 330 feet of the two known bald eagle nests and recreational activity is not expected to increase significantly as a result of any new project licenses. Because the existing bald eagle nests are accustomed to the current recreational use, project-related recreation is consistent with management guidelines. SCE uses helicopters in both the Big Creek Nos. 1 and 2 and Big Creek Nos. 2A, 8, and Eastwood projects; however, no landing sites are located in close proximity to the known nest locations. SCE occasionally flies helicopters close to the nests during nesting season; however, the known bald eagle nests appear to tolerate the occasional helicopter activity.

SCE proposes to rehabilitate the Rancheria Campground within 5 years of any new license for the Big Creek Nos. 1 and 2 Project, likely between May and October because of severe winter weather conditions. The portion of the campground that overlaps the 660-foot buffer around the bald eagle nest adjacent to Huntington Lake contains a small section of road that SCE would resurface and several campsites which SCE may regrade. Rehabilitation would replace or repair roads and trails in-kind, so SCE would not cut any trees and major grading would not be necessary. The capacity and type of recreational activities at this site are not expected to increase as a result of this rehabilitation. SCE states in its November 27, 2007 response to a Commission AIR that it would consult with and coordinate construction activities with the Forest Service. Overall, any adverse effect on the Huntington Lake bald eagle nest would be short-term in nature and would not affect the long-term productivity of this nesting pair.

Electrocution and/or collision with project transmission lines also can adversely affect bald eagles. SCE analyzed project power lines at the Big Creek ALP Projects to determine if they meet the guidelines contained in *Suggested Practices for Raptor*

Protection on Power Lines: The State of the Art in 1996 (APLIC, 1996) and determined that three transmission lines do not met the design and siting standards for avoidance or minimization of bird electrocutions and collisions: (1) the EPS-BC1 220 kV line at the Big Creek Nos. 2A, 8, and Eastwood Project; (2) the Musick 7 kV powerline at the Big Creek Nos. 1 and 2 Project; and (3) the MPPH-BC3 220 kV transmission line at the Mammoth Pool Project (SCE, 2007c). The risk of bird electrocution increases when transmission lines do not have adequate spacing between conductors or the lines and the ground. This is especially true for highly susceptible raptors with large wing spans, like the bald eagle. Bald eagles are at risk for collision with transmission lines with overhead groundwires because the small size of the wires makes them less visible to birds.

The proposed Bald Eagle Management Plan, including the Avian Protection Plan, would report any bald eagle mortality to SCE specialists and would provide FWS and Cal Fish & Game with annual bald eagle mortality reports in years where there is a project-related mortality. This reporting, including sending the mortality reports to the Forest Service as specified in 4(e) condition 15, would enable the agencies to monitor the hazard of these non-guideline compliant power lines and suggest any follow-up measures that SCE may need to implement to protect bald eagles and other raptors from electrocution. If SCE uses the most recent version of the APLIC guidelines, such as the 2006 update to the 1996 version, SCE would ensure that the most up-to-date guidance is met. In addition, the management plan specifies that SCE would conduct bald eagle nest surveys to locate any new nests and monitor the productivity of existing nests and bald eagle wintering surveys, which would enable SCE and the agencies to implement the measures in the management plan for any new nests and identify any activities that may be affecting bald eagles in the project areas.

Special Status Bats—The special-status western red bat, Townsend’s big-eared bat, and pallid bat occur in the Big Creek Nos. 2A, 8, and Eastwood, Big Creek Nos. 1 and 2, and Big Creek No. 3 Project areas. Often bats use man-made structures in which to roost, including the Townsend’s western big-eared bat roosting in a valve house at Powerhouse 2A and at the Eastwood School site and pallid bats roosting at Powerhouse 3 and at Adits 1, 2, and 3 at Tunnel 3 at the Big Creek No. 3 Project. Maintenance activities at project facilities housing special-status bat roosting or maternal colonies could disturb the bats or degrade their habitat. Regular maintenance is on-going and would not create any new disturbances; however, non-routine maintenance activities would potentially create new disturbance. Implementing the proposed measure would protect special-status bats located in project facilities listed in the proposed measure because SCE’s consultation with the agencies would identify the need for any avoidance or protection measures prior to any work.

Mule Deer

The San Joaquin mule deer herd must cross the San Joaquin River, particularly Mammoth Pool reservoir, as they migrate from their winter habitat at 1,200 to 3,600 feet in elevation to their breeding grounds at 6,000 to 10,000 feet in elevation. Deer could be injured or killed attempting to swim or cross project facilities because of high currents, build up of debris, or because they get trapped. Recreational use could increase this mortality when users spook deer, forcing them to jump into dangerous areas to escape. Mule deer also migrate through the Eastwood project area around Shaver Lake. Recreational use around the lake could also affect migrating deer. SCE has implemented several mule deer protection measures at the Mammoth Pool project; however, the potential for mule deer mortality remains.

SCE proposes, in measure 5.2 of the Settlement Agreement to maintain: (1) fences around the Mammoth Pool dam spillway; (2) the Daulton Creek bridge; and (3) a device to discourage deer from crossing the reservoir near the spillway; such as the barrel line that is present across the spillway. If at any time during the term of the license, one or more of these facilities requires repair or replacement, SCE proposes to maintain the facility as needed. Prior to replacement/repair of the facility, SCE would contact Forest Service, Cal Fish & Game, and FWS to inform them of the proposed work and provide a replacement/repair plan and schedule. The Forest Service, Cal Fish & Game, and FWS would approve any replacement/repair plan and schedule prior to implementation.

SCE also proposes, as part of this measure to ensure sand is present on the Mammoth Pool dam road to encourage deer to use the dam road to cross during the peak migration period (May 1 through June 15) and would close the road during the peak migration period to reduce any adverse effects from recreation.

Additionally, SCE proposes to provide annual photo documentation to Cal Fish & Game, the Forest Service, and FWS of the area at the floating boom above the Mammoth Pool spillway. SCE would also provide an estimate of the extent of any debris present to ensure that the presence of debris that may impede deer migration across Mammoth Pool reservoir is monitored and that any build up of debris is removed in a timely manner. If Cal Fish & Game and/or the Forest Service and/or FWS determines, based on review of the photographs and the estimate of the aerial extent of debris buildup, that the debris would impede deer migration, SCE proposes to remove sufficient levels of debris to allow deer to migrate without impediment.

At the Big Creek Nos. 2A, 8, and Eastwood Project, SCE proposes, in condition 5.2 of the Settlement Agreement, to implement road closures to prevent the disturbance of mule deer and other wildlife. Table 3-19 shows the roads proposed to be closed.

Table 3-19. Roads and road closure requirements. (Source: SCE, 2007b)

Forest Service Road No.	**Road Description**	**Gate (Closure Period)**
FS Road No. 9S58	FS Road No. 9S58 from gate to NF Stevenson gage	Gate A1 (*nights only*) Gates A2 & B (*all year*)
FS Road No. 9S32	FS Road No. 9S32 from gate near Highway 168 to EPH transmission line	Gates J & M (*all year*)
FS Road No. 9S32A	FS Road No. 9S32A, spur from 9S32 to east side of Balsam forebay	Gate L (*all year*)
FS Road No. 9S312	Access to Eastwood substation from Highway 168	Gate G (*all year*)
FS Road No. 9S24	From Highway 168 to NF Stevenson Creek gate 2 (Tunnel 7)	Gate H (*all year*)

Forest Service 4(e) condition 15 for the Mammoth Pool Project and 15 for the Big Creek Nos. 2A, 8, and Eastwood Project and Interior 10(j) recommendation 5 for the Mammoth Pool Project and 12 for the Big Creek Nos. 2A, 8, and Eastwood Project are consistent with the measures proposed in the Settlement Agreement.

Our Analysis

Cal Fish & Game, the Forest Service, and SCE monitored deer migration from 1958 to 1975 to document deer losses, problems, and behavior associated with the construction of the Mammoth Pool Project (SCE, 2003i). Substantial losses occurred at the diversion tunnel during construction and at the spillway after project construction during the spring when deer were migrating through the area. Deer mortality was also caused by the Daulton Creek diversion (steep-sided and hazardous during high-flows), trash buildup at points where deer were trying to swim the reservoir, and harassment from recreational activities on the reservoir (SCE, 2003i).

In response to these noted effects, SCE implemented several deer protection measures. SCE and the Forest Service close the road to Mammoth Pool dam and close the reservoir to boating during peak migration season (May 1 to June 15) and installed fencing along the west side of the Mammoth Pool spillway to keep deer from being frightened by cars or people and jumping into the spillway. SCE also placed 3 inches of sand on the bridge over the spillway to promote deer use. SCE maintains this fencing and sand placement. SCE maintains fencing blocking the migration trail west of the spillway and a barrel line across the spillway intake, in order to prevent deer from being pulled into the spillway when the reservoir is spilling. SCE built a bridge across Daulton Creek to aid in deer migration, and SCE places sand on the bridge to make it more appealing for deer use. A 2003 SCE study (2003i) assessed the effectiveness of these protection measures and found no signs of deer struggles or mortality. The mule deer protection measures appear to be effective and deer continue to use the bridges. SCE does not currently remove debris from the Mammoth Pool reservoir. Deer drowning is known to have occurred (SCE, 2003i), especially around the spillway when deer get trapped in debris.

SCE's proposal would ensure that SCE would continue to maintain the existing mule deer protection measures at Mammoth Pool that are currently effective in limiting deer mortality. Maintaining the fences and barrel line and closing the Mammoth Pool reservoir and dam road to recreation would encourage mule deer to cross the reservoir safely along the road instead of entering the hazardous spillway. Similarly, maintaining the Daulton Creek bridge encourages mule deer to use the bridge to cross the creek instead of getting trapped in the high flows and steep sides of the creek. Because mule deer are known to die after becoming trapped in debris and trash that build up in the area of the floating boom above the Mammoth Pool spillway while trying to swim across the reservoir, photographing and estimating the amount of debris in this location annually allows the agencies to monitor the hazardousness of the condition. This would allow SCE to remove the trash buildup when it reaches a hazardous level, without having to remove it annually.

Similar to the Mammoth Pool Project, migrating deer around the Eastwood Project can be spooked by cars and recreationalists using project roads. Closing the roads identified in SCE's proposal would allow mule deer migration pathways with minimal disturbance. Reducing disturbance would be beneficial to the health of the herd, along with other wildlife in the area.

Bear/Human Interaction

Black bears potentially occur in the vicinity of the Big Creek ALP Projects. Human activities could lure bears into close proximity to project facilities and recreational areas. In measure 5.7 of the Settlement Agreement, SCE proposes to install and maintain bear-proof dumpsters at the Big Creek No. 1 administrative offices and company housing, and other project facilities where people may dispose of or store food waste. SCE also proposes to implement a program to educate SCE personnel about proper food storage and garbage disposal.

Forest Service 4(e) condition 14 and Interior 10(j) recommendation 9 are consistent with SCE's proposed measure.

Our Analysis

Bears are often drawn into potentially dangerous proximity to humans by garbage or food that is left in places bears can access. Installing and maintaining bear-proof dumpsters at Big Creek No. 1 Project facilities would discourage bears from coming into areas used frequently by humans. Educating SCE personnel would further ensure that people do not leave food and garbage in places that could lure bears into close proximity to project facilities.

Effects of Proposed Operations

As discussed in section 3.3.1.2, *Aquatic Resources*, SCE proposes increased MIF requirements in many of the Big Creek ALP Project reaches, channel and riparian maintenance flow for several reaches in the Big Creek Nos. 2A, 8, and Eastwood Project, and sediment management activities for the Big Creek ALP Projects. These proposed measures are designed to improve the existing condition of the aquatic and riparian habitat for the benefit of fish. Several special-status amphibian and reptile species, including the federal candidate and Forest Service sensitive species MYLF and Yosemite toad, and Forest Service sensitive species western pond turtle and FYLF occur within various reaches in the Big Creek ALP Project areas. Additionally, riparian habitat could support special-status plants and wildlife at all four Big Creek ALP Projects. Altering project operations could potentially affect habitat for these species.

Our Analysis

The Big Creek Nos. 2A, 8, and Eastwood Project supports populations of Yosemite toad and western pond turtle, as well as several riparian special-status species such as flat-leaved bladderwort, willow flycatcher, and yellow warbler. Additionally, the project contains potential habitat for the MYLF and FYLF. Implementing the proposed project operation measures would enhance aquatic habitat, water quality, and riparian habitat, thereby maintaining or enhancing project conditions for these species. Improving fish habitat, however, could increase fish populations, which are often predators for special-status amphibians and reptiles. Although habitat conditions for these species may improve, increasing the predator population could keep amphibian and western pond turtle populations from increasing or becoming established in new areas.

SCE proposes to decommission the North and South Slide Creek, Crater Creek, and Tombstone Creek diversions. Permanently returning these reaches to free-flowing conditions would likely benefit habitat for Yosemite toad, which is known to occur near Tombstone Creek, and MYLF.

The Big Creek Nos. 1 and 2 Project supports populations of MYLF, Yosemite toad, and supports potential habitat for FYLF, western pond turtle, several special-status riparian plant species, and willow flycatcher and yellow warbler. Implementing the proposed project operation measures would enhance aquatic habitat, water quality, and potentially riparian habitat, thereby maintaining or enhancing project conditions for these species. Improving fish habitat could increase fish populations, which are often predators for special-status amphibians and reptiles. Although habitat conditions for these species may improve, increasing the predator population could keep amphibian and western pond turtle populations from increasing or becoming established in new areas.

The Mammoth Pool Project supports populations of western pond turtle and supports potential habitat for FYLF, several special-status riparian plant species, and willow flycatcher. Implementing the proposed project operation measures would enhance aquatic habitat, water quality, and potentially riparian habitat, thereby maintaining or enhancing project conditions for these species. Improving fish habitat, however, could increase fish populations, which are often predators for special-status amphibians and reptiles. Although habitat conditions for these species may improve, increasing the predator population could keep amphibian and western pond turtle populations from increasing or becoming established in new areas.

The Big Creek No. 3 Project supports populations of western pond turtle and supports potential habitat for FYLF and willow flycatcher. Implementing the proposed project operation measures would enhance aquatic habitat, water quality, and potentially riparian habitat, thereby maintaining or enhancing project conditions for these species. Improving fish habitat, however, could increase fish populations, which are often predators for special-status amphibians and reptiles. Although habitat conditions for these species may improve, increasing the predator population could keep amphibian and western pond turtle populations from increasing or becoming established in new areas.

3.3.2.3 Cumulative Effects

Construction and operation of the Big Creek ALP Projects, along with numerous other hydroelectric projects in the San Joaquin River Basin, has likely affected habitat for a number of native aquatic amphibians, and in particular, for the MYLF, FYLF, and Yosemite Toad. Existing operation of the Big Creek ALP Projects and proposed operation of the projects under the Settlement Agreement would result in continued cumulative effects on the amount and quality of aquatic amphibian habitat from flow diversion and reservoir inundation. Project operation would continue to alter the natural hydrograph, which may have ongoing adverse effects by impairing breeding, rearing, dispersal, and overwintering. The historic introduction of non-native salmonids is thought to have resulted in the extirpation of native amphibians from many sites in the Sierra Nevada. Ongoing stocking of trout in the basin by SCE and Cal Fish & Game is expected to occur and could continue to suppress FYLF and MYLF populations.

Cumulatively, implementation of the measures related to increased flow releases (both MIF and channel and riparian maintenance flow); control of herbicide and pesticide use, decommissioning of small backcountry diversion, grazing exclusion, and sediment and LWD management either required or proposed for the seven Big Creek Projects would improve aquatic and riparian habitat conditions in bypassed streams in the basin. The improved habitat conditions would likely result in higher fish and amphibian populations. Although the quality of potential habitat for special-status amphibians would increase in the basin in the future, higher fish populations may suppress any increase in amphibian populations in reaches where both are present.

3.3.3 Threatened and Endangered Species

3.3.3.1 Affected Environment

Valley Elderberry Longhorn Beetle

The federally threatened VELB (*Desmocerus californicus dimorphus*) is dependent upon its host species plant, the elderberry. The VELB occurs below 3,000 feet in elevation, generally along waterways and in floodplains that support riparian vegetation including various species of elderberry.

SCE conducted VELB surveys at the Big Creek ALP Projects during the spring and summer of 2002, 2003, and 2004. SCE mapped VELB habitat (i.e., elderberry shrubs located below 3,000 feet in elevation) within the project boundaries on 7.5-minute USGS quadrangles and incorporated the results into a geographic information system (GIS) database in conjunction with the special-status plant species surveys. Where accessible, SCE inspected elderberry shrubs for beetle exit holes. The survey area included all land within a 150-foot perimeter around the following project facilities: dams, reservoirs, moderate diversions, gaging stations, forebays, powerhouses, transmission lines, and recreational facilities in the study area. SCE surveyed all land within a 100-foot perimeter around small diversions, roads, and trails. Following initial elderberry shrub identification in 2002, SCE conducted a protocol-level survey according to FWS' *Conservation Guidelines for Valley Elderberry Longhorn Beetle* (FWS, 1999) on all 567 shrubs identified in the study area in 2002. The protocol-level survey included examining elderberry shrubs within the study area for beetle exit holes and counting the number of stems greater than or equal to 1 inch in diameter and less than or equal to 3 inches (≥ 1 and ≤ 3), stems greater than 3 and less than 5 inches in diameter (>3 and <5), and stems greater than or equal to 5 inches (≤ 5) in diameter (FWS, 1999). VELB occupancy was assumed, based upon the presence of exit holes (external evidence of prior beetle presence). No additional shrubs were detected in the study area in 2003. Five additional shrubs were identified in the study area in 2004.

Survey results identified the following potential VELB occurrences and habitat (SCE, 2007c):

- Big Creek Nos. 2A, 8, and Eastwood: a total of 15 elderberry shrubs occur in the vicinity of the Big Creek Nos. 2A, 8 and Eastwood Project, none of which showed signs of VELB occupancy. These shrubs are located near Powerhouse 8, Tunnel 8 and FS Road No. 8S03A (an access road to Powerhouse 8 from FS Road No. 8S03 [#166]).
- Big Creek Nos. 1 and 2: No potential VELB habitat occurs in the project area.
- Mammoth Pool: a total of 42 elderberry shrubs in the vicinity of the Mammoth Pool Project, of which 2 showed signs of beetle occupancy. The elderberry shrubs are located adjacent to FS Road No. 9S42, the Mammoth Pool powerhouse transmission line access road from gate near County Road 225, Italian Bar Road to FS Road No. 8S44.
- Big Creek No. 3: a total of 515 elderberry shrubs occur in the vicinity of the Big Creek No. 3 Project, 8 of which showed signs of beetle occupancy. The elderberry shrubs are located near: (1) Powerhouse 3 near the penstocks, rock/sand traps and surge chamber; (2) FS Road No. 8S05, Canyon Road (from junction with FS Road No. 8S03 to junction with Italian Bar Road); (3) FS Road No. 9S89 from Italian Bar Road east to Powerhouse 3 and administrative building; and, (4) miscellaneous Powerhouse 3 roads (i.e., water tank access road and shop).

California Red-Legged Frog

The California red-legged frog (CRLF) (*Rana aurora draytonii*) is federally threatened and occurs in aquatic and upland areas where suitable breeding and non-breeding habitat is interspersed and connected. CRLF historically occurred in aquatic, riparian, and upland habitats throughout much of California and northern Baja, California. It currently ranges from sea level to approximately 3,500 feet, although historical sightings have been reported as high as 4,900 feet in the Sierra Nevada (Entrix, 2003). The primary constituent elements for CRLF include an area with two (or more) suitable breeding locations, a permanent water source, and associated uplands surrounding these water bodies up to 300 feet from the water's edge. All these elements must be within 1.25 miles of one another and connected by barrier-free dispersal habitat that is at least 300 feet wide. There is no critical habitat for this species in the vicinity of the Big Creek ALP Projects.

The Big Creek ALP Projects are within the historic range, but not within the current known range, of the CRLF. The project vicinities occur within the Sierra Nevada Foothills and Central Valley Recovery Unit for CRLF (FWS, 2002a). This unit includes the western foothills and Sierra Nevada foothills, to approximately 5,000 feet elevation in the Central Valley hydrographic basin. However, the four project vicinities are not within a core area (SCE, 2007c). A site assessment was prepared for the Big Creek ALP Projects (Entrix, 2003). Historical records documenting CRLF presence nearest to the vicinity of the four projects are 30 miles to the south, near Minkler, and 15 miles to the northwest in Willow Creek near O'Neals. The Minkler record dates back to 1916 and CRLF are presumed extirpated at this site. The O'Neals records date back to 1951 with CRLF seen as late as 1968. They are currently presumed extirpated. The nearest known extant population of CRLF to the vicinity of the Big Creek ALP Projects is in Mine Creek (near Mercey Hot Springs), about 90 miles to the west in the Coast Range foothills in Fresno County.

The CRLF site assessment assessed 35 potential aquatic habitat sites for potential CRLF habitat (Entrix, 2003). With the exception of small sections in Jose and Chiquito creeks, the site assessment concluded that the project areas are unsuitable for CRLF. Jose and Chiquito creeks are not project reaches (i.e., bypass, flow-augmented, or flow-modified). The site assessment concluded that CRLF is not expected to occupy the Big Creek ALP Project areas due to a lack of suitable habitat and because the projects are outside of the species' current known range (Entrix, 2003).

Because CRLF is not expected to occupy the Big Creek ALP Project areas due to the lack of suitable habitat and the projects are outside of the species' current known range, the Big Creek ALP Projects would have no effect on the CRLF and are not discussed further.

3.3.3.2 Environmental Effects

Valley Elderberry Longhorn Beetle

SCE uses a combination of manual, mechanical, and chemical methods to control vegetation in the vicinity of the Big Creek ALP Projects. SCE also conducts regular road maintenance on project roads, including grading, graveling, and paving. These project management activities could result in adverse effects on the VELB by trimming or pruning elderberry bushes that provide potential habitat.

SCE proposes to implement the VELB Management Plan included in section 5.5 of the Settlement Agreement. The VELB Management Plan includes the following avoidance and protection measures at Big Creek Nos. 2A and 8, Eastwood, Mammoth Pool, and Big Creek No. 3 projects:

- Prior to implementation of management activities, flag each elderberry shrub, or group of shrubs, potentially affected by project operation or maintenance activities, with 1 or more stems measuring 1 inch in diameter or greater (>1) at ground level.
- Install signage in areas where elderberry shrubs are known to occur.

- Do not remove any elderberry shrub with 1 or more stems >1 inch in diameter at ground level.
- Do not trim any elderberry shrub stems or branches >1 inch in diameter.
- Only conduct annual and biannual vegetation control in July through April in areas within 100 feet of elderberry shrubs.
- Do not use any flail-type mower within an elderberry shrub dripline with 1 or more stems measuring >1 inch in diameter at ground level.
- Use basal bark or foliar techniques when herbicide application must occur within 100 feet of the dripline of an elderberry shrub with 1 or more stems measuring >1 in diameter or greater at ground level. Basal application techniques include cutting of a non-elderberry shrub and applying an oil-based herbicide directly to the stump. Foliar application techniques include hand spraying of an herbicide, with a deposition/retention additive, to control overspray. A certified pesticide applicator would complete or supervise the application of herbicides. Herbicide application would occur from July through April on an as-needed basis.
- Conduct non-emergency road grading July through April and restrict the use of a grader to the road surface and adjacent berms to remove any eroded material and to maintain roadside berms.

In addition to the above avoidance and protection measures, SCE also established several programs to train personnel on the recognition and avoidance of special-status species, as described in section 3.3.2.2, *Terrestrial Resources*.

SCE proposes to include several new roads as project roads that have not yet been surveyed for VELBs. In the VELB Management Plan, SCE proposes to survey the roads that are at or below 3,000 feet in elevation to determine the location of potential VELB habitat within 1 year of Commission approval of the VELB Management Plan. SCE also proposes to evaluate any elderberry shrubs identified during these surveys to determine potential project effects from vegetation management and road maintenance.

SCE proposes, as part of the VELB Management Plan, to provide mitigation for adverse effects on VELB, in accordance with FWS' 1999 Conservation Guidelines (FWS, 1999). SCE proposes to plant a total of eight elderberry seedlings on Forest Service property in the project vicinity adjacent to other elderberry shrubs, in a location agreed upon by SCE, FWS, and the Forest Service. SCE proposes to monitor the mitigation site following planting to assess the general condition of the site and the condition of the elderberry plantings. SCE also proposes to monitor the shrubs, and the 12 adjacent shrubs that SCE would trim during vegetation maintenance. SCE would monitor 7 times over a 15-year period, in years 1, 2, 3, 5, 7, 10, and 15, but would not monitor for VELB occupancy. SCE would prepare monitoring reports. SCE proposes that if a minimum elderberry survival rate of at least 60 percent is not maintained throughout the monitoring period, that it would replace, within 1 year, the failed plantings. If SCE determines that the success criteria cannot be met for reasons beyond its control, SCE would provide FWS with a letter report summarizing the reasons. FWS indicates that SCE already has established an FWS-approved VELB conservation area and planted a total of 30 elderberry seedlings (rather than the originally proposed eight seedlings) to compensate for current, potential, and limited future effects, not yet identified on the VELB and its habitat (letter from C.C. Goude, Acting Field Supervisor, FWS, Sacramento, CA to the Commission, dated December 16, 2008).

Forest Service 4(e) condition 16 for all Big Creek ALP Projects and Interior 10(j) recommendation 10 (Project No. 67), 7 (Project Nos. 120 and 2175), and 8 (Project No. 2085) are the same as the proposed VELB Management Plan with the addition of the Forest Service specifying that SCE provide survey data and completion reports to the Forest Service at the annual consultation meeting specified in 4(e) condition 1.

Our Analysis

At the Big Creek ALP Projects, SCE conducts vegetation management and road maintenance on a regular basis to reduce fire hazard, improve visibility, and provide for worker/public health and safety. Vegetation management includes trimming of vegetation by hand or equipment and the use of herbicides. In general these activities occur in the spring and summer and in areas within 150 feet of project facilities and within 10 feet on either side of roads. Vegetation trimming by hand and mechanical means occurs on an as-needed basis. Following trimming, SCE may apply herbicides using basal or foliar application methods. SCE uses basal application on shrubs including applying an oil-based herbicide directly to the cut shrub-stump. Foliar application includes hand spraying an herbicide with an additive to control overspray. Vegetation maintenance around roads typically occurs one or more times in a 5 year period, whereas maintenance of the actual roads occurs more infrequently, less than once every 5 years.

Both the vegetation and road maintenance occur in areas that support potential VELB habitat. As such, implementing these regular maintenance methods within areas of potential VELB habitat could adversely affect VELB. Implementing the VELB Management Plan, including the protection of elderberry shrubs by signage and flagging, and restrictions on vegetation management practices within proximity to elderberry shrubs would minimize the loss of potential VELB habitat and any VELB inhabiting these shrubs. Additionally, continuing vegetation maintenance in areas surrounding potential VELB habitat reduces the chance of a brush fire causing widespread loss of habitat. SCE also proposes to include new roads within the project boundaries which have not been surveyed for VELB. SCE's proposed measure to survey these roads within 1 year of license issuance and subsequently implementing the proposed VELB Management Plan measures in these locations would minimize the loss of any potential VELB habitat in these areas from maintenance associated with these roads.

Although implementing the proposed VELB Management Plan would reduce adverse effects on VELB habitat, some vegetation and road maintenance must continue to occur in VELB habitat adjacent to roads for safety reasons. As a result, some VELB habitat would continue to be affected under the proposed measures. The VELB Management Plan assessed the likelihood of continued vegetation and road management affecting the 572 elderberry shrubs known to occur within the Big Creek ALP Project boundaries, based on the type of management activities, the distance of the shrub from the facility, the presence of elderberry stems greater than or equal to 1 inch in diameter, and the ability to implement the previously identified protection and avoidance measures in that location. This assessment determined that SCE should not remove any elderberry shrubs over the term of the license at any of the Big Creek ALP Projects; however, trimming would occur on 18 of the 572 shrubs. This includes trimming 5 shrubs at the Big Creek Nos. 2A, 8, and Eastwood Project, and 13 shrubs in the Big Creek No. 3 Project. None of these shrubs showed evidence of VELB occupancy. Within these shrubs, during the course of any new project licenses, SCE would trim a total of 7 stems greater than 1 inch in diameter but less than 3 inches in diameter, 27 branches less than 1 inch in diameter, and 1 branch greater than 1 inch in diameter but less than 3 inches in diameter. As such, project vegetation and road maintenance would affect VELB habitat at Big Creek Nos. 2A, 8, and Eastwood and Big Creek No. 3; however, SCE would only trim approximately 1 percent of the total number of shrubs. Additionally, SCE's proposed employee training and sensitive species database programs would ensure that the proposed protection and avoidance measures are enforced and no unnecessary elderberry trimming or herbicide application would occur.

As a result of the necessary trimming of some elderberry shrub stems, SCE proposes mitigation based on the FWS Conservation Guidelines (FWS, 1999), with modifications developed cooperatively with FWS. SCE would plant eight elderberry seedlings and monitor the plantings to determine if a minimal 60 percent survival rate is met. SCE's proposed mitigation would meet FWS guidelines for VELB, and SCE would monitor the mitigation areas. The VELB Management Plan, however, does not specify that the mitigation sites occur within the project boundaries. If mitigation sites occur outside of project lands, the Commission would not be able to enforce the proposed monitoring and subsequent success criteria requirements. Locating any mitigation sites on project lands, at a location agreed upon by SCE, FWS, and the Forest Service would ensure that mitigation requirements are met. As previously noted, FWS indicates that SCE already has established a VELB conservation area, but the location of this site has not been provided to the Commission. Providing the Forest Service with the results of VELB surveys and monitoring results would increase the Forest Service's database and contribute to regional protection of VELB.

3.3.4 Recreational Resources

3.3.4.1 Affected Environment

Regional Recreational Resources

The Big Creek ALP Projects are all located within the 1.3 million-acre Sierra National Forest. The Sierra National Forest is bordered by the Stanislaus National Forest and Yosemite National Park to the north, the Inyo National Forest to the east, the Sequoia National Forest and Kings Canyon National Park to the south, and by private lands to the west. The Sierra National Forest provides year-round recreational opportunities and designated Wilderness areas; 60 campgrounds; more than 1,000 miles of hiking trails; snow recreation areas; resort areas; 11 major reservoirs and more than 470 smaller lakes offering flatwater recreational opportunities; 1,800 miles of streams and rivers providing canoeing, kayaking, and rafting; and 13 designated off-highway vehicle routes.

The San Joaquin River Trail is a public multi-use trail that runs through the San Joaquin River Canyon from Millerton Lake to the crest of the Sierra Nevada Mountains. The San Joaquin River Trail is co-aligned with the Mammoth Pool transmission line road for about 9 miles. The San Joaquin River Trail also crosses two other project roads: FS Road No. 8S03 (Mammoth Pool Powerhouse Road) and FS Road No. 7S47 (Rock Creek diversion access road). Within the region there are 14 trails that have trailheads within or near the Big Creek ALP Projects. Table 3-20 summarizes the trailhead and the closest reservoir/forebay.

Table 3-20. Regional trails. (Source: SCE, 2003a)

Project	Trailhead	Closest Reservoir/Forebay
Big Creek Nos. 2A, 8, and Eastwood Project	Dutch/Crater Trailhead	Florence Lake
	Bear Creek Trailhead at Kaiser Pass Road	Mono Creek forebay
	Bear Creek Trailhead at Forebay	Bear forebay
	Balsam Meadows Trailhead	Balsam forebay
Big Creek Nos. 1 and 2	Billy Creek Trailhead	Huntington Lake
	College Rock Trailhead	Huntington Lake

Project	Trailhead	Closest Reservoir/Forebay
	Rancheria Creek Trailhead	Huntington Lake
	Inspiration Point/ Sunset Point Trailhead	Huntington Lake
Portal	Margaret Lakes Trailhead	Lake Thomas A Edison
	Mono Creek Trailhead	Lake Thomas A. Edison
	Mono Crossing Trailhead	Portal forebay
	Rattlesnake Crossing Trailhead	Portal forebay
	Bear Ridge Trailhead	Lake Thomas A. Edison
Mammoth Pool	Logan Meadow Trailhead	Mammoth Pool reservoir

Big Creek Nos. 2A, 8 and Eastwood Project

The Big Creek Nos. 2A, 8, and Eastwood Project encompasses areas surrounding Florence Lake and the Mono Creek diversion (Upper Basin) and Shaver Lake and the Big Creek Canyon at Powerhouse 8 (Lower Basin). Developed public recreational facilities within this project include two boat launch areas, seven day-use picnic areas, four campgrounds, and one trailhead parking area. These facilities occur near Florence Lake and Mono Creek in the Upper Basin and near Shaver Lake and Balsam forebay in the Lower Basin. Dispersed recreational activities occur along the bypassed reaches, near the South Fork San Joaquin River, Mono Creek, Bear Creek and several small creeks in the Upper Basin and near North Fork Stevenson Creek in the Lower Basin.

Recreational Facilities

Figures 3-7 (Upper Basin) and 3-8 (Lower Basin) show the location and table 3-21 summarizes developed public recreational facilities at the Big Creek Nos. 2A, 8, and Eastwood Project.

Florence Lake—Florence Lake is located in a remote setting with a relatively low level of facility development. It has about 9.3 miles of shoreline. The lake is accessed from Florence Lake Road, which intersects Kaiser Pass Road east of Kaiser Pass. Kaiser Pass Road is typically open from late May through mid-November. The developed recreational facilities typically do not open until Kaiser Pass Road is opened and typically close around the beginning of October. The Forest Service closes Kaiser Pass Road to vehicular traffic in the winter and the road is used as a snowmobile trail. Except for areas where project- related facilities and dam structures are located, the entire shoreline is open to non-motorized public access. Visitors can access the headwaters of the South Fork San Joaquin River and the John Muir Wilderness area from Florence Lake.

Developed recreational facilities include Florence Lake boat ramp, Florence Lake day-use area, Jackass Meadow Campground, and the Dutch/Crater Trailhead. Florence Lake day-use area has 16 picnic sites and is located adjacent to the boat launch at the western end of the lake. Jackass Meadow Campground has 50 campsites and is located a short distance downstream of Florence Lake dam along South Fork San Joaquin River. The Dutch/Crater Trailhead is located at the northern end of Florence Lake near the day-use area. All of the developed recreational facilities, except for portions of the Lower Florence Lake boat ramp parking area and the entire upper parking area, are located within the existing project boundary.

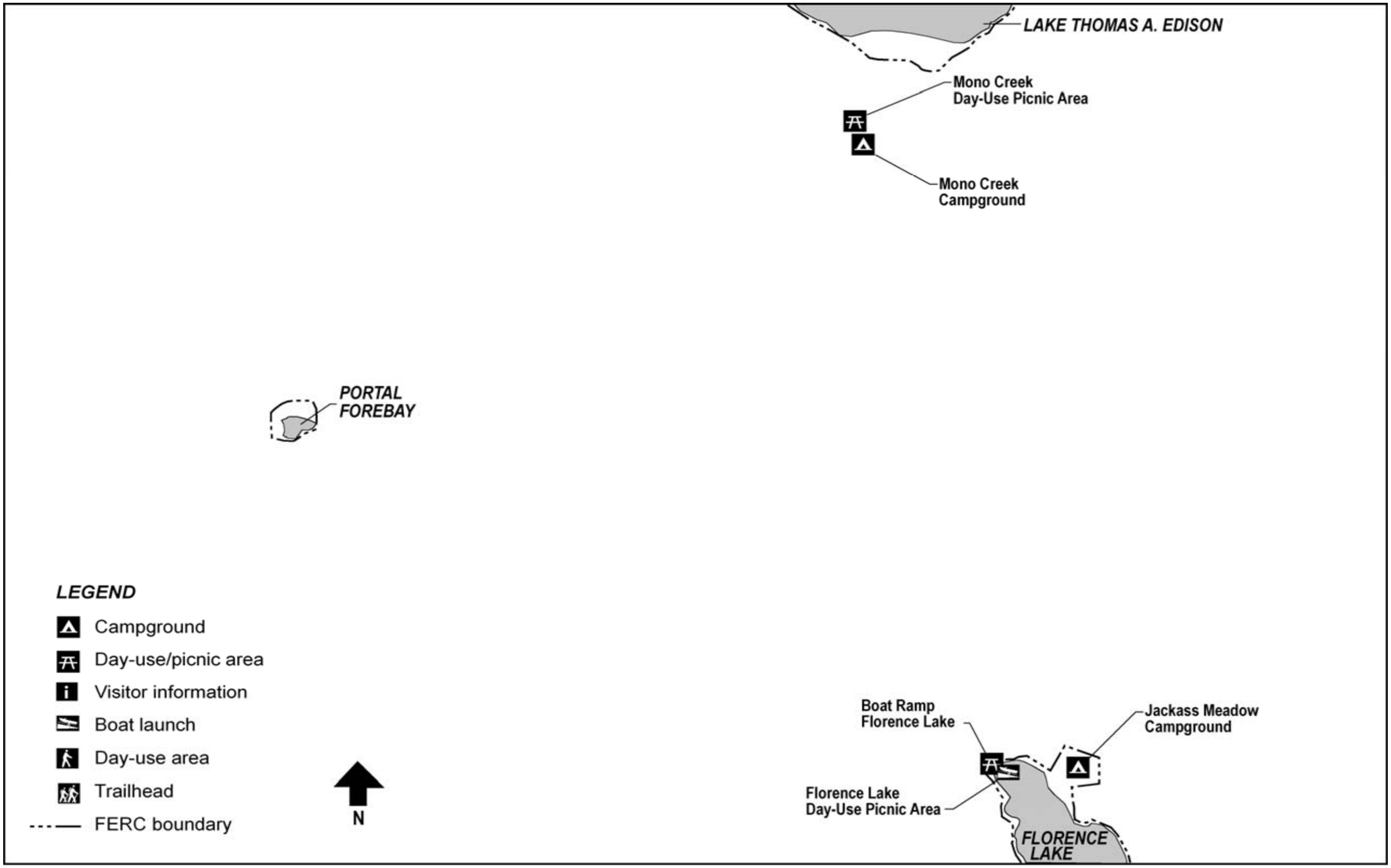

Figure 3-7. Location of the developed public recreational areas at the Big Creek Nos. 2A, 8 and Eastwood Project – Upper Basin. (Source: 2007a, as modified by staff)

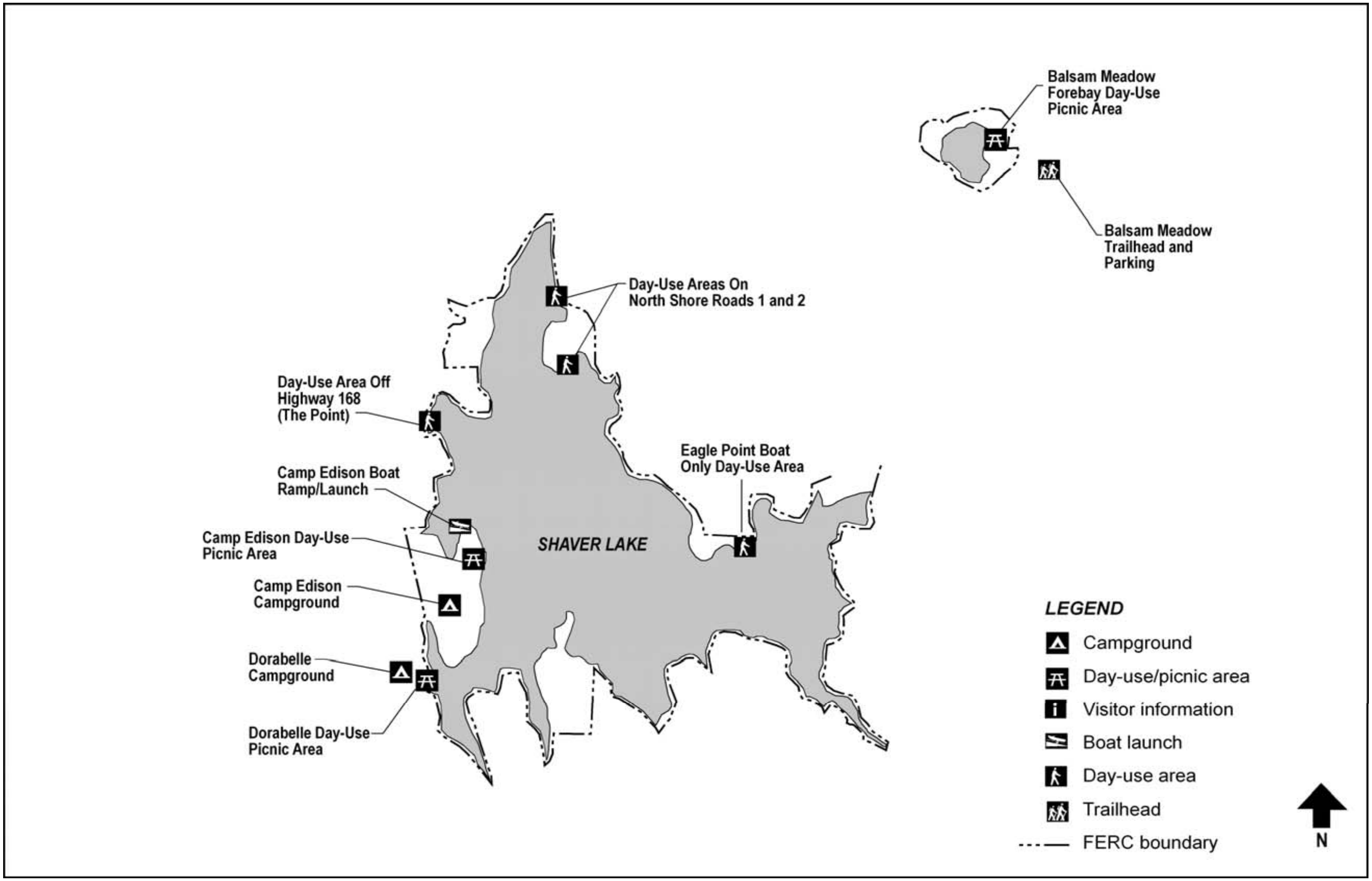

Figure 3-8. Location of the developed public recreational areas at the Big Creek Nos. 2A, 8 and Eastwood Project – Lower Basin. (Source: SCE, 2007a, as modified by staff)

Table 3-21. Big Creek Nos. 2A, 8, and Eastwood Project developed public recreational facilities. (Source: SCE, 2002b and 2007a)

Location	Site	Boat Ramps	Picnic Tables	Camp sites	Trails	Rest-rooms	Bear Boxes	Trash Facilities	Signage	Parking
Florence Lake	Florence Lake boat ramp and Parking Areas	1	-	-	X	-	-	-	-	X
	Florence Lake day-use picnic area	-	16	-	X	1	-	X	-	X
	Jackass Meadow Campground	-	50	50	-	2	50	X	X	-
Mono Creek Forebay	Mono Creek day-use picnic area	-	6	-	-	1	6	-	-	-
	Mono Creek Campground	-	16	14	-	2	16	-	X	X
Shaver Lake	Camp Edison Campground	-	290	252	-	13	252	X	X	X
	Camp Edison Boat Launch	1	-	-	-	-	-	X	X	X
	Dorabelle Campground	-	70	70	-	16	-	X	X	X

Location	Site	Boat Ramps	Picnic Tables	Camp sites	Trails	Rest-rooms	Bear Boxes	Trash Facilities	Signage	Parking
	Dorabelle day-use picnic area	-	22	-	-	2	-	X	X	X
	Day-use picnic areas on North Shore Roads 1 and 2	-	40	-	-	3	-	X	-	X
	Day-use picnic area off of Hwy 168 (The Point)	-	-	-	-	1	-	X	X	X
	Eagle Point boat-in day-use picnic area	-	7	-	-	1	-	X	-	-
Balsam Forebay	Balsam Meadows forebay day-use picnic area	-	2	-	X	1	-	X	X	-
	Balsam Meadows trailhead and parking	-	-	-	X	1	-	X	X	-
Huntington Lake Area	Eastwood Overlook and parking	-	-	-	-	1	-	X	X	X
	Eastwood Overflow Campground	-	-	-	-	-	-	-	-	-

The Florence Lake boat ramp is designed to provide access from full pool (7,330 feet elevation/64,406 acre-feet storage) to the end of the paved 25-foot ramp at 7,326 feet elevation (62,967 acre-feet storage); although boaters can access the reservoir at lower elevations by driving down the reservoir bank. From 1981 to 2001, Florence Lake was maintained on average between elevations 7,286 to 7,320 feet during the recreational season (Memorial Day to Labor Day) (see figure 3-2); however, during this period, boaters accessed the reservoir during the entire summer recreational season. The Florence Lake Ferry Service, operated by the Florence Lake Store, is located at the north end of the lake near the boat ramp. The Florence Lake Ferry Service transports hikers across Florence Lake to access the John Muir Wilderness Area bordering the southern portion of the lake. A floating dock is used for the ferry and is functional from elevation 7,327 feet (64,406 acre-feet storage) to 7,261 feet (12,237 acre-feet storage). SCE operates the reservoir to maintain relatively high elevation during the peak recreational season with the highest levels between May to August (see figure 3-2). In a visitor survey during summer 2002 to evaluate current uses and future demands at project-area recreational facilities, 93 percent of the respondents rated boat ramp availability at Florence Lake as acceptable (with 32 percent rating it moderately acceptable and 61 percent rating it highly acceptable).

Mono Creek Forebay—The Mono Creek forebay is located south of Thomas A. Edison Lake (Thomas A. Edison Lake is part of the Vermilion Valley Project) in the Upper Basin. Developed recreational facilities in this area include the Mono Creek day-use picnic area and Mono Creek Campground at the southeastern end of the Mono Creek forebay. The majority of the day-use area is located within the existing project boundary and the majority of the campground is located outside of the existing project boundary.

Shaver Lake—Shaver Lake, with about 22 miles of shoreline, is less remote than Florence Lake and has multiple developed user access points and developed recreational facilities. Developed public recreational facilities include one public boat launch area, four day-use picnic areas, and two campgrounds. In addition to the public facilities, private facilities include boat docks, winter boat storage, gas pumps, and concessions. Gold Arrow Island operates a summer waterskiing camp. Sierra Marina, Shaver Lake Marina, and the Fresno Fishing Club provide private recreational facilities.

Public day-use areas at Shaver Lake include Dorabelle day-use picnic area, day-use areas on North Shore Roads 1 and 2, day-use area off of Highway 168 (The Point), and Eagle Point boat-in day-use picnic area. Eagle Point boat-in day-use area is located on the east side of Shaver Lake. SCE maintains an access road to the boat-in day-use area which branches off FS Road No. 9S58. The access road to the boat-in day-use area is closed to public vehicular traffic. SCE uses this road exclusively to access the facility.

Campgrounds at Shaver Lake include Dorabelle Campground and Camp Edison Campground, both along the southwestern shoreline. Dorabelle Campground has 70 campsites, flush toilet restrooms, picnic tables, fires rings, and bear boxes. Camp Edison has 252 campsites with full hook-up RV sites, flush toilets, showers, fish-cleaning stations, an interpretive display, cable television connections, and an amphitheatre.

There is one public and one private boat launch area that provide boating access to Shaver Lake: Camp Edison boat ramp (public) and the Fresno County boat ramp at Sierra Marina (private with public access). The Camp Edison boat ramp is designed provide access to the lake from full pool (5,370 elevation/135,568 acre-feet) to elevation 5,348 feet (90,000 acre-feet). Beyond this point, potential users launching boats are required to leave the pavement and drive onto the reservoir bed to reach the water. The minimum reservoir elevation at which boats can access the water is 5,296 feet. The Fresno County boat ramp is designed to provide access to the lake from full pool (5,370 elevation/135,568 acre-feet) to elevation 5,333 feet (66,000 acre-feet). It is possible to launch boats from the reservoir bed (at elevation 5,300 feet). For the recreational seasons between 1983 and 2002, boaters accessed the lake from the Camp Edison boat ramp for the entire season during wet, above normal, and dry years, and 98 percent of the time during critically dry years. For the Fresno County boat ramp, during the same time period, boaters accessed the lake for the entire season during wet and above normal water years; 93 percent of the time during the dry water years; and 36 percent of the time in critically dry water years. SCE operates the reservoir to maintain a relatively high water elevation throughout the peak recreational season from May through October (see figure 3-3). In a visitor survey conducted during summer 2002 to evaluate current uses and future demands at project area recreational facilities, 90 percent of the respondents rated their satisfaction with boat ramp availability at Shaver Lake to be acceptable (29 percent moderately acceptable and 61 percent highly acceptable).

All of the recreational facilities, except for the Dorabelle Campground and portions of the Dorabelle day-use area and day-use area on North Shore Road 1 are located within the existing project boundary.

Balsam Forebay—Developed recreational facilities include the Balsam Meadows forebay day-use picnic area and the Balsam Meadows trailhead and parking area. Both facilities are located within the existing project boundary.

Huntington Lake Area—The Eastwood Overlook and the Eastwood Overflow Campground are currently within the existing project boundary of the Big Creek Nos. 2A, 8, and Eastwood Project. The Eastwood Overlook is located near the Portal Powerhouse at the north end of Huntington Lake. The Overlook provides an interpretive display containing signs, maps, and project area information. There is a Forest Service Visitor Center in this vicinity that is opened Memorial Day weekend through the end of September. The Eastwood Overflow Campground is a designated Forest Service dispersed camping area located just north of the Eastwood Overlook that is used when the developed campgrounds at nearby Huntington Lake are full.

River Corridors—In the Upper Basin, dispersed recreational use occurs along South Fork San Joaquin River near Mono Hot Springs, along South Fork San Joaquin

River below Florence Lake, along Mono Creek above and below the Mono diversion and along Bear Creek. In the Lower Basin, dispersed recreational use occurs along the North Fork Stevenson Creek upstream of Shaver Lake, and Stevenson Creek below Shaver Lake. There are no developed recreational facilities in these river corridor areas; however, there is a trailhead located at the Bear Creek forebay area.

Recreational Use

Upper Basin—In the Upper Basin, Florence Lake provides flatwater boating, hiking, angling, camping, and day-use recreational opportunities. Boat angling is the primary day-use activity, and hiking is popular due to the access to the John Muir Wilderness Area. The peak recreational season in the Upper Basin is primarily from late May/early June to early October. There are no developed facilities or services provided during the winter season; however, snowmobiling activities are popular within the Florence and Edison lakes area. The primary snowmobiling route extends along Kaiser Pass Road from Huntington Lake to Florence and Edison lakes. SCE, on rare occasions, removes snow along Kaiser Pass Road after consultation with the Forest Service.

About 77 percent of the recreational use in the Upper Basin is associated with overnight visitation; the remaining 23 percent is day-use visitation. In 2006, annual overnight visitation to the Upper Basin was 18,062 recreation days with an estimated 5,392 day-use visitation for a total estimated visitation of 23,534 recreation days. During 2006, the average weekend and weekday campsite occupancy was 26 and 17 percent, respectively, for Jackass Meadow Campground and 37 and 24 percent, respectively, at Mono Creek Campground. Future recreational use within the Upper Basin area is projected to increase by 8.2 percent between 2006 and 2040.

River corridor recreation in the Upper Basin occurs primarily along South Fork San Joaquin River near Mono Hot Springs and South Fork San Joaquin River below Florence Lake, along Mono Creek above and below the Mono diversion and along Bear Creek. The primary recreational activities include hiking, walking, fishing, swimming/wading, viewing wildlife/scenery, and relaxing. Cal Fish & Game conducts fish stocking (trout) in the Upper Basin in South Fork San Joaquin River, Mono Creek, and Florence Lake to support angling opportunities. Details on fish stocking efforts are described in section 3.3.1, *Aquatic Resources*.

Whitewater boating opportunities occur along the 6.5-mile-long reach of South Fork San Joaquin River from Florence Lake dam to Mono Crossing. Current whitewater boating use is low and there are no commercial whitewater boating operators on this reach. This reach, the "Florence Run" whitewater boating run, is classified as Class IV+ to V difficulty which is advanced to expert skill levels.[44]

In 2003, SCE conducted a single flow study of the "Florence Run" at a flow of 750 cfs. The study team of whitewater boaters estimated the minimum acceptable flow for the run to be between 350 and 700 cfs for kayaks and between 400 and 700 cfs for rafts; optimal flow was estimated between 650 to 1,000 cfs for kayaks and between 650 to 750 cfs for rafts; and the maximum acceptable flow was estimated to be between 800 and 2,000 cfs for kayaks and between 750 to 1,200 cfs for rafts. This resulted in the estimated boatable flow range for this reach to be between 350 to 2,000 cfs for kayaks and between 400 and 1,200 cfs for rafts.

SCE conducted an evaluation of historical boating opportunities from 1983 to 2002 under the existing hydrology. This assessment indicated that boating opportunity days within the boatable flow range on the "Florence Run" occurred in wet water year types between May through August, ranging from 0.5 to 14.5 boating opportunity days (average) per month, with no boating opportunity days occurring during September through April on average. During above normal water years, typically no boating opportunity days occurred.

Lower Basin—The primary recreational season for the Lower Basin is from mid to late May, with the opening of the developed public recreational facilities, to October. Primary recreational season activities at Shaver Lake include flatwater recreational activities (such as power boating, house boating, fishing, swimming, water skiing, jet-skiing) camping, sunbathing, picnicking, hiking mountain biking, motor biking, off-highway vehicle use, and horseback riding. Shaver Lake also serves as a vacation community for downhill and cross country skiers who use the Sierra Summit Ski Resort and other winter recreational facilities in the region. In addition, Shaver Lake serves as a vacation community with rental cabins. The Balsam forebay area provides day-use recreational and angling opportunities. Cal Fish & Game stocks Shaver Lake (trout and kokanee) to support angling opportunities (see section 3.3.1, *Aquatic Resources*).

Shoulder season (spring and fall) recreational activities are similar to peak season activities but use levels are lower and depend on the opening and closing of the recreational facilities, road access, and weather conditions. Winter recreational activities include snow play, cross country skiing, and snow shoeing. Highway 168 is plowed for

[44] Classification of rapids is based on the International Whitewater Classification System (AWA, 1998): Class IV, Advanced: Intense, powerful, but predictable rapids requiring precise boat handling in turbulent water; Class V, Expert: Extremely long, obstructed, or very violent rapids that expose a paddler to above average endangerment; Class VI, Extreme and exploratory: These runs have almost never been attempted and often exemplify the extremes of difficulty, unpredictability, and danger.

snow removal and is accessible year round. SCE operates Camp Edison year-round and maintains about 9 miles of cross-country ski trails.

In the Lower Basin, about 76 percent of the recreational use is associated with overnight visitation and the remaining 24 percent with day-use. For 2006, visitation to the Shaver Lake vicinity was estimated at a total of 51,701 recreation days. During 2006, the average weekend campground occupancy for Camp Edison was 83 percent, with weekday average occupancy of 73 percent. For Dorabelle Campground the average weekend campsite occupancy was 63 percent and the average weekday campsite occupancy was 43 percent. Camp Edison has the highest weekend and weekday campsite occupancies of any campground facility within the Big Creek ALP Projects. Future recreational use within the Shaver Lake vicinity is estimated to increase by 3.6 percent between 2006 and 2040.

River corridor recreational use occurs along the North Fork Stevenson Creek upstream of Shaver Lake for dispersed recreation day-use activities, such as hiking, fishing, swimming/wading, and wildlife/scenery viewing. Stevenson Creek below Shaver Lake is relatively inaccessible due to the steep channel and waterfalls.

Big Creek Nos. 1 and 2 Project

Recreational opportunities at the Big Creek Nos. 1 and 2 Project include developed recreational facilities around Huntington Lake and more informal recreational opportunities along Big Creek below Huntington Lake and Big Creek between Dam 4 and Dam 5.

Recreational Facilities

Figure 3-9 shows the location and table 3-22 summarizes the facilities of the developed public recreational areas at the Big Creek Nos. 1 and 2 Project. Developed public recreational facilities at Huntington Lake include two boat ramps, five day-use areas, seven campgrounds, and one overlook/parking area. In addition, there is an undeveloped area at the west end of the lake near Dam 3, which is used to access the lake for angling and other dispersed day-use recreational activities.

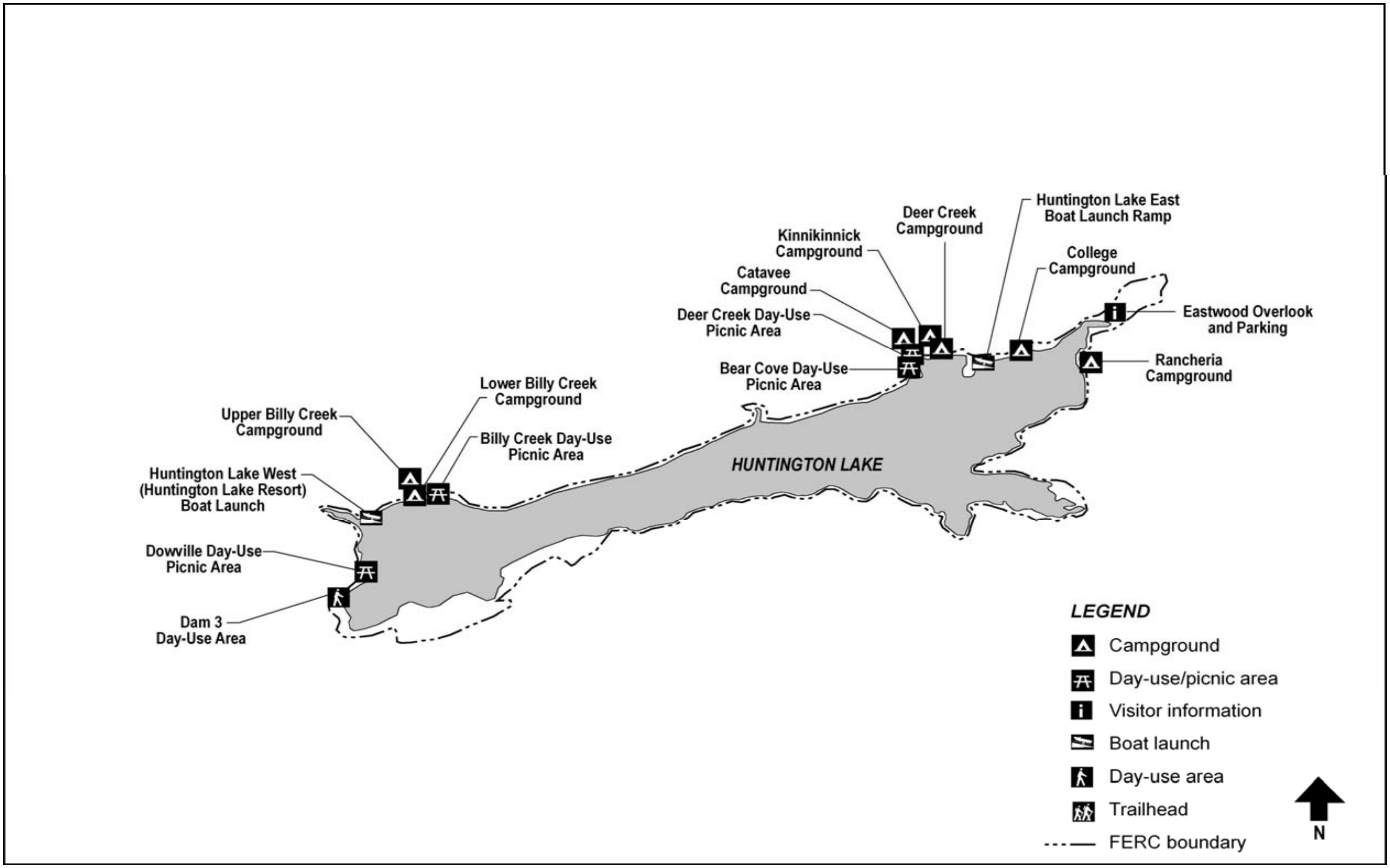

Figure 3-9. Location of the developed public recreational areas at the Big Creek Nos. 1 and 2 Project. (Source: SCE, 2007a, as modified by staff)

Table 3-22. Big Creek Nos. 1 and 2 Project developed public recreational facilities (Huntington Lake). (Source: SCE, 2002b; 2007a)

Site	Boat Ramps	Picnic Tables	Camp-sites	Trails	Rest-rooms	Bear Boxes	Trash Facilities	Signage	Parking
Boat Launch/Parking Huntington Lake East	1	-	-	-	2	-	X	X	X
Boat Ramp Huntington Lake West (Huntington Lake Resort)	1	-	-	-	-	-	-	-	X
Bear Cove day-use picnic area	-	30	-	-	1	-	X	X	X
Upper Billy Creek Campground	-	44	44	-	7	-	X	X	-
Lower Billy Creek Campground	-	13	13	-	1	-	X	X	-
Catavee Campground	-	24	24	-	1	-	X	X	X
College Campground	-	11	11	-	2	-	X	X	-
Deer Creek Campground	-	28	28	-	1	-	X	X	-
Kinnikinnick Campground	-	27	27	-	1	-	X	X	X
Rancheria Campground	-	161	161	-	18	-	X	X	X
Billy Creek day-use picnic area	-	7	-		-	-	-	X	X
Deer Creek day-use picnic area	-	5	-		1	-	X	X	X
Dowville day-use picnic area	-	5	-	-	1	-	X	X	X

The Huntington Lake West Boat Launch is located along the northern shoreline of the western end of the lake at the Huntington Lake Resort. The boat ramp extends to elevation 6,945 feet; however, the slope and surface of the reservoir bed beyond the paved ramp allow boaters to access the water to elevation 6,928 feet. Between 1983 and 2000, boaters accessed the lake from the boat launch during the entire recreational season in above normal and dry water years. During wet and critically dry water years, the lake was accessible from the ramp 90 and 99 percent of the recreational season, respectively.

The Huntington Lake East Boat Launch, located along the northern shoreline at the eastern end of the lake, extends to elevation 6,936 feet. The reservoir bed is too uneven and flat to extend the use of the boat ramp beyond the designed use. Between 1983 and 2000, boaters accessed the lake from the ramp during the entire recreational season of above normal and critically dry water years, and 93 percent of this time period during wet water years.

Under the existing license SCE is required to make every reasonable effort to maintain the water surface of Huntington Lake as high as possible and with as little fluctuation as possible from May 1 to September 10. Historically, other than the refill of the reservoir in May and June, water levels have remained stable from July through early September (see figure 3-4, in section 3.3.1, *Aquatic Resources*). When the lake elevations drop 3 to 5 feet below full pool elevation (6,950 feet), water depths are too shallow for launching deep-keeled sailboats at the boat launches. Other watercrafts, such as personal watercrafts, small sailboats, or angling boats are not as constrained by the lower water elevations. In a summer 2002 visitor survey to evaluate the current uses and future demands at project-area recreational facilities, 92 percent of the respondents rated their satisfaction with boat ramp availability at Huntington Lake to be acceptable (26 percent moderately acceptable and 66 percent highly acceptable).

The day-use areas include: Bear Cove, Billy Creek, Deer Creek, Dam 3 and Dowville day-use areas. The facilities provide 47 picnic sites and fire rings, restrooms, and trash dumpsters. The campgrounds include: Upper Billy Creek, Lower Billy Creek, Catavee, College, Deer Creek, Kinnikinnick, and Rancheria campgrounds. In total, the campgrounds provide 308 campsites and include picnic tables, fire rings, bear boxes (food storage), restrooms, and trash disposal facilities. Rancheria Campground also has an amphitheatre.

There is one established trail, the Huntington Shore Trail, which is about 2 miles long and extends from the Billy Creek Picnic Area to the Bear Cove Picnic Area along the northern shoreline of Huntington Lake. In addition, there are numerous informal trails that extend from the boat ramps, picnic areas, and campgrounds.

There are two private marinas at Huntington Lake: Rancheria Marina at the eastern end of the lake and Huntington Lake Resort Marina at the western end of the lake. Both marinas provide boat rental and docks with mooring slips. There are five private Boy Scout Camps around Lake Huntington, including on the south shore: Camp Kern;

Camp Olijato; Camp Mirimichi and Camp Gold Arrow; and on the north shore is Camp Silver Fir.

A private developed downhill ski area (Sierra Summit) is located along Highway 168 at the eastern side of the lake. During the winter months, the East Boat Launch and the Eastwood Visitor Center parking areas located near the eastern end of Huntington Lake are plowed to establish two snow-parks that provide parking and staging areas for winter recreational activities.

Developed public recreational facilities located within the existing project boundary include the Dowville day-use picnic area. Developed public recreational facilities located partially within the project boundary include: Huntington Lake Boat Launch (at Huntington Lake Resort) (ramp is within, parking area is outside), Lower Billy Creek Campground, Billy Creek day-use picnic area, Bear Cove day-use picnic area, Deer Creek day-use picnic area, Deer Creek Campground, Huntington Lake East boat ramp (ramp is within, parking area is outside), College Campground, and Rancheria Campground. Developed public recreational facilities located outside of the existing project boundary include: Upper Billy Creek Campground, Catavee Campground, Kinnikinnick Campground, and Eastwood Overlook and Parking Area.

Dispersed recreation occurs along Big Creek below Huntington Lake and Big Creek between Dam 4 and Dam 5. There are no developed recreational facilities in these river corridor areas.

Recreational Use

Recreational use in the vicinity of Huntington Lake includes motor boating, pontoon boating, sailing, canoeing/kayaking, personal watercraft use, windsurfing, swimming and angling, camping, picnicking, hiking, horseback riding and winter recreational activities, including snowmobiling and cross-country and downhill skiing. The Huntington Lake area provides year-round recreational opportunities. The peak recreational season begins in mid to late May, with the opening of developed recreational facilities, and continues through September to October when the facilities typically close. Shoulder season recreational activities are similar to peak season activities but at a lower use level and with angling being the primary recreational use activity. The level of use for winter activities is typically dependent on vehicular access to the project area. In the winter, Highway 168 is the only plowed road that provides access to the project area.

Cal Fish & Game conducts fish stocking at Huntington Lake (trout and kokanee) to support angling opportunities (see section 3.3.1, *Aquatic Resources*).

About 85 percent of the recreational use in the Huntington Lake vicinity is associated with overnight visitation with the remaining 15 percent being day-use visitation. In 2006, the estimated annual overnight visitation was 35,882 recreation days and day-use visitation was 6,332 for a total estimated visitation of 42,214 recreation days. For the campgrounds within the Big Creek Nos. 1 and 2 Project, the average weekend campsite occupancy in 2006 ranged from a low of 28 percent at Rancheria Campground to a high of 77 percent at Deer Creek Campground. The average weekday campsite occupancy during 2006 at these campgrounds ranged from a low of 18 percent at Rancheria Campground to a high of 66 percent at Deer Creek Campground. Future recreational use within the Big Creek Nos. 1 and 2 Project is projected to increase by 5.8 percent between 2006 and 2040.

Big Creek below Huntington Lake is readily accessible and is a popular area for dispersed recreation. Big Creek below Dam 4 and Dam 5 lies in a steep and narrow canyon and is primarily accessible by a foot trail on the southern side of the canyon. Dispersed recreational activities in these areas include hiking, walking, fishing, swimming/wading, viewing wildlife/scenery, and general relaxing.

Mammoth Pool Project

Opportunities at the Mammoth Pool Project include developed recreational facilities around Mammoth Pool reservoir and more informal recreational opportunities along the San Joaquin River between Mammoth Pool dam and Dam 6 forebay.

Recreational Facilities

Figure 3-10 denotes the location and table 3-23 summarizes facilities associated with the developed public recreational areas located at the Mammoth Pool Project. Mammoth Pool reservoir is located in a remote setting and is accessed through Mammoth Pool Road, off Minarets Road. The reservoir is closed to public vehicular access from May 1 to June 15 to avoid interference with the annual deer migration. Developed public recreational facilities at the Mammoth Pool Project include two boat launches, one picnic area, one trailhead/trail, and two campgrounds.

Mammoth Boat Launch is located along the southwestern corner of the reservoir and extends to elevation 3,262 feet. The boat ramp does not function well beyond the end of the paved section due to large rock hazards at the end of the paved ramp and a steep reservoir bed. However, when this boat ramp is not available, visitors can access the reservoir at the Windy Point boat ramp, which has no lower limit in terms of access. Between 1983 and 2000, the boaters accessed the water from Mammoth Boat Launch during 99 percent of the summer season during wet water years, 90 percent during above normal water years, 93 percent during dry water years, and 66 percent during critically dry water years.

Windy Point Boat Launch is an undeveloped ramp that was originally designed as an access road during reservoir construction and is now used as a boat launch when reservoir levels are low. While there is no lower limit to the use of this ramp, the launch is not suitable for most ski boats and larger fishing boats. Between 1983 and 2002, the water was accessible from Windy Point Boat Ramp during the entire summer recreational season. Windy Point Picnic Area has dispersed picnic sites with no picnic tables or restroom facilities.

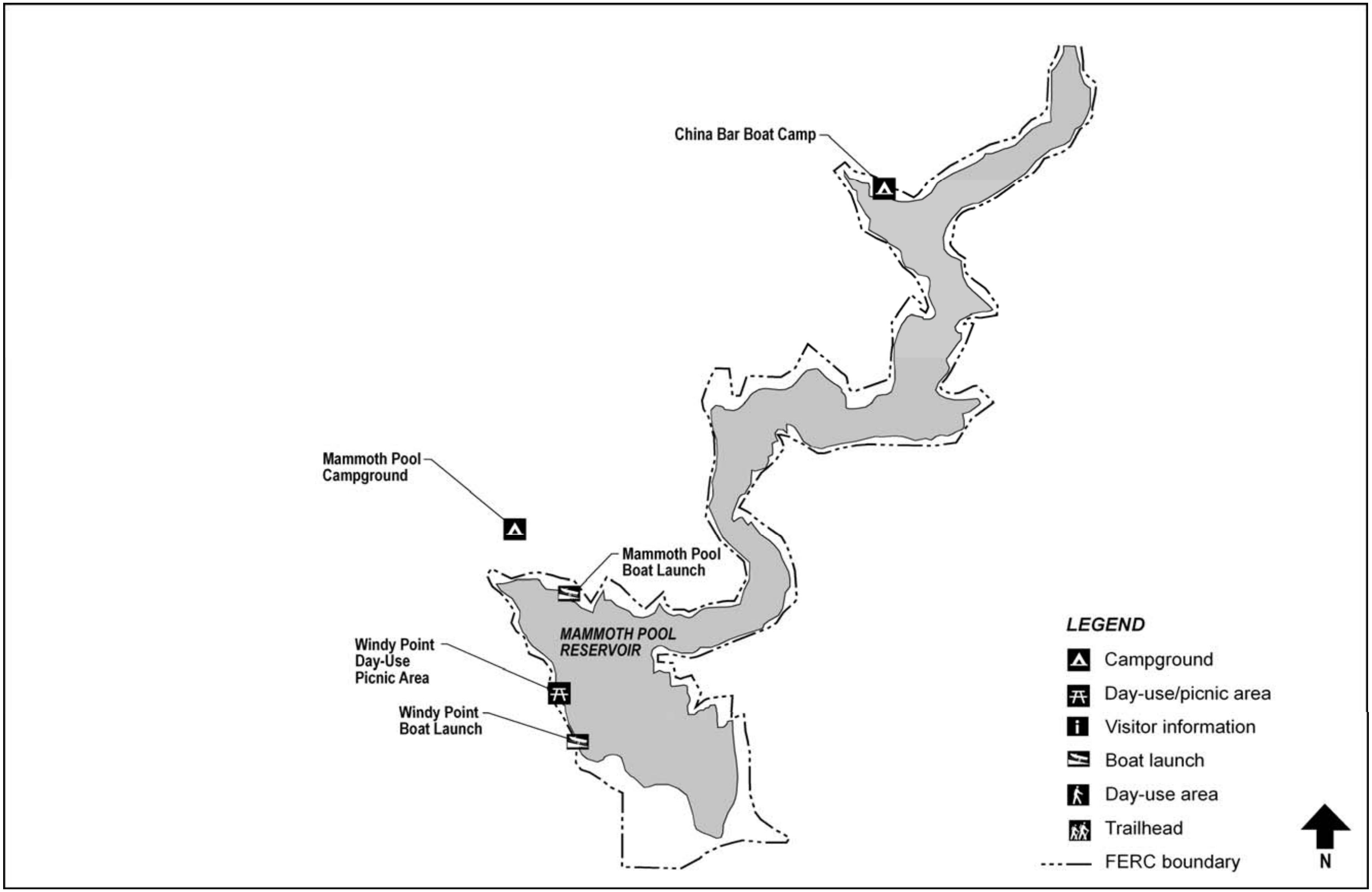

Figure 3-10. Location of the developed public recreational areas at the Mammoth Pool Project. (Source: SCE, 2007a, as modified by staff)

Table 3-23. Mammoth Pool Project developed public recreational facilities. (Source: SCE, 2002b and 2007a)

Site	Boat Ramps	Picnic Tables	Campsites	Trails	Restrooms	Bear Boxes	Trash Facilities	Signage	Parking
Windy Point Picnic Area	-	-	-	-	1	-	-	-	-
Mammoth Boat Launch	1	-	-	-	1	-	X	X	X
Windy Point Boat Launch	1	-	-	-	-	-	-	-	-
China Bar Boat Camp	-	-	6	-	2	-	X	X	-
Mammoth Pool Campground	-	-	47	-	8	-	X	X	-

For Mammoth Pool reservoir, historical average elevations range from about elevation 3,257 feet to 3,321 feet during the recreational season (see figure 3-5). The existing license requires SCE make every effort to maintain the water surface elevation at the maximum level, with a minimum amount of fluctuation from June 1 to September 1. According to historical records, the average decrease in water levels during the last half of the summer is between 1 and 1.5 feet per day. In a summer 2002 visitor survey to evaluate the current uses and future demands at project area recreational facilities, 92 percent of the respondents rated their satisfaction with boat ramp availability at Mammoth Pool reservoir to be acceptable (34 percent moderately acceptable and 58 percent highly acceptable).

Mammoth Pool Campground is located outside of the project boundary near Mammoth Pool Boat Launch and includes 47 campsites with tables, fire-rings, and restroom facilities. Logan Meadow Trailhead is located near the Mammoth Pool Campground and provides access to French Trail which runs to the northwest of the reservoir. China Bar Boat Camp is located about 2 miles upstream from the project dam along the northern shoreline and is a boat-in only campground. China Bar Boat Campground has six campsites, picnic tables, and restroom facilities.

Mammoth Boat Launch, Windy Point day-use picnic area, Windy Point Boat Launch, and China Bar Boat Camp are located within the existing project boundary. The parking area for Mammoth Boat Launch and Mammoth Pool Campground are located outside of the project boundary. The San Joaquin River Trail is a 75-mile long trail that runs through the vicinity of the Mammoth Pool Project and shares alignment with the Mammoth Pool Powerhouse-Big Creek No. 3 Transmission Line Road (FS Roads Nos. 9S42 and 8S44Y) within the Project.

Recreational Use

The primary recreational season is from June 16 to Labor Day when the vehicular access road is open. The recreational activities in the primary recreational season include: boating (waterskiing, jet-skiing, etc.), boat angling, camping, picnicking, and swimming. Following Labor Day weekend, recreational use decreases substantially and consists primarily of angling with some limited boating use. The Mammoth Pool Project area is not typically used for winter recreational activities because the primary access road, Minarets Road, is not plowed during the winter.

About 87 percent of the recreational use in the vicinity of Mammoth Pool Project is associated with overnight visitation with the remaining 13 percent being day-use visitation. In 2004, estimated annual overnight visitation was 3,009 recreation days and day-use visitation was 446 recreation days for a total estimated visitation of 3,455 recreation days. At Mammoth Pool Campground, the average weekend campsite occupancy in 2004 was 27 percent and the average weekday campsite occupancy was 17 percent. Future recreational use within Mammoth Pool Project area is projected to increase by 20 percent between 2004 and 2040.

Cal Fish & Game conducts fish stocking at the Mammoth Pool Reservoir (trout and kokanee) to support angling opportunities (see 3.3.1, *Aquatic Resources*).

Angling and whitewater boating use occurs along the 8.5-mile reach of the San Joaquin River between Mammoth Pool dam and Dam 6 forebay. Angling use is limited because of the steep topography of the river canyon in this reach. Whitewater boating along this reach, known as the "Tied-For-First" whitewater boating run, is classified as Class IV+ to V difficulty (advanced to expert skill level). Current whitewater boating use is low and there are no commercial whitewater boating operators on this reach.

In 2003, SCE conducted a single flow study of the "Tied-For-First" run at a flow of 862 cfs. The study team of whitewater boaters estimated the minimum acceptable flow for the run to be between 700 and 800 cfs; the optimal flow to be between 1,000 to 1,200 cfs; and the maximum acceptable flow to be between 1,400 and 2,000 cfs. The study team determined that the boatable flow range for this reach is between 700 and 2,000 cfs.

SCE conducted an evaluation of historical boating opportunities from 1983 to 2002 under the existing hydrology, which indicated that on the Tied-for-First run boating opportunity days within the boatable flow range occurred in wet and above normal water year types. During wet water years, boating opportunity days occurred between May through August, ranging from 1.9 to 3.9 boating opportunity days (average) per month, during January through April from 1.9 to 5.6 (average) per month. During September through December typical flows did not support boating. In above normal water years, boating opportunity days occurred in May and June, ranging from 4.7 to 8.7 boating opportunity days (average) per month, with typically no boating opportunity days during the remaining months.

Big Creek No. 3 Project

There are no developed overnight or day-use recreational facilities associated with the Big Creek No. 3 Project other than the angler access stairways and parking area near the Mammoth Pool Powerhouse. Recreational opportunities include angling and hiking along the Dam 6 forebay area and whitewater boating in the bypassed reach. This stretch of river has a steep incised river channel which severely limits stream access throughout the bypassed reach.

Angling use occurs along the Dam 6 forebay. An angler access stairway located near the Mammoth Pool Powerhouse provides access to the north shore at the upstream end of the forebay. A parking area is located near the stairs for use by anglers and hikers. Anglers and hikers can access the south side of the forebay on foot by crossing the bridge over the San Joaquin River, which ties into Canyon Road.

Whitewater boating opportunities occur along a stretch of about 8.3 miles of the San Joaquin River from the bottom of Dam 6 to the Italian Bar Bridge crossing at the head of Redinger reservoir. This reach is identified as the "Chawanakee Gorge Run" and is considered class V to V+ level of difficulty (expert only). In 2003, SCE conducted a single flow study of his reach at a flow of 662 cfs. The study team estimated the minimum acceptable flow for the run to be between 350 and 550 cfs; the optimal flow to be 600 cfs; and the maximum acceptable flow to be between 700 and 1,000 cfs for whitewater boating opportunities. The study team estimated that the boatable flow range is between 350 and 1,000 cfs.

SCE conducted an evaluation of historical boating opportunities from 1983 to 2002 under the existing hydrology, which indicated that for the "Chawanakee Gorge Run" boating opportunity days within the boatable flow range normally occurred in wet and above normal water years, and occasionally in a dry water year. During wet water years, boating opportunity days occurred between May through August, ranging from 1.3 to 4.0 boating opportunity days (average) per month, during January through April from 0.5 to 14.3 boating opportunity days (average) per month, and from 0 to 0.8 boating opportunity days (average) per month during the remaining months. In above normal years, boating opportunity days occurred in May and June, ranging from 3.3 to 7.0 boating opportunity days (average) per month, with typically no days in the other months.

3.3.2.2 Environmental Effects

Recreation Management Plan

As part of the Settlement Agreement, SCE proposes to implement the Recreation Management Plan for the Big Creek ALP Projects, included as appendix O in the Settlement Agreement. The Recreation Management Plan was developed in consultation with stakeholders and agencies as part of the ALP.

Forest Service final 4(e) condition 18 (Project No. 67) and condition 17 (Projects No. 120, 2175 and 2085) specify that SCE implement the Recreation Management Plan included as appendix O in the Settlement Agreement. Interior, as 10(a) recommendation 4 (Projects Nos. 67, 120, 2175 and 2085), recommends the same. Interior supports the Recreation Management Plan and states that the plan has been designed to minimize potential adverse effects of project-related recreation and its management on fish and wildlife resources.

The Recreation Management Plan provides measures for: annual coordination meetings; periodic review and reporting; recreational facility annual operational maintenance responsibilities, major rehabilitation, and capital improvements; interpretive displays; reservoir water surface elevations; reservoir water surface elevation information; stream flow information dissemination; whitewater boating flow releases; fish stocking; San Joaquin River Trail maintenance; and winter snow plowing. The following sections describe the proposed components of the Recreation Management Plan and our assessment of the potential effects of the plan on the Big Creek ALP Projects' recreational resources.

Annual Coordination Meeting

SCE proposes to meet with the Forest Service each year during the term of the new license to discuss measures needed to ensure protection and use of the recreational facilities at the Big Creek ALP Projects (sites listed in table 3-24). These annual meetings would allow SCE and the Forest Service to review the long-term planning and implementation schedule for the rehabilitation measures at existing recreational facilities and new capital improvements proposed by SCE, identify any revisions, and make adjustments to the plan or schedule if needed. SCE would coordinate with the Forest Service regarding proposed work at recreational facilities during the upcoming year, including permitting requirements and key resources that would need to be protected from potential adverse effects associated with the implementation of scheduled recreational projects. Any substantive revisions to the Recreation Management Plan would be distributed to signatories of the Settlement Agreement for review and comment prior to submittal to the Commission for review and approval. Within 60 days following the consultation meeting, SCE would file with the Commission a summary of the meeting and any agreements or revisions to the Recreation Management Plan that were reached by SCE and the Forest Service.

Our Analysis

Given the location of the Big Creek ALP Projects within the Sierra National Forest, many of the recreational facilities are Forest Service facilities and are affiliated with Forest Service lands. The Recreation Management Plan includes measures associated with recreational facilities which are located within the Sierra National Forest and within, outside, or partially within and outside of the existing project boundaries of the Big Creek ALP Projects. The proposed annual coordination meeting and associated coordination measures between the Forest Service and SCE would provide the means to manage the recreational resources in a coordinated and comprehensive manner over the term of new license. These annual meetings would also provide the means for interim review and assessment of the status of the implementation of measures incorporated in the Recreation Management Plan; thereby providing the means to ensure that these proposed measures are appropriately implemented. We expect that by reviewing specific proposed projects for the upcoming year, including permitting requirements and resources to be protected, best management practices would be effectively incorporated into specific plans, as appropriate. In addition, the proposed provisions for substantive revisions to the Recreation Management Plan would ensure that stakeholders would have the opportunity to provide input and provide the means for Commission review and approval of any substantive revisions to the Plan. The Recreation Management Plan and annual coordination meeting would, therefore, ensure that project-related recreational opportunities are maintained over the term of any new license that may be issued for the Big Creek ALP Projects.

Table 3-24. Summary of recreation management and rehabilitation for the Big Creek ALP Projects. (Source: SCE, 2007a and 2007e; Forest Service, 2008a, b, and c; as modified by staff)

Vicinity	Existing Recreation Facility	Within or Outside the Existing Project Boundary	Ownership and Annual Operation and Maintenance Responsibility	Year Rehabilitation Activity Would Begin Post-Settlement Agreement
Big Creek Nos. 2A, 8, and Eastwood Project				
Florence Lake Area	Boat Ramp – Florence Lake	Ramp – Within Parking – Partially	Forest Service	10
	Jackass Meadow Campground	Within	Forest Service	8
	Florence Lake day-use picnic area	Within	Forest Service	10
Mono Creek Forebay	Mono Creek Campground	Partially	Forest Service	17
	Mono Creek day-use picnic area	Partially	Forest Service	17
Shaver Lake Area	Camp Edison Campground	Within	SCE	[a]
	Camp Edison boat ramp/Launch	Within	SCE	[a]
	Dorabelle Campground	Outside	Forest Service	3
	Dorabelle day-use picnic area	Partially	Forest Service	3
	Day-use picnic areas on North Shore Roads 1 and 2	No. 1 - Partially No. 2 - Within	SCE	[a]

Vicinity	Existing Recreation Facility	Within or Outside the Existing Project Boundary	Ownership and Annual Operation and Maintenance Responsibility	Year Rehabilitation Activity Would Begin Post-Settlement Agreement
	Day-use picnic area off of Hwy 168 (The Point)	Within	SCE	[a]
	Eagle Point boat-in day-use picnic area	Within	SCE	[a]
Balsam Meadows Forebay	Balsam Meadows forebay day-use picnic area	Within	SCE	[a]
	Balsam Meadows Trailhead and Parking	Within	SCE	[a]
Big Creek Nos. 1 and 2 Project				
	Boat Ramp/Parking Huntington Lake East	Ramp - Within Parking - Partially	Forest Service	21
	Boat Ramp Huntington Lake West	Partially	Forest Service	5
	Bear Cove day-use picnic area	Partially	Forest Service	4
	Upper Billy Creek Campground	Outside	Forest Service	4
	Lower Billy Creek Campground	Partially	Forest Service	4
	Catavee Campground	Outside	Forest Service	22
	College Campground	Partially	Forest Service	2

Vicinity	Existing Recreation Facility	Within or Outside the Existing Project Boundary	Ownership and Annual Operation and Maintenance Responsibility	Year Rehabilitation Activity Would Begin Post-Settlement Agreement
	Deer Creek Campground	Partially	Forest Service	23
	Kinnikinnick Campground	Outside	Forest Service	23
	Rancheria Campground	Partially	Forest Service	1
	Billy Creek day-use picnic area	Partially	Forest Service	4
	Deer Creek day-use picnic area	Partially	Forest Service	23
	Dowville day-use picnic area	Within	Forest Service	3
	Eastwood Overlook and parking	Within	SCE	6
Mammoth Pool Project				
	Mammoth Pool Boat Launch	Partially	Forest Service	12
	China Bar Boat Camp	Within	Forest Service	16
	Mammoth Pool Campground	Outside	Forest Service	11
	Windy Point day-use picnic area	Within	Forest Service	14

Vicinity	Existing Recreation Facility	Within or Outside the Existing Project Boundary	Ownership and Annual Operation and Maintenance Responsibility	Year Rehabilitation Activity Would Begin Post-Settlement Agreement
	Windy Point Boat Launch	Within	Forest Service	14
Big Creek No. 3 Project				
	Angler Access Stairway at Mammoth Pool Powerhouse	Within	Forest Service	11
	Parking Area near Mammoth Pool Powerhouse Gate	Within	Forest Service	11

[a] These facilities are maintained by SCE and the rehabilitation of these facilities is conducted on an ongoing basis during the term of the license as part of the routine maintenance and repair activities.

Periodic Review and Reporting

SCE proposes to at least once every 6 years complete a recreational use and facilities condition survey of the recreational facilities at the Big Creek ALP Projects (sites listed in table 3-24). The survey would be designed to determine trends of use, the number of days parking capacity is met or exceeded, and whether resource damage is occurring. SCE would use Forest Service data when available. When the data indicate a need for increased campground facilities, SCE and the Forest Service would address the need through this periodic plan review process.

SCE proposes to prepare a Recreation Report every 6 years after license issuance, and file this report along with the Form 80 Licensed Hydropower Development Recreation Report that is required by the Commission. The Recreation Report would include the following information: the recreational use and facilities condition survey information, graphs and exceedance tables summarizing water surface elevations between May 1 and September 10 at Huntington Lake, dates when Kaiser Pass Road was opened to provide public vehicular traffic access into the backcountry for non-winter recreational use, annual number of whitewater boating opportunity days provided by SCE through pre-spill release flows below Mammoth Pool reservoir (Tied-for- First Reach) and channel and riparian maintenance flow releases below Florence Lake (Florence Run), and the number of days that Kaiser Pass Road was open concurrent with the channel and riparian maintenance flow releases. Boating opportunity days were defined as: for Florence Run – days when flow in this reach is between 350 to 2,000 cfs for kayaks and between 400 and 1,200 cfs for rafts; for the Tied-For-First Run – days when the flow is between 700 and 2,000 cfs.

Our Analysis

The condition of recreational facilities and recreational demand at the Big Creek ALP Projects may change over the term of a new license. Measures to monitor the recreational use and condition of the facilities at the projects would provide the means to periodically assess whether recreational opportunities are being adequately provided. The proposed recreational use and facilities condition report survey would provide information related to recreational use trends and conditions of the recreational facilities within the Big Creek ALP Projects. The inclusion of visitor use trends and capacity information, including both parking and campsite capacity at the project facilities, would help assess changes in recreational use and capacity at these facilities. The proposed Recreation Report would provide the means to summarize and assess the survey information and monitor other recreational management provisions, such as the whitewater boating releases and water surface elevation management (during May 1 and September 10 at Huntington Lake), and provision of public vehicular access (at Kaiser Pass Road) to the Big Creek ALP Projects. Conducting the surveys and Recreation Report every 6 years in coordination with the filing of the FERC Form 80 Report would help provide a systematic means of monitoring the recreational use, trends, and facility conditions over the term of new license at the Big Creek ALP Projects.

Recreational Facility Annual Operational Maintenance

SCE proposes to continue to operate and maintain its existing facilities at the Big Creek Nos. 2A, 8, and Eastwood Project, including: Camp Edison Campground, Camp Edison Boat Launch, day-use areas on North Shore Roads 1 and 2, day-use area off Highway 168 (The Point), Eagle Point boat-in day-use area, Balsam Meadows forebay day-use area, the Balsam Meadows trailhead and parking area, the Eastwood Overlook; and the angler access stairway at Big Creek No. 3. The Forest Service would be responsible for the maintenance of the remaining recreational facilities that it currently operates in the vicinity of the Big Creek ALP Projects.

Our Analysis

The Recreation Facility Annual Operational Maintenance provisions incorporated into the Recreation Management Plan provide the means to define the entities (SCE or Forest Service) who would be responsible for the annual operation and maintenance measures at the recreational facilities within and adjacent to the Big Creek ALP Projects. These provisions for the continued operation and maintenance of these facilities would help to ensure that these facilities and associated recreational opportunities are provided at the projects. The licensee is ultimately responsible for all recreational project-related facilities in the project boundary, including those operated by the Forest Service.

Recreational Facility Major Rehabilitation

SCE proposes to be responsible for the full cost for major rehabilitation of existing developed recreational facilities at the Big Creek ALP Projects listed in table 3-24. SCE proposes to do this by providing necessary personnel, equipment, materials, and management and to be responsible for replacing/rehabilitating recreational features currently existing at the developed recreational facilities.

The specific rehabilitation measures to be completed at each facility would be determined in consultation with the Forest Service during the planning process. SCE proposes to conduct rehabilitation measures on recreational facilities that are located within, outside, or partially within the existing project boundaries of the Big Creek ALP Projects (see table 3-24). SCE (2007d) provides a summary of the anticipated rehabilitation measures at each site, which we summarize below.

Facilities within the Existing Project Boundary

Big Creek Nos. 2A, 8, and Eastwood Project

- Jackass Meadow Campground: rehabilitate 50 campsites, install two single standing toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.
- Florence Lake day-use picnic area: rehabilitate 16 picnic sites; install one single standing toilet; regrade and resurface parking area; reconstruct trash disposal facilities; and replace informational and directional signage.
- Camp Edison Campground: rehabilitate 250 campsites; install 13 single standing vault toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.
- Camp Edison Boat Launch: resurface boat ramp; replace docks; regrade and resurface parking area; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.
- Day-use area No. 2 on North Shore: rehabilitate 40 picnic sites; install 3 single standing toilets; regrade and resurface parking area; reconstruct trash disposal facilities; and replace informational and directional signage.
- Day-use area off Hwy 168 (The Point): regrade the parking area; install one single standing toilet; reconstruct trash disposal facilities; and replace informational and directional signage.

- Eagle Point boat-in day-use area: rehabilitate 7 picnic sites; reconstruct 2 trash disposal facilities; and replace informational and directional signage.
- Balsam Meadows forebay day-use picnic area and trailhead: install one single standing toilet; regrade and resurface parking area; and replace informational and directional signage.

Big Creek Nos. 1 and 2 Project

- Dowville day-use picnic area: rehabilitate 5 picnic sites; install one single standing vault toilet; regrade and resurface parking area; reconstruct trash disposal facilities; and replace informational and directional signage.
- Eastwood Overlook and Parking[45]: replace the interpretive displays at Eastwood Powerhouse Overlook; regrade and resurface the parking and access pathways; and replace informational and directional signage.

Mammoth Pool Project

- China Bar Boat Camp: rehabilitate 6 campsites; install 2 single standing vault toilets; and replace informational and directional signage.
- Windy Point day-use picnic area: install one single vault toilet.
- Windy Point Boat Launch: resurface the boat launch ramp.

Big Creek No. 3 Project

- Angler Access Stairway at Mammoth Pool Powerhouse: replace the stairway providing water-edge access.
- Parking Area near Mammoth Pool Powerhouse Gate: regrade and resurface parking area.

Facilities Partially within the Existing Project Boundary

Big Creek Nos. 2A, 8, and Eastwood Project

- Florence Lake Boat Launch: resurface boat ramp; replace docks; install one single standing toilet; regrade and resurface parking area; replace vehicle control structures (i.e., gates); reconstruct trash disposal facilities; replace informational and directional signage; and construct an accessible boat loading platform.

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[45] This facility would be removed from the Big Creek Nos. 2A, 8, and Eastwood Project and included within the Big Creek Nos. 1 and 2 Projects.

- Mono Creek Campground: rehabilitate 14 campsites; install 2 single standing vault toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.
- Mono Creek day-use picnic area: rehabilitate 6 picnic sites; install one single standing toilet; regrade and resurface parking area; reconstruct trash disposal facilities; and replace informational and directional signage.
- Day-use area No. 1 on North Shore Road: rehabilitate 40 picnic sites; install 3 single standing toilets; regrade and resurface parking area; reconstruct trash disposal facilities; and replace informational and directional signage.
- Dorabelle day-use picnic area: rehabilitate 22 picnic sites; install 2 single standing toilets; regrade and resurface parking area; reconstruct trash disposal facilities; and replace informational and directional signage.

Big Creek Nos. 1 and 2 Project

- Huntington Lake East Boat Ramp: resurface the boat launch ramp; replace docks; install 3 single standing vault toilets; regrade and resurface parking area; replace informational and directional signage; replace vehicle control and barrier structures; reconstruct trash disposal facilities; refurbish the internal trail system and upgrade to current accessibility standards; and construct an accessible boat-loading platform.
- Huntington Lake West Boat Ramp: resurface the boat launch ramp; replace docks; regrade and resurface parking area; replace informational and directional signage; replace vehicle control and barrier structures; reconstruct trash disposal facilities; refurbish the internal trail system and upgrade to current accessibility standards; and construct an accessible boat-loading platform.
- Bear Cove day-use picnic area: rehabilitate 30 picnic sites; install one single standing vault toilet; regrade and resurface parking area; replace vehicle control structures; reconstruct trash disposal facilities; replace informational and directional signage; and rehabilitate internal trail system.
- Lower Billy Creek Campground: rehabilitate 13 campsites; install one single standing vault toilet; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.
- College Campground: rehabilitate 11 campsites; install 2 single standing vault toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal

facilities; replace informational and directional signage; and rehabilitate internal trail system.

- Deer Creek Campground: rehabilitate 28 campsites; install one single standing vault toilet; resurface the interior road system, all campsite parking spurs, and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; replace informational and directional signage; and rehabilitate internal trail system.
- Rancheria Campground: rehabilitate 161 campsites; install 18 single standing vault toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; replace informational and directional signage; and refurbish the amphitheater and rehabilitate the adjacent trail.
- Billy Creek day-use picnic area: rehabilitate 7 picnic sites; regrade and resurface parking area; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.
- Deer Creek day-use picnic area: rehabilitate 5 picnic sites; install one single standing vault toilet; regrade and resurface parking area; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.

Mammoth Pool Project

- Mammoth Pool Boat Launch: resurface boat ramp; replace docks; install one single standing toilet; regrade and resurface parking area; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.

Facilities Located Outside of the Existing Project Boundary

Big Creek Nos. 2A, 8, and Eastwood Project

- Dorabelle Campground: rehabilitate 70 campsites; install 16 single standing vault toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.

Big Creek Nos. 1 and 2 Project

- Upper Billy Creek Campground: rehabilitate 44 campsites; install 7 single standing vault toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.

- Catavee Campground: rehabilitate 24 campsites; install one single standing vault toilet; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; replace informational and directional signage; and rehabilitate internal trail system.
- Kinnikinnick Campground: rehabilitate 27 campsites; install one single standing vault toilet; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.

Mammoth Pool Project

- Mammoth Pool Campground: rehabilitate 47 campsites; install 8 single standing vault toilets; resurface the interior road system, all campsite parking spurs and parking areas; replace vehicle control structures; reconstruct trash disposal facilities; and replace informational and directional signage.

In all rehabilitation measures, an emphasis would be placed on minimizing ground-disturbing activities, or other measures that might affect cultural or biological resources. If facilities need to be removed to prevent ongoing or possible future resource damage, the area would be restored to a natural appearance, including re-vegetation, using species native to the area. The following list describes general rehabilitation guidelines that would be used in implementing the above specific measures:

- Relocate and reconstruct campsites, picnic sites, parking spurs, and restroom structures, if located in environmentally or culturally sensitive areas.
- Rehabilitate and stabilize erosive areas and inoperative water drainage facilities (culverts). At locations where ongoing resource damage occurs, the ground surface would be re-graded and re-vegetated with native materials to stabilize the area and prevent further resource damage. This may include the removal and replacement of drainage culverts that are deemed ineffective.
- Clear overgrown vegetation, if necessary. Thinning of trees and removal of overgrown brush may be conducted to improve accessibility and safety at campgrounds and day-use areas.
- Develop universally accessible facilities. The number of assets at each developed recreational facility that would need to be upgraded would be determined and reviewed with the Forest Service. Universally accessible facilities would be located where the topography is relatively flat and near other developed facilities, such as restrooms.

The proposed schedule for the rehabilitation of recreational facilities (provided in the Recreation Plan) spans a 25-year time period. Table 3-24 provides a summary of the year the proposed rehabilitation would begin at each facility. SCE proposes that it could revise the rehabilitation schedule after consultation with the Forest Service and submittal to and approval by the Commission. The rehabilitation schedule identifies for each of the recreational facilities a 5-year time frame in which SCE would complete the planning, design, contracting, and rehabilitation construction activities. This 5-year planning and implementation timeframe would include (1) preparation of a Design Narrative and Conceptual Plan; (2) completion of any necessary additional NEPA environmental review; (3) preparation of a Site Development Plan and Construction Plan; (4) contracting, reconstruction; and (5) acceptance of completion. Any required additional NEPA environmental review would be initiated by the Forest Service following its approval of the Design Narrative and Conceptual Plan.

In addition to these proposed rehabilitation measures, SCE proposes to remove the Florence Lake day-use area from the existing project boundary. SCE also proposes to remove the Eastwood Overflow Camping Area and the Eastwood Overlook from the existing project boundary of the Big Creek Nos. 2A, 8, and Eastwood Project and to include these two facilities within the Big Creek Nos. 1 and 2 Project. We discuss SCE's proposal for project boundary modifications in more detail in section 3.3.6, *Land Use and Aesthetic Resources*.

Our Analysis

SCE's proposed major facility rehabilitation measures, as provided for in the Recreation Management Plan, would provide the means for future rehabilitation and replacement (as needed) of existing recreational facilities within and adjacent to the Big Creek ALP Projects. The facility rehabilitation measures would help ensure that these access sites would continue to provide adequate facilities to meet recreational demand at the projects. Some of the proposed rehabilitation measures would include providing or enhancing recreational facilities to meet accessibility guidelines and would, therefore, increase the number and type of facilities that provide access for disabled individuals to the projects. Improving access for the disabled at the Big Creek ALP Projects would be consistent with the Commission's policy on recreational facilities[46] at licensed projects under which licensees are expected to consider the needs of the disabled in the design and construction of such facilities.

Facilities Located Within the Existing Project Boundary

The facilities owned and operated by SCE (with the exception of a portion of the day-use area on North Shore Road 1 at Big Creek Nos. 2A, 8, and Eastwood Project) are located within the existing project boundaries. SCE proposes to maintain its facilities

[46] See 18 CFR §2.7.

over the term of a new license as part of the ongoing measures associated with maintenance and repair activities at the Big Creek ALP Projects and, therefore, does not provide specific timeframes for major facility rehabilitation. SCE facilities and the facilities operated by the Forest Service located within the existing project boundary would be reviewed as part of the periodic review and reporting measures in the Recreation Plan. SCE's proposed rehabilitation measures and ongoing monitoring efforts would enhance these recreational facilities and ensure that these facilities are maintained over the term of a new license. If, during the term of a new license, the Forest Service would no longer operate facilities located within the project boundary, the licensee would ultimately be responsible for the provision of these project-related recreational facilities to maintain public recreational use and access to the project resources. Therefore, these measures, in addition to the provision that they are located within the project boundaries, would ensure that they are adequately maintained for public use and access over the term of any new license.

SCE's proposal to remove the Florence Lake day-use area from the project boundary would remove an existing facility that provides public use and access to the project. SCE proposes to remove this facility because it is used for public recreation and not for project operations. SCE has not demonstrated that these facilities and lands are no longer required for project purposes and that there is no nexus of these lands and facilities to the project and public recreational access to project resources.

The Florence Lake day-use area provides recreational day-use facilities associated with the project and is located adjacent to the Florence Lake boat ramp, which provides public access to project waters. Maintaining the Florence Lake day-use area within the project boundary would provide the Commission authority to ensure long-term public use and access at these facilities.

Facilities Located Partially Outside the Existing Project Boundary

For those facilities that are located partially outside of the project boundary, the long-term management of these facilities would not be clear over the term of a new license. These facilities are currently associated with the project and provide public access to project lands and waters. The proposed provisions in the Recreation Management Plan for future rehabilitation, and ongoing maintenance and operation measures associated with recreational facilities provides some means for long-term management of these facilities. However, for those portions of facilities that are located outside of the project, the Commission would have no authority under the license to ensure that these facilities are maintained or that the public could access project lands and waters over the term of new licenses unless these portions of the facilities are also included within the project boundary of the individual project.

The Commission can require the licensee to include recreational facilities within the project boundary in order to ensure public access to project facilities and waters (18 CFR § 2.7 (a)). Therefore, revisions to the existing project boundaries of the individual

Big Creek ALP Projects to include those facilities located partially outside the project boundary would provide the Commission authority to ensure long-term public use and access at these facilities. In that event, SCE would be required to provide the Commission a revised Exhibit G that includes the incorporation of these entire facilities within the revised project boundary.

Facilities Located Outside of the Existing Project Boundary

For the five Forest Service campgrounds located outside of the existing project boundaries of the Big Creek ALP Projects—Dorabelle, Upper Billy Creek, Catavee, Kinnikinnick, and Mammoth Pool—SCE's proposed rehabilitation measures under the Settlement Agreement would occur at one time for each facility.

At Shaver Lake, where the Dorabelle Campground is located, SCE currently meets camping needs and provides public access to project lands and waters by the use of its Camp Edison Campground, which also has a day-use area and boat launch. SCE also provides public access to Shaver Lake at four additional day-use areas along the shoreline and proposes to provide support of a fifth day-use area along the Shaver Lake shoreline.

At Huntington Lake, where Upper Billy Creek, Catavee, and Kinnikinnick Campgrounds are, SCE operates and maintains its Eastwood Overlook and Parking Area and proposes to provide support to the Forest Service for operation, maintenance, and rehabilitation of boat launches on the east and west sides of the lake, four day-use areas, and four campgrounds

At Mammoth Pool reservoir, the location of Mammoth Pool Campground, SCE proposes to provide public access to project lands and waters by supporting the Forest Service operation, maintenance, and rehabilitation of two boat launches, a day-use area overlooking the reservoir, and a small campground on the reservoir accessible only by boat. In addition to these facilities, existing camping needs are met by Sweetwater Campground, about 2 miles from the reservoir, and Placer Campground, about 3 miles from the reservoir. Two additional campgrounds, Rock Creek and Fish Creek, are located along Minarets Road, the primary access road to the reservoir.

Recreational Facility Capital Improvements

SCE proposes to develop four new recreational facility capital improvements: two at the Big Creek Nos. 2A, 8, and Eastwood Project and two at the Big Creek Nos. 1 and 2 Project. These proposed facility improvements are summarized below:

Big Creek Nos. 2A, 8 and Eastwood Project

- Develop an accessible fishing platform on the South Fork San Joaquin River near Jackass Meadows Campground. SCE proposes to consult with the Forest Service to select a location for the construction of this facility.
- Develop an accessible boat loading facility at the Florence Lake boat ramp.

Big Creek Nos. 1 and 2 Project

- Develop a day-use area adjacent to Dam 3 at Huntington Lake, including a parking area, trail from the parking area to Dam 3, toilet, three picnic tables, a new gate to prevent parking on Dam 3, and two designated disabled parking spots at the north end of the dam.
- Develop an accessible fishing platform at Huntington Lake. SCE proposes to consult with the Forest Service to select a location for this facility.

SCE would be responsible for the full cost of the capital improvements and for scheduling or performing all needed construction activities, including the provision of necessary personnel, equipment requirements, materials purchase, and management oversight. The proposed capital improvements would be designed in consultation with the Forest Service and designed and constructed according to applicable Forest Service specifications and standards and conform to current applicable accessibility and health and safety requirements. The Forest Service would be responsible for the operation and maintenance of these facilities.

Our Analysis

SCE's proposed recreational capital improvements would enhance recreational access and opportunities associated with angling and boating use at the Big Creek Nos. 2A, 8, and Eastwood Project and the Big Creek Nos. 1 and 2 Project. The implementation of the proposed accessible fishing platform and boat loading facilities at the Big Creek Nos. 2A, 8, and Eastwood Project would enhance recreational opportunities for disabled individuals by providing boating access at Florence Lake and fishing access along South Fork San Joaquin River near Jackass Meadows Campground.

At the Big Creek Nos. 1 and 2 Project, the proposed new day-use area adjacent to Dam 3 would provide developed recreational facilities in a location where dispersed day-use recreational activities currently occur. Input from stakeholders indicated that additional facilities were needed to meet demand at the Dam 3 area along Huntington Lake. Specifically, parking at this location was identified as a potential safety hazard on busy summer days and weekends when demand is high. Providing developed recreational facilities would enhance the recreational experience in this area and control recreational use and associated effects by providing support facilities, including parking, trail, and toilet facilities. In addition, the gate at Dam 3 would control parking on Dam 3 which would enhance public safety in this area. The proposed fishing platform would provide additional accessible fishing opportunities and would therefore enhance recreational opportunities in the vicinity of the Big Creek Nos. 1 and 2 Project.

At the Big Creek Nos. 2A, 8, and Eastwood Project, the Florence Lake boat ramp is located within the project boundary and therefore, the boat loading facility which would be placed at the Florence Lake boat ramp area would also be located within the existing project boundary. The location of the fishing access platform on the South Fork San Joaquin River would be determined in consultation with the Forest Service and portions of the facilities may be within the existing project boundary. At the Big Creek Nos. 1 and 2 Project, the location of the proposed day-use area within the vicinity of Dam 3 would be located outside of the existing project boundary (as illustrated on Figure 5.2.9-7 of the amended PDEA). The location of the accessible fishing platform at Huntington Lake would be determined in consultation with the Forest Service and portions of the facilities may be within the existing project boundary.

As discussed previously (under *Recreational Facility Major Rehabilitation*), the Commission would have no authority to ensure that these facilities are maintained over the term of new licenses unless these facilities are included within the project boundary. Therefore, revisions to the existing project boundaries, as needed, of the individual Big Creek ALP Projects to include these facilities, would provide the Commission authority to ensure long-term public use and access at these facilities.

Interpretive Displays

SCE proposes to design and install up to 13 interpretative display exhibits (kiosks) at various locations in the vicinity of the Big Creek ALP Projects. The kiosks would contain two display panels to educate the public on cultural, historical, pre-historic, biological and recreational resources in the Big Creek area. SCE would consult with the Forest Service and the Big Creek Heritage Advisory Committee (as defined in the HPMP) regarding the design, content, and placement of the interpretative display panels/kiosks. The final design would be submitted to the Commission for approval. The schedule for the design and installation of the interpretive display exhibits would be coordinated with the proposed rehabilitation of the recreational facilities where the kiosks are to be installed. The proposed locations of the kiosks include:

- Big Creek Nos. 2A, 8, and Eastwood Project area - Florence Lake Store, Jackass Meadows Campground, Mono Campground, and Whitebark Vista;
- Big Creek Nos. 1 and 2 Project area - Bear Cove day-use picnic area, Dam 3 parking area, Dowville day-use picnic area, and Eastwood Visitor Center; and
- Mammoth Pool Project area - Mammoth Pool vicinity and Redinger reservoir Overlook.

Our Analysis

The proposed interpretive displays would provide information regarding cultural, historical, pre-historic, biological and recreational resources within the region. They would enhance the recreational experience within the vicinity of the Big Creek ALP Projects by conveying this information to the public.

Reservoir Water Surface Elevations

SCE proposes to make a good faith effort to support reservoir-based recreation through the maintenance of reservoir water surface elevations, while meeting the primary purpose of the reservoirs. These proposed measures include the following:

- Florence Lake (FERC Project No. 67) - SCE proposes to maintain a minimum reservoir storage of 21,000 acre-feet level (elevation 7,276 feet) at Florence Lake during the period from July 1 through August 31, and a minimum reservoir storage of 1,000 acre-feet (elevation 7,231 feet) level during the remainder of the year.
- Shaver Lake (FERC Project No. 67) - SCE proposes to make every effort to maintain the water surface at the maximum elevation practical for water storage, with minimum noticeable fluctuation, from Memorial Day to September 10. (This is a change from current operations, which are detailed in table 3-5).
- Huntington Lake (FERC Project No. 2175) - SCE proposes to make every reasonable effort to maintain the water surface at as high an elevation and with as little fluctuation as feasible during the period between May 1 to September 10 of each water year as is consistent with the primary purpose of the reservoir, existing water rights, and contracts.
- Mammoth Pool Reservoir (FERC Project No. 2085) - SCE proposes to make every effort to maintain the water surface at the maximum elevation practical for water storage, with minimum noticeable fluctuation, from June 1 to September 1 of each year.

Reservoir elevations needed to support recreation would not be maintained when reduced water storage is necessary to (1) allow necessary repairs to the dam(s) or associated equipment; (2) provide water supplies during drought periods to downstream water users or for environmental purposes; (3) operate generating facilities to address power shortages in California due to unscheduled power outages of other power generation facilities, state-declared energy emergencies, or orders from a state agency with authority to dispatch power generated by the Big Creek ALP Projects; (4) reduce downstream flooding risks; (5) meet the terms of the Mammoth Pool Operating Agreement or other obligations to downstream water rights holders; or (6) meet other project license water release requirements. In addition, under the proposed action, SCE would not be required to reduce power generation to maintain reservoir elevations if the releases from the reservoir are required to meet license conditions, and/or generation is ordered by the Independent System Operator or another authority.

Our Analysis

Low water surface elevations at the reservoirs could reduce recreational opportunities and diminish recreational experiences as a result of limited boating access at the reservoir boat ramps. In addition, lower water surface elevations may result in more exposed shoreline areas and have an adverse effect on shoreline recreational use and access.

SCE's proposed measures to maintain the water surface elevations at Huntington Lake and Mammoth Pool reservoir during the primary recreational season would be the same as existing conditions and access to the water would remain similar to existing conditions. At Florence Lake, where minimum water surface elevations during July and August are specified, our review of the water surface elevations over a 26-year period (see figure 3-2) indicates that the proposed measure would have resulted in higher water surface elevations during the primary recreational season in 5 years. For Shaver Lake, SCE's proposal would have the potential to provide more stable elevations during the recreational season.

Reservoir Water Surface Elevation Information

SCE proposes to provide reservoir surface elevation information to the public through the Internet or other appropriate technology. Where feasible, SCE proposes to provide year-round midnight reservoir surface elevations at Florence Lake and Shaver Lake (Project No. 67), Huntington Lake (Project No. 2175), and Mammoth Pool reservoir (Project No. 2085). SCE would also post the functional operating ranges of the boat launch ramps at the reservoirs.

SCE proposes to annually notify the Forest Service, the Huntington Lake Resort, Lakeshore Resort, Rancheria Enterprises, Sierra Marina, Shaver Lake Marina, and post at the Sierra National Forest boat ramp and via a website or other similar method, its monthly storage targets for Florence Lake and Shaver Lake (Project No. 67), Huntington Lake (Project No. 2175), Mammoth Pool reservoir (Project No. 2085), and Thomas A. Edison reservoir (Vermilion Valley Project, No. 2086) for the recreational season (May through September). SCE proposes to make a good faith effort to notify these parties and post via website or other method, at least 2 weeks before it plans to substantially reduce the reservoir elevation for dam maintenance or annual drawdown unless SCE must reduce the reservoir elevation for emergency purposes or other circumstances that preclude the issuance of a notification. In such cases, SCE proposes to make a good faith effort to inform the above listed entities of the circumstances and expected reservoir elevation and fluctuations as soon as possible.

SCE proposes to install a staff gage and post the annual water plan for Huntington Lake (Project No. 2175) at the Forest Service boat ramp. The annual water plan for the lake would provide estimates of projected reservoir water surface elevations during the recreational season. SCE proposes to provide the annual report on Huntington Lake water surface elevations (including an exceedance table of water surface elevations) from the previous year to the Forest Service, the Huntington Lake Association, and interested parties. Upon request of the Huntington Lake Association, SCE would attend the

Association's annual meeting or meet with the Association's Board in lieu of the annual meeting to discuss the annual water plan.

Our Analysis

SCE's proposed staff gages, distribution of the annual water plans and dissemination of reservoir surface elevation information would provide the means for the public to gain information regarding reservoir surface elevations for the specified reservoirs within the Big Creek ALP Projects. This information could then be used to determine if recreational opportunities and desired surface water elevations for boating access and other recreational activities would be available. This would allow the public to take better advantage of opportunities for public recreational use of Florence, Shaver, and Huntington lakes, and Mammoth Pool reservoir.

Stream Flow Information Dissemination

SCE proposes to provide real-time streamflow information that shows the most recent 7 days of flow information to the public via the Internet or other appropriate publicly accessible technology. SCE would provide year-round hourly flow data for the following stream reaches:

- South Fork San Joaquin River below Florence dam;
- San Joaquin River below Mammoth Pool reservoir;
- San Joaquin River below Dam 6;
- Stevenson Creek below Shaver dam; and
- Mono Creek between Vermilion Valley dam and Mono diversion.

Under the proposed action, SCE could decline to post this information if it determines that the information has market value that could adversely affect SCE's power purchase bidding activities and power or ancillary service prices; or would be considered by a regulatory agency to be inappropriate or unlawful. If SCE decides to discontinue or modify the provision or method of providing flow data, it would post notice of the discontinuation or modification on the Internet at least 2 days prior to the suspension of data. Within 30 days of the suspension or modification, SCE would notify the Commission, and request approval to suspend posting of this data.

In addition to posted streamflow data, SCE proposes to install and maintain staff gages from which streamflow in cfs or reservoir elevation could be determined. Staff gages would be installed in the South Fork San Joaquin River below Florence dam, at the Forest Service Rancheria boat ramp at Huntington Lake, and in the San Joaquin River below Mammoth Pool dam. SCE proposes to make a good faith attempt to locate the gages near angling access and whitewater boating put-in locations, so they are viewable by the public.

By April 10 each year, SCE proposes to make the forecast of the water year type in the same fashion as the streamflow information available on the Internet, and the forecast of the probability of spill and/or supplemental flows at Florence Lake and Mammoth Pool dams, if available. SCE also proposes to make a good faith effort to provide notice of the anticipated date of the beginning of spill at these dams during years when spill is likely to occur.

Our Analysis

SCE's proposed staff gages and dissemination of streamflow information would provide the means for the public to gain information regarding streamflow for specified stream reaches. This information could then be used to determine if recreational opportunities and desired flow ranges for angling, whitewater boating, and other recreational activities would be available. This would allow the public to take better advantage of opportunities for public recreational use of these stream reaches.

Whitewater Boating Flow Releases

SCE proposes to provide pre-spill whitewater flow releases below Mammoth Pool and Florence reservoir dams in wet and above normal years. The presence of wet years and above normal years would be determined by CDWR in its April 1 forecast for the projected water runoff for the San Joaquin River Basin. Upon request of the American Whitewater or regional whitewater boating representatives after March 15, SCE would discuss the anticipated water runoff conditions in relation to pre-spill releases, as described below. If the water year type is determined to be a wet or above normal water year, the timing and flow magnitudes of the pre-spill releases would be proposed.

Channel and riparian maintenance flow at Florence Lake Dam - SCE proposes to provide channel and riparian maintenance flow in the South Fork San Joaquin River below Florence Lake in wet and above normal water years for riparian habitat enhancements (see section 3.3.2, *Terrestrial Resources*). SCE proposes to attempt to provide flows sufficient in timing and magnitude for whitewater boating opportunities during the descending portion of the channel and riparian maintenance flow release to the extent it is within SCE's control and consistent with the requirements of the channel and riparian maintenance flow schedule at Florence dam.

Wet Year Releases at Mammoth Pool Dam - In wet years, as defined by the CDWR forecast, SCE would provide a continuous release of between approximately 350 and 850 cfs until such time as Mammoth Pool dam spills. This pre-spill whitewater release would be targeted to begin on April 15. If, on April 15, Mammoth Pool dam is spilling, SCE would have no further responsibilities to provide whitewater recreational flows for the year. If, SCE determines conditions are suitable to provide pre-spill flows prior to April 15, SCE could initiate pre-spill releases at an earlier date. Pre-spill release flows would be provided by operation of the Howell Bunger valve at Mammoth Pool dam. Operation of the valve would be consistent with the requirements of the Sediment Management Prescriptions.

Above Normal Year Releases at Mammoth Pool Dam - To provide whitewater boating opportunities during above normal water years, SCE would provide pre-spill whitewater releases below Mammoth Pool dam of between approximately 350 and 850 cfs for 2 consecutive weekend days. At a minimum, the whitewater flows would be provided between the hours of 10 AM to 4 PM over one weekend. These pre-spill whitewater releases would be made after April 15. If by April 15, Mammoth Pool dam is spilling, SCE would have no further responsibilities to provide whitewater releases for that year. Upon the request of regional whitewater boating representatives and if SCE determines conditions are suitable, SCE could initiate pre-spill releases at an earlier date. Pre-spill release flows would be provided by operation of the Howell-Bunger valve at Mammoth Pool dam. Operation of the valve would be consistent with the requirements of the Sediment Management Prescriptions.

Pre-spill releases have the potential to affect flood control and water supply operations downstream of the Mammoth Pool reservoir. Prior to making pre-spill releases, SCE would consult with the U.S. Bureau of Reclamation (or the then current operator of Friant dam). If the U.S. Bureau of Reclamation determines that a pre-spill release would adversely affect its flood control or water supply operations, SCE would not make the planned pre-spill release. In that situation, SCE would make a good faith effort to identify another time acceptable to the U.S. Bureau of Reclamation when pre-spill releases may be made.

Our Analysis

Currently whitewater boating opportunities occur downstream of the Florence Lake dam on the 6.5 mile long reach of the South Fork San Joaquin River from Florence Lake dam to the Mono crossing (Florence Run) and downstream of the Mammoth Pool dam on the San Joaquin River along an 8.5 mile reach from the Mammoth Pool dam to Dam 6 (Tied-for-First Run) and along an 8.3 mile reach from bottom of Dam 6 forebay to the head of Redinger reservoir (Chawanakee Gorge Run).

Under the existing hydrology (for the period 1993 through 2002), estimated boating opportunity days at the boatable flows for these reaches occur on the Florence Run. During wet water years there were no boating opportunity days during April and for May there were an average of 0.5 days. During above normal years, on average, there were no boating opportunity days during April and May.

On the Tied-for-First Run during the wet water years, in April and May there were an average of 3.7 and 3.9 boating opportunity days per month, respectively, and during the above normal water years there were no boating opportunity days during April and May. For the Chawanakee Run, during wet water years, in April and May there were an average of 14.3 and 4.0 boating opportunity days per month, respectively, and during the above normal water years there were an average of 0.3 and 3.3 boating opportunity days per month, respectively, during April and May.

SCE's proposal of additional whitewater boating flows below the Florence Lake dam would provide an increased number of boating opportunity days by providing the channel and riparian maintenance flows, when possible, in a manner of timing and magnitude that would provide boatable flows in the Florence Run reach. SCE's proposed whitewater boating flow releases below the Mammoth Pool dam would provide increased opportunities for whitewater boating through the provision of boatable flows during a period when flows, particularly in above normal water years, are somewhat limited.

Fish Stocking

SCE proposes to match equally the Cal Fish & Game stocking of the Big Creek ALP Project reservoirs and bypassed stream reaches below the projects' diversions and upstream of Redinger reservoir, up to the following amounts:

- Rainbow Trout: Fingerlings – up to 20,000 per year; Catchables – up to 60,000 per year; and Subcatchables – up to 40,000 per year
- Kokanee: Fingerlings – up to 30,000 per year

SCE would consult with Cal Fish & Game annually to obtain fish stocking targets and verify the completion of the previous years stocking efforts. At SCE's option, it would either acquire the fish directly through available sources or reimburse Cal Fish & Game for the cost of fish production.

Our Analysis

SCE's proposed assistance to Cal Fish & Game to annually contribute to fish stocking activities within Big Creek ALP Projects reservoirs and stream reaches would help to maintain fish stocking activities within the project region. These fish stocking provisions enhance angling opportunities on Big Creek reservoirs and stream reaches within the vicinity of the projects.

San Joaquin River Trail Maintenance

SCE proposes to maintain the section of the San Joaquin River Trail that is co-aligned with the Mammoth Pool transmission line project road located within the Mammoth Pool Project. The Mammoth Pool transmission line project road would be maintained in accordance with, and to Forest Service road standards for a Maintenance Level 2 road. In addition, SCE proposes to maintain the two project road crossings of the trail with a surface material that accommodates multiple use of the San Joaquin River Trail.

Our Analysis

The San Joaquin River Trail is co-aligned with the Mammoth Pool transmission line project road for about 9 miles. The San Joaquin River Trail has Trail Class 3 designation under the Forest Service National Trail Management Class System. A Class 3 trail is defined as a developed/improved trail that is obvious and continuous; the width accommodates unhindered one-lane travel with occasional allowances constructed for passing, and typically has native materials (Forest Service, 2006).

The Mammoth Pool transmission line project road has a Level 2 maintenance designation. Road Maintenance Level 2 is defined in the Forest Service Transportation System Maintenance Handbook (FSH 7709.58,10,12.3) and described in the Forest Service Guidelines for Road Maintenance Levels (Forest Service, 2005) as: "Assigned to roads open for use by high-clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level. Appropriate traffic management strategies are either to (1) discourage or prohibit passenger cars or (2) accept or discourage high-clearance vehicles."

SCE's proposed maintenance of the Mammoth Pool transmission line project road in accordance with Level 2 road maintenance prescriptions would help maintain the portion of the San Joaquin River Trail that coaligns the road with the trail's prescribed management Class 3 trail designation. This routine maintenance would help ensure that the trail would remain functional, minimize the need for additional trail reconstruction activities along this portion of trail, and help ensure that the trail would remain accessible to the public for recreational opportunities.

Winter Snow Plowing

To protect winter recreational use and opportunities in the vicinity of Big Creek Nos. 1 and 2 Project and Big Creek Nos. 2A, 8, and Eastwood Project, SCE proposes to plow Kaiser Pass Road (5S80) and Florence Lake Road (7S01) (in the event it needs to plow for emergency access to project facilities) as follows:

- Unless required for larger equipment, SCE would plow one lane only on the Eastwood/Badger Flat segment of road 5S80 and the other lane would be maintained and reserved for winter sports use. SCE would avoid placement of blown snow on the reserved lane.
- Provide a uniform travel surface of a maximum one tractor blade width on snow adjacent to the cleared roadway, where practical.

Our Analysis

Kaiser Pass Road (5S80) and Florence Lake Road (7S01) provide snowmobiling and cross-country skiing opportunities during the winter recreational season (the season varies dependent on snow conditions). The Forest Service maintains the snowmobile trail along these roads by grooming the trail following each winter storm. On occasion, SCE may need to gain emergency access to project facilities and plow portions of Kaiser Pass Road to provide vehicular access. The plowing of these roads could lead to the disruption of the snowmobile and cross-country skiing recreational opportunities. SCE's proposed methods for plowing would help to maintain a portion of the road so that these recreational activities could continue without being adversely affected.

3.3.4.3 Cumulative Effects

Ongoing project effects associated with recreational resources would result in continued recreational access and associated public use of the project waters and lands. Public use and recreational access would potentially result in cumulative effects on project lands and waters, including the potential adverse effects of boating use, noise related to power boats and jet skis, and associated wave-related erosion on project reservoirs, and soil compaction and erosion as a result of recreational use along the reservoir shoreline areas. Beneficial cumulative effects from the provision of recreational facilities and access to project lands and waters over the term of any new license would also occur by focusing recreational activities at specific sites designed to handle public use in a manner that is minimally disruptive to the environment.

Implementation of SCE's proposed environmental measures, specifically the Recreation Management Plan and associated recreational rehabilitation and capital improvement measures at the Big Creek ALP Projects, would likely enhance recreational opportunities within the vicinity of the projects. Proposed recreational measures would generally not increase the capacity of existing recreational facilities and thus would not draw additional recreational visitors to the project areas. Additional recreational use in sensitive areas could have adverse effects on natural and cultural resources. Proposed new recreational facilities would better enable persons with disabilities to enjoy recreational experiences and, in the case of the proposed day-use area at Huntington Lake, would formalize existing informal and dispersed recreational use that currently occurs at this location, which creates unsafe conditions for the public. In addition, the proposed recreational facility rehabilitation measures and enhancements would likely complement the management objectives of the Forest Service's management objectives for the Sierra National Forest. The provisions included in the Recreation Management Plan for the recreational facilities within the vicinity of the Big Creek ALP Projects would provide the means for these recreational facilities to be managed in a coordinated and comprehensive manner between the Forest Service and SCE. In addition, the proposed Recreation Management Plan would provide the means for adaptive management of these facilities over the term of any new license for the Big Creek ALP Projects through the annual coordination meetings and periodic review and update. Therefore, the proposed recreational enhancements and rehabilitation measures at the Big Creek ALP Projects would likely result in a cumulative beneficial effect on regional recreational resources.

3.3.5 Cultural Resources

3.3.5.1 Affected Environment

Definition of Cultural Resources, Historic Properties, Effects, and Area of Potential Effects

Historic properties are cultural resources listed or eligible for listing in the National Register. Historic properties can be buildings, structures, objects, districts (a term that includes historic and cultural landscapes), or sites (archaeological sites or locations of important events). Historic properties also may be resources of traditional religious and cultural importance to any living community, such as an Indian tribe or a local ethnic group, that meet the National Register criteria; these properties are known as traditional cultural properties. Cultural resources must possess sufficient physical and contextual integrity to be considered historic properties. For example, dilapidated structures or heavily disturbed archaeological sites, although they may retain certain historical or cultural values, may not have enough integrity to be considered eligible.

Section 106 of the National Historic Preservation Act requires federal agencies including the Commission to consider the effects of their undertakings on historic properties. An undertaking means a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including, among other things, processes requiring a federal permit, license, or approval. Advisory Council on Historic Preservation (Advisory Council) regulations implementing section 106 define effects on historic properties as those that change characteristics that qualify those properties for inclusion in the National Register. In this case, the undertaking is the proposed issuance of new licenses for continued operation of the Big Creek ALP Projects. Potential effects of licensing may result from construction of project facilities, day-to-day operation and maintenance of the project, or other actions required by the license, such as those associated with land or natural resource management or recreation.

Determination of effects on historic properties first requires identification of historic properties in the APE. The Advisory Council's regulations define the APE as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. For the Big Creek ALP Projects, the APE includes lands within the projects' licensed boundaries, plus any locations outside the licensed boundaries where project operation or project-related activities (e.g., those required under the terms of a license) may affect the character or use of historic properties.

Advisory Council regulations also require the Commission to seek concurrence from the State Historic Preservation Officer (SHPO) on any finding involving effects or no effects on historic properties, and allow the Advisory Council an opportunity to comment on any finding of adverse effects. In addition, regulations require the Commission to consult with interested Native American tribes that might attach religious or cultural significance to historic properties within the APE.

Cultural History Overview

The archaeological record documents at least 7,000 years of human activity in the southern Sierra Nevada. Archaeological sites are physical evidence of Native American use of regional uplands for settlement, food, and other resource procurement, trade, and travel. Historical records describe traditional use of the Big Creek ALP Projects area by Mono and Paiute people, although other Native American groups (e.g., Miwok and Yokuts) may have used the area as well, especially on trading ventures.

Earliest encounters between Native Americans and Europeans in the project area probably date to the late 1700s when incidental Spanish exploration of the region began. By the 1820s contact between Mono, Yokuts, and other indigenous groups and Spanish expeditions intensified, and Native American groups came under military attack. Soon thereafter (if not before) introduced European diseases devastated susceptible Native American populations. In the 1830s, American trappers began exploring the region, but it was the Gold Rush of the late 1840s and early 1850s that brought the greatest influx of Americans and others. While the southern Sierra was not the focus of Gold Rush activities, disappointed would-be miners and others recognized the abundant timber and grazing potential of this region and began timbering, livestock grazing, and homesteading with some limited mining. These activities further disrupted traditional Native American ways of life as Euro-Americans displaced Mono and other groups from their traditional lands, confined them to reservations and rancherias, denied them access to subsistence and other resources, and assimilated them into cash-based economies. Throughout the 20th century and to the present, the local economy has focused on timbering, grazing, hydropower development and production, and recreation.

The construction of the Big Creek System was a major factor in the development of the project area. The first components of this system were the Huntington dam and reservoir, which were built between 1911 and 1913. Additional dams, reservoirs, and associated facilities were erected over the next 40 years. Completed in 1987, the Balsam Meadows development (Balsam Meadows forebay and Eastwood power station) is the youngest component of the Big Creek System. Over the decades, the reservoirs have served as catalysts for recreational development on National Forest lands around and in the vicinity of these water bodies.

Cultural Resources Investigations

Many components of the Big Creek System dating from 1911 to 1929 have been determined eligible for the National Register as a result of initial work by Shoup et al. (1988). Since that time, additional components contributing to the significance of the Big Creek Hydroelectric System Historic District (BCHSHD) have been identified; however, there has been to date no formal documentation of the entire inventory of contributing and non-contributing system elements. A second potential historic district, known as the Huntington Lake Historic Recreation District, has been identified as a result of various studies by the Sierra National Forest over the last two decades. As the name suggests, this potential district focuses on resources related to recreational development in the Huntington Lake Basin between 1913 and 1960. The Sierra National Forest is working with NPS to complete evaluations of recreational residence tracts, with an eye toward completion of a multiple-property document and National Register nomination forms for historic properties in the Huntington Lake Basin.

Cultural resources investigations for the Big Creek ALP Projects incorporated information from previous studies, such as those cited above, plus results of an archaeological survey for prehistoric and historic resources commissioned by SCE. SCE contracted with Pacific Legacy, Inc. (Legacy) to conduct this survey, which was completed between spring 2002 and winter 2004. Cultural resources consultants also conducted interviews and multiple site visits with tribal members to obtain information about locations and resources of cultural or historical value to Native Americans. This information was incorporated into Legacy's final cultural resources report. The SHPO has not yet reviewed nor commented on Legacy's report and recommendations regarding National Register eligibility. Based upon the information provided in Legacy's report, we find that the resources identified in that report warrant consideration regarding their eligibility for inclusion in the National Register.

Known Cultural Resources

Within the Big Creek Nos. 1 and 2 Project are 15 prehistoric archaeological sites, 11 historic archaeological sites, portions of one historic railroad grade, and portions of two historic districts (BCHSHD and Huntington Lake Historic Recreation District). Legacy recommended one of the 15 prehistoric sites as eligible for the National Register. Five archaeological sites, as yet unevaluated, are being managed by SCE as eligible for the National Register until they can be evaluated. Additional cultural resources that Legacy has recommended as eligible for the National Register are historically documented Native American trail routes and river crossings in the general area of Huntington Lake; though no physical evidence of the trails was found in the APE during Legacy's survey.

Big Creek Nos. 2A, 8, and Eastwood contain 28 prehistoric archaeological sites, 14 historic archaeological sites, 17 archaeological sites with prehistoric and historic material, and portions of one historic district (BCHSHD). Nine of the archaeological sites, identified prior to the Legacy surveys, have been determined eligible for the National Register by the SHPO. Legacy recommended two archaeological sites, or components of sites, as eligible for the National Register. SCE is managing six unevaluated archaeological sites as eligible for the National Register until they can be evaluated. Additional cultural resources that Legacy recommended as eligible for the National Register are historically documented Native American trail routes and river crossings in the general area of Florence Lake, Shaver Lake, and the Mono Creek diversion dam, although Legacy has found no physical evidence of the trails in the APE.

Big Creek No. 3 contains eight historic archaeological sites, two prehistoric archaeological sites, one historic road (Million Dollar Mile Road), and portions of one historic district (BCHSHD). Legacy recommended one of the archaeological sites as eligible for the National Register.

Mammoth Pool contains 25 prehistoric sites, portions of one potential archaeological district (Chawanakee Flats), and one potential traditional cultural property (Mammoth Pool Cultural Use Area). The Mammoth Pool Cultural Use Area, recommended by Legacy as eligible for the National Register, comprises locations where Native Americans traditionally hunted, fished, and gathered plants; gathering places; medicine places; archaeological sites; river crossings; and trail routes. The Chawanakee Flats Archaeological District is located in an area of the Sierra National Forest that has been identified in ethnographic studies as an important Mono settlement location. All but two of the known prehistoric and ethnographic sites that compose the Chawanakee Flats Archaeological District are located on Forest Service land outside of the project boundaries of the Big Creek ALP Projects. Preferring that sites remain untested unless absolutely necessary, the Forest Service asked SCE to limit testing and evaluation of Chawanakee Flats sites to the two lying within project boundaries. Neither of these two sites was recommended by Legacy as eligible for the National Register.

Legacy recommended 17 archaeological sites in the Mammoth Pool Project as eligible for the National Register. SCE is managing seven unevaluated archaeological sites as eligible for the National Register until they can be evaluated. Legacy also has recommended historically documented Native American trail routes and river crossings in the general area of Mammoth Pool as eligible for the National Register, although no physical evidence of the trails has been found to date in the APE.

3.3.5.2 Environmental Effects

Effects on cultural resources within the APE can result from project-related activities such as reservoir operations, modifications to project facilities, or project-related ground-disturbing activities. Effects also can result from other forces such as wind and water erosion, recreational use (project and non-project related), vandalism, and private and commercial development. The type and level of effects on cultural resources can vary widely, depending upon the setting, size, and visibility of the resource, as well as whether there is public knowledge about the location of the resources.

SCE proposes to complete its HPMP for the Big Creek ALP Projects (a draft of which was filed with the Commission in November 2005), in consultation with the Commission, the parties to the Settlement Agreement (including the Forest Service and Interior), and the Tribes, and would implement the finalized HPMP upon execution of the PA. A draft PA was sent to the consulting parties on September 23, 2008. No comments on it have been received as of the date of the preparation of this final EIS. We anticipate circulating a final PA for signature in April 2009.

The HPMP would enumerate measures both general and site-specific for management and protection of historic properties and of "important cultural resources" (defined in the HPMP as plant species of importance to Native Americans and archaeological sites associated with Native American occupation and/or recreational use of the area that do not meet National Register criteria). The HPMP also provides for establishment of a Big Creek Advisory Committee, open to the Tribes and organizations that participated in the Cultural Resources Working Group during the Big Creek ALP. Throughout license terms, SCE would consult with the Advisory Committee on the development and implementation of management and monitoring plans for cultural resources, review and evaluation of cultural resources data, and development and implementation of cultural resources protection measures.

SCE proposes that the finalized HPMP would specify coordination of the plan with other plans to be implemented over the license terms, including but not limited to the vegetation management, recreational management, and riparian monitoring plans. It would specify Forest Service representation on the Big Creek Heritage Advisory Committee. SCE would also provide the Forest Service with GIS-compatible electronic data so that archaeological survey coverage and site locations could be entered into the Forest Service database.

Forest Service preliminary 4(e) condition 20 and 21 are the same as those contained in the Settlement Agreement. Interior's recommendations regarding cultural resources in the Big Creek ALP Projects also mirror the specifications of the Settlement Agreement and the Forest Service conditions.

By letters of February 25, 2005, to the Commission, the Tribes recommend that SCE provide funding for the following measures:

- development of a tribal-specific communications protocol for future use in negotiations between SCE and the Tribes;
- recovery of expenses incurred by the Tribes during their participation in the Big Creek ALP;
- retention of a third-party facilitator to facilitate negotiations between the Tribes and SCE;
- capital and subsequent staffing and operating costs for a Native American center, to be located at Shaver Lake on land donated by SCE to the Tribes;
- comprehensive ethnographic studies and evaluation of traditional cultural properties within the Big Creek ALP Project areas;
- a solar powered infrastructure and delivery program for the Tribes;
- Native American interpretive and signage programs; and
- a Native American historical monument.

In letters to the Commission dated January 20, 2006, and April 22, 2008, the North Fork Mono Tribe expressed concerns regarding treatment of archaeological sites threatened by erosion on reservoir shorelines.

Our Analysis

SCE's finalization of its HPMP in accordance with the provisions of the Settlement Agreement would provide for management and protection of historic properties and important cultural resources throughout the Big Creek ALP Projects APE over the license terms. In addition, it would address Forest Service concerns (expressed in its preliminary 4(e) conditions) regarding participation in the management and protection of cultural resources in those portions of the APE lying in or adjacent to the Sierra National Forest.

Organization and operation of the Big Creek Advisory Committee, as specified in the finalized HPMP, would afford the Tribes ongoing opportunity to make their views and concerns regarding cultural resources known through a forum whose protocols and procedures will be established by its members. Regarding the use of a third-party facilitator, SCE stated in the HPMP that it would employ a facilitator from an organization outside the Advisory Committee membership in the event that a majority of the membership so chooses.

The HPMP also includes provisions for educating the public about Native American heritage and historical values of the Big Creek ALP area through permanent display boards, printed matter, and other media. These educational materials would be developed in consultation with the Advisory Committee, thereby affording the Tribes opportunity to comment on and contribute to the design, content, and placement of cultural and heritage informational materials. Educational/interpretive signage at pertinent locations would provide an effective vehicle for memorializing the past, present, and future value of the Big Creek area to Native Americans. Signage and other informational/interpretive media would effectively educate the public and foster public appreciation of the area's heritage values within the context of new licenses for the Big Creek ALP Projects. Such measures would have a closer nexus to the projects and resources than would SCE's building a cultural center as the Tribes recommend.

The cultural resources technical report submitted as part of SCE's license application adequately summarizes existing ethnographic information about the Big Creek ALP Project area. Additionally, SCE and its cultural resources consultants conducted interviews and multiple site visits with tribal members to identify and obtain information about locations and resources of cultural or historical value to Native Americans. This information, incorporated into the cultural resources report and the draft HPMP, provides a reasonable basis for management of these locations and resources over the license term. Participation in the Big Creek Advisory Committee would afford the Tribes opportunities over the license term to contribute additional ethnographic information as they may choose.

Development and implementation of alternative sources of electrical power (specifically solar generation) is an issue of increasing importance throughout the United States today. However, there appears to be no nexus between the purpose and operation of the Big Creek ALP Projects (which is to generate electricity from water power) and the Tribes' request for funding for solar power generation.

In its draft HPMP, SCE proposes an initial 5-year monitoring program for certain eligible archaeological sites and several important cultural resources that are or may be affected by project operations, chiefly but not limited to, shoreline erosion. All such sites would be monitored at least twice during the 5-year period; however, SCE proposes to monitor sites "where archaeological data recovery is a consideration" more frequently. The draft HPMP also specifies that the Big Creek Advisory Committee would visit each of the monitored resources twice during the 5-year period and provide SCE with recommendations regarding the monitoring or possible alternative treatments. At the end of the initial 5-year period, the Advisory Committee would advise SCE regarding whether, and how frequently, monitoring should continue for each designated site. Implementation of these measures under a finalized HPMP would ensure appropriate management and treatment of resource conditions under the new license.

In anticipation of license issuance, the Commission would execute the PA with the SHPO, and would include SCE, the Tribes, and Forest Service as consulting parties. The PA would include a stipulation for finalization of the HPMP in consultation with the SHPO, Tribes, and Forest Service.

3.3.6 Land Use and Aesthetic Resources

3.3.6.1 Affected Environment

Land Use

Land Management Plans and Policies

Lands in the vicinity of the Big Creek ALP Projects are generally rural forest and foothills in character, and the existing land uses include: small communities of private residences or seasonal homes, hydroelectric power generation, rangeland, timber production, mining, research areas, wilderness areas, and recreation. The private land holdings in the vicinity of the project include small private in-holdings and lands owned by SCE. Depending on the ownership status, the land use and management is governed by federal or local plans and regulations. Lands within and adjacent to the project boundaries are administered by the Sierra National Forest, under the Forest Service. Long-term land management direction is provided by the Sierra National Forest Land and Resource Management Plan (Forest Service, 1991). This plan follows the framework guidance of the Sierra Nevada Forest Plan, which was amended in 2001 (Forest Service, 2001). In response to growing concern about fuels and fire management, the *Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement* further modified this framework guidance and Record of Decision dated January 21, 2004. The standards and guidelines presented in that final EIS would be made part of a future amendment to the Sierra National Forest Plan.

County Plans

Project lands located in Fresno and Madera counties are subject to the Fresno County General Plan (2000) or the Madera County General Plan (1995). Big Creek Nos.1 and 2 and Big Creek Nos. 2A, 8, and Eastwood projects are located within Fresno County. Big Creek No. 3 and Mammoth Pool projects are located in Fresno and Madera counties. The Fresno County General Plan covers issues of land use, transportation, and environmental resource management. The plan identifies the project vicinity lands as being within the Sierra-North Regional Plan Area and designates its land use as Public Lands and Open Space. This designation is applied to land or water areas that are unimproved and planned to remain open in character. The designation provides for preservation of natural resources; managed production of resources, parks and recreation; and the protection of the community from natural and manmade hazards. Although project lands are within Fresno County boundaries, the Fresno County General Plan does not refer specifically to the Big Creek ALP Projects' areas because they are managed by the Sierra National Forest, whose jurisdiction supersedes that of Fresno County.

The Madera County General Plan directs land use in the northeastern portion of the area in which the Big Creek ALP Projects are located, from the middle of the San Joaquin River, Dam 6 forebay, and Mammoth Pool reservoir northward. The plan designates the lands in the vicinity of the projects as Open Space with some smaller parcels of land designated as Agriculture Exclusive. The Open Space designation provides for land uses that include: low intensity agricultural uses, irrigation canals, grazing, forestry, recreation and equestrian, transmission lines, and areas under public control. The Agricultural Exclusive designation provides for agricultural uses, limited agricultural support service uses, agriculturally-oriented services, timber production, mineral extraction, public and quasi-public uses, and similar uses. Although project areas are within Madera County boundaries, the Madera County General Plan does not specifically refer to the Big Creek ALP Projects.

Big Creek Nos. 2A, 8, and Eastwood Project

The Big Creek Nos. 2A, 8 and Eastwood Hydroelectric Project is located in Fresno County, California, near the town of Shaver Lake within the South Fork San Joaquin River, Big Creek, and Stevenson Creek watersheds. As currently licensed, the Big Creek Nos. 2 A, 8, and Eastwood Project occupies 2,389.54 acres of land in an unincorporated portion of Fresno County, California. The project area lies within the

Sierra National Forest, Pineridge Ranger District, and occupies 2,388.8 acres[47] of federal lands. No state or county owned lands fall within the project boundary. SCE owns land within the project boundary near Shaver Lake and Balsam Meadows forebay that it uses for hydroelectric generation, recreation, timber harvesting, and wildlife management.

The project boundary encompasses three geographic areas:

- The Upper Basin area (includes Florence Lake located on the South Fork San Joaquin River);
- Shaver Lake (located on Stevenson Creek) and Balsam Meadows forebay area; and
- The Lower Big Creek Canyon (includes Big Creek Nos. 2A, 8, and Eastwood powerhouses).

The Upper Basin area contains eight small diversion dams on small tributary streams which flow to the South Fork San Joaquin River (see figure 3-6). Two of the small diversions, Crater Creek and Tombstone Creek diversions, are located within the John Muir Wilderness Area, which surrounds the Florence Lake area. Another two small diversions, North and South Slide Creek diversions, are located within 200 feet of the wilderness area boundary. These four small diversions were constructed in 1945 before the designation of the wilderness area in 1964. Non-industrial land uses within the project boundary in the Upper Basin area are mainly recreation-oriented and are described in section 3.3.4, *Recreational Resources*. Non-industrial land uses adjacent to the project boundary at Florence Lake include recreation and wildlife resource management.

Non-industrial land uses within the project boundary near Shaver Lake also are mainly recreation-oriented. Detailed descriptions of the recreational facilities are included in section 3.3.4, *Recreational Resources*. Adjacent land use in the vicinity of Shaver Lake includes private residential and commercial in-holdings in the community of Shaver Lake, timber harvest and wildlife management on SCE owned lands, and recreational use at the Dorabelle Campground and day-use area managed by the Sierra National Forest. The land uses adjacent to the project boundary in the vicinity of Balsam Meadows forebay include timber harvest and wildlife management on SCE owned lands, and natural resource management on adjacent Sierra National Forest lands. In addition, portions of SCE's private lands in the project boundary on the western and southwestern shore of Shaver Lake are designated as "Public Facilities" in the *Fresno County Shaver Lake Community Plan* amended in 1986.

The Sierra National Forest Land and Resource Management Plan (Forest Service, 1991) divides the forest into management and analysis areas. The Big Creek Nos. 2A, 8,

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[47] See 124 FERC ¶62,068, Order Approving Revised Exhibit K Drawings and Revising Annual Charges (July, 25, 2008).

and Eastwood Project is within Management Area 1 and Analysis Areas 45 (Florence Lake) and 36 (Shaver Lake). In these areas, developed recreational opportunities such as public campgrounds, day-use areas, visitor information centers, resorts, and recreational residences are emphasized. Lands adjacent to the Powerhouse 2A project boundary are managed by the Sierra National Forest for natural resource management use.

Facilities in the Upper Basin area are accessed via Kaiser Pass Road (FS Road No. 5S80) and Florence Lake Road (FS Road No. 7S01). Both roads are maintained by the Forest Service and are open to vehicular travel from approximately the end of May until the first snow fall in late October or early November. Kaiser Pass Road begins at the east end of Huntington Lake. At approximately 3 miles northeast of Huntington Lake, Kaiser Pass Road changes from a two-lane to a single-lane road. Kaiser Pass Road climbs over Kaiser Pass and provides access to the Upper Basin back-country area terminating at Lake Thomas A. Edison (a component of the Vermilion Valley Hydroelectric Project [Project No. 2086]). At Camp 62 in the back-country, Kaiser Pass Road intersects with Florence Lake Road. Florence Lake Road is also a single-lane road that continues for 7 miles to Florence Lake. SCE vehicles use Kaiser Pass Road and Florence Road during the summer months and SCE estimates its vehicle use on Kaiser Pass Road accounts for approximately 1.4 percent of the total vehicle traffic on the road. SCE also uses FS Road No. 7S65 to access facilities on Hooper Creek in the Florence Lake area, and FS Road No. 6S83 (a 4-wheel drive route) to access the Bear diversion facilities. Both of these roads are maintained by the Sierra National Forest. SCE maintains a number of spur roads and foot trails to access facilities associated with the Florence Work Camp and the small diversions in the Upper Basin area.

Project facilities in the vicinity of Shaver Lake and Balsam Meadows forebay are accessed via State Highway 168 and Huntington Lake Road. SCE maintains and controls access along a number of secondary roads and associated spur roads on SCE owned lands to access project facilities, including a road along the northeast side of Shaver Lake (FS Road No. 9S58), and a road to Balsam Meadows forebay (FS Road No. 9S32).

Project facilities in the Big Creek Canyon area associated with Powerhouses 2A and 8 are accessed via the Canyon Road (FS Road No. 8S05) and a few spur roads. The Canyon Road is closed to public vehicle access and is maintained by SCE.

Big Creek Nos. 1 and 2 Project

As currently licensed the Big Creek Nos. 1 and 2 Project, owned and operated by SCE, occupies 2,078.51 acres in an unincorporated portion of Fresno County. The project area lies within the Sierra National Forest, Pineridge Ranger District, and occupies 2,017.78 acres[48] of federal land. No state or county owned lands are within the project boundary. SCE owns some land parcels located at Huntington Lake and near

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[48] See 123 FERC ¶ 62,209, Order Approving Revised Exhibit K Drawings and Revising Annual Charges (June 9, 2008).

Powerhouse 2. The project boundary includes: Dam 4, Huntington Lake reservoir, a water conveyance system, two powerhouses, and roads and trails that are maintained by SCE and needed for the operation and maintenance of the project.

Non-industrial land uses within the project boundary are recreation-oriented. Section 3.3.4, *Recreational Resources* describes the recreational facilities. Land uses adjacent to the project boundary are Sierra National Forest lands and are primarily natural resource conservation or recreation-based. Pursuant to the Sierra National Forest Land and Resource Management Plan, the Big Creek Nos. 1 and 2 Project is within Management Area 1 and Analysis Area 47 (Huntington Lake) (Forest Service, 1991). In this area, developed recreational opportunities such as public campgrounds, day-use areas, visitor information centers, resorts, and recreational residences are emphasized.

The recreation-based lands include seven developed Forest Service campgrounds and four day-use areas that are located around the northern perimeter of Huntington Lake. Immediately north of Huntington Lake is the Kaiser Wilderness Area (designated as a wilderness area in 1976). Other existing land uses include small communities of private residences and vacation homes, private Boy Scout camps, and several commercial business facilities (store, restaurant and marina).

The system of roads and trails needed for project operation and maintenance provide access to two geographic areas: Huntington Lake and the Big Creek Canyon. Huntington Lake facilities are accessed via State Highway 168 and Huntington Lake Road (M2710, a Fresno County maintained road). Both roads provide access to Huntington Lake from Shaver Lake. State Highway 168 climbs up and crosses Tamarack Ridge and provides access to the east end of Huntington Lake. Huntington Lake Road begins at State Highway 168 at Shaver Lake and drops into the Big Creek Canyon, to the community of Big Creek, and continues along the north shore of Huntington Lake. In the Huntington Lake area, SCE maintains a number of roads (FS Road No. 8S66 and associated spurs) that provide access to Dams 1, 2, 3 and 3A and associated facilities located at the southwestern end of the Huntington Lake.

The community of Big Creek, Powerhouse 1, and Powerhouse 2 are located within the Big Creek Canyon. SCE maintains a number of roads in the community of Big Creek that provide access to Powerhouse 1, Northern Hydro offices, and other various project support facilities. Access to project facilities located downstream in Big Creek Canyon is provided via the Canyon Road (FS Road No. 8S05) which is located off Huntington Lake Road. SCE maintains Canyon Road which is gated; public vehicular access is restricted. Canyon Road provides access to Powerhouse 2 and associated facilities. SCE also maintains a number of secondary roads off Canyon Road which provides access to ancillary facilities associated with the project.

Mammoth Pool Project

As currently licensed, the Mammoth Pool Project occupies approximately 2,035.84 acres in unincorporated portions of Madera and Fresno counties. The project area straddles the Sierra National Forest Pineridge Ranger District in Fresno County and the Bass Lake Ranger District in Madera County. The project occupies 2,029.68 acres[49] of federal lands administered by the Sierra National Forest. No state or county owned lands are within the project boundary. Privately owned land within the project boundary is located in the Kinsman Flat area where the Mammoth Pool powerhouse-Big Creek 3 transmission line alignment crosses a private land parcel.

Non-industrial land uses within the project boundary are recreation-oriented. These include: a boat-in campground, boat launch, and picnic area at the Mammoth Pool reservoir. The lands adjacent to the project area are Forest Service lands and the land uses are primarily natural resource conservation or recreation based. Pursuant to the Sierra National Forest Land and Resource Management Plan, the Mammoth Pool Project is within Management Area 1 and Analysis Area 28 (Mammoth Pool) (Forest Service, 1991). This is an area where developed recreational opportunities such as public campgrounds, day-use areas, visitor information centers, resorts, and recreational residences are emphasized.

The recreation-related facilities in the vicinity of the Big Creek ALP Projects include the Mammoth Pool Campground (located adjacent to the northern upstream extent of the reservoir along the San Joaquin River) and the Ansel Adams Wilderness, which was designated in 1964.

Roads and trails needed for the operation and maintenance of the project provide access to four geographic areas: (1) Mammoth Pool dam and reservoir; (2) Shakeflat helicopter landing site, trail and stream gage; (3) Mammoth Pool powerhouse; and (4) Mammoth Pool powerhouse-Big Creek 3 transmission line.

The Mammoth Pool reservoir is accessed via Minarets Road (FS Road No. 4S81), a Madera County road, and FS Road Nos. 6S25 (Mammoth Pool Road) and 6S76. Mammoth Pool Road provides access to the Mammoth Pool dam and spillway, and is maintained by the Forest Service from Minarets Road to the project boundary at the dam and spillway. Mammoth Pool boat ramp is accessed via FS Road No. 6S76 which is maintained by the Forest Service. In cooperation with the Cal Fish & Game, the Forest Service closes Mammoth Pool Road to vehicular traffic each year between May 1 and June 15, to protect mule deer during the spring migration season.

Mammoth Pool powerhouse is accessed via FS Road No. 8S03. This road is maintained by the Forest Service and is open to public access from Minarets Road (FS Road No. 4S81) to the San Joaquin River. At the San Joaquin River crossing, public vehicular access is restricted by a SCE-controlled gate. SCE maintains the road beyond the locked gate.

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[49] See 99 FERC ¶62,191, Order Amending License, Approving Revised Exhibits and Revising Annual Charges (June 14, 2002).

SCE maintains a number of roads along the Mammoth Pool powerhouse-Big Creek 3 transmission line corridor and public vehicle access to these roads is restricted and controlled by SCE locked gates. These roads include FS Road Nos. 8S44 and 9S42, and a number of spur roads.

Big Creek No. 3 Project

As currently licensed, the Big Creek No. 3 Project facilities, owned and operated by SCE, occupy 508.14 acres of land in unincorporated Fresno County. The project area is located in the San Joaquin River canyon of the Sierra National Forest, Pineridge Ranger District. Total federal land occupied by the project is 508.14 acres.[50] No state or county owned lands are within the project boundary. Private lands within the project boundary, owned and managed by SCE, are located near Powerhouse 3.

The community of Big Creek 3, located adjacent to Powerhouse 3, includes administrative offices, maintenance shops, and facilities that support the hydroelectric operations in the lower canyon area. The community also includes three employee housing structures. The lands associated with these support facilities and employee housing are located within the project boundary.

Non-industrial land uses in the project boundary are open space-oriented. Lands in the project boundary adjacent to Powerhouse 3 forebay are Sierra National Forest lands and are managed primarily for open space and natural resources.

Project facilities are accessed through a system of project roads and trails associated with the operation and maintenance of the project which provide access to two geographic areas:

- Dam 6 forebay and
- Powerhouse 3.

Dam 6 facilities are accessed via Canyon Road (FS Road No. 8S05) which is gated and closed to public vehicle access and maintained by SCE. There are three ways to access Dam 6 forebay: (1) from the Northern Hydro offices area by taking Huntington Lake Road and then Canyon Road along Big Creek to the San Joaquin River; (2) from the Powerhouse 3 area, by traveling north on Canyon Road along the San Joaquin River; or (3) from the Mammoth Pool powerhouse area by traveling south on FS Road No. 8S03, along the San Joaquin River.

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[50] By Order Approving Revised Exhibit K Drawings (122 FERC ¶ 62,241, March 20, 2008), the Commission authorized SCE to take a distribution line, telephone line, and other miscellaneous structures out of the project once it obtains the appropriate Forest Service permits. Removing these project features will reduce the federal lands from 508.14 to 421.33 acres.

Powerhouse 3 and the Big Creek No. 3 community are accessed via Jose Basin Road (a Fresno County maintained road) from the Northern Hydro offices through the community of Auberry, or by Canyon Road (FS Road No. 8S05) from Dam 6 forebay. SCE also uses and maintains a number of spur roads in the Big Creek No. 3 area.

Aesthetic Resources

SCE, in consultation with resource agencies and stakeholders, conducted a visual quality assessment to evaluate the visual compatibility of project facilities with the surrounding landscapes. The aesthetic character and visual effects of the four Big Creek ALP Projects was evaluated using the Forest Service's Visual Management System. This consultation and subsequent analysis was conducted in support of the Big Creek ALP (SCE, 2003j; 2004).

Big Creek Nos. 2A, 8, and Eastwood Project

The Upper Basin consists of an upper high alpine plateau of Jeffrey pine and white fir/lodgepole pine forest. It is in a predominantly granite landscape that abuts the rugged peaks of the high Sierra Mountains to the east. The South Fork San Joaquin River Canyon is also a dominant feature in the Upper Basin area. The project features in this landscape setting include: Florence dam, Bear Creek and Mono Creek diversions and forebays; eight small diversion facilities that are located on small tributaries to the South Fork San Joaquin River; and the Mono-Bear siphon control flow line.

Florence Lake is a large, high elevation alpine lake located in a glacial valley surrounded by large granite domes and mountains. The area around the dam and lake is surrounded by Jeffrey pine and white fir/lodgepole pine forests. It is interspersed with mixed Montane chaparral along the lake shoreline. Vehicular access to the reservoir is limited to locations on its northwestern shore near the dam and boat launch. The upstream shores of the reservoir are only accessible by boat or on foot. Florence Lake is managed by SCE to reach peak storage in the summer, and then is reduced in the fall to its lowest level during the winter to avoid water freezing on the dam face. During summer, when reservoir levels are high, there is relatively little exposed shoreline. However, in the fall and winter with reduced water surface elevation, the shoreline becomes exposed. The Forest Service designates the area around Florence Lake as a visual "Retention" area under its Visual Quality Objective (VQO) criteria. Retention areas imply a high degree of scenic integrity where the landscape appears to be intact.

The Mono-Bear siphon control flow line is visible at its crossing over the South Fork San Joaquin River. It is adjacent to a portion of Kaiser Pass Road immediately north of the South Fork San Joaquin River. The area is dominated by granitic boulder outcrops interspersed with areas of mixed Montane chaparral. The designated VQO around the flow line is "Retention."

The Bear Creek diversion and forebay is a moderate-sized dam and water body located in an area of granitic outcrops amongst Jeffrey pine and white fir/lodgepole pine forests. Access to the dam and forebay is by a 4-wheel drive road (FS Road No. 6S83). Views of the dam and forebay are limited to visitors who travel specifically to the site. This facility is not visible from other locations in the Big Creek Basin. The designated VQO in the area around Bear Creek diversion and forebay is "Retention."

The Shaver Lake Basin area of the project consists mostly of steep mountains with dense Sierran mixed conifer forest and mixed Montane chaparral shrubs. The project features in this setting include Shaver Lake and dam, Balsam forebay and dam, Pitman Creek diversion, Balsam Creek diversion, and the 220 kV Eastwood to Big Creek No. 1 transmission line.

Shaver Lake is surrounded by a dense forest of mixed conifer forests and Montane chaparral shrubs interspersed with granite outcrops. It is surrounded by mountains along the west, north, and east. Shaver Lake is the largest lake in the Big Creek System. It has housing developments, recreational facilities, and commercial marina facilities along its western shore. Public road access to Shaver Lake is limited to the western shore. Road access is limited to the Forest Service, Cal Fish & Game, and SCE on the northern shore. The designated VQO around Shaver Lake is "Retention."

Balsam forebay is surrounded by chaparral and conifer forests. It is located on the ridge of granite peaks northeast of Shaver Lake. A foot trail provides public access to and around the forebay and vehicular access to Balsam forebay is from the southeast shore. Road access to the forebay is limited to SCE, Cal Fish & Game, and Forest Service vehicles. The designated VQO around Balsam forebay is "Retention."

The Lower Big Creek Canyon area consists mostly of a steep, narrow river canyon, characterized by a bare, rocky riverbank in a dry setting of chaparral and oak woodland. The project facilities viewed in this vicinity include Dam 5 and impoundment and Powerhouses 2A and 8. Access to these facilities is along Canyon Road; public vehicles are restricted. The designated VQO in the area around Dam 5 and forebay is "Retention." In the area of Big Creek 8 Powerhouse it is "Retention/Partial Retention." Partial retention refers to landscapes where the valued landscape characters appear slightly altered.

One key observation point, the Mono-Bear siphon control flow line over the South Fork San Joaquin River, was identified in consultation with the Forest Service as a project feature that can be viewed from Kaiser Pass Road.

Big Creek Nos. 1 and 2 Project

The Big Creek Nos. 1 and 2 Project occupies terrain which includes Huntington Lake, dense Sierran mixed conifer forest, the surrounding peaks of resistant sedimentary roof pendants, granitic outcrops to the north, and remnant volcanic peaks to the southeast. Lower in elevation below Huntington Lake is Big Creek Canyon; a steep narrow canyon characterized by mixed conifer forest transitioning to oak woodland with interspersed granitic outcrops. Kerckhoff Dome, a large granite dome, is a dominant feature in the landscape and is located in the background of the Big Creek community.

Huntington Lake is located in a valley surrounded by mountains to the south, east and north. Huntington Lake is a large, man-made, high mountain reservoir that supports developed recreational use. The area is vegetated with Sierran mixed conifer forest and mixed Montane chaparral shrubs. Project features viewed in the vicinity of Huntington Lake include the reservoir and Dams 1, 2, 3, and 3A, located at the southwest end of the lake. Views of the dams are generally limited to motorists along Huntington Lake Road and to visitors in the immediate vicinity of the dams.

Public access to Huntington Lake is from the southeast via Highway 168, and from the southwest from the town of Big Creek via Huntington Lake Road, which provides public access to the lake along its northern shore. A number of private cabins are located along the northern shores of Huntington Lake. There are seven developed campgrounds around the lake, mostly located along the northern shore. The water surface elevation of the lake is managed by SCE to include spill prevention and keeping the lake at near maximum capacity to support recreational uses from Memorial Day through Labor Day. To protect the dam structures during the winter season, and to prepare for spring run-off, the water surface elevation of the lake is reduced in the fall, after the peak recreational season. This reduction typically exposes an observable shoreline ring.

The project features viewed in the Big Creek Canyon area include: SCE's administrative buildings and company housing; Dam 4 and forebay; and Powerhouse 1 penstocks and switchyard. Powerhouse 2 is not readily viewed by the public as it is located down Big Creek Canyon along Canyon Road, which is not open to public vehicular access. The Northern Hydro administrative facilities and company housing, Powerhouse 1 penstocks switchyard, and Dam 4 forebay are all located in a mixed conifer forest setting. Views of the community, powerhouse, dam, and forebay are limited by the steep narrow river canyon and forest vegetative growth bordering the road. However, from Huntington Lake Road, motorists can view the penstocks for Powerhouse 1 adjacent to Kerckhoff Dome and the Big Creek No. 1 switchyard next to the powerhouse. The designated VQO in this vicinity is "Retention."

Two key observation points were identified along Huntington Lake Road. From these key observation points along Huntington Lake Road the general public can easily view the Big Creek No. 1 penstocks and the switchyard. These key observation points were identified in consultation with the Forest Service.

Mammoth Pool Project

The dam and reservoir occupy terrain which consists of steep sided granite mountains in a mixed conifer and oak woodland transition zone forest. The reservoir shoreline consists of exposed granite outcrops interspersed with areas that are vegetated with shrubs and trees. Access to the reservoir is limited to locations on its south shore near the dam, boat launch, and developed campground. The northwest and southeast shores of the reservoir are only accessible by boat or on foot. The reservoir is managed by SCE to maintain a relatively stable water surface elevation during the recreational season. During the fall and late winter the reservoir water surface elevation is reduced in preparation for the capture of spring run-off, exposing a ring of barren shoreline around the perimeter of the reservoir. The designated VQO in the area around Mammoth Pool reservoir is “Retention.”

The area around Mammoth Pool powerhouse consists of a steep, narrow river canyon characterized by a bare, rocky riverbank in a dry setting of chaparral and oak woodland. The project facilities viewed in this landscape include the Mammoth Pool powerhouse and penstocks. Public access to the location is via FS Road No. 8S03 from Minarets Road located on the ridge to the west of the powerhouse and canyon. The designated VQO in the area of Mammoth Pool powerhouse and penstocks is “Partial Retention/Modification.”

One key observation point along FS Road No. 8S03 was identified in consultation with the Forest Service where the general public can easily view the Mammoth Pool powerhouse and penstock when looking in a southeasterly direction.

Big Creek No. 3 Project

The significant landscape feature in the vicinity of the Big Creek No. 3 Project is the San Joaquin River Canyon. It is characterized by a steep, narrow river canyon, commonly referred to as Chawanakee Gorge. This reach of the river is interspersed with sections where the canyon is deeply incised as the river cuts through large granitic domes, exposing dramatic views of sheer granite walls along the edge of the canyon. Project features within this landscape include Dam 6 at the upper reach of the project, the Powerhouse 3 and penstocks, and Big Creek No. 3 administrative facilities.

Dam 6 and its forebay are located at the confluence of Big Creek and the San Joaquin River. The landscape is of a steep, narrow river canyon in a dry oak woodland and chaparral setting. The forebay is confined in the narrow canyon, and is subject to limited fluctuation of water surface elevation. Public vehicle access is only available at the upstream northern extent of the forebay. This location is accessible by FS Road No. 8S03 from Minarets Road, located on the ridge to the west of the forebay. At the river crossing of FS Road No. 8S03, there is a public parking area and a locked gate that restricts public vehicle access along the eastern shore of the forebay. The view of Dam 6 is limited, due to the narrow canyon and public vehicular access is restricted by a SCE-controlled gate. The designated VQO in the vicinity of Dam 6 is “Partial Retention.”

Powerhouse 3 and its associated penstocks are located on the San Joaquin River at the upstream end of Redinger reservoir. The topography opens up into a small basin area, commonly referred to as Jose Basin. This small basin is an area of rolling hills in dry oak woodland and grassland setting that is surrounded by steep mountains. Access into the basin is provided by Italian Bar Road from the west and Jose Basin Road from the south. Public vehicular access upstream along the San Joaquin River is restricted and controlled by a locked gate.

Powerhouse 3 and penstocks are located against the steep granite mountain located at the mouth of Chawanakee Gorge. The views of these facilities from Italian Bar Road or Jose Basin Road are limited by the narrow steep topography. However, the powerhouse and penstocks are easily viewed by boaters on the upstream end of Redinger reservoir. The designated VQO in the vicinity of Powerhouse 3 and penstock is "Partial Retention."

The Big Creek No. 3 administrative facilities consist of a number of administrative support buildings in an area of rolling hills in an oak woodland and grassland setting. Views of project facilities are generally limited to motorists traveling along Jose Basin Road. The designated VQO in the vicinity of Big Creek No. 3 administrative facilities is "Partial Retention."

One key observation point was identified from Redinger reservoir and Italian Bar Road in consultation with the Forest Service where the general public can easily view the Big Creek No. 3 penstocks.

3.3.6.2 Environmental Effects

Project Boundary Revisions

Big Creek Nos. 2A, 8, and Eastwood Project

SCE proposes to remove eight parcels from the Big Creek Nos. 2A, 8, and Eastwood Project boundary. SCE states that the parcels proposed to be removed are lands that are not needed for access to, or for the safe and efficient operation and maintenance of, the Big Creek Nos. 2A, 8, and Eastwood Project. The eight parcels include: lands located southwest of powerhouses 2 and 2A and along the southern side of Rancheria Creek; Eastwood Overflow Campground; Eastwood Overlook; two Forest Service roads (FS Road No. 5580H, the access road to Bolsillo Creek diversion from FS Road No. 5S80 and FS Road No. 9S311 from Highway 168 to the Eastwood power station switchyard); Chinquapin diversion piping; and the Florence Lake day-use area. SCE proposes to add 27 parcels to the project boundary which include: 11 project roads; 4 foot trails leading to project facilities; 3 gaging stations; and 9 helicopter landing sites. SCE states that the parcels proposed to be added are lands necessary for the maintenance and safe and efficient operation of the project.

Areas proposed for inclusion in the project boundary include:

- FS Road No. 8S08A, the access road to the upper penstock valves for Tunnel 5 from FS Road No. 8S08 (Railroad Grade Road);
- Bolsillo Creek diversion and Stream Gage Trail
- Chinquapin Creek diversion and Stream Gage Trail;
- FS Road No. 9S17 access road to Eastwood power station – Big Creek 1 transmission line tower M0 T3;

- FS Road No. 9S312, access road to Eastwood power station switchyard;
- Gaging station on the South Fork San Joaquin River above Hooper Creek confluence (SCE gage no. 128S);
- FS Road No. 8S83 from the current project boundary for Big Creek Nos. 1 and 2 Project to the Huntington-Pitman-Shaver siphon;
- FS Road No. 8S94, Pitman Creek diversion access road;
- FS Road No. 9S32C, access road to the Eastwood power station-Big Creek No. 1 transmission line;
- FS Road No. 8S47, access road to the Eastwood power station-Big Creek 1 transmission line;
- FS Road Nos. 8S02 and 8S02B, access road to the Huntington-Pitman-Shaver tunnel adit;
- FS Road No. 9S58, access road to Eastwood power station and the North Fork Stevenson Creek gage;
- FS Road No. 9S58K, access road to Eastwood power station entrance tunnel;
- Access road to Eagle Point boat-in day-use area;
- Trail to Big Creek stream gage below Dam 5;
- Bear Creek Stream Gage Trail;
- Gaging station on South Fork San Joaquin River below Hooper Creek confluence (SCE gage no. 129);
- Land surrounding the gaging station on Hooper Creek below Hooper Creek diversion (SCE gage no. 114) and the Hooper Creek diversion helicopter landing site; and
- Helicopter landing sites at South Fork San Joaquin River at Florence spill station; Summit at Shaver Hill; Tiffany Pines at Camp Edison; Bear Creek diversion; South Fork San Joaquin River below Hooper Creek; Mount Givens telecom site; Florence Lake dam; Mono Creek diversion; and Mono Creek below Lake Edison.

Our Analysis

According to 18 CFR 4.51(h), land included within a project's boundary must enclose those lands necessary for operation and maintenance of the project and for other project purposes such as recreation, shoreline control, or protection of environmental resources. The Big Creek Nos. 2A, 8, and Eastwood Project covers the largest geographical area of all seven projects in the Big Creek System. Pursuant to SCE's request to include the three gaging stations, access is important to SCE's ability to monitor flows within the project's water conveyance system at remote sites.

The nine helicopter landings, eleven roads, and four foot trails proposed to be added to the project boundary would all be used frequently by SCE for project purposes to gain access to project facilities, the transmission line, and stream gages located in remote areas during all types of weather.

Eastwood Overflow Campground is used as a designated Forest Service dispersed camping area when developed campgrounds at nearby Huntington Lake are full. The Forest Service allows camping here for a maximum of 24 hours. The Eastwood Overlook is located on 2 acres of land near Portal powerhouse at the north end of Huntington Lake. The overlook provides an interpretive display containing signs, maps, and project area information. The facility features several informational signs about the Big Creek System. SCE states the Eastwood Overflow Campground is more strongly associated with recreational use at Huntington Lake, a primary feature of Big Creek Nos. 1 and 2 Project, than it is with the Big Creek Nos. 2A, 8, and Eastwood Project. SCE recommends the campground and overlook be removed from the Big Creek Nos. 2A, 8, and Eastwood Project boundary and included in the Big Creek Nos. 1 and 2 Project. Commission staff analyzed this issue during the relicensing of the Portal Project (Project No. 2174) and agreed that the removal of these facilities from the Big Creek Nos. 2A, 8, and Eastwood and Portal projects and their incorporation into the Big Creek Nos. 1 and 2 Project would ensure the three project boundaries no longer overlap and the two facilities would be managed under one project's management strategy. This action would not affect the Forest Service's management capabilities of the Eastwood Overflow Campground or uses of these parcels.

The Florence Lake day-use area is located near the Florence Lake boat ramp by the Crater Creek diversion channel that flows into the northwestern corner of Florence Lake. The day-use area consists of 16 picnic sites, a toilet, and dumpster and is operated and maintained by the Forest Service. SCE's proposal to remove the Florence Lake day-use area from the project boundary would remove an existing facility that provides public use and access to the project. SCE has not demonstrated that these facilities and lands are no longer required for project purposes and that there is no nexus of these lands and facilities to the project and public recreational access to project resources. By maintaining the Florence Lake day-use area within the project boundary, the Commission would retain the authority to ensure that SCE provides long-term public use and access at these facilities.

The Florence Lake boat ramp would remain within the project boundary and would help ensure that long-term public access to the project's reservoir for recreational opportunities over the term of a new license.

Approximately 16.48 acres located southwest of Powerhouses 2 and 2A are proposed to be removed from the project boundary. Land use for this area has changed since the project was first licensed. Formerly, this land was occupied by SCE company housing. The structures have been removed and the land has been restored after consultation with the Forest Service. In addition, 12.53 acres located along the southern side of Rancheria Creek from approximately 500 feet upstream of Portal powerhouse downstream to Huntington Lake is proposed to be removed from the project boundary. These lands are not used by SCE and SCE states it does not require any access to these lands for the operation of the project. A review of the record for this proceeding does not indicate any formal recreational facilities or shoreline issues on these lands.

FS Road No. 5580H (access road to Bolsillo Creek diversion, from FS Road No. 5S80) and the access road to the Bolsillo Creek diversion are proposed to be removed from the project boundary. FS Road No. 5S80 is open to public access and provides access to the Forest Service's Bolsillo Campground, a Forest Service horse corral, and the Corbett Lake trailhead. This road is not used by SCE for project purposes and would not affect the Forest Service's management capabilities.

The Chinquapin diversion piping and co-aligned segment of FS Road No. 7S01 is also proposed to be removed from the project boundary. The Chinquapin diversion was relocated in 2002 and the associated steel diversion piping alongside of the road was removed at that time. The change in land use associated with these lands no longer requires SCE to access them and their removal from the project boundary would not affect the operation of the project or the Forest Service's management capabilities.

FS Road No. 9S311 from Highway 168 to the Eastwood power station switchyard is also proposed to be removed from the project boundary. SCE employees use FS Road No. 9S312 to gain access to the switchyard which is a feature of the transmission grid and not associated with the hydroelectric project. Therefore, removal of this road would not affect project operations or the Forest Service's management capabilities.

Big Creek Nos. 1 and 2

SCE proposes ten modifications to the Big Creek Nos. 1 and 2 Project boundary. Six modifications include the removal of lands from the project boundary. SCE states that the parcels proposed to be removed are lands that are not needed for access to, or for the safe and efficient operation and maintenance of, the Big Creek Nos. 1 and 2 Project. These modifications include: a portion of Rancheria Creek; a portion of a road right-of-way along a Forest Service road; a communication line right-of-way; former company housing areas; a Forest Service road; and excess lands near Powerhouses 2 and 2A. Four modifications include the addition of lands within the project boundary. These modifications include: the Eastwood Overflow Campground; the Eastwood Overlook; and two Forest Service roads. SCE states in its application that all these parcels proposed to be added are lands necessary for the maintenance and safe and efficient operation of the project. The Forest Service concurs with the project boundary changes SCE is proposing at the project.

Our Analysis

SCE proposes to add the access road beginning from the gate located at the terminus of Fresno County Road 3380 (Huntington Lodge Road) to the west end of Dam 2 (FS Road No. 8S66) and the segment of FS Road No. 8S83 from the junction with FS Road No. 8S83A to the current project boundary to the project boundary. SCE uses both of these roads to access project facilities in the vicinity of Dams 1 and 2.

SCE proposes to take out of the project boundary the area surrounding Rancheria Creek from Portal powerhouse to the high water line of Huntington Lake (Portal tailrace). This reach is primarily affected by flow through the Ward Tunnel and is currently included in the project boundaries of two other FERC licensed projects (Big Creek Nos. 2A, 8, and Eastwood, Project No. 67; and Portal Project, Project No. 2174). Commission staff analyzed this issue during the relicensing of the Portal Project and concurred with SCE's recommendation that this reach be removed from the Portal Project (FERC, 2006) boundary. Removal of this reach from the Big Creek Nos. 1 and 2 Project would be consistent with the action proposed for the Portal Project. Since this reach is the primary water conveyance from the back-country diversions, which are largely part of Project No. 67, protection of this reach under the Big Creek Nos. 2A, 8, and Eastwood Project would ensure the project's continued operation.

The right-of-way along the access road to the gaging station located on Big Creek below Huntington Lake (FS Road Nos. 8S66 and 8S66A) is proposed to be reduced from 100 ft to 50 ft. The project boundary is proposed to be modified to align with two road segments as follows: (1) FS Road No. 8S66 from near the east end of Dam 2 to the intersection with FS Road No. 8S66A; and (2) FS Road No. 8S66A from FS Road No. 8S66 to the gaging station. Aligning the project boundary with project roads would allow for easier administrative management of project lands. Removal of these lands would not change the Forest Service's management capabilities or change SCE's responsibilities under the Transportation System Management Plan, discussed later in this section.

Two parcels of land that have been used in the past for company housing areas are proposed to be removed from the project boundary. The land use for both parcels has changed since the project was first licensed. The structures have been removed and the land has been restored after consultation with the Forest Service. SCE does not need continued access to these lands; therefore, they are not necessary for project purposes. A review of the record for this proceeding indicates no formal recreational facilities or shoreline issues within the 36.19 acres proposed for removal from the project boundary.

The segment of FS Road No. 8S13 between the gate near the top of the penstocks for Powerhouses 2 and 2A and FS Road No. 8S08 (Railroad Grade Road) is proposed to be removed. SCE uses Canyon Road (FS Road No. 8S05) as its primary access to project facilities in this area. SCE does not use this road, and it not needed for project purposes.

The communication line right of way from the dispatcher's office near Powerhouse 3 to Powerhouse 2 and the Northern Hydro offices near Powerhouse 1 is proposed to be removed. The land use for this area has changed and the communication line and associated equipment have been removed, after consultation with the Forest Service. Communication between the project facilities is currently conducted via microwave transmission or by fiber optic cable. SCE does not need access to this area any more and the land is not needed for any project purpose.

Mammoth Pool Project

SCE proposes two project boundary modifications to include a helicopter landing site adjacent to the San Joaquin River above Shakeflat Creek and trail along Shakeflat Creek that would provide access leading to the stream gage (SCE gage no. 157) located on the San Joaquin River. The net change in project area would be an increase of 3.6 acres, revising the total federal land acreage within the project to 2,033.28. The Forest Service concurs with these project boundary changes.

Our Analysis

SCE's request to include the trail and helicopter landing in the project boundary in order to access SCE gage no. 157 is important to SCE's ability to monitor flows within the project's water conveyance system at remote sites. The helicopter landing is needed to access the trail and maintain the stream gage. The helicopter landing and foot trail would be used frequently by SCE for project purposes to gain access to the project stream gage, located in a remote area of the project, during all types of weather.

Big Creek No. 3 Project

SCE proposes to remove 44.17 acres of federal land above the high water line around Dam 6 forebay. SCE states the land is not needed for access to the forebay or for the operation and maintenance of the project. The net change in project area would be a reduction of 44.17 acres, ultimately revising the total federal land acreage to 377.16 acres. The Forest Service concurs with the project boundary changes SCE is proposing at the project.

Our Analysis

A review of the record for this proceeding does not indicate any formal recreational facilities or shoreline issues on the 44.17 acres proposed for removal. The area does is not needed for project operations or maintenance needs; therefore, SCE does not need access to these lands for project purposes.

Land Management Plans

Transportation System Management Plan

The Transportation System Management Plan was developed for all four Big Creek ALP Projects subject to this environmental analysis. SCE proposes to implement the Transportation System Management Plan filed as appendix N in the Settlement

Agreement. The plan's objective is to address transportation system management issues in a comprehensive manner and put all requirements of the license in one plan that would cover the Big Creek System. The plan addresses road and trail issues related to access, maintenance activities, rehabilitation needs, road use, and traffic control measures. The plan describes measures that SCE would implement to repair, minimize, or eliminate effects associated with the maintenance and operation of SCE's Big Creek ALP Projects. The plan addresses only those project roads and trails that are located within the project boundaries or used by SCE for the operation and maintenance of the project.

The plan states that SCE would maintain roads and trails outside license boundaries where the primary purpose is to provide access for SCE to operate its facilities. These roads would be authorized by a Road Use Permit and SCE would be responsible for maintenance at a rate commensurate with its use. The Forest Service would calculate commensurate share responsibilities based on SCE access to SCE facilities. Estimates may be based on traffic surveillance, recreational use reports, or estimates derived through observation. SCE may perform maintenance of these roads and/or provide the Forest Service with deposits for maintenance activities at the Forest Service's discretion.

The plan states SCE would have full responsibility and would take appropriate measures to rehabilitate unsafe conditions or resource damage on project roads and trails. SCE would consult with the Sierra National Forest annually to identify road rehabilitation and maintenance projects and other activities that would be performed each year.

Big Creek Nos. 2A, 8, and Eastwood Project

Forest Service specifies in condition 19, implementation of the Transportation System Management Plan included as appendix N in the Settlement Agreement. The condition is generally consistent with the Settlement Agreement. SCE responded to Forest Service condition 19 and made 12 corrections in the Forest Service's table 1. These corrections included changes in road length and SCE operation and maintenance activities conducted on specific roads.[51] In addition, SCE states that condition 19 included non-project roads that would be regulated by the Forest Service, not by SCE. SCE states the manner in which non-project roads will be addressed does not belong in a 4(e) condition.

Big Creek Nos. 1 and 2, Mammoth Pool, and Big Creek No. 3 Projects

Forest Service condition 18 specifies implementation of the Transportation System Management Plan included as appendix N in the Settlement Agreement. For the

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[51] In its draft EIS comments, the Forest Service indicated that it would provide copies of the tables that should have been included as agreed to in the Settlement Agreement with its revised final section 4(e) conditions (letter from E. Cole, Forest Supervisor, Sierra National Forest, Clovis, CA to the Commission, October 29, 2008.

Mammoth Pool Project, the Forest Service also states that SCE would continue to maintain the graded natural road surface on portions of the road that have a shared alignment, and also at those locations where the San Joaquin River Trail crosses a project road. The condition is generally consistent with the Settlement Agreement.

SCE's response to Forest Service condition 18 for the Big Creek Nos. 1 and 2 Project included 3 corrections to the Forest Service's Table 1 Project Roads and 20 corrections for Big Creek Project No. 3. These corrections included changes in road length and SCE operation and maintenance activities conducted on specific roads.[52] In addition, SCE states that non-project roads and how those roads would be regulated by the Forest Service does not belong in a 4(e) condition.

Our Analysis

The Transportation System Management Plan helps to clarify SCE use of Forest Service roads and trails and establish a forum for coordination of road maintenance activities between SCE and the Forest Service. This plan delineates SCE's responsibilities for maintaining project roads and trails used for project operations and maintenance and ensures that safety and environmental measures associated with these roads are addressed in the proper manner.

The establishment of the cost-sharing agreement for non-project roads based on use classification helps provide an equitable basis for funding the maintenance of project related roads among users. Roads and trails located outside of the project boundary are not subject to Commission jurisdiction or the terms and conditions of the license, therefore, outside of the scope of 4(e) conditions.

Land Resource Plans

The Forest Service specifies in its conditions that SCE would develop and file with the Commission, in consultation with the Forest Service, Land Resource Plans that are approved by the Forest Service, as they relate to resource management on the National Forest. The plans would include a Fire Management and Response Plan and a Visual Resources Plan.

Fire Management and Response Plan

SCE states that fire management responsibility in the Big Creek ALP Projects' vicinity falls to the Forest Service and local fire districts. SCE states that mutual aid agreements are in place for the fire responders to assist each other. SCE maintains a basin-wide fire plan that is developed and reviewed annually in consultation with the Forest Service. The plan outlines responsibilities for fire prevention and suppression during planned field activities for the duration of each declared fire season, or when ground litter and vegetation would sustain combustion, causing the spread of fire. The

[52] See footnote 51.

plan also includes initial attack and reporting procedures that would be followed in the event of a fire in the vicinity of the projects, or resulting from any SCE operations on federal lands.

Forest Service conditions specify that SCE, within 1 year of license issuance, file with the Commission a fire prevention and response plan that is approved by the Forest Service, and developed in consultation with appropriate state and local fire agencies. The plan would set forth in detail SCE's responsibility for the prevention (excluding vegetation treatment as described in Forest Service condition 16), reporting, control, and extinguishing of fires in the vicinity of the Big Creek ALP Projects resulting from project operations. At a minimum the plan would address the following categories: (1) fuels treatment/vegetation management; (2) prevention; (3) emergency response preparedness; (4) reporting; and (5) fire control/extinguishing. Forest Service conditions further describe the cooperative relationship that would be maintained during investigations of fires on project lands.

Our Analysis

The development of a fire management response plan would inform Forest Service staff of potential threats to natural resources and project facilities from project induced fires, and how to protect project facilities from natural wildfires. The fire management response plan would enable the Forest Service to prepare or train staff to assist in preventing or controlling fires on or adjacent to project facilities for the protection of the project or natural resources. The plan would identify the cooperative roles and responsibilities of SCE and the Forest Service in fire investigation on project lands.

Visual Resources Plan

The Visual Resources Plan was developed for all four Big Creek ALP Projects subject to this environmental analysis. SCE proposes implementing the Visual Resources Plan included as appendix M of the Settlement Agreement. The plan includes an evaluation of existing visual resources in the projects' vicinity, mitigation measures for facilities that have been identified as currently having a visual effect on the landscape character, and a discussion for the selection of colors for future painting of project facilities to minimize potential visual effects on aesthetic resources.

The Visual Resources Plan states SCE would consult with the Forest Service for the selection of three test colors to be used in test patches that blend best with the surrounding environment. SCE would paint three 10 foot by 10 foot or other readily visible and appropriately sized test panels on the penstock and conduit using the agreed upon test colors. These test patches would be observed for a 1-year period to determine which color best blends with the natural environment. The 1-year period would allow for seasonal color contrast comparisons. SCE would select the final color in consultation with the Forest Service. SCE would repaint project facilities using the agreed upon color during the normal painting schedule for that facility.

The Visual Resources Plan states that a number of project facilities associated with the four Big Creek ALP Projects are proposed contributing elements of the National Register of Historic Places-eligible BCHSHD and are proposed key components of the historic landscape. Upon determination by the State Historic Preservation Officer (SHPO) of the Big Creek Historic District Designation and concurrence that the penstocks and flow line conduit are contributing elements of the BCHSHD, SCE would seek guidance from the SHPO regarding the selection of paint colors that would preserve the historic character of the BCHSHD. Upon approval by SHPO, SCE would seek approval from the Forest Service and the Commission. These facilities would be repainted using a color that retains the historic character of the BCHSHD.

According to the Forest Service, the following project facilities with a VQO of Partial Retention are noticeable deviations from the landscape character and are inconsistent with a Partial Retention VQO.

- for the Big Creek Nos. 2A, 8, and Eastwood Project: the Mono-Bear siphon control flow line conduit over the San Joaquin River from Kaiser Pass Road;
- for the Big Creek Nos. 1 and 2 Project: the Big Creek No. 1 penstocks from Huntington Lake Road;
- for the Mammoth Pool Project: the penstock area; and
- for the Big Creek No. 3 Project, the penstocks from Redinger reservoir.

In addition, according to the Forest Service the Big Creek No. 1 switchyard deviates from the landscape character and is inconsistent with a Retention VQO when viewed from Huntington Lake Road.

Forest Service conditions require that SCE implement the Visual Resources Plan, included in the Settlement Agreement, appendix M. The conditions are consistent with the Settlement Agreement.

Our Analysis

The landscape views of the project penstocks and Mono-Bear siphon control flow line over the San Joaquin River from Kaiser Pass Road have a VQO of Partial Retention. The facilities are deviations from the landscape character and are inconsistent with Partial Retention VQO. The project facilities are not compatible with the current Forest Service VQOs for the area. SCE's implementation of the Visual Resources Plan, specifically the selection of neutral paint color schemes that blend in with the surrounding landscapes, would reduce visual effects to the aesthetic resources at the project.

The landscape view of the Big Creek No. 1 switchyard can be viewed from one location along Huntington Lake Road when looking across Big Creek Canyon. The facilities are deviations from the landscape character and are inconsistent with Partial Retention VQO. The project facilities are not compatible with the current Forest Service VQOs for these areas. SCE's implementation of the Visual Resources Plan, specifically the selecting of neutral paint color schemes that blend in with the surrounding landscapes and the screening of the Big Creek No. 1 switchyard would reduce visual effects to the aesthetic resources at the project.

Sign Plan

Forest Service condition 20 (Project No. 67) and 19 (Project Nos. 120, 2175, and 2085) specify that SCE prepare a Sign Plan (as a component of the Land Resource Plans) in consultation with the Forest Service, California Department of Transportation, Fresno County, and other interested parties, within 1 year of license issuance. The plan would conform to the Manual of Uniform Traffic Control Devices, Forest Service sign handbook, and other applicable standards. The Forest Service specifies that the Sign Plan should at a minimum include the measures for sign format/consistency and the location, design, size, color, and message for the following types of signs: information and education, fire prevention, regulatory and warning, project license, road, recreational, directional (to assist non-local visitors), and safety.

The Forest Service also specifies that the Sign Plan address maintenance standards so that all signs are maintained in a neat and presentable condition and that signs which are to be placed on National Forest System lands be approved by the Forest Service. The Forest Service specifies that SCE would not be required to consult or obtain the prior approval of the Forest Service for signs on SCE-owned land that are not visible from National Forest System lands. The Forest Service specifies that SCE implement the Sign Plan upon Commission approval of the plan.

Our Analysis

Development and implementation of a Sign Plan and associated measures for the Big Creek ALP Projects would provide the means for coordinated and systematic development of signage associated with the projects. The Sign Plan, as specified by the Forest Service, would also provide the means to ensure that signage within the Big Creek ALP Projects conforms to applicable standards and are maintained and conform to Forest Service standards on lands that are visible from National Forest Service lands. Review and approval of the Sign Plan by the Commission would ensure that the recommended components of the Sign Plan conform to Commission regulations for licensed hydropower projects.

3.3.7 Air Quality

3.3.7.1 Affected Environment

The California Air Resources Board (CARB), as part of the California Department of Environmental Protection, is responsible for protecting public health and the environment from the harmful effects of air pollution. Pollutants associated with air emissions, such as ozone, particulate matter, and nitrogen dioxide, are associated with respiratory illness. Carbon monoxide, another air pollutant, can be absorbed through the lungs into the bloodstream and reduce the ability of blood to carry oxygen. Sources of air emissions include commercial facility operations, fugitive dust, on-road vehicles and trucks, aircraft, boats, trains, and natural sources such as biogenic and geogenic hydrocarbons and wildfires.

The topography and meteorology of the western slope of the Sierras are the important factors in the environmental effects of air quality emissions. Dispersion of high pollutant concentrations in downwind areas is hindered by the mountainous topography. Frequent inversions, in which warm air overlays cool air, trap pollutants close to the ground. In summer, long days, stagnant air, and high temperatures facilitate photochemical production of ozone from precursor air pollutants such as volatile organic compounds and oxides of nitrogen. Although the San Joaquin Valley is influenced by pollutants transported from other air basins, the effect declines from north to south. Most of the air pollution caused from ozone in the valley is a result of local emissions from agricultural operations, motor vehicle emissions, and larger industrial sources such as oil production and refining in the southern portion of the San Joaquin Valley (CARB, 2001). CARB has designated Fresno and Madera counties, which are located in the eastern portion of San Joaquin Valley Air Basin, as a severe impact zone for ozone measured over a 1-hour period (CARB, undated).

The central portion of the San Joaquin Valley, which includes the city of Fresno, has a rapidly growing population. Recently, the Fresno area has experienced the highest ozone concentrations in the valley, consistently violating the state ozone standard. These violations are predominantly caused by local emissions (CARB, 2001). From the San Joaquin Valley, winds carry pollution eastward up the canyons of the western Sierra Nevada during the day, as far as the crest of the mountains. This conduit includes the area in which the Big Creek ALP Projects are located. From there, pollutants flow east via gaps in the crest, contributing to ozone violations in the Mammoth Lakes area on the eastern slope of the Sierra Nevada (CARB, 2001).

To reduce harmful exposure to air pollutants, the federal Clean Air Act requires EPA to set outdoor air quality standards for the nation with the option for states to adopt additional or more protective standards if needed. CARB has adopted ambient (outdoor) air quality standards that are more protective than federal standards and has implemented standards for some pollutants not addressed by federal standards. An ambient air quality standard establishes the concentration above which the pollutant is known to cause adverse health effects to sensitive groups within the population such as children and the elderly. The goal is for localized project effects not to cause or contribute to an exceedance of the standards. Criteria pollutants for which ambient air quality standards have been established are ozone, carbon monoxide, lead, nitrogen dioxide, particulate matter, sulfur dioxide, sulfates, hydrogen sulfide, and vinyl chloride. California and federal ambient air quality standards for criteria pollutants are presented in table 3-25.

Table 3-25. California and federal ambient air quality standards. (Source: CARB, 2008)

Pollutant	Averaging Time	California Standards	Federal Standards	
			Primary	Secondary
Ozone (O_3)	1 hour	0.09 ppm (180 μg/m^3)	-	Same as primary standard
	8 hour	0.07 ppm (137 μg/m^3)	0.08 ppm (157μg/m^3)	
Respirable Particulates (PM_{10})	24 hour	50 μg/m^3	150μg/m^3	Same as primary standard
	Annual mean	20 μg/m^3	--	
Fine Particulates ($PM_{2.5}$)	24 hour	No standard	35 μg/m^3	Same as primary standard
	Annual mean	12 μg/m^3	15 μg/m^3	
Visibility Reducing Particulates	8 hour	Extinction coefficient of 0.23 per km; visibility of 10 miles or more	--	--
Carbon Monoxide (CO)	1 hour	20 ppm (23 μg/m^3)	35 ppm (40 μg/m^3)	None
	8 hour	9.0 ppm (10 μg/m^3)	9 ppm (10 μg/m^3)	
Nitrogen Dioxide (NO_2)	1 hour	--	--	Same as primary standard
	Annual mean	0.25 ppm (470 μg/m^3)	0.053 ppm (100 μg/m^3)	
Sulfur Dioxide (SO_2)	1 hour	0.25 ppm (655 μg/m^3)	--	--
	3 hour	--	--	0.5 ppm (1300 μg/m^3)
	24 hour	0.04 ppm (105 μg/m^3)	0.14 ppm (365 μg/m^3)	_
	Annual mean	--	0.03 ppm (80 μg/m^3)	--

Pollutant	Averaging Time	California Standards	Federal Standards	
			Primary	Secondary
Lead	30 day average	1.5 μg/m^3	--	--
	Calendar quarter	--	1.5 μg/m^3	Same as primary standard
	Rolling 3-month average	--	0.15 μg/m^3	
Sulfates	24 hour	25 μg/m^3	--	--
Hydrogen Sulfide	1 hour	0.03 ppm (42 μg/m^3)	--	--
Vinyl Chloride	24 hour	0.01 ppm (26 μg/m^3)	--	--

Existing Air Quality

To manage air quality problems, California is divided into 15 air basins, each of which is associated with an Air Quality Management District. The Big Creek ALP Project study area is located in Fresno and Madera counties, which are within the San Joaquin Valley Air Basin.

Both the California and federal governments use ambient air monitoring data to classify areas according to their attainment status with respect to criteria pollutants. These designations are used to identify areas with air quality problems and help determine whether project emissions would be considered significant under the NEPA and CEQA assessments. The three basic designation categories are:

- Attainment—indicates that ambient air quality is not in violation of the established standard for the specific criteria pollutant.
- Non-attainment—indicates that the ambient air quality violates the established standard for the specific criteria pollutant.
- Unclassified—indicates that there is currently insufficient data for determining attainment or non-attainment.

Fresno and Madera counties are currently in attainment for state standards for carbon monoxide, nitrogen dioxide, sulfur dioxide, sulfates, and lead, non-attainment for ozone and particulate matters ($PM_{2.5}$ and PM_{10}), and unclassified for hydrogen sulfide and visibility reducing particles. Both counties are also in attainment for national standards for carbon monoxide, nitrogen dioxide, and sulfur dioxide, and non-attainment for ozone and $PM_{2.5}$. On September 25, 2008, EPA reclassified the San Joaquin Valley as attainment for the PM_{10} national air quality standard (San Joaquin Valley Air Pollution Control District, 2008a).

During the years 2003 through 2005, the San Joaquin Valley recorded an average of 105 exceedance days per year for the national ozone standard. The 1990 amendments to the Clean Air Act require federal agencies to conform to applicable State Implementation Plans for non-attainment areas. State Implementation Plans are state air quality regulations that provide for the implementation, maintenance, and enforcement of the national ambient air quality standards and include emissions limitations and control measures to attain and maintain the standards. The San Joaquin Valley Air Pollution Control District developed the 2007 Ozone Plan as the State Implementation Plan for ozone non-attainment (San Joaquin Valley Air Pollution Control District, 2007a). From 1990 through 2005, valley-wide emissions of two ozone precursors, oxides of nitrogen and volatile organic compounds, have decreased by 42 percent and 37, respectively and ozone values measured at every monitoring site in the San Joaquin Valley were lower in 2005 than in 2003 (San Joaquin Valley Air Pollution Control District, 2007a).

The San Joaquin Valley Air Pollution Control District submitted a request for redesignation of the valley to attainment for PM_{10}, and a maintenance plan documenting steps that would be taken to ensure continued attainment of the national air quality standard (San Joaquin Valley Air Pollution Control District, 2007b). As previously noted, EPA designated the valley as attainment for PM_{10} in September 2008. According to Rule 8011, developed by the San Joaquin Valley Air Pollution Control District pursuant to guidance from EPA for serious PM_{10} non-attainment areas, activities conducted at an elevation of 3,000 feet or higher above msl are exempt from the required actions to prevent or reduce fugitive dust emissions (San Joaquin Valley Air Pollution Control District, 2004). According to the District, this exemption was enacted because studies within the District have indicated that mountainous areas do not significantly contribute to PM_{10} non-attainment in the District (personnel communication, H. Guerra, Senior Air Quality Planner, San Joaquin Valley Air Pollution Control District, as cited in SCE, 2004b). SCE determined that there are 13 project-related road segments below elevation 3,000 feet that provide access to Dams 5 and 6 and the Mammoth Pool and Big Creek No. 3 powerhouses. SCE's analysis of PM_{10} emissions from these roads indicates that under existing conditions, fugitive dust is less than half of *de minimis* levels identified by the San Joaquin Valley Air Pollution Control District (SCE, 2004b). All but one of the 13 road segments are paved, providing the highest level of dust reduction.

The San Joaquin Valley Air Pollution Control District (2008b) also developed a proposed $PM_{2.5}$ State Implementation Plan. This plan documents that $PM_{2.5}$ levels have been decreasing in the valley since monitoring began in 1999 and that oxides of nitrogen are the dominant contributor to current $PM_{2.5}$ levels, although direct reductions in $PM_{2.5}$ and SO_2 would contribute to reductions in the overall $PM_{2.5}$ levels. Mobile sources (i.e., trucks, passenger vehicles, farm equipment, and off-road equipment) contribute 80 percent of the San Joaquin Valley's oxides of nitrogen emissions (San Joaquin Valley Air Pollution Control District, 2008b).

SCE holds seven air permits for emergency generators, transportable air compressors, and snow blowing equipment, and four permits for above ground fuel storage tanks (SCE, 2004b). Compliance with the permit conditions is ensured by the San Joaquin Valley Air Pollution Control District, which inspects the permitted facilities on an annual basis.

3.3.7.2 Environmental Effects

Relicensing of the Big Creek ALP Projects in accordance with the provisions of the Settlement Agreement would entail construction to implement some of the environmental measures. As such, there is potential for air quality effects, depending on the nature of the construction.

Operation of the Big Creek ALP Projects under the flow regimes specified in the Settlement Agreement would reduce the ability of each project to generate electricity. SCE would need to replace this lost energy from an alternative source because it does not have any deactivated or retired plants that could be restarted to address the generation shortfall. The needed energy would be purchased by SCE on the open market. The most likely source of this replacement energy would be from a natural gas-fired combined cycle generating station. Therefore, relicensing the Big Creek ALP Projects could have an indirect effect on air emissions associated with the generation of replacement energy. No entity has made any recommendations pertaining to air emissions.

Effects of Construction

The no-action alternative would not involve construction of any kind beyond what might be required for maintenance of project facilities and thus would not have air emissions effects related to construction activities. Some activities related to construction associated with proposed environmental measures and to diversion dam decommissioning could have the potential to contribute limited , short-term air emissions. We list those activities in table 3-26.

Table 3-26. Activities under the proposed project that entail construction or use of equipment to remove or replace existing project features. (Source: SCE, 2007a, modified by staff)

Environmental measure	Year(s) from license issuance when measure would be implemented
Big Creek Nos. 2A, 8, and Eastwood Project	
Decommission Crater Creek diversion	2
Decommission Tombstone Creek diversion	3
Decommission North Slide Creek diversion	4
Decommission South Slide Creek diversion	4
Rehabilitation of existing recreational facilities	1-10,13-17
New recreational facilities (accessible fishing platform at Jackass Meadows and accessible boat loading platform at Florence Lake)	1-5
Big Creek Nos. 1 & 2 Project	
Decommission Pitman Creek domestic diversion	5
Decommission Snow Slide Creek domestic diversion	5
Rehabilitation of existing recreational facilities	1-6, 17-23
New recreational facilities (Dam 3 day-use area and accessible fishing platform)	1-5
Mammoth Pool Project	
Rehabilitation of existing recreational facilities	7-16
Big Creek No. 3 Project	
Rehabilitation of existing recreational facilities	7-11

Our Analysis

The proposed decommissioning of five of the six diversion dams will be accomplished with hand tools and explosives. In most cases, non-rock and mortar debris will be cut into manageable pieces and transported from the demolition site. The Crater Creek and Tombstone Creek diversion dams are in a designated wilderness area that is not accessible by road. If determined by the Forest Service to be consistent with the management of the wilderness area, SCE may remove larger sections of pipe and other debris via helicopter. We estimate that no more than two helicopter flights would be needed to remove large debris from these two sites. The South Slide Creek diversion dam is already breached and what remains of the dam would be left in place. The ends of the buried piping at this site would be sealed with concrete and no further demolition would occur. We estimate that decommissioning activities at each site would be accomplished in less than a month. Given the minor construction activity involved in removing the diversion dams, we do not see any potential for diversion dam decommissioning to adversely influence air quality.

SCE proposes to be responsible for rehabilitation of recreational facilities at all four Big Creek ALP Projects. As indicated in table 3-24, some of these facilities are currently owned and operated by SCE, but many are operated, maintained, and managed by the Forest Service. As indicated in footnote "a" of table 3-24, SCE considers rehabilitation of facilities that it owns to be part of routine maintenance and repair activities. Consequently, if SCE did not fund this rehabilitation, either the Forest Service would need to fund this work or the facilities would fall into disrepair and eventually become unusable by the public. Thus, any construction-related air emissions associated with the rehabilitation of recreational facilities would likely occur under either the no-action alternative or the proposed action alternative.

As indicated in table 3-26, the rehabilitation work would be spread over a 23-year period, thus keeping air emissions from this work at any one time to a minimum. Specific rehabilitation work would typically entail transporting items that are pre-fabricated off-site (e.g., vault-type toilets, bear-proof trash receptacles, and picnic tables) or materials to repair or rebuild existing facilities (e.g., lumber, bricks, mortar, cement) to the site via truck; using equipment to unload this material at the designated recreational facility; and primarily using hand tools to install, repair, or rebuild the facilities. Additional equipment would be needed where regrading of roads, parking areas, campsites, and eroded areas may be needed and where resurfacing of existing areas is proposed. Rehabilitation work at any one recreation site would be short-term; we expect most rehabilitation projects at specific sites would take a month or less to complete. Therefore, any air quality effects from recreational facility rehabilitation would be minor, short-term, and local in nature.

Proposed new recreational facilities include accessible fishing platforms, an accessible boat loading platform, and a new day-use area. The fishing platforms and boat loading platform likely would need to be removed during the winter to prevent ice damage. As such, most of the components of these new facilities could be pre-fabricated off-site and moved to the proposed site for installation. Similarly, most of the components of the day-use area (e.g., picnic tables and toilets) could be pre-fabricated off-site. On-site work for the four proposed new recreational facilities would be limited to installation of facility components, and grading and surfacing needed for access and parking. This on-site work likely could be completed in a month or less. As with proposed recreational facility rehabilitation, we expect any air quality effects associated with construction of new recreation facilities to be minor, short-term, and local.

EPA has developed two conformity regulations for transportation and non-transportation projects. Transportation projects are governed by the "transportation conformity" regulations (40 CFR Parts 51 and 93). Non-transportation projects are governed by the "general conformity" regulations (40 CFR Parts 6, 51, and 93) described in the final rule for Determining Conformity of General Federal Actions to State or Federal Implementation plans. Since the Big Creek ALP Projects are not related to transportation, only the general conformity rule applies.

The general conformity rule applies to federal actions occurring in air quality regions designated as being in non-attainment for the national ambient air quality standards or attainment areas subject to maintenance plans (maintenance areas). Federal actions occurring in attainment areas are not subject to the conformity rules. The proposed projects are in an air basin currently designated as serious non-attainment for 8-hour ozone, non-attainment for $PM_{2.5}$, and as PM_{10} maintenance (previously nonattainment) areas.

Because of the minor, short-term and local construction associated with the proposed Big Creek ALP Project environmental measures, we conclude these actions would have de minimis effect on basin air quality. In reaching our finding on the air quality effects of the proposed Big Creek ALP Project environmental measures, we compared construction activities at the Big Creek ALP Projects with two recently completed Commission air quality analyses of hydroelectric projects that involve substantially more extensive construction but were found to have de minimis effects on air quality. The first project is the Upper American River Project (FERC No. 2101), located in El Dorado County, to the north of the Big Creek ALP Projects. The second is the proposed Lake Elsinore Advanced Pumped Storage Project (FERC No. 11858) located primarily in Riverside County, to the south of the Big Creek ALP Projects.

Effects of Operations

The existing Big Creek ALP Projects produce 3,366,594 MWh of renewable energy by utilizing the water cycle. The implementation of SCE's proposed flow regime at each of the four projects in accordance with the Settlement Agreement would reduce this energy production by 189,404 MWh, as shown in table 3-27.

Table 3-27. Annual energy generation at the Big Creek ALP Projects. (Source: SCE, 2007a, as modified by staff)

Project	No-Action (MWh)	Proposed Action (MWh)	Difference (MWh)
Big Creek Nos. 2A, 8, and Eastwood	1,173,296	1,125,429	47,867
Big Creek Nos. 1 and 2	765,483	657,072	108,411
Mammoth Pool	603,734	592,449	11,285

Project	No-Action (MWh)	Proposed Action (MWh)	Difference (MWh)
Big Creek No. 3	824,081	802,240	21,841
Total	3,366,594	3,177,190	189,404

Conventional hydroelectric generation is a reliable, efficient, economical, and less polluting source of energy resulting in zero air emissions. In section 1.2.2, *Need for Power*, we conclude that there is a need for the energy produced by these four hydroelectric projects. Reducing the energy produced by the Big Creek ALP Projects would require an equivalent amount of energy to be generated from an alternative source. SCE conducted an analysis of air emissions offsets from hydroelectric generation and developed values for equivalent emissions per MWh. The values derived by SCE are shown in table 3-28. SCE assumed that the offsets would be derived from natural gas-fired combined-cycle stations operating with the current Best Available Control Technology emission controls that would be required in the South Coast Air Quality Management District (SCE, 2004b). We consider this a reasonable assumption.

Table 3-28. Air Emission offsets of hydroelectric generation; equivalent emissions from fossil-fuel generation per MWh. (Source: SCE, 2004b)

Unit emissions	Oxides of nitrogen	CO	Reactive organic compounds[a]	PM_{10}	Oxides of sulfur	Ammonia
Pounds/MWh	0.053	0.033	0.019	0.048	0.004	**0.049**
Tons/MW-year	**0.234**	**0.143**	**0.082**	**0.210**	**0.019**	**0.216**

[a] Reactive organic compounds are emissions defined by CARB that are essentially the same as what EPA defines as volatile organic compounds.

Our Analysis

Operation of the existing Big Creek ALP Projects would not contribute meaningfully to air emissions. It may offset the need to generate electricity from sources that would contribute to air emissions under both the no-action and proposed project alternatives. We estimate the annual emissions offsets of these alternatives in table 3-29 using the annual generation values presented in table 3-27 and SCE's unit emission estimates presented in table 3-28.

Table 3-29. Annual air emission offsets from operation of the Big Creek ALP Projects. (Source: Staff)

		Annual Offset Emissions (tons/year)					
Alternative	**Project**	**Oxides of nitrogen**	**CO**	**Reactive organic compounds**	**PM_{10}**	**Oxides of sulfur**	**Ammonia**
No-action	Big Creek Nos. 2A, 8, and Eastwood	274,551	167,781	96,210	246,392	22,292	253,432
	Big Creek Nos. 1 and 2	179,123	109,464	62,770	160,751	14,544	165,344
	Mammoth Pool	141,274	86,334	49,506	126,784	11,471	130,407
	Big Creek No. 3	192,835	117,844	67,575	173,057	15,658	178,001
	Total	**787,783**	**481,423**	**276,061**	**706,985**	**63,965**	**727,184**
Proposed	Big Creek Nos. 2A, 8, and Eastwood	263,350	160,936	92,285	236,340	21,383	243,093
	Big Creek Nos. 1 and 2	153,755	93,961	53,880	137,985	12,484	141,928
	Mammoth Pool	138,633	84,720	48,581	124,414	11,257	127,969
	Big Creek No. 3	187,724	114,720	65,784	168,470	15,243	173,284
	Total	**743,462**	**454,338**	**260,530**	**667,210**	**60,367**	**686,273**
Net increase in air emissions from Proposed Alternative	Big Creek Nos. 2A, 8, and Eastwood	11,201	6,845	3,925	10,052	909	10,339
	Big Creek Nos. 1 and 2	25,368	15,503	8,890	22,766	2,060	23,417
	Mammoth Pool	2,641	1,614	925	2,370	214	2,438
	Big Creek No. 3	5,111	3,123	1,791	4,587	415	4,718
	Total	**44,321**	**27,085**	**15,531**	**39,775**	**3,599**	**40,911**

We note that the potential net increase in air emissions associated with the proposed Big Creek ALP Projects is an indirect effect. Although SCE assumes that the source of replacement energy would be from a gas-fired generation plant located in the South Coast Air Quality Management District, the actual source of electricity that SCE would need to purchase on the open energy market to meet its customers' demands could come from elsewhere in California or from sources outside of California. The owner of the source generation facility would be responsible for complying with applicable state and federal regulations that would apply to the specific geographic area in which the generation facility is located. Therefore, precise quantification of the environmental effects of operating the proposed projects is difficult. However, our analysis illustrates that although the flow regimes proposed in the Settlement Agreement would represent environmental enhancements to the aquatic and riparian habitat in the project areas, it would not be without environmental consequences elsewhere.

3.3.8 Noise

3.3.8.1 Affected Environment

Noise is defined as unwanted sound. It is emitted from many sources including airplanes, factories, railroads, power generation plants, and highway vehicles. The magnitude of noise is described by its sound pressure. Because the range of sound pressure varies greatly, a logarithmic scale is used to relate sound pressures to some common reference level, the decibel. Sound pressures described in decibels are called sound pressure levels.

Sound levels measured using an A-weighted decibel scale are expressed as dBA. Throughout this analysis, all noise levels are expressed in dBA. Several examples of noise pressure levels in dBA are listed in table 3-30.

The degree of disturbance or annoyance of unwanted sound depends essentially on three things:

- the amount and nature of the intruding noise;
- the relationship between the background noise and the intruding noise; and
- the type of activity occurring where the noise is heard.

In considering the first of these factors, it is important to note that individuals have different sensitivities to noise. Loud noises bother some individuals more than others, and some patterns of noise also enter into an individual’s judgment of whether or not a noise is offensive.

With regard to the second factor, individuals tend to judge the annoyance of an unwanted noise in terms of its relationship to noise from other sources (background noise). The blowing of a car horn at night when background noise levels are approximately 45 dBA generally would be more objectionable than the blowing of a car horn in the afternoon when background noises might be 55 dBA.

Table 3-30. A-weighted (dBA) sound levels of typical noise environments. (Source: FICON, 1992, as modified by staff)

A-Weighted	Overall Level	Noise Environment
120	Uncomfortably Loud (32 times as loud as 70 dBA)	Military jet takeoff at 50 feet
100	Very loud (8 times as loud as 70 dBA)	Jet flyover at 1,000 feet
80	Loud (2 times as loud as 70 dBA)	Propeller plane flyover at 1,000 feet; diesel truck 40 mph at 50 feet
70	Moderately loud	Freeway at 50 feet from pavement edge; vacuum cleaner (indoor)
60	Relatively quiet (1/2 as loud as 70 dBA)	Air condition unit at 10 feet; dishwasher at 10 feet (indoor)
50	Quiet (1/4 as loud as 70 dBA)	Large transformers; small private office (indoor)
40	Very quiet (1/8 as loud as 70 dBA)	Bird calls; lowest limit of urban ambient sound
10	Extremely quiet (1/64 as loud as 70 dBA)	Just audible
0	Threshold of hearing	

Note: dBA – A-weighted decibel scale

The third factor is related to the interference of noise with activities of individuals. In a 60-dBA environment, normal work activities requiring high levels of concentration may be interrupted by loud noises, while activities requiring manual effort may not be interrupted to the same degree.

Time-averaged descriptors are utilized to provide a better assessment of time-varying sound levels. The three most common noise descriptors used in community noise surveys are the equivalent sound level (L_{eq}), percentile distributions of sound levels ($L_{\%}$), and the day-night average sound level (L_{dn}).

The L_{eq} is an energy-averaged sound level that includes both steady background sounds and transient short-term sounds. The L_{eq} is equivalent in energy to the fluctuating sound level over the measurement period. The L_{eq} is commonly used to describe traffic noise levels, which tend to be characterized by fluctuating sound levels.

The $L_{\%}$ indicates the sound level exceeded for a percentage of the measurement period. For example, the L_{90} is the sound level exceeded for 90 percent of the measurement period and is commonly used to represent background sound levels. The L_{10} is the sound level exceeded for 10 percent of the measurement period and represents the peak sound levels present in the environment.

The L_{dn} is another descriptor used to evaluate community noise levels. The L_{dn} is a 24-hour average sound level, which includes a 10 dBA penalty added to nighttime sound levels (10:00 p.m. to 7:00 a.m.) because people tend to be more sensitive to noise during the nighttime. The day-night average sound level is commonly used to describe aircraft and train noise levels.

For the state of California, noise intensity is also discussed in terms of Community Noise Equivalent Level, which presents a weighted average noise level that increases the relative significance of evening and nighttime noise. The Community Noise Equivalent Level descriptor is used to evaluate community noise levels, which includes a 5 and 10 dBA penalty added to evening (7:00 p.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) sound levels, respectively, in consideration of people's increased sensitivity to noise during these times.

Existing Noise Environment

The Big Creek ALP Projects' features are generally located in remote and forested areas within the Sierra National Forest. Clusters of residences and recreational facilities are located near project reservoirs, particularly Shaver and Huntington lakes and to a lesser degree, Mammoth Pool reservoir and Florence Lake. Fresno County community noise surveys indicate that most communities in unincorporated portions of the county, which would include much of the area of the Big Creek ALP Projects, have light levels of activity and are relatively quiet (Fresno County, 2000). Measured day-time noise levels range between the high 30s dBA to mid-50s dBA L_{eq}. Noise was not identified as a project-related issue during the ALP. The only indirect conflicts that referenced noise were identified in recreational surveys conducted at Huntington Lake; survey participants complained about noise associated with motorboats and jet skis disrupting their recreational experiences (2007a).

Noise Standards

The Fresno County General Plan Policy HS-G-7 states that where existing noise levels are less than 60 dBL_{dn} at outdoor activity areas of noise-sensitive sites, a 5dBL_{dn} increase in noise levels will be considered significant (Fresno County, 2000). Noise sensitive sites include residences, schools, hospitals, churches, and libraries. The Fresno County Noise Control Ordinance (Fresno County Code Chapter 8.40) states that at sensitive sites, sources that cause exterior noise levels to exceed 50 dBA daytime L_{50} or 45 dBA nighttime L_{50} are prohibited (Fresno County, 2000). Non-emergency construction in sensitive areas is limited to daytime hours.

Madera County General Noise Regulations (Chapter 9.58.020) have no numeric standards, but list a number of factors that are considered when determining whether a violation of the regulations has occurred, including the level, origin, duration, recurrence interval, and time of day of the noise; level of background noise; and density of inhabitants near the source (Madera County, undated). The objective of the regulation is to protect residences, schools, courts, churches, hospitals, and libraries from excessive noise levels.

3.3.8.2 Environmental Effects

Activities associated with granting new licenses to the Big Creek ALP Projects that have the potential to generate noise are those that entail construction or use of equipment to remove or replace existing project features. We list those activities in table 3-26 and describe them in our analysis of Air Quality in section 3.3.7.2.

Our Analysis

The diversion dams proposed for removal are between 0.25 (Pitman Creek and Snow Slide Creek domestic diversions) and over a mile (North Slide and Crater creek diversions) from the nearest residence or recreational facility. Consequently, the public would be unlikely to hear any noise associated with the hand tools associated with decommissioning activities. If explosives or helicopters are used to remove the dams or transport debris from the diversion dam sites, there would be short-term noise that could be audible to persons in the area. Any such noise would not rise to levels considered a public nuisance.

Noise associated with rehabilitation of recreational facilities currently managed by the Forest Service would likely occur regardless of the outcome of this proceeding (rehabilitation would still be implemented by either the Forest Service or SCE). Activities that could generate noise include trucks delivering supplies for rehabilitation work; trucks and machinery used to resurface boat launches, day-use areas, and campgrounds; and hand tools such as hammers and electric saws and drills. It is probable that major rehabilitation work would be scheduled to occur outside the peak recreational season (i.e., before Memorial Day or after Labor Day), thus reducing the number of people who would hear noises associated with rehabilitation work.

Construction of two of the proposed four new recreational facilities (accessible fishing platform and Jackass Meadows and an accessible boat loading platform at Florence Lake) likely would entail using largely pre-fabricated components. Thus on-site construction would be relatively brief and minimally disruptive to nearby recreational visitors from a noise perspective. Scheduling on-site work to avoid peak recreational periods would further reduce the effects of noise on recreational visitors. Constructing the proposed Dam 3 day-use area and an accessible fishing platform at Huntington Lake could involve some minor increase in noise to nearby residences and recreational users of the lake. However, we expect most of the on-site work to be short-term, entailing trucks to deliver prefabricated items such as picnic tables, vault toilets, and platforms, and equipment to prepare and surface access routes and parking areas. Any noise generated from these construction activities would be minor and short-term in nature.

SCE compliance with applicable Fresno and Madera county noise ordinances should minimize the effects on noise level levels during construction and rehabilitation work. We expect no noise effects from continued operation of the Big Creek ALP Projects beyond those associated with dam decommissioning and construction and rehabilitation of recreational facilities.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative (baseline condition), the Big Creek ALP Projects would continue to operate as they have in the past. None of SCE's proposed measures specified in the Settlement Agreement would be implemented by SCE. The continued operation of existing Big Creek ALP Projects would not result in any atmospheric emission of criteria pollutants or other hazardous material that can affect air quality. The continued operation of the existing facilities under the no-action alternative would, on average, result in the annual generation of 3,366,590 MWh of clean energy.

COVER SHEET

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSES

BIG CREEK ALP PROJECTS
Docket Nos. P-67, 2175, 2085, and 120

Chapter 4
Developmental Analysis
Pages 4-1 to 4-12
FEIS

4.0 DEVELOPMENTAL ANALYSIS

In this section, we analyze the Big Creek ALP Projects' use of the water resources of the San Joaquin River Basin to generate power, estimate the economic benefits of the SCE facilities, and estimate the cost of various environmental measures and the effects of these measures on project operations.

4.1 POWER AND ECONOMIC BENEFITS OF THE PROJECTS

4.1.1 Economic Assumptions

Under its approach to evaluating the economics of hydropower projects, as articulated in Mead Corporation, Publishing Paper Division (72 FERC ¶61,027, July 13, 1995), the Commission employs an analysis that uses current costs to compare the costs of the project and likely alternative power with no consideration for potential future inflation, escalation, or deflation beyond the license issuance date. The Commission's economic analysis provides a general estimate of the potential power benefits and costs of a project and reasonable alternatives to project-generated power. The estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license.

For our economic analysis of the project alternatives, we used the assumptions, values and sources shown in table 4-1.

Table 4-1. Staff assumptions for economic analysis of SCE's Big Creek ALP Projects. (Source: Staff)

Assumption	Value	Source
Base year for costs and benefits	2008	Staff
Energy value (mills/kWh)[a]	$52.40	SCE
Dependable capacity value ($/kW-yr)[b]	$73.93	SCE
Period of analysis[c]	30 years	Staff
Term of financing	20 years	Staff
Federal and state tax rate	35%	Staff
Local tax rate[d]	1.08%	SCE

Assumption	Value	Source
Insurance rate	0.25%	Staff
Discount rate[e]	10.0%	SCE

[a] SCE provided an energy rate for 2009 in exhibit D, table D-3, of the license applications for Big Creek Projects Nos. 67, 120, and 2175. The application for Mammoth Pool was filed earlier and used older energy rate forecast information.

[b] SCE provided dependable capacity rates for 2009 in exhibit D, table D-3, of the license applications for Big Creek Projects Nos. 67, 120, and 2175. The application for Mammoth Pool was filed earlier and used older capacity rate forecast information.

[c] Although our period of financial analysis is 30 years, SCE provided costs in its comments on the draft EIS for 44 years, reflecting a potential 50-year license. We have recognized the expenditures beyond year 30 by computing the present value of the expenditures over 44 years and then computing the annualized cost over 30 years.

[d] We derived the local tax rate by dividing the local taxes paid by the net investment values as provided by SCE. The rate for each project was very similar, so we used a simple average of the rates for all four Big Creek ALP Projects.

[e] We used cost of capital provided by SCE in table 7.0-1 of the amended PDEA.

4.1.2 Current Annual Costs and Future Capital Costs for the Big Creek ALP Projects under the No-action Alternative

Total annualized costs for the no-action alternative for the Big Creek Nos. 2A, 8, and Eastwood Project amount to $37,317,930 (table 4-2).

Table 4-2. Summary of current annual costs and future costs for SCE's Big Creek Nos. 2A, 8, and Eastwood Project under the no-action alternative. (Source: SCE, 2007a)

Cost	Capital and One-Time Costs	Annual Costs, Including O&M	Total Annualized Costs (2009$)
Original net investment[a]	$219,234,230 (12/31/06)		
Relicensing cost[a]	$14,884,000 (12/31/06)		
Total net investment	$234,118,230 (12/31/06)		$24,721,510

Cost	Capital and One-Time Costs	Annual Costs, Including O&M	Total Annualized Costs (2009$)
Plant operation and maintenance[b]		$12,012,890 (12/31/06)	$12,596,420
Total			$37,317,930

[a] The values shown above were presented by SCE in the license application. We have updated these values to current year dollars by depreciating using a 150 percent declining balance over 20 years, which is the federal tax method cited in table 7.0-1 of the amended PDEA.

[b] The values shown above were presented by SCE in the license application. We have updated these values to 2009 dollars by escalating them at a rate of 2.4 percent per year.

Total annualized costs for the no-action alternative for the Big Creek Nos. 1 and 2 Project amount to $12,973,290 (table 4-3).

Table 4-3. Summary of current annual costs and future costs for Big Creek Nos. 1 and 2 Project under the no-action alternative. (Source: SCE, 2007a)

Cost	Capital and One-Time Costs	Annual Costs, Including O&M	Total Annualized Costs (2009$)
Original net investment[a]	$39,594,900 (12/31/05)		
Relicensing cost[a]	$10,741,000 (12/31/06)		
Total net investment	$47,366,280 (12/31/06)		$5,001,600
Plant operation and maintenance[b]		$7,602,400 (12/31/06)	$7,971,690
Total			$12,973,290

[a] The values shown above were presented by SCE in the license application. We have updated these values to current year dollars by depreciating using a 150 percent declining balance over 20 years, which is the federal tax method cited in table 7.0-1 of the amended PDEA.

[b] Values shown above were presented by SCE in the license application. We have updated them to 2009 dollars by escalating them at a rate of 2.4 percent per year.

Total annualized costs for the no-action alternative for the Mammoth Pool Project amount to $8,520,220 (table 4-4).

Table 4-4. Summary of current annual costs and future costs for the Mammoth Pool Project under the no-action alternative. (Source: SCE, 2007a)

Cost	Capital and One-Time Costs	Annual Costs, Including O&M	Total Annualized Costs (2009$)
Original net investment[a]	$27,172,070 (12/31/04)		
Relicensing cost[a]	$4,944,470 (12/31/06)		
Total net investment	$28,193,570		$2,977,070
Plant operation and maintenance[b]		$5,286,360 (12/31/06)	$5,543,150
Total			$8,520,220

[a] The values shown above were presented by SCE in the license application. We have updated these values to current year dollars by depreciating using a 150 percent declining balance over 20 years, which is the federal tax method cited in table 7.0-1 of the amended PDEA.

[b] Values shown above were presented by SCE in the license application. We have updated them to 2009 dollars by escalating them at a rate of 2.4 percent per year.

Total annualized costs for the no-action alternative for the Big Creek No. 3 Project amount to $11,757,710 (table 4-5).

Table 4-5. Summary of current annual costs and future costs for SCE's Big Creek No. 3 Project under the no-action alternative. (Source: SCE, 2007a)

Cost	Capital and One-Time Costs	Annual Costs, Including O&M	Total Annualized Costs (2009$)
Original net investment[a]	$37,174,160 (12/31/05)		
Relicensing cost[a]	$5,310,000 (12/31/06)		
Total net investment	$39,696,100 (12/31/06)		$4,191,670
Plant operation and maintenance[b]		$7,215,534 (12/31/06)	$7,566,040
Total			$11,757,710

[a] The values shown above were presented by SCE in the license application. We have updated these values to current year dollars by depreciating using a 150% declining balance over 20 years, which is the Federal tax method cited in table 7.0-1 of the amended PDEA.

[b] Values shown above were presented by SCE in the license application. We have updated them to 2009 dollars by escalating them at a rate of 2.4 percent per year.

4.2 COST OF ENVIRONMENTAL MEASURES

As proposed under the Settlement Agreement and as recommended by staff, the environmental measures for the Big Creek ALP Projects would both reduce generation and increase annual O&M costs and capital costs. SCE does not anticipate the environmental measures would affect the dependable capacity of the project, which we find reasonable.

4.2.1 Cost of Environmental Measures for the Big Creek ALP Projects

SCE provided updated costs for environmental measures in 2009 dollars. Although our period of financial analysis is 30 years, SCE provided costs in its comments on the draft EIS for 44 years, reflecting a potential 50-year license. We have recognized the expenditures beyond year 30 by computing the present value of the expenditures over 44 years and then computing the annualized cost over 30 years.

Tables 4-6 through 4-9 summarize the costs by major resource area for both the proposed action and the proposed action with staff modifications for the Big Creek ALP Projects. In its comments on the draft EIS, SCE indicated that they support the staff alternative. We interpret this to mean that SCE's proposed project is now the same as the staff alternative. For details of the costs of specific measures included in each resource category in tables 4-6 through 4-9, see appendix B, *Capital and Annual Costs of Measures for the Big Creek ALP Projects and the Portal Project*.

Table 4-6. Summary of annualized costs for measures included in the proposed action and proposed action with staff modifications for the Big Creek Nos. 2A, 8, and Eastwood Project. (Source: Staff)

	Proposed Action and Proposed Action with Staff Modifications		
Resource Area	**Capital Cost**	**Annualized O&M Cost**	**Total Annualized Cost**
Aquatic resources	$4,880,050	$2,933,710	$3,535,940
Terrestrial resources	$25,350	$104,530	$107,660
Recreation, land use, and aesthetics	$3,162,330	$628,630	$1,021,180
Cultural resources	$228,120	$35,980	$64,130
Total	$8,295,850	$3,702,850	$4,728,910

Table 4-7. Summary of annualized costs for measures included in the proposed action and proposed action with staff modifications for the Big Creek Nos.1 and 2 Project. (Source: Staff)

	Proposed Action and Proposed Action with Staff Modifications		
Resource Area	**Capital Cost**	**Annualized O&M Cost**	**Total Annualized Cost**
Aquatic resources	$2,915,130	$5,882,810	$6,212,560
Terrestrial resources	$25,350	$72,360	$75,490
Recreation, land use, and aesthetics	$12,225,270	$488,120	$1,996,860
Cultural resources	$36,820	$5,900	$10,440
Total	$15,202,520	$6,449,190	$8,295,350

Table 4-8. Summary of annualized costs for measures included in the proposed action and proposed action with staff modifications for the Mammoth Pool Project. (Source: Staff)

	Proposed Action and Proposed Action with Staff Modification		
Resource Area	**Capital Cost**	**Annualized O&M Cost**	**Total Annualized Cost**
Aquatic resources	$27,035,610	$770,850	$4,107,370
Terrestrial resources	$27,270	$87,210	$90,570
Recreation, land use, and aesthetics	$731,020	$465,170	$555,390
Cultural resources	$41,610	$6,280	$11,420
Total	$27,835,510	$1,329,510	$4,764,750

Table 4-9. Summary of annualized costs for measures included in the proposed action and proposed action with staff modifications for the Big Creek No. 3 Project. (Source: Staff)

	Proposed Action and Proposed Action with Staff Modifications		
Resource Area	**Capital Cost**	**Annualized O&M Cost**	**Total Annualized Cost**
Aquatic resources	$1,956,370	$1,230,860	$1,471,820
Terrestrial resources	$25,390	$52,930	$56,080
Recreation, land use, and aesthetics	$106,390	$422,530	$435,660
Cultural resources	$38,490	$6,280	$11,030
Total	$2,126,640	$1,712,600	$1,974,590

4.2.2 Effect of Proposed Operations on the Big Creek ALP Projects

Several measures affect energy generation. Energy estimates were provided by SCE for the proposed minimum flows and proposed channel and riparian maintenance flows (see section 3.3.1, *Aquatic Resources*). Staff notes that a reduction of 47,867 MWh would result from flows needed for environmental requirements at the Big Creek Nos. 2A, 8, and Eastwood Project as detailed in appendix B. A reduction of 108,411 MWh would result from flows needed for environmental requirements at the Big Creek Nos. 1 and 2 Project as and detailed in appendix B.

A reduction of 11,285 MWh would result from flows needed for environmental requirements at the Mammoth Pool Project as detailed in appendix B and a reduction of 19,841 MWh would result from flows needed for environmental requirements at the Big Creek No. 3 Project detailed in appendix B.

4.3 COMPARISON OF ALTERNATIVES

Table 4-10 compares the power value, annual costs, and net benefits of the no-action alternative, proposed action, and the proposed action with staff modifications for the Big Creek Nos. 2A, 8, and Eastwood. In section 5.2, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the proposed action with staff modifications, and explain why we conclude the environmental benefits are worth these costs.

Table 4-10. Summary of annual net benefits for the no-action, proposed action, and proposed action with staff modifications for the Big Creek Nos. 2A, 8, and Eastwood Project. (Source: Staff)

	No Action	**Proposed Action**	**Proposed Action with Staff Modifications**
Dependable capacity (MW)[a]	370	370	370
Value of dependable capacity ($)	$27,354,100	$27,354,100	$27,354,100
Generation (MWh)[b]	1,173,296	1,125,429	1,125,429
Value of generation ($)	$61,480,710	$58,972,480	$58,972,480
Annual power value ($)	$88,834,810	$86,326,580	$86,326,580
Annual power value ($/MWh)	75.71	76.71	76.71

	No Action	Proposed Action	Proposed Action with Staff Modifications
Annualized cost of operations and current environmental measures ($)	$37,317,930	$37,317,930	$37,317,930
Annualized cost of new environmental measures ($)	$0	$2,216,540	$2,216,540
Annual cost ($)	$37,317,930	$39,534,470	$39,534,470
Annual cost ($/MWh)	31.81	35.13	35.13
Annual net benefit ($)	$51,516,880	$46,792,110	$46,792,110
Annual net benefit ($/MWh)	43.90	41.58	41.58

[a] The dependable capacity for each project was provided in the license applications.

[b] The average annual generation was provided in table 7.1-6 of the amended PDEA.

Table 4-11 compares the power value, annual costs, and net benefits of the no-action alternative, proposed action, and the proposed action with staff modifications for the Big Creek Nos. 1 and 2 Project. In section 5.2, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the proposed action with staff modifications, and explain why we conclude the environmental benefits are worth these costs.

Table 4-11. Summary of annual net benefits for the no-action, proposed action, and proposed action with staff modifications for the Big Creek Nos. 1and 2 Project. (Source: Staff)

	No Action	Proposed Action	Proposed Action with Staff Modifications
Dependable capacity (MW)[a]	150	150	150
Value of dependable capacity ($)	$11,089,500	$11,089,500	$11,089,500
Generation (MWh)[b]	765,483	657,072	657,072
Value of generation ($)	$40,111,310	$34,430,570	$34,430,570
Annual power value ($)	$51,200,810	$45,520,070	$45,520,070
Annual power value ($/MWh)	66.89	69.28	69.28

	No Action	Proposed Action	Proposed Action with Staff Modifications
Annualized cost of operations and current environmental measures ($)	$12,973,290	$12,973,290	$12,973,290
Annualized cost of new environmental measures ($)	$0	$2,614,620	$2,614,620
Annual cost ($)	$12,973,290	$15,617,910	$15,617,910
Annual cost ($/MWh)	16.95	23.76	23.76
Annual net benefit ($)	$38,227,520	$29,902,160	$29,902,160
Annual net benefit ($/MWh)	49.94	45.52	45.52

[a] The dependable capacity for each project was provided in the license applications.

[b] The average annual generation was provided in table 7.1-6 of the amended PDEA.

Table 4-12 compares the power value, annual costs, and net benefits of the no-action alternative, proposed action, and the proposed action with staff modifications for the Mammoth Pool Project. In section 5.2, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the proposed action with staff modifications, and explain why we conclude the environmental benefits are worth these costs.

Table 4-12. Summary of annual net benefits for the no-action, proposed action, and proposed action with staff modifications for the Mammoth Pool Project. (Source: Staff)

	No Action	Proposed Action	Proposed Action with Staff Modifications
Dependable capacity (MW)[a]	187	187	187
Value of dependable capacity ($)	$13,824,910	$13,824,910	$13,824,910
Generation (MWh)[b]	603,734	592,449	592,449
Value of generation ($)	$31,635,660	$31,044,330	$31,044,330
Annual power value ($)	$45,460,570	$44,869,240	$44,869,240

	No Action	Proposed Action	Proposed Action with Staff Modifications
Annual power value ($/MWh)	75.30	75.74	75.74
Annualized cost of operations and current environmental measures ($)	$8,520,220	$8,520,220	$8,520,220
Annualized cost of new environmental measures ($)	$0	$4,173,430	$4,173,430
Annual cost ($)	$8,520,220	$12,693,640	$12,693,640
Annual cost ($/MWh)	14.11	21.43	21.43
Annual net benefit ($)	$36,940,350	$32,175,600	$32,175,600
Annual net benefit ($/MWh)	61.19	54.31	54.31

[a] The dependable capacity for each project was provided in the license applications.

[b] The average annual generation was provided in table 7.1-6 of the amended PDEA.

Table 4-13 compares the power value, annual costs, and net benefits of the no-action alternative, proposed action, and the proposed action with staff modifications for the Big Creek No. 3 Project. In section 5.2, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the proposed action with staff modifications, and explain why we conclude the environmental benefits are worth these costs.

Table 4-13. Summary of annual net benefits for the no-action, proposed action, and proposed action with staff modifications for the Big Creek No. 3 Project. (Source: Staff)

	No Action	Proposed Action	Proposed Action with Staff Modifications
Dependable capacity (MW)[a]	181.9	181.9	181.9
Value of dependable capacity ($)	$13,447,870	$13,447,870	$13,447,870
Generation (MWh)	824,081	804,240	804,240
Value of generation ($)[b]	$43,181,840	$42,142,170	$42,142,170
Annual power value ($)	$56,629,710	$55,590,040	$55,590,040

	No Action	Proposed Action	Proposed Action with Staff Modifications
Annual power value ($/MWh)	68.72	69.12	69.12
Annualized cost of current operations and environmental measures ($)	$11,757,710	$11,757,710	$11,757,710
Annualized cost of new environmental measures ($)	$0	$934,930	$934,930
Annual cost ($)	$11,757,710	$12,692,640	$12,692,640
Annual cost ($/MWh)	14.27	15.78	15.78
Annual net benefit ($)	$44,872,000	$42,897,400	$42,897,400
Annual net benefit ($/MWh)	54.45	53.34	53.34

[a] The dependable capacity for each project was provided in the license applications.

[b] The average annual generation was provided in table 7.1-6 of the amended PDEA.

4.4 OTHER ECONOMIC CONSIDERATIONS

In addition to the costs evaluated in sections 4.2, 4.3, and 4.4, SCE would incur costs associated with measures that are not part of a potential Commission license. Because the measures are not part of our recommended action, we do not account for them here.

COVER SHEET

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSES

BIG CREEK ALP PROJECTS
Docket Nos. P-67, 2175, 2085, and 120

Chapter 5
Conclusions and Recommendations
Pages 5-1 to 5-36
FEIS

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPARISON OF EFFECTS OF PROPOSED ACTION AND ALTERNATIVES

In this section, we compare the developmental and non-developmental effects of SCE's proposal, SCE's proposal as modified by staff, and the no-action alternative. We summarize the environmental effects of the different alternatives in the following section.

Aquatic Resources—Under SCE's and the staff alternatives: (1) habitat for trout and other aquatic biota would be enhanced by increased flows; (2) trout spawning and riparian habitat downstream of seven dams associated with the Big Creek Nos. 2A, 8, and Eastwood Project would be exposed to seasonal high flows that would flush sediment from gravel, thus enhancing potential for spawning success, and enhanced wildlife habitat from increased riparian vegetation regeneration; (3) the potential for inadvertent flow-related adverse affects on aquatic habitat from releases of inappropriate flows would be minimized by upgraded streamflow measurement capabilities; (4) habitat diversity and the amount of spawning gravel would be increased by provisions to pass sediment downstream of project dams; (5) project diversions would be decommissioned, and the affected stream reaches returned to essentially natural flow and sediment transport conditions; and (6) aquatic habitat downstream of the Bear Creek diversion would be enhanced by passing LWD previously blocked by the diversion dam.

Terrestrial Resources—Under SCE's and the staff alternatives: (1) wildlife habitat would be enhanced; (2) bald eagle, mule deer, bats, and special status species of wildlife and their habitat would be protected; and (3) vegetation would be managed and the spread of noxious weeds controlled in accordance with a defined plan.

Threatened and Endangered Species—Under SCE's and the staff alternatives VELB habitat and mature elderberry shrubs would be protected and potential widespread loss of VELB habitat from brush fires would be reduced by vegetation maintenance adjacent to elderberry shrubs.

Recreation—Under SCE's and the staff alternatives: (1) operation, maintenance, and rehabilitation of existing recreation facilities would enhance the recreational experience of the public; (2) new recreational opportunities for the general public and people with disabilities would be created by the construction of new facilities, including accessible fishing platforms and boat loading platforms, and a day use area; (3) angling opportunities would be enhanced by stocking fish in project reservoirs and stream reaches; and (4) more water dependent recreational use at project reaches would likely occur because of whitewater boating releases and improved dissemination of flow information to the public.

Cultural Resources—Under SCE's and the staff alternatives, cultural resources would be protected under provisions specified in the finalized HPMP. There would also be increased awareness of cultural resources by the general public with the implementation of proposed environmental programs.

Land Use and Aesthetics Resources—Under SCE's and the staff alternatives: (1) project-related roads would remain functional and safe by clearly defining maintenance, monitoring, and rehabilitation responsibilities; (2) the experience of visitors to the area would be enhanced by the installation of interpretive signs at selected locations; and (3) certain project features would be less noticeable to the public by use of painting strategies defined in a Visual Resources Plan.

Under the no-action alternative, environmental conditions would remain the same, and there would not be any enhancement of environmental resources.

5.2 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. This section contains the basis for and a summary of our recommendations to the Commission for relicensing the Big Creek ALP Projects. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on the Big Creek ALP Projects and our review of the environmental and economic effects of the proposed projects and their alternatives, we selected the staff alternative as the preferred alternative. This alternative includes elements of the applicant's proposal, section 4(e) conditions, resource agency recommendations, and some additional measures. We recommend this alternative because (1) issuance of a new hydropower license by the Commission would allow SCE to operate the Big Creek ALP Projects as economically beneficial and dependable sources of electrical energy for its customers; (2) the 865-MW projects may eliminate the need for an equivalent amount of fossil-fuel derived energy and capacity, which helps conserve these nonrenewable resources and reduce atmospheric emissions; (3) the public benefits of this alternative would exceed those of the no-action alternative; and (4) the recommended measures would protect and enhance fish and wildlife resources and would provide improved recreational opportunities at the Big Creek ALP Projects.

We recommend approving most of the Settlement Agreement terms with some minor modifications and making these terms conditions of the license to be issued for the Big Creek ALP Projects. However, we recommend modifications and finalization of some of the plans as proposed in the Settlement Agreement. Any such modified or finalized plans would be filed with the Commission for approval. This would allow Commission staff to monitor compliance with the conditions of the license and review the results of many of the proposed studies and measures.

We evaluate numerous recommendations in the resource sections of this final EIS and, given the environmental benefits, we recommend including the following measures that SCE proposes in any license issued by the Commission for the Big Creek ALP Projects. Our recommended modifications to SCE's originally proposed measures are *italicized*. In its comments on the draft EIS, SCE states that it supports our modifications to its originally proposed projects.

5.2.1 All Big Creek ALP Projects

- Implement the streamflow requirements including new MIF releases in the bypassed reaches of Rock Creek, Ross Creek, Lower Stevenson Creek, Balsam Creek (forebay to diversion), Upper Balsam Creek (diversion to Big Creek), Lower Big Creek (Dam 5 to San Joaquin River), Middle Big Creek (Dam 4 to Dam 5), Upper Big Creek (Huntington Lake to Dam 4), Ely Creek, North Fork Stevenson Creek, Pitman Creek, Bear Creek, Mono Creek, Bolsillo Creek, Camp 62 Creek, Chinquapin Creek, and Hooper Creek; the San Joaquin River, including Dam 6 to Redinger -"Stevenson reach" and Mammoth Pool dam to Dam 6; and the South Fork San Joaquin River. (The Settlement Agreement also specifies proposed MIF releases for Camp 61 Creek, which is part of the Portal Project [No. 2174] and not a Big Creek ALP Project; we recommend the proposed MIFs be included in a license for the Portal Project).
- Implement the Temperature Monitoring and Management Plan in the San Joaquin River (Mammoth and Stevenson reaches), South Fork San Joaquin River, Big Creek, Florence Lake, Mammoth Pool reservoir, Mono Creek, and North Fork Stevenson Creek. (The Settlement Agreement also includes Camp 61 Creek in the Temperature Monitoring and Management Plan; we recommend this measure be included in a license for the Portal Project).
- Implement the Flow Monitoring and Reservoir Level Measurement Plan in the bypassed reaches of Rock, Ross, Stevenson, Balsam, Big, Ely, North Fork Stevenson, Pitman, Bear, Mono, Bolsillo, Camp 62, Chinquapin, and Hooper creeks; the San Joaquin River; the South Fork San Joaquin River; Mammoth Pool reservoir; and Huntington, Florence, and Shaver lakes and, as appropriate, adjust the MIFs, many of which are based on water year types, based on the April 1 and May 1 water year forecasts if it is revised from the March 1 forecast. (The Settlement Agreement also includes Camp 61 Creek in the Flow Monitoring and Reservoir Level Measurement Plan; we recommend this measure be included in a license for the Portal Project).

- Implement the Fish Monitoring Plan in the bypassed reaches of Big Creek downstream of Dams 4 and 5, Mono Creek, Bear Creek, North Fork Stevenson Creek, and Stevenson Creek; the San Joaquin River downstream of Mammoth Pool and downstream of Dam 6; South Fork San Joaquin River downstream of Florence dam; Mammoth Pool reservoir; and Huntington, Florence, and Shaver lakes at years 3, 8, 18, 28, and 38, if a 50-year license is granted.
- Attend annual consultation meeting for water and aquatic resources.
- Implement wildlife habitat enhancements.
- Implement the Bald Eagle Management Plan *but modify the plan to ensure that when investigating any raptor mortality that may be associated with a project transmission line, the most recent APLIC guidelines be used to assess potential corrective actions*.
- Implement the Vegetation and Integrated Pest Management Plan.
- Implement environmental programs for environmental training, avian protection, noxious weeds, environmental compliance, the Endangered Species Alert Program, and the Northern Hydro Special-Status Species Information Program.
- Attend annual consultation meeting for terrestrial resources.
- Prepare a report on recreational resources, *including information on reservoir elevations, boat ramp accessibility, and parking and campsite capacity*.
- Attend annual consultation meeting for recreational resources.
- Implement the proposed project boundary changes detailed in section 2.2.5, *Proposed Project Boundary*, and analyzed in section 3.3.6.2, *Project Boundary Revisions, with the exception of maintaining the Florence Lake day-use area within the project boundary and including portions of the recreational facilities that are partially outside of the existing project boundary inside the revised project boundary.*
- Implement the Transportation System Plan.
- *Develop a Sign Plan*.
- *Develop a Fire Management Plan*.
- *Develop a Spill Prevention and Countermeasure Plan*.
- Attend annual meeting for land management resources.
- Provide transportation system plan labor and equipment.
- Finalize and implement one HPMP for the Big Creek ALP Projects.
- Implement environmental programs for cultural resources awareness.

- Attend annual consultation meeting for cultural resources.

5.2.2 Big Creek Nos. 2A, 8, and Eastwood Project

- Implement the Channel Riparian Maintenance Flow Plan in South Fork San Joaquin River and in Bear, Bolsillo, Camp 62, Chinquapin, and Mono creeks. (The Settlement Agreement also includes Camp 61 Creek in the Channel Riparian Maintenance Flow Plan; we recommend this measure be included in a license for the Portal Project).
- Implement the Flow Monitoring and Reservoir Water Level Measurement Plan including installation of gaging equipment at Dam 5 and Mono Creek diversion and modifying MIF release facilities at the Bolsillo Creek and Camp 62 diversions.
- Implement temperature monitoring programs in the South Fork San Joaquin River, Big Creek, Florence Lake, and North Fork Stevenson Creek, including real-time telemetry monitoring of water temperatures in the South Fork San Joaquin River downstream of Florence Lake.
- Implement the Small Diversions Decommissioning Plan on Crater Creek, Tombstone Creek, North Slide Creek, and South Slide Creek.
- Implement the Riparian Monitoring Plan at the South Fork San Joaquin River (Jackass Meadow Complex) and Mono creeks. (The Settlement Agreement also includes Camp 61 Creek in the Riparian Monitoring Plan; we recommend this measure be included in a license for the Portal Project).
- Implement the sediment management prescriptions at small diversions on Balsam, Bolsillo, Camp 62, Chinquapin, Hooper, Mono, and Pitman creeks.
- Implement the sediment management prescriptions at Dam 5, Portal, and Balsam Meadows forebays.
- *Monitor spawning gravel embeddedness after sediment pass-through at Dam 5*.
- Implement the LWD Management License Article at the Bear Creek diversion.
- Implement the VELB Management Plan.
- Implement proposed license articles for mule deer, special-status species, and bats.
- Perform operation and maintenance of recreational facilities.
- Implement rehabilitation of existing recreation facilities, *but not including Dorabelle Campground located in the Sierra National Forest outside of the project boundary*.
- Construct new recreational facilities including an accessible fishing platform at Jackass Meadows and an accessible boat loading platform at Florence Lake.

- Provide maintenance of the accessible fishing platform.
- Manage reservoir water surface elevations at Florence Lake.
- *Stock fish in project reservoirs and stream reaches.*
- *File an annual stocking report with the Commission.*
- Disseminate to the public flow information for whitewater boating.
- Install interpretive signs.

5.2.3 Big Creek Nos. 1 and 2 Project

- Install minimum flow devices and gaging equipment at Ely Creek diversion, Balsam Creek diversion, and Dam 4.
- Implement the sediment management prescriptions at Ely Creek diversion.
- Implement the sediment management prescriptions at Dam 4.
- *Remove Rancheria Creek from the Big Creek Nos. 1 and 2 Project license*.
- *Monitor spawning gravel embeddedness after sediment pass-through at Dam 4*.
- Implement the Small Diversions Decommissioning Plan at Pitman Creek and Snow Slide Creek domestic diversions.
- Implement proposed license articles for special-status species, bats, and bear-human interactions.
- Implement rehabilitation of existing recreation facilities, *but not including Upper Billy Creek, Catavee, and Kinnikinnick campgrounds located in the Sierra National Forest outside of the project boundary*.
- Construct new recreational facilities including a day-use area at Dam 3 and an accessible fishing platform.
- *Stock fish in project reservoirs and stream reaches.*
- *File an annual stocking report with the Commission.*
- Install interpretive signs.
- Implement the Visual Resources Plan.

5.2.4 Mammoth Pool Project

- Implement fishwater turbine upgrade.

- Install minimum flow devices and gaging equipment at Mammoth Pool dam and the Ross and Rock Creek diversions.

- Implement temperature monitoring programs in the San Joaquin River and Mammoth Pool reservoir, including real-time telemetry monitoring of water temperatures in the Mammoth Pool reach.

- Implement the sediment management prescriptions at Ross and Rock creeks.

- Implement the sediment management prescriptions at Mammoth Pool reservoir.

- *Conduct a feasibility assessment to evaluate the effects of gravel augmentation into, or immediately below, the Mammoth Pool spillway channel on project facilities. (This measure was included in the Settlement Agreement but not to be included in a new license).*

- Implement the VELB Management Plan.

- Implement proposed license articles for mule deer, special-status species and bats.

- Implement rehabilitation of existing recreation facilities, *but not including Mammoth Pool Campground located in the Sierra National Forest outside of the project boundary.*

- *Stock fish in project reservoirs and stream reaches.*
- *File an annual stocking report with the Commission.*
- Disseminate flow information for whitewater boating.

- Provide pre-spill whitewater boating releases.

- Provide interpretive signs.

- Implement the Visual Resources Plan.

5.2.5 Big Creek No. 3 Project

- Install minimum flow devices and gaging equipment at Dam 6.

- Implement temperature monitoring programs in the San Joaquin River, including real-time telemetry monitoring of water temperatures in the Stevenson reach.

- Implement a supplemental fish, water temperature, and DO study in the San Joaquin River - Stevenson reach to evaluate use and importance of this reach for transitional zone fish species.

- Implement the sediment management prescriptions at Dam 6.
- *Monitor spawning gravel embeddedness after sediment pass-through at Dam 6.*
- Implement the VELB Management Plan.
- Implement proposed license articles for special-status species and bats.
- Attend annual consultation meeting for terrestrial resources.
- Implement rehabilitation of existing recreational facilities.
- Disseminate flow information for whitewater boating.

Our recommended measures include all but two of the project-specific conditions specified by the Forest Service: (1) manage reservoir surface elevations at Huntington and Shaver lakes and Mammoth Pool in accordance with unspecified criteria during the summer recreational season; and (2) fund the rehabilitation of five campgrounds in the Sierra National Forest that are located entirely outside of any project boundary (Dorabelle, Upper Billy Creek, Cavatee, Kinnikinnick, and Mammoth Pool). We note that section 4(e) of the FPA provides that any license issued by the Commission "for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation." Thus, any 4(e) condition that meets the requirements of the law must be included in any license issued by the Commission, regardless of whether we include the condition in our staff alternative.

5.2.6 Rationale for Staff Recommendations

This section describes the rationale for some of our recommendations on measures that we conclude should be included as conditions of any licenses issued, as well as any measures that we do not recommend as license conditions. This section is arranged by major resource topic. Within each topic we discuss each of the Big Creek ALP Projects or provide our rationale for recommending or not recommending specific measures.

Aquatic Resources

Project operations could affect aquatic habitats and sediment transport in the stream reaches. The Settlement Agreement includes a set of measures (Proposed Articles 1.1.1 through 1.5) focused on the ecological health and suitability of reaches downstream of project dams to support native fish, amphibian, and reptile populations.

Minimum Instream Flows

Under Settlement Agreement measure A1.1.1, SCE proposes to implement increased MIFs in 21 of the bypassed reaches downstream of project diversion dams. In most cases, the MIFs vary by season and by water type, and include both minimum daily average and instantaneous minimum flows (see section 3.3.1.2 for specific flows and analysis). The Forest Service filed a 4(e) condition and Interior filed a 10(j) recommendation for all four Big Creek ALP Projects consistent with this measure.

Many of the bypassed reaches were naturally fishless, but most currently support self-sustaining populations of introduced rainbow, brown, and/or brook trout because of stocking efforts by Cal Fish & Game. In many of the project reaches, low flows due to project operations create barriers to fish passage, limit the quantity of available fish habitat, and contribute to daily mean and maximum water temperatures that exceed optimal levels for trout growth.

SCE conducted a series of studies in collaboration with the agencies and other interested parties to identify limiting factors in each reach, including habitat surveys and fish population evaluations, habitat modeling to evaluate the effects of streamflow on fish habitat, evaluation of current and historic flow regimes, temperature monitoring, and evaluation of the effect of stream flows on fish passage at potential barriers to upstream migration. Based on this collaborative effort, SROs were developed for each reach, and the flow regimes included in the Settlement Agreement were designed to meet the resource objectives while minimizing reductions in hydropower generation.

Based on our analysis of the proposed flows in section 3.3.1.2, *General Streamflow Requirements*, we conclude that the proposed MIFs would enhance aquatic conditions and would benefit fisheries for naturally produced and stocked trout in each of the 21 reaches where MIFs would be implemented. Specific environmental benefits for each of the individual 21 reaches comparing baseline conditions to those under proposed MIFs are presented in section 3.3.1.2; however, overall these benefits would mainly improve conditions for cold water species such as brook, rainbow, brown, and rainbow x golden trout hybrids. Overall, the proposed MIFs would benefit these species by increasing rearing habitat, increasing spawning habitat, increasing invertebrate production, improving water temperatures, improving passage for spawning migrations, and improving habitat connectivity during the rearing season.

Camp 61 Creek currently does not have a MIF requirement under the Portal Project license (Project No. 2174). To improve habitat access and increase the amount of spawning habitat during the brown trout spawning period, in the Portal Project final EA, Commission staff recommended, consistent with SCE's proposal, that during all water year types, a MIF of 1.0 cfs should be provided to Camp 61 Creek from March 1 through July 31 and a MIF of 0.5 cfs from August 1 through February. Commission staff further recommended that SCE should provide an additional 0.5 cfs during the period of October 1 through December 15. Commission staff concluded that its recommended flow regime in the Portal Project final EA would substantially improve aquatic habitat conditions in Camp 61 Creek for both brown trout and benthic macroinvertebrates, improve fish passage conditions, and improve water quality downstream of the Portal forebay.

MIFs proposed in the Settlement Agreement for Camp 61 Creek are slightly greater than those recommended by Commission staff in the Portal Project final EA, and are consistent with the Forest Service revised final 4(e) conditions filed for the Portal Project. For wet, above, and below normal water year types, the following MIFs would be released to Camp 61 Creek: October 1 through March 31, 2 cfs; April 1 through June 30, 4 cfs; July through September 30, 3 cfs; and during dry and critical water year types, 1.25 cfs would be released. Although, the MIFs proposed in the Settlement Agreement for Camp 61 Creek are slightly greater than those Commission staff recommended in the Portal Project final EA, we find that these additional flows proposed in the Settlement Agreement would provide an additional amount of wetted area and habitat for brown trout in Camp 61 Creek, provide conditions more conducive to fish passage, and decrease thermal warming in Camp 61 Creek, as further discussed in section 3.3.1.2. Therefore, we recommend the MIFs as proposed in the Settlement Agreement for Camp 61 Creek.

Collectively, implementation of the MIFs included in the Settlement Agreement would have an annualized cost of $9,819,970 (which also includes channel and riparian maintenance flows as discussed below), including a loss of 187,404 MWh of generation. Because the proposed MIFs would provide substantial benefits to recreational fisheries and to aquatic ecosystems and improve compliance with water temperature objectives in the basin plan, we conclude that these benefits warrant the cost of this measure.

We estimate that our recommended MIFs would decrease the annual benefit of the Portal Project by about $214,900, which is about $128,000 greater than the annualized cost of the MIFs that we recommended in the Portal Project final EA. However, we note that any flows diverted from the Portal Project into Camp 61 Creek would enter the South Fork of the San Joaquin River upstream of the Mammoth Pool Project. Consequently, much of this flow would be available for generation purposes at the Mammoth Pool Project and the net loss in generation and associated revenue would be minimal.

Removal of Adit 8 and Rancheria Creeks from the Project Licenses

The Forest Service specifies in its 4(e) conditions that Adit 8 and Rancheria creeks should be removed from the Big Creek Nos. 1 and 2 Project license. Interior, in its 10(j) recommendation 1.3 states that "the current diversion at Adit 8 Creek is not to be used per the Settlement Agreement." No resource issues were identified with either Adit 8 or Rancheria creeks in SCE's study and neither the Forest Service nor Interior provides an explanation discussing why these creeks should be removed from the Project license.[53] Interior's recommendation is not a specific measure to protect or enhance fish and wildlife, but we consider it under section 10(a) of the FPA.

[53] Section 1.1.1.0 of the Settlement Agreement does not specifically mention Adit 8 diversion.

In its response to the 4(e) conditions filed on April 9, 2008, SCE states that this 4(e) condition is not needed because in its license application, SCE does not propose to include Adit 8 and Rancheria creeks in the project boundary for the Big Creek Nos. 1 and 2 Project.

Because of the lack of identified aquatic issues in the reach and the fact that the diversion dam is infrequently if ever used, a decision to include or remove Adit 8 Creek and the Adit 8 Creek diversion dam from the Big Creek Nos. 1 and 2 Project license would have little if any effect on aquatic resources. Although the diversion on Adit 8 Creek has not been used for several decades, the dam gives SCE the flexibility to divert water from Tunnel 5 to Tunnel 2 in the event of an outage at Powerhouse 2A, which would help to avoid adverse effects associated with a large and sudden increase in flows in Stevenson Creek. For these reasons, we recommend that the Adit 8 Creek diversion dam remain within the project boundary.

Rancheria Creek conveys outflows from the Portal powerhouse and any flows that pass from the Portal surge chamber into Huntington Lake. Both of these facilities are part of the Portal Project. SCE proposes to take out of the project boundary the area surrounding Rancheria Creek from Portal powerhouse to the high water line of Huntington Lake (Portal tailrace). This reach is primarily affected by flow through the Ward Tunnel and is currently included in the project boundaries of two other FERC licensed projects (Big Creek Nos. 2A, 8, and Eastwood [Project No. 67]; and Portal Project [Project No. 2174]). Rancheria Creek supports self-sustaining populations of rainbow, brown, and brook trout and Sacramento sucker, and kokanee from Huntington Lake have been observed spawning in the Portal powerhouse tailrace and in the lower portion of Rancheria Creek. Because the Portal surge chamber and powerhouse are not part of the Big Creek ALP Projects, removal of Rancheria Creek would not have any effect on the ability of the Commission to implement any measures that are determined to be needed to protect aquatic and other resources in Rancheria Creek downstream of the Portal surge chamber and powerhouse. As a result, we recommend that Rancheria Creek should be removed from the Big Creek Nos. 1 and 2 Project license as proposed in the Settlement Agreement. Because this reach is the primary water conveyance from the back-country diversions, which are largely part of Big Creek Nos. 2A, 8, and Eastwood Project (Project No. 67), protection of this reach under this license would ensure the project's continued operation.

Channel and Riparian Maintenance Flows

Under Settlement Agreement measures A1.2 through A1.5, SCE would implement channel and riparian maintenance flows in the South Fork San Joaquin River and six of its tributaries: Bear, Bolsillo, Camp 62, Chinquapin, Mono, and Camp 61 creeks. Detailed plans for implementing channel and riparian maintenance flows in the South Fork San Joaquin River and in Mono and Camp 61 creeks are provided in appendices D, E, and F to the Settlement Agreement. The Forest Service filed 4(e) conditions and

Interior filed 10(j) recommendations that are consistent with the channel and riparian maintenance flows proposed in the Settlement Agreement measures and listed above.

Under the Riparian Monitoring Plan (Settlement Agreement measure A1.11), SCE would monitor trends in riparian and meadow health in response to the channel and riparian maintenance flows in the South Fork San Joaquin River (Jackass Meadow Complex), Camp 61 Creek, and Mono Creek throughout the term of the new license.

The flow regime in the South Fork San Joaquin River and in the bypassed reaches of its tributary streams has been substantially altered by diversion of flow into Huntington Lake and the Big Creek System. Project bypassed reaches have been affected by disruption of natural geomorphic processes including sediment retention behind dams and diversion, altered floodplain connectivity, and flow regulation that alters the timing, magnitude, and duration of peak flows and base flows. These alterations affect aquatic habitat conditions including the condition of spawning gravels and the extent and condition of riparian vegetation.

The proposed channel and riparian maintenance flow releases would occur during the peak spring hydrograph to maximize the channel's ability to mobilize and transport sediment and increase riparian vegetation regeneration. Spring channel and riparian maintenance flow releases would also contribute flow to the South Fork San Joaquin River to benefit spring spawning trout.

Channel and riparian maintenance flows would increase the magnitude and duration of spring peak flows compared to current project operations and would ensure that overbank flows would occur during most wet water years (see section 3.3.1.2 for analysis). These increased peak flows would benefit riparian habitats by helping to (1) scour encroaching upland and riparian vegetation in the formerly active channel and on the channel bars; (2) deposit fresh alluvium; (3) regenerate and/or establish riparian vegetation; (4) provide higher soil moisture and water table to support riparian vegetation; and (5) discourage continued encroachment of upland species on the channel bars.

The higher peak flows would have a greater capacity to mobilize and transport accumulated sediments; increase the recruitment of LWD to the channel; contribute to the formation of physical habitat features such as riffles, pools, runs, and point bars; support dynamic geomorphic processes over time; and decrease spawning gravel embeddedness. As spawning substrate conditions improve and LWD increases over time, we expect trout recruitment would increase, benthic macroinvertebrate productivity would increase, and young-of-the-year trout would have increased access to spaces within the substrate, which provide cover during floods.

In the Portal Project (Project No. 2174) final EA, Commission staff recommended that: (1) SCE release a channel and riparian maintenance flow to Camp 61 Creek during a 10-day period between June 1 and July 31, ramping up to 28 cfs in an above normal water year and up to 39 cfs in a wet water year; and (2) flows be released between June 1 and July 31. In the final EA, Commission staff concluded this recommended channel and riparian maintenance flow would likely mobilize and transport accumulated sediments out of the Camp 61 Creek system, leading to improved aquatic and riparian habitat conditions. Commission staff further concluded that channel and riparian maintenance flow releases after June 1 would avoid potential adverse effects on brown trout recruitment due to redd scour, and the later releases are less likely to adversely affect young brown trout because juveniles would be able to seek cover from high flows.

SCE's proposal for a channel and riparian maintenance flow in Camp 61 Creek in the Settlement Agreement differs from Commission staff's recommendation in the Portal Project final EA, and is consistent with Forest Service revised final 4(e) condition submitted for the Portal Project. Under the proposal in the Settlement Agreement, channel and riparian maintenance flows would be slightly greater in magnitude (30 cfs versus 28 cfs in above normal years; 40 cfs versus 39 cfs in wet water years), flows would be released between May 1 and June 30, as opposed to June 1 and July 30, and if the weighted mean value of the level of fine sediments measured downstream of Portal forebay is greater than 0.25 following the release of two wet water year flows, the duration of the channel and riparian maintenance flows would be increased by adding two days of flows at 30 cfs in above normal years and two days at 40 cfs in wet years.

We conclude that the slightly greater flows and the extended release periods under the Settlement Agreement proposal would have a somewhat greater capacity to mobilize and transport accumulated sediments and contribute to the formation of physical habitat features in Camp 61 Creek. These increased flows would also help support dynamic geomorphic process over time and decrease spawning gravel embedddedness; therefore, we recommend the slightly greater channel and riparian maintenance flows and extended release periods proposed in the Settlement Agreement.

Movement of gravels prior to brown trout emergence could result in physical damage to the incubating embryos and alevins still present in redds or among other substrate. Following emergence, juvenile brown trout would be able to seek cover from high flows along the channel margins and would not be subject to redd scour. Brown trout in California are fall or winter spawners (November and December) with embryos typically hatching 7 to 8 weeks thereafter, and alevins emerging from the gravel and beginning to feed 3 to 6 weeks after hatching (Moyle, 2002). This indicates brown trout emergence from the gravel would typically occur by March or April, prior to the May 1 through June 30 channel and riparian maintenance flows proposed in the Settlement Agreement. Therefore, we recommend releasing channel and riparian maintenance flows to Camp 61 Creek between May 1 and June 30, because it would protect young brown trout and likely minimize impacts on juvenile trout recruitment, as emergence from the gravel would occur prior to May 1.

Implementing channel and riparian maintenance flows in the South Fork San Joaquin River and in these six tributaries would provide a substantive benefit to recreational fisheries for naturally produced trout, aquatic ecosystems, and riparian-dependent wildlife species. The annual costs of implementing channel and riparian maintenance flows in these reaches (estimated to be $1,555,760 for those reaches associated with the Big Creek ALP Projects) and the reduction in the average annual value of power generation are included in the total costs of the MIFs. However, given the substantial benefits identified above, we conclude that these benefits justify the costs.

We estimate that our recommended channel and riparian maintenance flows would decrease the annual benefit of the Portal Project by about $58,800, which is about $19,600 greater than the annualized cost of the channel and riparian maintenance flows that we recommended in the Portal Project final EA. As noted in our previous discussion of MIFs, any flows diverted from the Portal Project into Camp 61 Creek would enter the South Fork of the San Joaquin River upstream of the Mammoth Pool Project. As a result, much of this flow would be available for generation purposes at the Mammoth Pool Project and the net loss in generation and associated revenue would be minimal.

Streamflow and Reservoir Elevation Monitoring

SCE plans to add or upgrade gages (see table 3-11) within the vicinity of the Big Creek ALP Projects to ensure compliance with MIFs and other flow requirements that may be specified in new licenses for these projects in accordance with the Flow Monitoring and Reservoir Water Level Measurement Plan (appendix L of the Settlement Agreement). SCE proposes to continue to monitor water levels in Mammoth Pool reservoir and Huntington, Florence, and Shaver lakes. Accurate measurement and documentation of flows is necessary to ensure compliance with MIFs, channel and riparian maintenance flows, and seasonal high flow events. In reaches used for recreational purposes (angling and boating), telemetried flow and reservoir level information that SCE plans to make available to the public via the Internet or other suitable means, would enable recreational visitors to better plan their visits to the project area. SCE plans to use existing gages to measure reservoir water levels, thus there would be no incremental cost associated with this continued monitoring. The cost to modify or replace streamflow gages, including structural modifications needed to accommodate the gages, would result in an annualized cost of $579,710 at the Big Creek Nos. 2A, 8, and Eastwood Project; $468,880 at the Big Creek Nos. 1 and 2 Project; $1,786,360 at the Mammoth Pool Project; and $348,720 at the Big Creek No. 3 Project. However, because of the complexity of the interactions of flows within the Big Creek ALP Projects, sophisticated flow monitoring schemes are necessary for Big Creek System water management and to document compliance of project flows with license conditions; therefore, we conclude that the costs are warranted.

Small Diversions Decommissioning

Under Settlement Agreement measure A1.6, SCE would implement the proposed Small Diversions Decommissioning Plan included as Settlement Agreement, appendix G. SCE proposes to complete the decommissioning of the six small diversions within 5 years following issuance of the new licenses, assuming required permits are obtained.

The small diversions that would be decommissioned include four backcountry hydroelectric generation diversions on North Slide, South Slide, Tombstone, and Crater creeks, and two domestic water diversions on Pitman and Snow Slide creeks. The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations that are consistent with this measure.

Under the Settlement Agreement, these six diversions would be decommissioned because they (1) are currently not in service, (2) are no longer needed for the operation and maintenance of the project, or (3) have been requested to be removed by resource agencies participating in the ALP. Decommissioning and removing these diversions would maintain or restore natural flow to the affected bypassed reaches, which would serve to provide cooler water temperatures to these streams and the South Fork San Joaquin River bypassed reach. Decommissioning these diversions would generally enhance the aquatic and riparian habitats associated with these bypassed reaches, improve fish passage, and increase the recruitment of spawning gravel to the South Fork San Joaquin River bypassed reach, which has a spawning gravel deficit due to impoundments. The combined annualized cost of decommissioning these six diversions is $141,830. We expect the energy loss associated with the decommissioning of these diversions to be minimal, given the small amount of water impounded and diverted by each of these diversions. Based on the benefits identified above, we conclude that the benefits warrant the costs.

Large Wood Debris Management at Bear Creek

The Bear Creek diversion dam blocks the transport of LWD from the upper watershed to the Bear Creek bypassed reach. Under Settlement Agreement measure A1.7, SCE would return large wood to Bear Creek by allowing LWD to pass over the Bear Creek diversion spillway during spill. SCE would also collect LWD from the impoundment in the vicinity of the intake gates and dam for placement in the bypassed reach. For purposes of this measure, LWD is defined as dead or dying wood 10-feet or longer and at least 4-inches in diameter. SCE may cut large pieces of wood that otherwise would not be feasible to collect and move the wood from the Bear Creek forebay as long as the minimum dimensions for LWD, as defined above, are maintained. SCE would consult with the resource agencies annually to decide if the amount of LWD is sufficient or the LWD procedures are adequate to transport downstream during spill events. The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations that are consistent with this measure.

In the reference reach upstream of the Bear Creek diversion, more than half of the habitat units had 1 to 15 pieces of LWD. Most of the habitat units in the bypassed reach did not have LWD; six habitat units had 1 to 5 pieces of LWD and one unit had 5 to 10 pieces of LWD. The limiting factors analysis of the bypassed reach suggests that adult rearing and spawning habitat is heavily used by an abundant trout population, and the physical habitat may be approaching limiting values.

LWD contributes to productive aquatic ecosystems, and is an important component in the formation of complex aquatic habitat units and channel maintenance. The proposed LWD supplementation in the bypassed reach would increase the amount of available trout habitat by creating deep pools that provide thermal refugia and increasing habitat complexity. LWD creates high flow velocity breaks and provides cover from predators, including other trout. Snorkel surveys conducted by the Sierra National Forest indicate that the highest trout densities are associated with LWD. The velocity breaks created by LWD also retain and sort substrate to create gravel bars and spawning habitat for salmonids. The annualized cost of this measure is estimated to be $6,850. Given the relatively low cost of this measure and the substantial resource benefits identified above, we conclude that the benefits warrant the costs.

Temperature Monitoring and Management

Under Settlement Agreement measure A1.8, SCE would implement a Temperature Monitoring and Management Plan, included as Settlement Agreement, appendix H, to document the effects of proposed MIFs on water temperatures and allow for adaptive management where needed. SCE would monitor water temperatures during at least the first 3 to 5 years that new MIFs are released, including at least one dry or critically dry water year. Water temperature monitoring would be conducted at seven sites on the South Fork San Joaquin River and in two of its tributaries (Camp 61 and Mono creeks), at six sites in the Mammoth and Stevenson reaches of the San Joaquin River, at four sites in the middle and lower Big Creek reaches, and at two sites in North Fork Stevenson Creek. In addition, monthly temperature profiles would be measured in Mammoth Pool and in Florence Lake during the summer. Water temperature monitoring programs would be implemented in the San Joaquin River, South Fork San Joaquin River, Mammoth Pool reservoir, Florence Lake, and North Fork Stevenson Creek, including real-time telemetry monitoring of water temperatures in the Mammoth and Stevenson reaches and in the South Fork San Joaquin River downstream of Florence Lake. The monitoring results would be presented and discussed at an annual agency consultation meeting, and would be used to develop interim and long-term water temperature control programs including measures that may be feasibly implemented by SCE to maintain water temperatures below target temperatures. Interior filed 10(a) recommendations for all four Big Creek ALP Projects that are consistent with Settlement Agreement measure A1.8, except that it would expand the program to include monitoring of all of stream reaches and reservoirs affected by the projects.

The proposed Temperature Monitoring and Management Plan would benefit coldwater fisheries for trout by documenting how project operations affect water temperatures so that flows could be adjusted through adaptive management if needed, based on monitoring results. The plan includes measurement of water temperatures at 19 sites in 6 bypassed stream reaches where daily mean water temperatures exceeded 20°C or daily maximum water temperatures exceeded 22°C in 2000 or 2001, based on criteria supplied by the Water Board to protect coldwater beneficial uses. The estimated annualized cost of the temperature monitoring program as proposed by SCE is $96,190. The program would help to determine the effectiveness of proposed MIFs in attaining temperature objectives, and in conjunction with the proposed fish monitoring program described below, would help to determine associated fish population responses. Because this information would help to foster cost-effective adaptive management of MIFs, we conclude that the benefits of this measure warrant its costs.

Interior's 10(a) recommendation would expand the monitoring program to include 9 additional bypassed stream reaches (Stevenson, Upper Balsam, Bear, Mono, Hooper, Pitman, Bolsillo, Chinquapin, and Camp 62 creeks), none of which exceeded a daily mean temperature of 20°C or a daily maximum water temperature of 22°C in 2000 or 2001. Short-term (3 year) water temperature monitoring is proposed for Mono Creek upstream of the San Joaquin River at RM 0.1 in the Temperature Monitoring and Management Plan due to thermal heating in the reach that exceeds the Basin Plan standard (>5ºF). Based on monitoring data collected in 2000 and 2001, these reaches currently support all beneficial uses of coldwater aquatic life, would continue to do so under the MIFs proposed in the Settlement Agreement, and the proposed Mono Creek MIF is expected to decrease thermal warming to meet Basin Plan standards. Therefore, Interior's 10(a) recommendation is unnecessary.

Interior's 10(a) recommendation would also expand the monitoring program to include all 15 affected reservoirs and impoundments. However, only two project reservoirs (Shaver and Huntington) besides Mammoth Pool and Florence Lake have sufficient storage to suggest that they have the potential to be used to manage downstream water temperatures. Shaver Lake has a maximum storage of 135,568 acre-feet and likely could be used to manage water temperatures in the downstream reach of Stevenson Creek, but SCE's temperature monitoring data from 2000 and 2001 indicate that the temperature in this reach already meets the objectives to support coldwater life, and would continue to do so under the increased MIFs proposed in the Settlement Agreement. Similarly, Huntington Lake has a substantial amount of usable storage capacity (89,166 acre-feet), but the upper Big Creek reach downstream of the reservoir already meets the objectives to support coldwater life, and would also be expected to do so under the increased flows proposed in the Settlement Agreement.

Expanding the program to include monitoring of 9 additional stream reaches and 13 additional reservoirs as recommended by Interior, would increase the annualized cost of the temperature monitoring program by about $192,380, to approximately $288,570. Based on the results of temperature monitoring conduced by SCE in 2000 and 2001, all of the additional stream reaches that would be monitored under Interior's 10(a) recommendation currently support coldwater life, and would continue to do so under the MIFs proposed in the Settlement Agreement. In addition, only four of the project reservoirs appear to have sufficient storage to provide opportunities to control downstream water temperatures, and water temperatures in reaches downstream of Huntington Lake and Shaver Lake already fully support the beneficial use of coldwater life. As a result, we conclude there would be little benefit in expanding the temperature monitoring program to include the additional reaches and reservoirs included in Interior's 10(a) recommendation and conclude that these limited benefits do not justify its costs. We note that SCE's proposed annual consultation meeting would provide an opportunity for the potential need for inclusion of additional reaches to be considered, if warranted.

Fish Monitoring

Under Settlement Agreement measure A1.9, SCE would implement the Fish Monitoring Plan included in Settlement Agreement, appendix I. The Fish Monitoring Plan would evaluate the response of fish populations in selected reaches and major reservoirs to the MIFs and other enhancement measures (channel and riparian maintenance flows, LWD, sediment) included in the new licenses. Species composition, relative abundance, size and age distribution, biomass, density, and condition factor would be monitored during the months of August and September. Fish monitoring would be conducted at seven sites on the South Fork San Joaquin River, in Mono, North Fork Stevenson, and Bear creeks, and in two of its tributaries, in the Mammoth and Stevenson reaches of the San Joaquin River, in the middle and lower Big Creek reaches, and in Stevenson Creek. Fish monitoring in reservoirs would occur in Mammoth Pool reservoir, Huntington Lake, Florence Lake, and Shaver Lake. Monitoring would be implemented at years 3, 8, 18, 28 (and in year 38, if a 50-year license is granted). Monitoring would not begin until the new MIFs have been implemented in each survey reach. If monitoring is scheduled for a wet water year, it would be postponed until the next non-wet water year to prevent confounding the effect of high flows on fish recruitment and populations. The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations for all four Big Creek ALP Projects that are consistent with this measure.

Trout populations in a number of the bypassed reaches have low densities, fragmented distributions, or skewed age class distributions (see our analysis in section 3.3.1.2). In many cases, fish populations appear to be constrained by the effects of flow diversions and project structures on stream flows, water temperatures, fish passage, and the transport and supply of spawning gravel and LWD. The Settlement Agreement includes measures that are expected to enhance fish populations by addressing many of these project-related effects. Monitoring fish populations in the specified bypassed reaches would provide a means of assessing the effects of the new MIFs and other enhancement measures on fish populations in these reaches and would apply adaptive management based on monitoring, as needed. Fish population monitoring in bypassed reaches would also help determine if the Forest Service, Interior, and Basin Plan objectives are being met in these reaches. Monitoring fish populations in project reservoirs would provide a means of assessing the effects of the new MIFs on fish populations in the major reservoirs, including potential effects of earlier depletion of cool water in dry years on reservoir trout. This information would help to determine if Cal Fish & Game's management objectives for these reservoirs are being met, and would assist in guiding adaptive management.

A supplemental study that includes fish, water temperature, and DO data collection would be implemented to evaluate the use and importance of the Stevenson reach for transitional zone species including hardhead, Sacramento pikeminnow, and Sacramento sucker. If the supplemental study concludes that Stevenson reach is an important native fish transition zone, and the consensus recommendation of SCE and the resource agencies is to change the beneficial use designation of the reach or the lower portion of the reach (downstream of the Stevenson Creek confluence), SCE would propose an amendment of the coldwater habitat designation in the Basin Plan.

The estimated annualized cost of fish monitoring in project bypassed reaches and reservoirs is $35,340. Because the monitoring effort would help to determine the effectiveness of proposed measures and facilitate adaptive management, we conclude that the benefits warrant the costs of this measure.

Sediment Management

Project dams impede or interrupt the flow of sediments, spawning gravels, and other materials beneficial to fish and wildlife from continuing downstream through the project affected stream reaches. Under Settlement Agreement measure A1.10, SCE would implement the sediment management measures described in Settlement Agreement, appendix J. These include measures for passing accumulated sediment through project facilities followed by flushing flows to redistribute passed sediments, removing accumulated sediment from behind dams, if needed, that may block low level outlets or intake structures, and monitoring of turbidity and pool filling. The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations for all four Big Creek ALP Projects that are consistent with this measure.

Sediment retention behind project dams has resulted in depletion of spawning gravels in the bypassed reaches. Sediment pass-through activities, as proposed in the Settlement Agreement, would restore sediment transport processes in four tributaries to the South Fork San Joaquin River (Hooper, Chinquapin, Camp 62, and Bolsillo creeks), which would help to restore spawning gravels in the bypassed reaches of these creeks and in the South Fork San Joaquin River. Sediment pass-through would also occur in three tributaries and three mainstem dams within Big Creek (Balsam, Pitman, and Ely creeks, and Dams 4, 5 and 6), providing similar benefits to the bypassed reaches downstream of each of these dams. Within the mainstem San Joaquin River, sediment pass-through would occur at the Rock and Ross creek dams and at Mammoth Pool dam. Likely benefits of restoring the passage of sediment into downstream reaches include: increasing the volume of spawning gravels,[54] improving benthic macroinvertebrate production, creating greater quality and diversity of aquatic habitat to benefit native fishes, and

[54] Except below Mammoth Pool dam, where our analysis (see section 3.3.1.2) indicates that the proposed pass-through activities are unlikely to restore movement of spawning gravels because of the large size of the reservoir.

fostering point bar development to enhance riparian habitat. Sediment pass-through activities would be implemented in wet water years, prior to the implementation of channel and riparian maintenance flows in the reaches where they are proposed. Both of these provisions would assist with ensuring flows re-distribute spawning gravel, maintain pool depths via scouring, and flush fine sediment from the stream channel.

Sediment removal activities would help to prevent MIF release structures from becoming blocked by sediment, and would reduce the transport of fine sediments into downstream reaches, which could prevent potential adverse effects from fine sediment such as reducing the permeability of spawning gravels and smothering incubating trout eggs. As proposed in the Settlement Agreement, sediment removal activities would be implemented, if needed, at each of the dams where sediment pass-through activities are proposed, except for Dam 4 and Mammoth Pool dam where sediment build-up is not an issue. Removed sediments would be either placed above the mean annual flood elevation where they would not be re-entrained or removed to pre-approved, off-site locations. Therefore, mechanical sediment removal would have no adverse effects on fish habitat in downstream areas.

The sediment management measures in the Settlement Agreement include monitoring of turbidity levels downstream of seven of the larger dams to ensure that turbidity levels do not rise to levels that would be harmful to aquatic biota (see table 3-14). Monitoring of pool depths would also be performed downstream of Dams 4, 5 and 6 prior to and after implementation of sediment pass-through measures, to determine whether deposition of fine sediments has caused pools to fill with sediments and the volume of the pools reduced. Monitoring pool depth in these reaches would allow effects of sediment pass-through on pool habitat to be assessed, and would provide information that could be used to alter the implementation of sediment pass-through measures if excessive pool filling occurs, which would adversely affect habitat availability and thermal refugia for adult trout.

The Settlement Agreement does not require monitoring of pool depths for the other dams where sediment pass-through measures would be implemented, including Mammoth Pool and nine smaller headwater diversions. Because of the large size of the Mammoth Pool impoundment (approximately 8 miles in length), we expect that most of the sediment retained in this reservoir is deposited in the upstream portion of the reservoir, and that only small amounts of fine sediments would be released when pre-spill whitewater flows are released via the Howell-Bunger valve, and that these sediments would be easily transported downstream and pose little threat of pool-filling. The nine headwater diversions are on high gradient streams with very small impoundments, all of which have a surface area of less than 1 acre and a volume of less than 1 acre-foot. Given the relatively small amount of sediment that could be retained in these impoundments and the high transport capacity of these headwater streams, we conclude there is little risk of pool-filling from sediment pass-through activities on the tributaries.

The estimated annualized cost of sediment pass-through, removal and sediment monitoring measures proposed in the Settlement Agreement is $85,340. Given the importance of keeping minimum flow structures open and the ecological benefits of restoring sediment transport processes, we conclude that these measures are warranted and justify these costs.

Expansion of the monitoring of pool-filling proposed for Dams 4, 5 and 6 to include an assessment of embeddedness of spawning gravels with fine sediment at representative potential spawning sites would allow potential adverse effects on spawning gravel and the adequacy of flushing flows to be evaluated and adjusted if warranted. A relatively simple visual assessment of the abundance of fine sediment on the surface of potential spawning areas, such as the method for estimating percent cobble embeddedness described in the California Salmonid Stream Habitat Restoration Manual (Cal Fish & Game, 1998), could be conducted at a relatively low cost, especially if it were conducted in association with monitoring of pool-filling at the reaches downstream of Dams 4, 5 and 6.[55] We estimate that this additional effort would add approximately $5,820 to the annualized cost of the sediment management measures included in the Settlement Agreement, assuming that sediment pass-through and monitoring activities would occur every 5 years. Because of its low cost and its importance in detecting and addressing any adverse effects of sediment pass-through activities on spawning gravel, we conclude that the benefits of this additional measure warrant its costs. We also conclude that limiting this monitoring effort to Dams 4, 5 and 6 is appropriate, given the more limited volume of sediments likely to be passed through at other project diversions.

Gravel Augmentation

To address project effects on the recruitment of spawning gravels in the Mammoth reach, SCE proposes to implement the Gravel Augmentation Plan described in Settlement Agreement measure B.1.2. Interior filed a 10(j) recommendation consistent with this measure.

Under the proposed plan, SCE would coordinate with the Forest Service, FWS, Cal Fish & Game, Water Board, and other interested resource agencies to implement a gravel augmentation feasibility assessment to determine if placing gravel in or near the spillway channel at Mammoth Pool dam is feasible and whether gravel placed at this location would be moved and redistributed by spill flows. The feasibility assessment would include assessing whether placing gravel at this location would cause any adverse effects on project operation or to dam safety by assessing whether it would impair the Mammoth Pool dam spillway function, cause erosion and undermine the access road, result in dam instability, or impair the operation of release structures or hinder inspection of the dam and release structures.

[55] We anticipate that the specific methodology to be used at Dams 4, 5, and 6 to assess embeddedness would be determined in consultation with the agencies.

If the assessment concludes that the placement of gravel in or below the spillway channel would lead to any of these problems or would create other reliability or operational problems, then alternative locations for gravel placement would be evaluated. The alternative locations must have sufficient physical space and access for placement of gravels and be comparable in cost to the placement of gravels in or below the spillway. These alternative locations would include, but would not be limited to, a location below the confluence of Rock Creek.

Gravel augmentation would begin after the first fish monitoring effort has been completed following the initiation of the new flow regime. SCE would place 300 tons of gravel into the Mammoth reach immediately below the Mammoth dam spillway, or at alternative feasible location(s). SCE would monitor gravel transport and distribution and evaluate whether the next two above normal or wet water year spill events with a peak flow of at least 5,000 cfs are capable of moving the gravel from the emplacement site. The pilot project may be considered successful if after the two spill events, more than 50 percent of the gravel has moved downstream from the emplacement site.

SCE would prepare a report following the completion of gravel monitoring after the second spill event for agency review and comment. If the feasibility assessment is successful SCE and the agencies would meet and decide whether to continue or modify the gravel augmentation program. If the gravel augmentation program is not implemented, then a supplemental fish stocking program in the Mammoth reach would be implemented by Cal Fish & Game.

If gravel augmentation is conducted, the proposed feasibility assessment would be needed to assess the potential for gravel augmentation to cause adverse effects to project facilities, including the Mammoth Pool dam, spillway, and access road.

We conclude that the proposed gravel augmentation feasibility assessment would be necessary in order to assess the potential for gravel augmentation to cause adverse effects to project facilities, including the Mammoth Pool dam, spillway, and access road. The estimated annualized cost of conducting the feasibility assessment, as proposed in Settlement Agreement measure B.1.2, is $5,250. Given that the feasibility assessment is needed to ensure dam safety, we conclude that the benefits of this measure warrant its costs and that this measure should be included as a condition of a new license. In order to ensure that gravel augmentation does not adversely affect dam safety or the integrity of project facilities, SCE should file a detailed study plan with the Commission for approval prior to conducting the feasibility assessment. Upon completing the feasibility assessment, we also recommend that notification be provided to the Commission, in addition to the agencies noted above, detailing the results of the feasibility assessment. Further, if the pilot project is successful, and gravel augmentation is proposed by SCE to be implemented over the life of the license, SCE would be required to request an amendment to its license.

Wildlife and Plant Protection Measures

Vegetation and Integrated Pest Management Plan

Vegetation management, including trimming of vegetation by hand or equipment and the use of herbicides, occurs at several locations within the Big Creek ALP Projects. This regularly occurring management could have both beneficial and adverse effects on special-status plans and wildlife and the proliferation of noxious weeds. SCE's proposed Vegetation and Integrated Pest Management Plan specifies measures that would be implemented to ensure vegetation management in a manner that minimizes adverse effects on the environment, protects sensitive plants and wildlife, controls the spread of noxious weeds, ensures revegetation of disturbed sites, and provides for weed-free erosion control measures. SCE also would monitor the effectiveness of vegetation management activities that it implements. In addition, SCE would implement multifaceted training programs to ensure that employees are aware of sensitive plants and wildlife that could be affected by operation and maintenance of the Big Creek ALP Projects. SCE would also attend annual consultation meetings with the Forest Service, Interior, and Cal Fish & Game to discuss past and proposed terrestrial resource management activities. The resource and land management agencies support SCE's proposed approach to vegetation management. We consider the proposed measures to manage vegetation and control the spread of noxious weeds to represent an effective approach to minimizing and avoiding project related effects on vegetation and the wildlife that depend on this vegetation for habitat. We estimate the annual cost of implementing the Vegetation and Integrated Pest Management Plan and associated training and agency consultation would be $57,110 at the Big Creek Nos. 2A, 8, and Eastwood Project; $57,110 at the Big Creek Nos. 1 and 2 Project; $57,110 at the Mammoth Pool Project; and $22,850 at Big Creek No. 3 Project. Given the benefits of implementing these measures, we consider these costs to be warranted.

Riparian Monitoring

Quantitative and qualitative riparian studies completed for the Big Creek ALP Projects identified potential riparian or meadow resource issues along certain bypassed streams associated with the Big Creek Nos. 2A, 8, and Eastwood Project. Under Settlement Agreement measure A1.11, SCE would implement the Riparian Monitoring Plan included as Settlement Agreement, appendix K, to determine the effectiveness of channel and riparian maintenance flows for maintaining channels and riparian and meadow ecosystems. The Riparian Monitoring Plan would be designed to monitor the status and trends of the riparian resources along the Mono Creek, South Fork San Joaquin River, and Camp 61 Creek bypassed reaches in response to the channel and riparian maintenance flows and MIFs required under the new licenses. Specific objectives for the plan include monitoring riparian and meadow vegetation composition in selected reaches; riparian vegetation age class structure, including regeneration, in selected bypassed reaches; and trends in riparian and meadow health in selected reaches over the length of the new license. The Forest Service filed 4(e) conditions and Interior filed 10(j) recommendations that are consistent with this measure.

Under the Settlement Agreement, monitoring in Camp 61 Creek would occur the first year after license issuance, and at 10-year intervals thereafter, consistent with Commission staff recommendations in the Portal Project final EA. However, under the Settlement Agreement, monitoring would also occur 5 years following the channel and riparian maintenance flow releases made in the first wet water year for Camp 61 Creek. We support this additional monitoring event recommended in the Settlement Agreement as it would provide additional information in the short-term to determine the effectiveness of channel and riparian maintenance flows in Camp 61 Creek.

Overall, the proposed monitoring effort would provide information to determine whether or not the proposed channel and riparian maintenance flows and MIFs promote healthy riparian and meadow communities; result in successful establishment of native species' on alluvial surfaces in reaches with identified age class resource issues; support native riparian or meadow species; and discourage the establishment of mature woody vegetation and upland species on lower surfaces within the channel causing channel encroachment. Adaptive management would be implemented to ensure that the channel and riparian management goals are met in Bear, Bolsillo, Camp 62, Chinquapin, Mono, Camp 61, and South Fork San Joaquin River bypassed reaches. The estimated annualized cost of Settlement Agreement measures A1.11 is $17,170, and based on the benefits described above, we conclude that the cost of this measure is warranted.

Wildlife Protection

Numerous special-status wildlife species, including bald eagles, western red bat, Townsend's western big-eared bat, and pallid bat are known to occur in the vicinity of the Big Creek ALP Projects. SCE proposes to consult with the Forest Service, Interior, and Cal Fish & Game prior to conducting any non-routine maintenance at structures known to support sensitive bats, and would implement appropriate avoidance and protection measures as necessary to minimize disturbance of bats and their habitat. SCE also plans to implement its Bald Eagle Management Plan, which would ensure that disturbance of nesting bald eagles is minimized and foraging and roosting habitat is protected. Known nest sites would be monitored, as would wintering bald eagle populations. In addition, cases of raptor mortality at project transmission lines would be investigated and potential corrective actions developed in consultation with the Forest Service, Interior, and Cal Fish & Game. We consider these proposed measures to represent best management practices for the protection of bats and bald eagles; however, the final plan should include the most recent APLIC guidelines to assess potential corrective actions when investigating any raptor mortality that may be associated with a project transmission line.

Mule deer migration routes cross the San Joaquin River, specifically in the Mammoth Pool Project area. In addition, project roads in the vicinity of the Big Creek Nos. 2A, 8, and Eastwood Project have the potential to disturb mule deer migrations in that area. SCE proposes to install fences at specific locations where deer crossing of the river would be unsafe and ensure that sand is present on the Mammoth Pool dam road to encourage deer to use this road as a means to safely cross the river. Monitoring of debris at the floating boom upstream of the Mammoth Pool spillway would be used to facilitate annual consultations with the Forest Service, Interior, and Cal Fish & Game. Road closures at Mammoth Pool and Big Creek Nos. 2A, 8, and Eastwood projects during the deer migration season would minimize potential disturbance of migrating deer. Implementation of these measures would address known sources of deer mortality and disturbance during annual migrations.

Human interactions with black bears in the wild can result in injury to humans, loss of wild instincts by bears that can easily obtain food in trash receptacles, and litter from bears strewing trash during their search for food. SCE proposes to minimize these effects by installing and maintaining bear-proof dumpsters at the Big Creek No. 1 administrative offices and company housing, and other project facilities where people may dispose of or store food waste. Such bear-proof receptacles are the standard means to minimize bear/human interactions.

The resource and land management agencies are in agreement with SCE's proposed measures to protect bats, bald eagles, mule deer, and black bears. We estimate that the total annual cost of implementing these measures at all four Big Creek ALP Projects would be $48,120, but the cumulative protection of wildlife that would be afforded by these measure is warranted.

Valley Elderberry Longhorn Beetle Management Plan

SCE conducted VELB habitat surveys at the Big Creek ALP Projects and found potential occurrences and habitat at all projects except Big Creek Nos. 1 and 2. To ensure the protection of VELB habitat (elderberries with stems greater than 1 inch in diameter), SCE developed the VELB Management Plan, which includes such protective measures as using flags and signage to identify mature elderberry shrubs, limitation on trimming of elderberry branches >1-inch in diameter, herbicide restrictions near elderberries, and limitations on when non-emergency road grading would occur. To compensate for project-related losses of elderberry shrubs, SCE proposed to plant elderberry seedlings at a location agreed upon by the Forest Service, Interior, and SCE, and to monitor the seedlings to ensure pre-determined success rates are achieved. SCE established a 1.5 acre elderberry conservation area in consultation with FWS and is currently monitoring that site. Interior's 10(j) recommendations and the Forest Service's 4(e) conditions are consistent with SCE's proposed measure. Measures to protect, monitor, and mitigate project effects on VELB are specified in FWS' 1999 Conservation Guidelines, SCE's proposed plan is consistent with provisions specified in these guidelines, and we recommend implementation of the VELB Management Plan. In addition, we recommend that SCE provide the Commission with the location of any VELB conservation area that is established and include this area in the project boundary.

We estimate the total annual cost of implementing the VELB Management Plan would be $44,550, but this cost is warranted to ensure the protection of the federally listed VELB.

Recreation Management Plan

Recreation Operation, Maintenance, and Administration

Existing recreational use during high use periods at some of the project facilities reaches up to 70 to 80 percent capacity. Future recreational use at the projects is projected to increase from between 4 and 20 percent by the year 2040, depending on the project. Therefore, recreational use at the projects is anticipated to increase over the term of any new licenses. SCE proposes to meet annually with the Forest Service to ensure protection and use of the recreational facilities at the Big Creek ALP Projects. Long-term planning and the implementation schedule for major facility rehabilitation and new capital improvements would be reviewed and adjustments to the Recreation Management Plan or implementation schedule considered, as needed. SCE would also complete a recreational use and facilities condition survey every 6 years, and file the results with the Commission along with the required Form 80 report. This report would summarize capacity data, including parking and campsite capacity, at formal recreational sites, days when recreational access to the projects was available to vehicular traffic, major reservoir water surface elevations during the recreational season, boat ramp accessibility, and the number of whitewater boating opportunity days provided at boatable reaches (downstream of Florence Lake and Mammoth Pool). The results of this survey would provide a basis for SCE and the Forest Service to make adjustments to the Recreation Management Plan. We recommend implementation of the survey and annual consultation with the Forest Service.

Currently, the Forest Service operates and maintains the majority of recreational facilities that provide public access to project lands and waters (see table 3-23). A sufficient number of recreational access sites are within the project boundary to ensure continued public access to project lands and waters. Those facilities outside the project boundary are on Sierra National Forest lands and are managed by the Forest Service; consequently, public access to those facilities is expected to continue in the future. SCE would continue to operate and maintain its existing facilities at the Big Creek ALP Projects. In addition, SCE proposes to maintain the section of the San Joaquin River Trail that is co-aligned with the Mammoth Pool transmission line, which would ensure that this portion of the trail would remain functional. Finally, SCE proposes to use specific snow plowing techniques at Kaiser Pass Road and Florence Lake Road to ensure that snowmobiling and cross-country skiing opportunities are retained along these roads during the winter. SCE's proposed operation and maintenance measures would ensure continued public recreational opportunities to project lands and waters and we recommend that they should be implemented.

We estimate the annualized cost to SCE for annual meetings, recreational use surveys, and operation and maintenance at the Big Creek ALP Projects would be

$102,660. However, given the need to coordinate with the Forest Service on various aspects of recreational use within the Sierra National Forest, and the appropriateness of SCE maintaining its own recreational facilities at the projects, we consider the benefits that would result from these measures to be worth the cost.

Major Recreation Facility Rehabilitation and Capital Improvements

As previously noted, the Forest Service currently maintains the majority of recreational sites that provide public access to project lands and waters. To assist the Forest Service with its maintenance of these facilities, SCE proposes numerous one-time major rehabilitation projects at each of these sites as discussed in section 3.3.2.2, *Recreational Resources* (and shown in table 3-23). We consider this a reasonable approach to share the responsibilities of continuing to provide recreational opportunities to those visitors who are attracted to the area because of its location within the Sierra National Forest and its project-related features (i.e., reservoirs). However, the licensee is ultimately responsible for the operation and maintenance of the project's recreation facilities located within the project boundary.

In addition, SCE proposes and Forest Service conditions specify that SCE undertake major rehabilitation at five campgrounds in the Sierra National Forest that are located entirely outside of any project boundary—the Dorabelle, Upper Billy Creek, Cavatee, Kinnikinnick, and Mammoth Pool campgrounds. In our analysis, we conclude that SCE already provides adequate camping facilities at these lakes. Therefore, we do not recommend that these additional campgrounds be included in the project boundary or that SCE's cost to undertake major rehabilitation at these facilities be made a condition of the license.

SCE also proposes to construct new recreational facilities at areas where specific recreational needs were identified during its studies and consultations with stakeholders. At the Big Creek Nos. 2A, 8, and Eastwood Project, SCE would develop an accessible fishing platform on the South Fork San Joaquin River near Jackass Meadows Campground and an accessible boat loading facility at the Florence Lake boat ramp. At the Big Creek Nos. 1 and 2 Project, SCE would develop a day-use area adjacent to Dam 3 at Huntington Lake that would include accessible access and develop an accessible fishing platform at Huntington Lake. These four proposed new recreational facilities would provide public access, especially for those with disabilities, and alleviate informal recreational use that can lead to adverse environmental effects and unsafe conditions associated with crowding. We recommend that all four proposed measures be implemented and that the new recreational facilities be included within the project boundary. We also recommend that the plans for these new facilities include best management practices to minimize effects on sensitive resources and the potential for water quality degradation of adjacent water bodies.

We estimate the annual cost of implementing SCE's proposed major rehabilitation of facilities currently operated and maintained by the Forest Service at the Big Creek

ALP Projects (with exception of the five campgrounds located outside the project boundaries) and the construction of new recreational facilities at two of the four projects to be $1,947,390, but we consider the benefits associated with maintaining existing recreational infrastructure and expanding recreational opportunities to be worth this cost. These recreational facilities provide public access to project lands and waters and would provide more formal facilities where informal recreational use currently occurs, enhance access, particularly for those individuals with disabilities, and provide the means to help meet future recreational demand at the Big Creek ALP Projects.

Fish Stocking, Recreational Flow Releases, Reservoir Water Level Management, and Information Distribution

SCE proposes to provide resources to match stocking of Big Creek ALP Project reservoirs and stream reaches conducted by Cal Fish & Game. SCE proposes to provide this match by either acquiring fish directly or by reimbursing Cal Fish & Game for half the cost of annual stocking. Although we agree enhanced stocking would improve the recreational experience of visitors to the four Big Creek ALP Projects, funding Cal Fish & Game's stocking is contrary to the Commission's policy on the imposition of funds and cost caps. Although we encourage the cooperation between SCE and Cal Fish & Game, we note that SCE should be solely responsible for ensuring that the Big Creek ALP Project reservoirs and stream reaches are stocked. Therefore, we recommend that SCE, after consultation with Cal Fish & Game, file an annual fish stocking report with the Commission detailing the quantity, species, size, location, and frequency of stocking efforts in Big Creek ALP Project reservoirs and stream reaches.

SCE proposes to provide channel and riparian maintenance flows from Florence Lake during wet and above average water years so that the descending portion of the flow release is timed to facilitate whitewater boating opportunities. In addition, SCE proposes to provide pre-spill whitewater flow releases from Mammoth Pool to the extent practical and controllable by SCE. As previously discussed, SCE proposes to include the number of recreational boating opportunity days in its recreational use and facility condition report that would be submitted to the Commission at 6 year intervals, which would provide a measure of effectiveness of these flow releases for whitewater boating and whether adjustments to release procedures need to be considered. We conclude the proposed releases have the potential to enhance boating opportunities and concur with SCE's proposed measure.

SCE also proposes to make a good faith effort to maintain water surface elevations of Shaver and Huntington lakes and Mammoth Pool at a level that would support flatwater recreational opportunities during the recreational season. However, SCE proposes no specific elevation ranges associated with the reservoir level operations for these lakes. We note that the terminology in the Settlement Agreement "to make every effort" or "to make every reasonable effort" relative to water surface elevations at the reservoir is extremely difficult for the Commission to enforce. Because of our inability to enforce compliance with these conditions and the fact that the proposed conditions for Huntington and Shaver lakes and Mammoth Pool do not differ from how SCE now operates these reservoirs, we do not recommend including these measures in the Big Creek Nos. 1 and 2 (Huntington Lake), Big Creek Nos. 2A, 8, and Eastwood Project (Shaver Lake), and Mammoth Pool licenses. However, we conclude that SCE's "good faith effort" to maintain these three reservoirs at full pool during the recreational season should enhance recreational opportunities.

At Florence Lake, SCE proposes to implement more specific minimum water surface elevations. SCE's proposed measure would result in higher water levels during July and August about 20 percent more often than currently occurs. As such, associated flatwater boating opportunities would be enhanced by SCE's proposed measure to maintain a minimum water surface elevation of 7,276 feet during July and August and we recommend inclusion of this measure in a new license for the Big Creek Nos. 2A, 8, and Eastwood Project. The estimated annualized cost for implementing water level management at Florence Lake would be about $2,150.

Additionally, SCE proposes to provide streamflow and water level information to the public via the Internet, and install staff gages at representative locations to allow visitors to know the approximated flow and reservoir level when they visit specific sites. Recreation and other project-related information would be also be available to the public at interpretive display exhibits that SCE proposes to construct at locations heavily used by the public. We conclude that SCE's proposed water management plans and its proposed means to publicize flows, reservoir water levels, and other project-related recreational and cultural resources would enhance recreational opportunities at the Big Creek ALP Projects, and we recommend that they be implemented.

The cost of fish stocking, pre-spill recreational releases at Mammoth Pool, water level management at Florence and Shaver lakes, and information distribution to the public would have an annualized cost of $190,610 (the cost of releases from Florence Lake is included under our discussion of channel and riparian maintenance flows). We consider the benefits to the public who visit these project areas that would result from these measures to be worth the cost.

Cultural Resources

SCE proposes to provide for the continued protection of cultural resources through finalization of an HPMP for the Big Creek ALP Projects. SCE's cultural consultant identified a number of cultural resources within the APE and made recommendations pertaining to their National Register eligibility in its report. The SHPO has not yet reviewed and evaluated the recommendations in this report. Our review leads us to conclude that the unevaluated resources identified in that report warrant consideration regarding their eligibility for inclusion in the National Register. SCE's finalization of its HPMP in accordance with the provisions of the Settlement Agreement would provide for management and protection of historic properties and important cultural resources throughout the Big Creek ALP Projects APE over the license terms. It would also address Forest Service concerns (expressed in its preliminary 4(e) conditions) regarding participation in the management and protection of cultural resources in those portions of the APE lying in or adjacent to the Sierra National Forest. In addition, SCE would implement environmental programs for cultural resource awareness, and conduct annual meetings with the Big Creek Advisory Committee, which would be open to the Tribes and organizations that participated in the Cultural Resources Working Group during the Big Creek ALP. The Commission would execute a PA with the SHPO and Advisory Council, which would include SCE, the Tribes, the Forest Service, and Interior as consulting parties

Finalization and implementation of SCE's HPMP in consultation with the SHPO, Tribes, and the Forest Service would ensure that adverse effects on historic properties arising from project operations or project-related activities over the term of the license would be avoided or satisfactorily resolved. Annual consultation would facilitate development of management and monitoring plans, review and evaluation of cultural resources data, and development and implementation of cultural resources protective measures. We recommend finalizing and implementing the HPMP. We estimate that implementation of the final HPMP, implementation of programs for cultural awareness, and annual consultation would cost about $90,180 annually at the four Big Creek ALP Projects and the benefit of protecting cultural resources would outweigh the cost of these measures.

The Tribes made the following recommendations: (1) develop a tribal-specific communications protocol for future negotiations between SCE and the Tribes; (2) retain a third-party facilitor for those negotiations; (3) develop Native American interpretive and signage programs; (4) construct a Native American historical monument; (5) address archaeological sites threatened by erosion on reservoir shorelines; (6) conduct comprehensive ethnographic studies and evaluation of TCPs within the APE; (7) construct and fund the operation of a Native American center at Shaver Lake; (8) develop a solar-powered infrastructure and delivery program for the Tribes; and (9) reimburse the Tribes for expenses incurred during the participation in the Big Creek ALP. We conclude that Tribal participation in the Big Creek Advisory Committee would facilitate implementation of the first five recommendations, which are provided for or, in the case of recommendation 4, could be provided for, in the draft HPMP. Regarding recommendation 6, we conclude that the ethnographic and TCP descriptions in SCE's existing cultural report are sufficient, but Tribal participation on the Advisory Committee would enable updates to those descriptions to be made as they may choose. We conclude that recommendations 7 and 8 do not have a sufficient nexus to the Big Creek ALP Projects for us to recommend that they be included in the licenses for these projects. Regarding recommendation 9, we recognize that numerous parties included the Tribes have spent thousands of hours and incurred substantial expenses to participate in the ALP process. However the Commission has no authority to require an applicant to reimburse these costs to participating parties.

Land Use Management and Visual Resources Protection

SCE proposes to implement its Transportation System Management Plan to ensure that responsibilities and schedule for maintaining, monitoring, and rehabilitating project-related roads is clearly defined. In addition, Proposed Article 3.1 for the Big Creek Nos. 1 and 2 and Mammoth Pool projects provides for the implementation of Visual Resources Plan to ensure to the extent possible, project features are consistent with the Forest Service VQOs for the Big Creek ALP Projects. Many project roads pass through land managed by the Forest Service, and therefore we consider it important to delineate SCE's and the Forest Service's responsibilities to ensure that these roads are well maintained and ensure appropriate access to project facilities for inspection, operation, and maintenance purposes as well as provision of appropriate public access to project lands and waters. When project facilities require painting, the consultation with the Forest Service specified in the Visual Resources Plan would enable the current inconsistencies with the VQOs at the Big Creek Nos. 1 and 2 and Mammoth Pool projects to be addressed to the extent practical. We recommend that both plans be implemented. The annualized cost associated with implementing the Visual Resources Plan at these two projects would be $27,450, and this relatively modest cost would be worth the benefits to the aesthetic resources of the Big Creek ALP Projects. The annualize cost of implementing the Transportation System Management Plan, and associated annual consultation with the Forest Service regarding land use issues in general at all four projects would be $1,702,190. Although this would be a costly measure, considering the rough terrain and winter conditions at high altitudes, this high cost associated with maintaining project roads is not unexpected and the benefits of this plan would be worth the cost.

The Forest Service specifies three land use management measures that are not include in the Settlement Agreement but would be consistent with the Land Use Management Plan for the Sierra National Forest; a Fire Management Plan, a Spill Prevention and Countermeasure Plan, and a sign plan. SCE already has developed fire management procedures in place at each of its project facilities, and packaging them into a plan for Forest Service review would ensure coordination of efforts to prevent, control, report, and investigate fires in the vicinity of the project. Spill Prevention and Countermeasures Plan are required to be in place at all facilities that store hazardous waste in excess of threshold levels. It is therefore likely that SCE has already developed these plans for appropriate project facilities. Providing such plans for review by the Forest Service would ensure that appropriate input is provided to protect the resources associated with the Sierra National Forest. Finally, SCE proposes to install a number of interpretive signs and would also place signs at appropriate places along project roadways. Ensuring that such signage is consistent with the signage standards of the Forest Service is appropriate when SCE signage is within or visible from National Forest System lands. We recommend implementation of the three plans specified by the Forest Service. We expect that the information needed to prepare these plans already exists or would be developed under the auspices of other plans. Therefore, we expect the annual cost of implementing these three plans would be $32,080, and worth the benefits that would accrue from such coordination with the Forest Service.

Project Boundary Revisions

As discussed in section 3.3.6.2, *Land Use and Aesthetic Resources*, SCE proposes to add 27 parcels to the project boundary at the Big Creek Nos. 2A, 8, and Eastwood Project, including: 11 roads; 4 foot trails leading to project facilities; 3 gaging stations; and 9 helicopter landing sites. We reviewed these proposed additions and conclude that they all would be necessary for continued operation and maintenance of this project under the conditions of a new license.

SCE proposes to delete 8 parcels from the Big Creek Nos. 2A, 8, and Eastwood Project boundary: (1) surplus land along Rancheria Creek; (2) land formerly occupied by company housing that is no longer there; (3) land formerly occupied by Chinquapin diversion piping; (4) a Forest Service Road (No. 5580H) that does not provide sole access to any project facility; (5) a Forest Service Road (No. 9S311) that is no longer used to provide access to the Eastwood power station switchyard; (6) the Eastwood Overflow Campground; (7) the Eastwood Overlook; and (8) the Florence Lake day-use area. We agree with SCE that lands associated with items 1 through 5 either no longer serve project purposes or, in the case of item 4, provide exclusive access to project-related facilities. Items 6 and 7 would be deleted from the project boundary of this project and included in the project boundary of the Big Creek Nos. 1 and 2 Project. We agree with this deletion. It would not affect the Commission's jurisdiction over these two facilities and is primarily administrative. Regarding item 8, we conclude that the Florence Lake day-use area provides recreational day-use facilities associated with the project and is located adjacent to the Florence Lake boat ramp, a project facility, which also provides public access to project waters. SCE has not demonstrated that this facility is no longer required for project purposes (providing public access to project lands and waters). Therefore, we recommend that the Florence Lake day-use-area remain in the existing project boundary.

SCE proposes to add four parcels to the Big Creek Nos. 1 and 2 Project boundary: (1) the Eastwood Overflow Campground (discussed in the previous paragraph); (2) the Eastwood Overlook (discussed in the previous paragraph); (3) a portion of Forest Service Road No. 8S66 that provides access to Dams 1 and 2; and (4) a portion of Forest Service Road No. 8S83 that also provides access to Dams 1 and 2. We reviewed the proposed additions of road segments associated with items 3 and 4 and conclude that they would be appropriately included in the project boundary for the Pig Creek Nos. 1 and 2 Project.

SCE proposes to delete six parcels from the Big Creek Nos. 1 and 2 Project boundary: (1) land associated with Rancheria Creek which is also included in the project boundary of the Big Creek Nos. 2A, 8, and Eastwood Project; (2) land associated with narrowing the right-of-way associated with Forest Service Road Nos. 8S66 and 8S66A, which provide access to a gaging station on Big Creek, from 100 feet to 50 feet; (3) land associated with a communication line that has been removed; (4) land associated with former company housing that has been removed; (5) portions of Forest Service Road Nos. 8S13 and 8S08 that are no longer used for access to the area near the penstocks of Powerhouses 2 and 2A; and (6) excess land not needed for project purposes near Powerhouses 2 and 2A. We agree that lands associated with items 1 through 6 are not necessary for project purposes and recommend they be deleted from the project boundary.

SCE proposes to add land associated with a helicopter landing site near Shakeflat Creek and a trail along Shakeflat Creek to a gage on the San Joaquin River to the project boundary of the Mammoth Pool Project. Both of these proposed additions would facilitate operation and maintenance of a stream gage that we recommend be included in a new license for this project. Therefore, we recommend that these two parcels be included in the project boundary.

SCE proposes to delete about 44 acres of land above the high water mark around the Dam 6 forebay, which are not needed for project purposes. This land is on land managed by the Forest Service and is not necessary for project operation and maintenance. We recommend deletion of this land from the project boundary.

As shown in table 3-24, many of the recreational facilities that SCE would rehabilitate are located partially outside of the project boundary. Partial inclusion in the project boundary raises questions about the responsibility for the long-term management of these recreation facilities. Because these recreational facilities provide public access to project lands and water, and because SCE is undertaking major rehabilitation that includes components of facilities that are on lands partially outside the project boundary, following the Commission's settlement policies on project boundaries, we recommend that these facilities be included in the respective project boundary in their entirety.

5.3 UNAVOIDABLE ADVERSE EFFECTS

Project dams and diversions would continue to block upstream migration to higher quality spawning and rearing habitat upstream of the bypassed reaches, and block downstream transport of sediment and LWD from the upper watersheds to the bypassed reaches. Big Creek project operations would continue to alter natural flow regimes, adversely affecting the quality and quantity of coldwater fish habitat in some project bypassed reaches, although cool tailwater releases also improve trout habitat in some reaches. Changes in the timing, magnitude, and duration of peak and base flows, and loss of sediment and LWD recruitment from the upper watersheds would continue to adversely affect channel morphology and aquatic and riparian habitat in the project bypassed reaches. Mortality of some fish entrained into project diversions would continue to be caused due to pressure changes or other injuries associated with turbine passage. The low densities of fish observed near the powerhouse intakes during hydroacoustic surveys and the lack of fish encountered during tailrace sampling conducted by SCE at several of the project powerhouses suggest that the magnitude of entrainment mortality at the Big Creek ALP Project powerhouses is generally low.

The proposed decommissioning and removal of five small diversion dams would result in the unavoidable release of sediment that may have accumulated behind the dams, resulting in a short-term, minor effect on aquatic habitat.

The proposed conservation measures would reduce some of these effects to varying degrees, particularly increased MIFs, channel and riparian maintenance flows, and LWD management. However, many of the current adverse effects (e.g., blocked upstream passage at dams and diversions and entrainment mortality) would continue as unavoidable adverse effects to native, coldwater fishes.

We have identified no other unavoidable adverse effects to resources influenced by project operations.

5.4 RECOMMENDATIONS OF FISH AND WILDLIFE AGENCIES

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that, whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of the agency.

In response to the Commission's notice soliciting final terms and conditions for SCE and the REA notice for the Big Creek ALP Projects issued on December 5, 2006, for the Mammoth Pool Project and January 8, 2008, for the remaining three projects, NMFS filed letters in response to the REA notice but did not make specific recommendations pursuant to section 10(j). NMFS requested inclusion of a reopener provision in new licenses should the need arise. The Commission typically includes such a standard fish and wildlife reopener provision in new licenses that it issues. Interior filed letters of comment that included section 10(j) recommendations.[56] Interior is also a party to the Settlement Agreement.[57] In its letters, Interior recommends that the Commission approve the Settlement Agreement and all the provisions thereof. Commission staff is also recommending the provisions of the Settlement Agreement that are within the scope of section 10(j) be included as terms of any new licenses. Among

[56] NMFS filed letters in response to the initial notice dated February 5, 2007, August 31, 2007, and September 1, 2007. Interior filed letters in response to the initial notice dated February 2, 2007 and March 5, 2008.

[57] The Settlement Agreement was filed with the Commission on February 23, 2007.

the measures that Interior filed under section 10(j), we consider one component of one measure to be outside of the scope of section 10(j)—Interior's provision within its streamflow recommendations that the Adit 8 Creek "not be used." We evaluate this measure under section 10(a) in section 5.2, *Comprehensive Development and Recommended Alternative*.

5.5 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2) of the FPA requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving waterways affected by the project. Under section 10(a)(2), federal, state, and local agencies filed comprehensive plans that address various resources in California. The continued operation of the Big Creek ALP Projects, as recommended in this EIS, is consistent with the 13 state and federal plans listed below that are applicable to the projects.

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COVER SHEET

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSES

BIG CREEK ALP PROJECTS
Docket Nos. P-67, 2175, 2085, and 120

Cover Letter
Pages i to viii
FEIS

FERC/FEIS-0226F

ENVIRONMENTAL IMPACT STATEMENT
FOR HYDROPOWER LICENSES

Big Creek Nos. 2A, 8, and Eastwood—FERC Project No. 67

Big Creek Nos. 1 and 2—FERC Project No. 2175

Mammoth Pool—FERC Project No. 2085

Big Creek No. 3—FERC Project No. 120

California

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Environmental and Engineering Review
888 First Street, NE
Washington, DC 20426

March 2009

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FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, DC 20426

OFFICE OF ENERGY PROJECTS

To the Agency or Individual Addressed:

Reference: Final Environmental Impact Statement

Attached is the final environmental impact statement (EIS) for the Big Creek Projects (Big Creek Nos. 2A, 8, and Eastwood, Project No. 67; Big Creek Nos. 1 and 2, Project No. 2175; Mammoth Pool, Project No. 2085; and Big Creek No. 3, Project No. 120), located in Fresno and Madera counties, California.

This final EIS document documents the views of governmental agencies, non-governmental organizations, affected Indian tribes, the public, the license applicant, and Commission staff. It contains staff evaluations on the applicant's proposal and the alternatives for relicensing the Big Creek Projects.

Before the Commission makes a licensing decision, it will take into account all concerns relevant to the public interest. The final EIS will be part of the record from which the Commission will make its decision. The final EIS was sent to the U.S. Environmental Protection Agency and made available to the public on or about March 13, 2008.

Copies of the final EIS are available for review in the Commission's Public Reference Branch, Room 2A, located at 888 First Street, N.E., Washington DC 20426. The final EIS also may be viewed on the Internet at www.ferc.gov/ferris.htm. Please call (202) 502-8222 for assistance.

Attachment: Final Environmental Impact Statement

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COVER SHEET

a. Title: Relicensing the Big Creek Projects in California, Federal Energy Regulatory Commission (FERC or Commission) Project Nos. 67, 120, 2085, and 2175.

b. Subject: Final Environmental Impact Statement

c. Lead Agency: Federal Energy Regulatory Commission

d. Abstract:

The Big Creek Project Nos. 2A, 8, and Eastwood (FERC No. 67) is located in Fresno County, California. The project affects 2,388.80 acres of federal lands administered by the Sierra National Forest.

The Big Creek Nos. 1 and 2 Hydroelectric Project (FERC No. 2175) is located in Fresno County, California, within the Sierra National Forest. The project affects 2,017.78 acres of federal land administered by the Sierra National Forest.

The Mammoth Pool Hydroelectric Project (FERC No. 2085) is located in Fresno and Madera counties, California and affects 2,029.68 acres of federal land administered by the Sierra National Forest.

The Big Creek No. 3 Hydroelectric Project (FERC No. 120) is located in Fresno and Madera counties, California. The project occupies 508.14 acres of federal land administered by the Sierra National Forest.

SCE proposes to relicense the Projects in accordance with a comprehensive Settlement Agreement that was developed under the Commission's alternative licensing procedures. The Settlement Agreement contains 23 proposed license articles containing various protection, mitigation, and enhancement measures.

The staff's recommendation is to relicense the Projects as proposed, with certain modifications, and additional measures recommended by the agencies.

e. Contact:

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f. Transmittal: This final environmental impact statement prepared by the Commission's staff on the hydroelectric license applications filed by Southern California Edison for the existing Big Creek Projects (FERC Nos. 67, 120, 2085, and 2175) is being made available to the public on or about March 13, 2009, as required by the National Environmental Policy Act of 1969[1]

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[1] National Environmental Policy Act of 1969, amended (Pub. L. 91-190. 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, §4(b), September 13, 1982).

FOREWORD

The Federal Energy Regulatory Commission (Commission), pursuant to the Federal Power Act (FPA)[2] and the U.S. Department of Energy Organization Act[3] is authorized to issue licenses for up to 50 years for the construction and operation of non-federal hydroelectric development subject to its jurisdiction, on the necessary conditions:

That the project…shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in section 4(e)…[4]

The Commission may require such other conditions not inconsistent with the FPA as may be found necessary to provide for the various public interests to be served by the project.[5] Compliance with such conditions during the licensing period is required. The Commission's Rules of Practice and Procedure allow any person objecting to a licensee's compliance or noncompliance with such conditions to file a complaint noting the basis for such objection for the Commission's consideration.[6]

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[2] 16 U.S.C. §791(a)-825r, as amended by the Electric Consumers Protection Act of 1986, Public Law 99-495 (1986), the Energy Policy Act of 1992, Public Law 102-486 (1992), and the Energy Policy Act of 2005, Pub. Law 109-58 (2005).

[3] Public Law 95-91, 91 Stat. 556 (1977).

[4] 16 U.S.C. §803(a).

[5] 16 U.S.C. §803(g).

[6] 18 C.F.R. §385.206 (1987).

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COVER SHEET

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSES

BIG CREEK ALP PROJECTS
Docket Nos. P-67, 2175, 2085, and 120

Executive Summary
Pages xix to xxiv
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EXECUTIVE SUMMARY

On November 29, 2005, Southern California Edison (SCE) filed a license application for the Mammoth Pool Project (SCE, 2005) with the Federal Energy Regulatory Commission (FERC or the Commission). On February 23, 2007, SCE filed license applications for Big Creek Nos. 2A, 8, and Eastwood; Big Creek Nos. 1 and 2; and Big Creek No. 3 (SCE, 2007a).

The Big Creek Project Nos. 2A, 8, and Eastwood (FERC No. 67) is located in Fresno County, California. The project affects 2,388.80 acres of federal lands administered by the Sierra National Forest. The Big Creek Nos. 1 and 2 Hydroelectric Project (FERC No. 2175) also is located in Fresno County, California, within the Sierra National Forest. The project affects 2,017.78 acres of federal land administered by the Sierra National Forest. The Mammoth Pool Hydroelectric Project (FERC No. 2085) is located in both Fresno and Madera counties, California, and affects 2,029.68 acres of federal land administered by the Sierra National Forest. The Big Creek No. 3 Hydroelectric Project (FERC No. 120) also is located in both Fresno and Madera counties, California, and occupies 508.14 acres of federal land administered by the Sierra National Forest.

SCE is using the alternative licensing process (ALP) for these four projects together and as such filed a comprehensive Settlement Agreement (SCE, 2007b). The four Big Creek ALP Projects considered in this final environmental impact statement (EIS) are part of the Big Creek System. The Big Creek System is an integrated operation of nine major powerhouses, six major reservoirs, numerous small diversions, various conveyance facilities, access roads, electrical transmission lines, and appurtenant facilities. The Big Creek System is authorized under seven Commission licenses with coordinated operations to maximize the value of hydropower produced from the available water supply. The Big Creek ALP Projects and their relationship to the other three projects in the system are described in detail in sections 2.1.1 and 2.1.2. This final EIS evaluates the potential natural resource benefits, environmental effects, and economic costs associated with relicensing the Big Creek ALP Projects.

Proposed Action

SCE proposes no capacity changes at any of the Big Creek ALP Projects, but proposes a comprehensive set of measures covering the full range of resources in the Upper San Joaquin River Basin as specified in a comprehensive Settlement Agreement filed with the Commission in February 2007. Modifications to project operations include provision or modification of minimum instream flow (MIF) releases from several dams and diversions, provision of channel and riparian maintenance flows from some diversions, provision of pre-spill whitewater flow releases from some diversions, and elimination of some flow diversions through diversion decommissioning. In addition, SCE proposes to implement plans and monitoring to manage large woody debris (LWD), sediment, bald eagles, valley elderberry longhorn beetles (VELB) and its habitat, vegetation and noxious weeds, cultural resources, visual resources, transportation, and recreation. The Recreation Management Plan includes provisions to conduct major facility rehabilitations, construct new recreational facilities, provide information to the public regarding project-related recreation, conduct fish stocking, monitor recreational use, and consult with the U.S. Department of Agriculture, Forest Service (Forest Service). SCE also proposes to monitor temperatures, fish populations, and riparian habitat, and implement measures that would protect special status bats, mule deer, and other special status species, and measures that would reduce bear/human interactions. These measures are described in more detail in section 2.2.4.

Alternatives Considered

This final EIS analyzes the effects of continued operation of the Big Creek ALP Projects and recommends conditions for a new license for each project. In addition to SCE's proposal, we consider two alternatives: (1) SCE's proposal with staff modifications (staff alternative); and (2) no action, which would represent continued operation with no changes.

Under the staff alternative, the Big Creek ALP Projects would include SCE's proposal, including the Settlement Agreement except for provisions to manage reservoir water surface elevations for recreational purposes at the Big Creek Nos. 1 and 2 and Mammoth Pool projects and funding rehabilitation of five campgrounds that are outside the existing project boundaries. Additional measures that we recommend for inclusion in any licenses that may be issued for the Big Creek ALP Projects are: (1) assess gravel embeddedness in association with pool depth assessments following flushing flow releases from Dams 4, 5, and 6 (providing an additional assessment of potential habitat degradation beyond pool depth monitoring); (2) include the gravel augmentation feasibility assessment specified in section B.1.2.2 of the Settlement Agreement (measures not to be included in a new license) as a condition of a new license because this feasibility assessment pertains to Mammoth Pool dam spillway functions and the maintenance of a project access road; (3) specify in SCE's Avian Protection Plan that as follow-up to any documented bald eagle mortality at project transmission lines, the most recent Avian Power Line Interaction Committee (APLIC) guidelines would be used to assess appropriate corrective actions (the most recent guidance was issued in 2006 and it is likely to be updated during the life of the project); (4) include a Fire Management Plan in the land resource plans that are approved by the Forest Service (this is a 4(e) condition); (5) include a Sign Plan in the land resource plans that are approved by the Forest Service (this is a 4(e) condition); and (6) include a Spill Prevention and Countermeasure Plan in the land resource plans that are approved by the Forest Service (this is a 4(e) condition). In its comments on the draft EIS, SCE expressed support for the staff alternative. We include all but two of the measures specified by the Forest Service as 4(e) conditions: (1) manage reservoir surface elevations at Huntington and Shaver lakes in accordance with unspecified criteria during the summer recreational season; and (2) fund rehabilitation for five campgrounds located outside the project boundaries of three of the four Big Creek ALP Projects. We include all measures within the scope of section 10(j) recommended by Interior in the staff alternative. No other fish and wildlife agency filed 10(j) recommendations for the Big Creek ALP Projects.

Public Involvement and Areas of Concern

SCE conducted the National Environmental Policy Act scoping process as part of the ALP. SCE held a publicly noticed meeting with interested stakeholders and issued the Initial Information Package for the Big Creek ALP Projects in May 2000. The purpose of this meeting was to outline the ALP goals and objectives; identify process protocols; provide an overview of the Big Creek ALP Projects and associated resources; identify early stakeholder resource interests and issues; and identify opportunities for the public to participate and provide comment. In May 2000, the Plenary was established, which consists of representatives of the state and federal resource agencies, Native American tribes, local and regional authorities, non-governmental organizations, and members of the public. SCE held an additional publicly noticed meeting and a site tour of the Big Creek ALP Projects with interested stakeholders in June 2000. In addition, on July 24, 25, and 26, 2007, Commission and SCE staff held a publicly noticed site visit to the Big Creek ALP Projects. The site visit was open to the public and resource agencies.

SCE and the parties to the Settlement Agreement held more than 300 meetings during the last 5 years for the Big Creek ALP Projects. The Big Creek ALP involved the design and implementation of 67 studies designed to identify effects associated with the Big Creek ALP Projects. Reports were prepared based upon these studies and used to identify potential project effects and serve as the basis for a Settlement Agreement (SCE, 2007b). SCE filed the Settlement Agreement on February 23, 2007, concurrently with the applications for three of the Big Creek ALP Projects (the Mammoth Pool license application was filed on November 29, 2005). The Settlement Agreement was signed by 23 representatives of federal and state agencies, and non-governmental organizations.

The primary issues associated with the relicensing of the four Big Creek ALP Projects include establishment of appropriate flow regimes in project-affected stream reaches, protection of wildlife resources, provision of recreational opportunities, and protection of cultural resources.

Project Effects

Aquatic Resources—Under SCE's proposal: (1) MIFs in project-affected reaches would be enhanced for trout and other aquatic biota; (2) channel and riparian maintenance flows would be released at the Big Creek Nos. 2A, 8, and Eastwood Project, enhancing riparian habitat; (3) the March 1 preliminary water year forecast would be used to determine which category of instream flows would be implemented on April 1, with an option to adjust flows based on the April 1 and May 1 water year forecast updates, if those updates are revised; (4) streamflow measurement capabilities would be enhanced; (5) fish populations would be monitored to assess population trends under the new project operating regimes; (6) provisions to pass sediment downstream of project dams would be implemented, which should enhance habitat diversity and increase spawning gravel; (7) monitoring of pool depths following sediment pass-through events would detect habitat degradation; (8) project diversions would be decommissioned, and the affected stream reaches returned to essentially natural flow conditions; (9) water temperature would be monitored at selected bypassed reaches and reservoirs to ensure that California Central Valley Region Water Quality Control Board Basin Plan water temperature objectives are met to the extent that they are project-controllable effects; and (10) LWD would be passed downstream of the Bear Creek diversion (Big Creek Nos. 2A, 8, and Eastwood Project) thus enhancing downstream aquatic habitat and increasing fisheries productivity.

With our modifications to SCE's proposal: (1) gravel embeddedness would be monitored following flushing flow releases from Dams 4, 5, and 6, thus providing an additional assessment of potential habitat degradation beyond pool depth monitoring; and (2) the gravel augmentation feasibility assessment specified in the Settlement Agreement would be a condition of a new license. In its comments on the draft EIS, SCE expressed support for these modifications to its proposal.

Terrestrial Resources—Under the proposed action, SCE would implement: (1) wildlife habitat enhancements; (2) the Bald Eagle Management Plan; (3) the Vegetation and Integrated Pest Management Plan that would, among other things, control the spread of noxious weeds; (4) proposed license articles that would protect mule deer, special-status species, and bats; and (5) environmental programs for environmental training, avian protection, noxious weeds, environmental compliance, the Endangered Species Alert Program, and the Northern Hydro Special-Status Species Information Program. In addition, under the staff alternative, the Bald Eagle Management Plan would be clarified to ensure that corrective actions following any raptor mortalities at project transmission lines would use current APLIC guidelines for protecting against avian collisions.

Threatened and Endangered Species—Under the proposed action, SCE would implement the VELB Management Plan, including the protection of elderberry shrubs, which would reduce the loss of potential VELB habitat and any VELB inhabiting these shrubs. Vegetation maintenance in areas surrounding potential VELB habitat also would reduce the chance of a brush fire causing widespread loss of habitat.

Recreation—Under SCE's proposal, SCE would be responsible for implementing the following measures at some or all of the Big Creek ALP Projects: (1) operation and maintenance of recreational facilities; (2) rehabilitation of existing recreational facilities; (3) management of reservoir levels to facilitate recreational use while achieving project purposes; (4) fund fish stocking with a 50 percent cost share; and (5) dissemination to the public flow information for whitewater boating. In addition, SCE would (1) construct new recreational facilities at the Big Creek Nos. 2A, 8, and Eastwood Project, including an accessible fishing platform at Jackass Meadows and an accessible boat loading platform at Florence Lake; (2) construct new recreational facilities at the Big Creek Nos. 1 and 2 Project, including a day-use area at Dam 3 and an accessible fishing platform; and (3) provide pre-spill whitewater boating releases at the Mammoth Pool Project, to the extent possible.

With our modifications to SCE's proposal, the Florence Lake day-use area would remain within the project boundary. The existing project boundary would be revised to include all project recreational facilities that are partially outside the existing project boundary. The cost for the rehabilitation of the five Forest Service-managed campgrounds located in the Sierra National Forest that are outside of the project boundary would not be included in the staff alternative. SCE would be responsible for stocking fish, not funding fish stocking, and file a report with the Commission summarizing the fish stocking efforts. In addition, SCE would provide reservoir elevation, boat ramp accessibility information, and parking and campsite capacity as a component of the Form 80 Recreation Report. We do not recommend SCE's reservoir management measures at Huntington and Shaver lakes and Mammoth Pool Reservoir because SCE proposes no specific elevation ranges associated with the reservoir level operations, and as such, the Commission would have no basis to determine whether SCE is in compliance with a reservoir surface water management regime. In its comments on the draft EIS, SCE expressed support for our recommended measures.

Cultural Resources—Under SCE's proposal, cultural resources would be protected under provisions specified in a finalized Historic Properties Management Plan, and SCE would implement environmental programs for cultural resources awareness.

Land Use and Aesthetics Resources—SCE proposes to remove lands from the project boundaries. SCE also proposes to add land to the project boundaries that would include project-related features. The Forest Service concurs with the proposed project boundary changes. In addition, SCE would implement the Transportation Management Plan at the Big Creek ALP Projects, which defines maintenance, monitoring, and rehabilitation responsibilities for project-related roads; interpretive signs would be installed at the Big Creek Nos. 2A, 8, and Eastwood, Big Creek Nos. 1 and 2, and Mammoth Pool projects; and the Visual Resources Plan would be implemented at the Big Creek Nos. 1 and 2 and Mammoth Pool projects, which would target painting project features to be more consistent with applicable Visual Quality Objectives.

With our modifications to SCE's proposal, project-related signage would be consistent with Forest Service standards through the development of a sign plan; fire management responsibilities would be clearly defined in a fire management plan; and a spill prevention and countermeasure plan, which is required by law to be in place where threshold amounts of hazardous materials are stored, would be available for Forest Service review.

Under the no-action alternative, environmental conditions would remain the same, and there would not be any enhancement of environmental resources.

Conclusions

Based on our analysis, we recommend licensing the four Big Creek ALP Projects as proposed by SCE with additional measures (staff alternative). The recommended staff modifications include measures provided by federal land use and resource agencies with an interest in the resources that may be affected by continued operation of the four projects, as well as our independent analysis. Our additional measures are summarized in the previous section.

In section 4.3 of this final EIS, we estimate the annual net benefits of operating and maintaining the Big Creek ALP Projects under the three alternatives identified above. Our analysis shows that the annual net benefit for the staff alternative for the Big Creek Nos. 2A, 8, and Eastwood Project would be $46,792,110 The annual net benefit for the staff alternative for the Big Creek Nos. 1 and 2 Project, Mammoth Pool Project, and Big Creek No. 3 Project would be $29,902,160, $32,175,600, and $42,897,400, respectively.

We recommend the Commission issue new licenses for the Big Creek ALP Projects because: (1) the four projects would provide a dependable source of electrical energy for the region (3,177,093 megawatt-hours annually); (2) the projects may continue to save the equivalent amount of fossil-fueled generation and capacity, thereby continuing to help conserve non-renewable energy resources and reduce atmospheric pollution; and (3) the recommended environmental measures proposed by SCE, as modified by staff, would adequately protect and enhance environmental resources affected by the projects. The overall benefits of the staff alternative would be worth the cost of the proposed and recommended environmental measures.

COVER SHEET

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSES

BIG CREEK ALP PROJECTS
Docket Nos. P-67, 2175, 2085, and 120

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ACRONYMS AND ABBREVIATIONS

ALP	alternative licensing process
APE	area of potential effects
APLIC	Avian Power Line Interaction Committee
Basin Plan	California Central Valley Region Water Quality Control Board Basin Plan
BCHSHD	Big Creek Hydroelectric System Historic District
ºC	degrees Celsius
Cal Fish & Game	California Department of Fish and Game
CARB	California Air Resources Board
CDWR	California Department of Water Resources
CEQA	California Environmental Quality Act
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
CRLF	California red-legged frog
CTR	California Toxics Rule
DO	dissolved oxygen
EIR	environmental impact report
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
Forest Service	U.S. Department of Agriculture, Forest Service
FPA	Federal Power Act
FWS	U.S. Fish and Wildlife Service
FYLF	foothill yellow-legged frog
GIS	geographic information system
HPMP	Historic Properties Management Plan
IHA	indicators of hydraulic alteration
Interior	U.S. Department of the Interior
kV	kilovolt
Legacy	Pacific Legacy, Inc.
LWD	large woody debris
µ/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MIF	minimum instream flow
msl	mean sea level
MW	megawatt
MWh	megawatt-hours
MYLF	mountain yellow-legged frog
National Register	National Register of Historic Places

NEPA	National Environmental Policy Act
NMFS	U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NTR	National Toxics Rule
PA	Programmatic Agreement
PDEA	preliminary draft environmental assessment
SCE	Southern California Edison
SRO	specific resource objective
USGS	U.S. Geological Survey
VELB	valley elderberry longhorn beetle
VQO	Visual Quality Objective
Water Board	State Water Resources Control Board (California)
WECC	Western Electricity Coordinating Council
WUA	weighted usable area

Document Content(s)