FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, DC 20426
December 22, 2011

OFFICE OF ENERGY PROJECTS

Project No. 2299-075--California
Don Pedro Hydroelectric Project
Turlock Irrigation District
Modesto Irrigation District

Mr. Robert Nees
Director of Water Resources
Turlock Irrigation District
333 East Canal Drive
Turlock, CA 95381

Mr. Greg Dias
Project Manager
Modesto Irrigation District
P.O. Box 4060
Modesto, CA 95352

Reference: Study Plan Determination for the Don Pedro Hydroelectric Project

Dear Messrs. Nees and Dias:

Pursuant to 18 C.F.R. § 5.13(c) of the Commission's regulations, this letter contains the study plan determination for the Don Pedro Hydroelectric Project (Don Pedro Project). The determination is based on: the study criteria set forth in section 5.9(b) of the Commission's regulations; applicable law; Commission policy and practice; and the record of information.

Background

On July 25, 2011, Turlock Irrigation District and Modesto Irrigation District (Districts) filed their proposed plans for 30 studies on a range of resource areas including: water use and allocation, water quality, fish and other aquatic resources, terrestrial resources, threatened and endangered species, recreation, aesthetic resources, and cultural resources in support of its intent to relicense the Don Pedro Project.

On August 23, 2011, the Districts held their first study plan meeting to discuss the details of the study plan. Thereafter, and until November 3, 2011, the Districts held

about 20 additional meetings to resolve differences regarding the proposed studies. Following the conclusion of the study plan meetings, and after receipt of comments on its proposed study plan, the Districts filed a revised study plan with 35 studies on November 22, 2011.

Comments on the revised study plan were filed by the National Park Service (NPS) on December 6, 2011, the Bureau of Land Management (BLM), Mr. Bob Hackamack, City and County of San Francisco Public Utilities Commission (CCSF), California Department of Fish and Game (CDFG), National Marine Fisheries Service (NMFS), Conservation Groups,[1] and State Water Resources Control Board (Water Board) on December 7, 2011. The U.S. Fish and Wildlife Service (FWS) filed comments on December 8, 2011.

General Comments

La Grange Dam

Many commenters recommended that, in advance of the study determination, the Commission determine whether the La Grange Project and associated facilities are jurisdictional and whether they should be considered as Don Pedro Project works for relicensing purposes. In the alternative, Conservation Groups' request a reopener in the Don Pedro study plan, triggered if the Commission determines that the La Grange Project is jurisdictional after the study determination is issued.

On July 26, 2011, the Commission staff initiated a review of the unlicensed La Grange Project to determine whether it is subject to the Commission's licensing jurisdiction under Part I of the Federal Power Act. That review is ongoing. Depending on the timing and outcome of this review, a reopener may or may not be necessary. Therefore, we are continuing to move forward with the Don Pedro Project pre-filing process and this study determination in a timely fashion. We will determine what action, with respect to the LaGrange Project, is appropriate after the jurisdictional review is completed.

[1] American Rivers, American Whitewater, California Sportfishing Protection Alliance, California Trout, Inc., Central Sierra Environmental Resource Center, Environmental Defense Fund, Friends of the River, Golden West Women Flyfishers, Northern California Council Federation of Fly Fishers, Merced Fly Fishing Club, Pacific Coast Federation of Fishermen's Associations, Trout Unlimited, Tuolumne River Trust, and Water 4 Fish (collectively, Conservation Groups)

Study Plan Criteria

A number of relicensing participants submitted study requests under section 5.9(a) of the Commission's regulations that did not address the study criteria required by section 5.9(b). While this determination does not address these requests, the majority of the information requested in these requests are included in studies proposed by the Districts or in study requests submitted by other relicensing participants that did address the study criteria. In addition, a number of comments were received that do not address study plan issues. This determination does not address these comments but rather addresses only the merits of the study plan submitted pursuant to section 5.13 of the Commission's regulations and comments received thereon.

Study Plan Determination

The Districts' revised study plan is approved with staff's recommended modifications. As indicated in Appendix A, 14 of the Districts' studies are approved as filed, 16 are approved with modifications, 2 are not required to be conducted, and 3 draft study plans are approved.[2] Of the 78 study/information requests filed by relicensing participants, 1 was approved as a new study, 21 others were approved but, because they cover the same issue as the Districts' study, were incorporated into the Districts' study plans, 19 were approved with modifications and incorporated into the Districts' study plans, and 37 were not required. The specific modifications to the Districts' study plan and the bases for this determination are explained in Appendix B. Studies for which no issues were raised are not discussed in Appendix B. Although all study plan criteria in section 5.9 of the Commission's regulations were considered, only specific study criteria that are relevant to the determination are referenced in Appendix B.

Nothing in this study plan determination is intended, in any way, to limit any agency's proper exercise of its independent statutory authority to require additional studies.

[2] Final study plans to be filed for Commission approval.

If you have any questions, please contact Jim Hastreiter at (503) 552-2760.

Sincerely,

Jeff C. Wright
Director
Office of Energy Projects

Enclosures: Appendix A-- Approved and modified studies and studies not required
Appendix B-- Staff's recommendations on proposed and requested studies

cc: Mailing List
Public Files

APPENDIX A
APPROVED AND MODIFIED STUDIES AND STUDIES NOT REQUIRED

Study No.	Study	Recom-mending Entity	Approved	Approved with Modifi-cations	Not Required
CR-1	Historic Properties Study	Districts	X		
CR-2	Native American Traditional Cultural Properties Study	Districts	X		
RR-1	Recreation Facility Condition and Public Accessibility Assessment	Districts		X	
RR-2	Whitewater Boating Take Out Improvement Feasibility Study	Districts	X		
RR-3	Lower Tuolumne River Boatable Flow Study	Districts		X	
RR-4	Visual Quality Study	Districts	X		
TR-1	Special-Status Plants Study	Districts		X	
TR-2	ESA- and CESA-Listed Plants Study	Districts		X	
TR-3	Wetland Habitats Associated with Don Pedro Reservoir Study	Districts		X	
TR-4	Noxious Weed Survey	Districts		X	
TR-5	ESA-Listed Wildlife- Valley Elderberry Longhorn Beetle Study	Districts	X		
TR-6	Special Status Amphibians and Aquatic Reptiles Study	Districts	X		
TR-7	ESA-Listed Amphibians-California Red-Legged Frog Study	Districts	X		
TR-8	ESA-Listed Amphibians-California Tiger Salamander Study	Districts	X		
TR-9	Special-Status Wildlife-Bats Study	Districts	X		
W&AR-1	Water Quality Assessment	Districts	X		
W&AR-2	Project Operations/Water Balance Model	Districts		X	
W&AR-3	Reservoir Water Temperature Model	Districts	X		
W&AR-4	Spawning Gravel Study	Districts		X	
W&AR-5	Salmonid Populations Information Integration and Synthesis Study	Districts		X	
W&AR-6	Tuolumne River Chinook Salmon Population Model	Districts		X	
W&AR-7	Predation Study	Districts		X	
W&AR-8	Salmonid Redd Mapping Study	Districts		X	
W&AR-9	Chinook Salmon Fry Movement Study	Districts			X
W&AR-10	*Oncorhynchus mykiss* Population Study	Districts		X	
W&AR-11	Chinook Salmon Otolith Study	Districts	X		

Study No.	Study	Recom-mending Entity	Approved	Approved with Modifi-cations	Not Required
W&AR-12	*Oncorhynchus mykiss* Habitat Assessment	Districts		X	
W&AR-13	Fish Assemblage and Population Between Don Pedro Dam and La Grange Dam Study	Districts	X		
W&AR-14	Temperature Criteria Assessment	Districts			X
W&AR-15	Socioeconomics Study	Districts	X		
W&AR-16	Lower Tuolumne River Temperature Model	Districts		X	
W&AR-17	Reservoir Fish Population Survey	Districts		X	
W&AR-18	Draft Sturgeon Study[1]	Districts	X		
W&AR-19	Draft Lower Tuolomne Riparian Information and Synthesis Study[1]	Districts	X		
W&AR-20	Draft *Oncorhynchus mykiss* Scale Collection and Age Determination Study[1]	Districts	X		
NMFS-1	Effects of the Project and the Related La Grange Complex Facilities on Anadromous Fish	NMFS		X*	
NMFS-2	**Request for Information or Study Effects of the Project and Related Facilities Evaluated Through an Operations Model**	NMFS			
Element 1	Develop Don Pedro Hydroelectric Project Water Balance/Operations Model	NMFS	X*		
Element 2	Develop Water Year Types	NMFS	X*		
Element 3	Validate Model	NMFS	X*		
Element 4	Develop Base Case	NMFS	X*		
NMFS-3	**Request for Information or Study Effects of the Project and Related Activities on Fish Passage for Anadromous Fishes**	NMFS			
Element 1	Information about Hydraulic Conditions and Bathymetry	NMFS			X
Element 2	Development of Conceptual Level Fish Passage Alternatives	NMFS			X
Element 3	Investigation of Reservoir Fish Passage	NMFS			X
Element 4	Fish Passage Conditions in the Upper Tuolumne River	NMFS			X
Element 5	Pilot Field Experiments For Anadromous Fish Reintroduction	NMFS			X

Study No.	Study	Recom-mending Entity	Approved	Approved with Modifi-cations	Not Required
NMFS-4	**Request for Information or Study Effects of the Project and Related Facilities on Hydrology for Anadromous Fish: Magnitude, Timing, Duration, and Rate of Change**	NMFS			
Element 1	Data Development and Statistical Analysis	NMFS			X
Element 2	Additional Analysis of Tuolumne River Below La Grange Dam (USGS #11289650)	NMFS	X*		
Element 3	Peak Flow Analysis	NMFS	X*		
Element 4	Rate of Stage Change Analysis	NMFS	X*		
Element 5	Quantify Lower Tuolumne Flow Accretion and Depletion	NMFS	X*		
Element 6	Evaluate Potential to Increase Lower Tuolumne River Flood Capacity	NMFS	X*		
NMFS-5	**Request for Information or Study Effects of the Project and Related Facilities and Operations on Fluvial Processes and Channel Morphology for Anadromous Fishes**	NMFS			
Element 1	Quantify the volumetric flux of coarse and total sediment trapped in Don Pedro Reservoir on an average annual basis	NMFS	X*		
Element 2	Quantify the frequency and volume of LWD trapped and removed from the riverine ecosystem on an annual basis in Don Pedro Reservoir	NMFS	X*		
Element 3	Quantify coarse sediment storage in the lower Tuolumne River	NMFS	X*		
Element 4	Quantify available spawning habitat for anadromous fish in the lower Tuolumne River	NMFS	X*		
Element 5	Quantify fine sediment storage in the lower Tuolumne River	NMFS	X*		
Element 6	Quantify the frequency and volume of LWD stored in the Tuolumne River channel downstream of Don Pedro Dam to the confluence of the San Joaquin River	NMFS		X*****	
Element 7	Develop coarse and fine sediment budgets and LWD budgets for the lower Tuolumne River	NMFS		X*	

Study No.	Study	Recom-mending Entity	Approved	Approved with Modifi-cations	Not Required
Element 8	Synthesize data from this study with other study requests to assess potential Project effects on anadromous fish and their habitats	NMFS	X*		
NMFS-6	**Request for Information or Study Effects of the Project and Related Facilities and Operations on Water Temperature for Anadromous Fishes**	NMFS			
Element 1	Interim Flows	NMFS			X
Element 2	Water Temperature Monitoring	NMFS			X
Element 3	Water Temperature Modeling	NMFS		X*	
Element 4	Reservoir Temperature Modeling	NMFS	X*		
NMFS-7	**Request for Information or Study Effects of the Project and Related Facilities and Operations on Upper Tuolumne River Habitats for Anadromous Fishes**	NMFS			
Element 1	Migration Barriers	NMFS			X
Element 2	Water Temperatures	NMFS			X
Element 3	Implement Monitoring Actions	NMFS			X
Element 4	Salmonid Life-Cycle Model	NMFS			X
NMFS-8	**Request for Information or Study Salmon and Steelhead Full Life-Cycle Population Models to Assess the Effects of the Project and Related Activities**	NMFS			
Element 1	Fall-run Chinook Salmon Model	NMFS		X*	
Element 2	Central Valley Steelhead Model	NMFS		X*	
NMFS-9	**Request for Information or Study Effects of the Project and Related Activities on the Losses of Marine-Derived Nutrients in the Tuolumne River**	NMFS			
Element 1	Estimate a range of the historic mass of marine-derived nitrogen transported annually by Chinook salmon (all runs) to the Tuolumne River	NMFS			X
Element 2	Estimate the historic mass of marine-derived nitrogen transported annually by spring-run Chinook salmon to the upper Tuolumne River	NMFS			X
Element 3	Estimate the current annual mass of marine-derived nitrogen transported by fall-run Chinook salmon to the Tuolumne River	NMFS			X

Study No.	**Study**	**Recom-mending Entity**	**Approved**	**Approved with Modifi-cations**	**Not Required**
Element 4	Estimate the annual loss, from historic to current levels of marine-derived nitrogen transported by fall-run Chinook salmon to the Tuolumne River	NMFS			X
Element 5	Compare the difference of marine-derived nitrogen incorporated into periphyton and aquatic benthic macroinvertebrates collected in the upper and lower Tuolumne river	NMFS			X
FWS-1	Instream Flow and Juvenile Chinook Salmon Floodplain Rearing Study	FWS		X*	
FWS-2	Age and Growth Study of *O. mykiss* in the Tuolumne River	FWS	X*		
FWS-3	Chinook Salmon Egg Viability Study	FWS			X
FWS-4	Juvenile Chinook Salmon Survival Study	FWS			X
FWS-5	Genetics of Chinook in the Upper Tuolumne River	FWS		X*	
BLM	CESA-Listed Wildlife (Bald Eagle)	BLM	X		
CDFG-1	Water Balance/Operations Model	CDFG		X*	
CDFG-2	Water Temperature Model-Modification of Ongoing Study	CDFG		X*	
CDFG-3	Reservoir Water Temperature Management Feasibility	CDFG			X
CDFG-4	Instream Flow Study-Modification of Ongoing Study	CDFG			X
CDFG-5	Bioenergetics Study	CDFG			X
CDFG-6	Chinook Health Study	CDFG			X
CDFG-7	Reservoir Fish Population Study	CDFG		X*	
WB-1	Fish Assemblage and Population Study between Don Pedro Dam and La Grange Dam	WB		X*	
WB-2	Lower Tuolumne River Bioenergetics Study	WB			X
WB-3	Lower Tuolumne River Riparian Study	WB	X*		
WB-4	Lower Tuolumne River Freshwater Mussel Study	WB			X
WB-5	Lower Tuolumne River Predation Study	WB		X*	
WB-6	Sediment Transport	WB		X*	
WB-7	Spawning Gravel Study	WB		X*	
WB-8	Large Woody Debris Study	WB		X*	

Study No.	Study	Recom-mending Entity	Approved	Approved with Modifi-cations	Not Required
WB-9	Effect of Water Temperature and Turbidity on Predation of Juvenile Anadromous Fish in the Lower Tuolumne River	WB		X*	
WB-10	Impact of Water Levels on Recreational Uses in Don Pedro Reservoir	WB	X*		
WB-11	Sturgeon Study	WB	X*		
WB-12	Pacific Lamprey Study	WB			X
WB-13	Operations Model	WB	X*		
WB-14	Lower Tuolumne River Flood Capacity	WB			X
WB-15	Socioeconomic Study	WB			X
CG-1	Upper Tuolumne River Anadromous Fish Habitat Recovery	CG			X
CG-2	Upper Tuolumne River Steelhead/Rainbow Trout Genetics Evaluation	CG			X
CG-3	Economic Value and Activity Associated with a Restored Fishery	CG			X
CG-4	Economic Value and Activity Associated with Improved Recreation	CG			X
CG-5	Economic Value and Activity Associated with Improved Ecosystem Services	CG			X
CG-6	Economic Value and Activity Associated with Modified Water Supply Allocations to Urban, Agricultural, and Environmental Uses	CG			X
CG-7	Effects of the Project and Related Activities on Large Wood and Microhabitat Structures for Anadromous Fish	CG		X*	
CG-8	Effects of the Project and Related Activities on Coarse Substrate for Anadromous Fish; Sediment Distribution, Transport, and Storage	CG		X*	

CG-9	Effects of the Project and Related Activities on Recruitment of Cottonwoods and Other Native Riparian Vegetation	CG			X
CG-10	Don Pedro Reservoir Water Supply (Dead Storage) Management Feasibility	CG			X
WSS-1	Riparian Brush Rabbit and Aleutian Cackling Goose	WSS			X

Districts=Turlock & Modesto Irrigation Districts; NMFS=National Marine Fisheries Service; FWS=U.S. Fish and Wildlife Service; BLM=Bureau of Land Management; NPS= National Park Service; CDFG=California Department of Fish and Game; CG=Conservation Groups; WB=State Water Resources Control Board; and WSS=Western Strategic Solutions.

* Indicates all or part of study requests by relicensing participants is included in the Districts study plans approved in this determination.

[1] Final study plan to be filed for Commission approval.

APPENDIX B
STAFF RECOMMENDATIONS ON PROPOSED AND REQUESTED STUDIES

The following explains staff's recommendations on studies proposed by the Turlock and Modesto Irrigation Districts (Districts) and relicensing participants' comments and study proposals based on criteria outlined in the Commission's regulations [18 C.F.R. section 5.9(b)(1)-(7)].

Workshop Consultation on Study Plan Decisions

A number of the Districts' proposed studies provide for consultation via workshops for certain decision-points outlined in the studies, particularly those which involve model development. In cases where "consultation" is required by the study plan, we expect that the Districts would make a reasonable effort to reach a consensus with relicensing participants, and such decisions would be final and filed with the Commission.

While we see value in the use of consultation, we are concerned with the workshop process should there be disagreements, especially if the Commission staff would not be involved in those decisions. Therefore, in cases where the Districts propose consultation via workshops with interested parties, they must consult with the interested parties as noted above and, if a consensus is not reached, the Districts must file their proposal with the Commission for approval. In such cases, the Districts must allow a minimum of 30 days for the interested entities to provide written comments and recommendations on any proposal. In each instance, the filing must include the Districts' proposed action, a description of the dispute, including copies of any comments and recommendations received, and a discussion of how the consulted entities' comments and recommendations have been considered. If the Districts do not adopt a recommendation from a consulted entity, the filing must include their reasons, based on project-specific information.

STUDY PLANS FILED BY DISTRICTS

Study RR-1-- Recreation Facility Condition and Public Accessibility Assessment, and Recreation Use Assessment Study Plan

Applicants' Proposed Study

The Districts propose to assess the need for maintenance or enhancement of existing recreation facilities and collect information about current recreation use to support current and near-term future demand for public recreation in the project area. The study would assess the condition of existing developed recreation facilities, including existing use, gather information on current recreation users, estimate current capacity of those facilities to support present and future demand for public recreation, and provide information useful for determining present and future public recreation use and facility needs at the project.

Comments on the Study

Identification of Users

The National Park Service (NPS) and the Bureau of Land Management (BLM) state that motorized and non-motorized boaters may often be the same people.

In response, the Districts state that visitors who report both motorized and non-motorized boating would not be included at all in the analysis of difference in recreation experience between these groups. However, they say the number of respondents who report participation in, what are normally considered to be, "conflict" groups will be of interest and will be noted.

Despite their response, the NPS and the BLM state they continue to be concerned that motorized and non-motorized boaters may often be the same people and excluding visitors completely from this analysis may not be appropriate. They state they would like the licensees to explore another way to capture those visitors in the survey.

Facility Site Condition Evaluation Criteria

NPS and BLM request alterations to Table 5.3.1-1, Facility Site Condition Evaluation Categories and Criteria, to include an additional category of "excellent" and include specific time frames within that category in the table. NPS states its proposed table is more comprehensive (four categories instead of three) and includes time frames

for actions that make the criteria within the table more relevant and conducive to protection, mitigation, and enhancement (PM&E) development.

The Districts indicate that the NPS and BLM recommended alteration to the rating table would also introduce generic time frames for major maintenance (e.g., within 10 years for a facility that is in "excellent" condition and 5 years for a facility evaluated in "fair" condition) and they do not feel that a generic time frame for project recreation facilities improvements is appropriate. They believe that facilities wear at different rates depending on the original quality of construction and the type and amount of use. The Districts further state this assessment should be made by experienced personnel on a site-specific basis.

Sample Size

NPS and BLM state the proposed sample size of 384 surveys is too low to produce a statistically valid sample based on the 400,000 annual visitor days the project sees annually. They also state the Yuba River project had 128,000 visitor days and its sample size was 762. However, NPS and BLM did not propose an alternative sample size for this study.

The Districts maintain that the sample size proposed meets the statistical criterion of 95 percent confidence level with five percent margin of error for a homogenous population, and the sample size chosen meets an industry standard. The Districts state another licensee choice of a different margin of error or confidence interval should not create a precedent for other licensees.

Visitor Survey Sites

NPS and BLM request that the visitor surveys include actual contact with visitors at dispersed sites. NPS and BLM further state it is unlikely that a representative sample of these people can be contacted at boat launches, parking lots, etc.

The Districts state all visitors (with exception of the very limited cul-de-sac access points and Ward's Ferry) pass through the three developed parks. The Districts own all the lands within the project boundary, except for federal lands, and there is very little development adjacent to the project boundary. The Districts state there is no other vehicular access to the reservoir except at the Don Pedro Recreation Agency's (DPRA) three developed sites. The Districts state the focus of the study efforts at the dispersed sites is to assess impacts of recreation use and indicate that recreationists using dispersed sites will be adequately surveyed at the DPRA access points.

Observation Survey

NPS and BLM state that the state of origin based on license plate should also be recorded.

The Districts state the origin data is thoroughly collected by DPRA at the entry kiosks, and as such recording license plates is unnecessarily intrusive and would add nothing to existing data.

Recreation Survey Field Protocol

In response to requests from NPS and BLM to administer the visitor survey at an earlier start time in areas where angling occurs, the Districts have modified the study schedule based on a November 3, 2011 conference call with California Department of Fish and Game, and agree to start the survey effort at noon rather than 1:00 p.m. The Districts state if this is not effective in capturing anglers, the time will be adjusted.

NPS and BLM state that beginning the survey effort at 12:00 p.m. means missing the vast majority of anglers who arrive and leave early. These agencies believe that this is particularly important because fishing is, perhaps, the most popular activity on the Project. NPS further states its experience with angler behavior suggests earlier time frames are common on California reservoirs and requests the Districts amend the study to administer the visitor use survey to begin no later than 10 a.m. to capture the angler community.

Discussion

Identification of Users

Although motorized and non-motorized boaters may often be the same people visitors who report both types of recreational uses should not be considered as a part of the "conflict" group analysis. Visitors who report both uses will still be captured overall within the use survey, but it would be inappropriate and poor methodology to include them in the analysis of difference in recreation experience between these groups (study criterion 6).

Facility Site Condition Evaluation Criteria

The purpose of the Facility Condition, Public Accessibility, and Recreation Assessment Study Plan is to assess the current condition of existing recreation facilities, to support current and near-term future demand for public recreation in the project area,

and propose appropriate PM&E measures based on that assessment. Although the Districts state that facilities wear at different rates and that a generic time frame for project recreation facilities improvements would be inappropriate, we note that the Districts have already included these generic timeframes within their proposed rating table.

We agree with NPS and BLM that including four categories of criteria variables instead of three with additional time frames would be more comprehensive because the fourth proposed category "excellent" would more accurately account for newly constructed recreation facilities, signs, and roads (study criterion 6).

Sample Size

Although NPS and BLM state the proposed sample size of 384 surveys is too low to produce a statistically valid sample, it did not propose a statistically valid alternative. The Districts' proposed sample size is appropriate based on the based on the statistical criterion they used to determine sample size. As with any proposed study, we expect that any results be valid results and include an accompanying discussion of assumptions or uncertainty where appropriate (study criterion 6).

Visitor Survey Sites

The purpose of the proposed study is to evaluate the effects of recreation use at the project, including dispersed sites, in order to make appropriate future recreation management decisions. Recreationists using dispersed sites will be adequately surveyed at the DPRA access points through the visitor survey, and impacts of recreation use at dispersed sites will be appropriately assessed within the proposed study.

Observation Survey

NPS and BLM request the state of origin based on license plate should be recorded during the observation survey, however, recording license plates is unnecessary. The visitor survey already includes a question asking recreation users to provide the zip code of their primary residence. Further, although the Districts state the origin data is already collected by DPRA at the entry kiosks, this type of data does not account for rental cars and may be inaccurate at predicting visitors' origin.

Recreation Survey Field Protocol

Conducting the survey only in the afternoons would focus more attention on water sports rather than angling. Starting the survey no later than 10:00 a.m. would be more

appropriate when surveying this particular user group, and it would most likely result in capturing more anglers.

Staff Recommendation

We recommend the Districts modify the RR-1 *Recreation Facility Condition and Public Accessibility Assessment* by including a fourth criteria variable "excellent", as requested by NPS and BLM, in Table 5.3.1-1, Facility Site Condition Evaluation Categories and Criteria. We also recommend modification of RR-1 to include a start time for administering the survey no later than 10:00 a.m., instead of 12:00 p.m.

Study RR-3-- Lower Tuolumne Boatable Flow Study Plan

Applicants' Proposed Study

The Districts propose to determine the lowest flow that can provide adequate non-motorized, recreational river boating opportunities on the lower Tuolumne River. The Districts propose to: 1) use existing recreation information, where possible; 2) assess river boating; 3) determine the number of days by month at or above the minimum boatable flow for non-motorized river boating opportunities (e.g., rafting, kayaking, and canoeing) under current project operations; 4) determine operational constraints related to providing flows for boating opportunities; 5) identify currently used put-in and take-out locations for river boating between La Grange dam and the confluence with the San Joaquin River; and 6) evaluate the adequacy of flow information (i.e., availability, reliability, and real-time access).

Comments on the Study

Boatable Flows

The American Rivers, American Whitewater, California Sportfishing Protection Alliance, California Trout, Inc., Central Sierra Environmental Resource Center, Environmental Defense Fund, Friends of the River, Golden West Women Flyfishers, Northern California Council Federation of Fly Fishers, Merced Fly Fishing Club, Pacific Coast Federation of Fishermen's Associations, Trout Unlimited, Tuolumne River Trust, and Water 4 Fish (collectively, the Conservation Groups) state that the flows proposed by the Districts are generally too low for adequate boating. They further state flows as low as 50, 75, and even 100 cubic feet per second (cfs) will also cause harm to the fishery in the river. The Conservation Groups request that the Districts begin the flow studies at 200 cfs.

The Districts modified the study plan to start the flow test at 100 cfs. The Districts state if this is not a boatable flow, then the flow test will move to 150 cfs; if this is not boatable, then the flow test will move to 175 cfs, and continue in 25 cfs increments. The Districts further state that any reductions in flow below what is occurring in the river at the time of the test may require consultation with National Marine Fisheries Service.

Types of Water Crafts

The Conservation Groups state that the study proposal presently focuses on canoeing and kayaking. They further state that similar to the lower Stanislaus River in the Knights Ferry area, the lower Tuolumne River can provide excellent drift rafting opportunities as well, so long as sufficient flow is available. The Conservation Groups request that drift rafters be explicitly included in the boatable flow experiments.

The Districts state the study is not intended to identify which type of craft is usable at each flow; it is to test the lowest flow that ordinarily available water craft can float portions of the river. The Districts further state not every type of boat needs to be able to make progress down the river in order to define the lowest boatable flow.

Angling

The Conservation Groups request that recreational fishing be evaluated as part of the study.

The Districts state no parties have identified an adverse effect on angling under the current flow regime and maintain there is no evidence that angling use is hindered by the current flows.

Discussion

Boatable Flows

The Districts have modified the study plan to start the flow test at 100 cfs. However, the Conservation Groups state that the flows proposed by the Districts are generally too low for adequate boating and request that the Districts begin the flow studies at 200 cfs. Based on information provided in the Districts' Pre-Application Document (PAD), flows in the lower Tuolumne River, in an intermediate below normal-above normal water year,[3] are between 250 and 300 cfs from April through September. Based on this information, we agree with the Conservation Groups that 200 cfs is an

[3] Table 3.6.7-2 in the Districts' Pre-Application Document for the Don Pedro Project, filed February 10, 2011.

appropriate starting test flow for the proposed study because it is consistent with flows in the Lower Tuolumne River during a normal water year.

Types of Water Crafts

The purpose of this study is to determine the lowest flow that can provide adequate non-motorized, recreational river boating opportunities on the lower Tuolumne River. Because drift rafting is a type of recreational use that could occur on this reach and recreational flows could inform future recreation management decisions, it would be appropriate to include drift rafts in the study (study criterion 5).

Angling

The Conservation Groups request that recreational fishing be evaluated in this study. However, the Districts state no parties have identified an adverse effect on angling under the current flow regime and maintain there is no evidence that angling use is hindered by the current flows. Again, the intent of this study is to determine the lowest boatable flow on the lower Tuolumne River, not to evaluate recreational fishing. Further, recreational fishing will be evaluated as a part of RR-1 *Recreation Facility Condition, Public Accessibility, and Recreation Use Study Plan*.

Staff Recommendation

Study RR-3 *Lower Tuolumne Boatable Flow Study Plan* should be modified to include drift rafts and start the flow test at 200 cfs, as proposed by the Conservation Groups, and increasing or decreasing the flow in 25 cfs increments based upon whether or not the 200 cfs flow is insufficient for boating.

TR-1-- Special-Status Plants Study; TR-2-- ESA- and CESA-Listed Plants Study; and TR-4-- Noxious Weed Survey

Applicants' Proposed Studies

The Districts propose three different studies pertaining to botanical resources at the project. These include the TR-1 *Special-Status Plants Study*, TR-2 *ESA- and CESA-Listed Plants Study*, and TR-4 *Noxious Weed Survey*. The studies encompass the same study areas and have similar goals. Specifically, the goal of each study is to provide information to determine whether certain project operation and maintenance activities and/or recreational activities may adversely affect the botanical resources associated with each study (special-status plants, Endangered Species Act (ESA)- and California Endangered Species Act (CESA)- listed plants, and noxious weeds).

The Districts' study plans include a list of study areas within the project boundary that are subject to project-related operation and maintenance and/or recreation activities, including high-use dispersed recreation areas. The Districts' list also includes proposed study areas that include botanical habitats associated with certain project features, such as the powerhouse, to the extent they could reasonably be affected by project operation and maintenance and/or recreation. The Districts believe these study areas should be less than 100 feet from the project feature and should not extend beyond the project boundary. If botanical occurrences are located, the study area would be expanded to the full extent of the occurrence or the project boundary, whichever is less.

Comments on the Study

BLM submitted revised versions of the Districts' three study plans. BLM's revisions pertain primarily to the Districts' proposed geographic extent of the study areas. For each of the three botanical plans, BLM recommends that the study areas be extended to include:

- out to 300 feet or the project boundary, whichever is greater, within the high-use dispersed recreation areas identified in the Districts' three proposed study plans;
- out to at least 100 feet from the high water mark of the project reservoir on BLM lands, or the project boundary, whichever is greater;
- out to 300 feet from the high water mark of the project reservoir, or the project boundary, whichever is greater, within BLM lands in the Red Hills Area of Critical Environmental Concern (Red Hills ACEC);
- out to 300 feet from BLM land onto private land wherever BLM land borders private lands;
- out to at least 100 feet from the high water mark of the project reservoir wherever BLM land borders private lands; and
- if botanical occurrences specified in the studies are found within the study area, the study area would be expanded to the full extent of the occurrence, or to one quarter mile outside the project boundary, whichever is less.

The Districts did not adopt the BLM's recommended geographic range of the study, stating that there are large portions of land within the project boundary that are not subject to any project-related activities or any management efforts or discernable

recreational use. The Districts further argue that the BLM has not provided rationale or a project nexus for its proposed extended study areas, some of which are well outside the project boundary. The Districts have estimated without elaboration that the additional cost to conduct the BLM proposed study scope would be $300,000 for these three botanical studies.

Discussion

The Districts would not propose to extend the study area beyond the project boundary. However, extending botanical surveys beyond the project boundary may be appropriate if project effects extend beyond the project boundary into the remainder of a botanical occurrence (study criterion 5). Therefore, we agree with BLM and recommend that the Districts extend the study area out to 300 feet or the project boundary, whichever is greater, within the high-use dispersed recreation areas identified in the Districts' three proposed study plans. These areas may include high levels of human activity and project-related use, thereby increasing the likelihood of dispersal of noxious weeds or adverse effects on special-status plants.

We also agree with BLM that the survey area within the Red Hills ACEC should extend out to 300 feet from the high water mark of the project reservoir, or the project boundary, whichever is greater. The Districts and the BLM both state that the Red Hills ACEC has been designated to protect the important and relevant values which include Delpiedra soils derived from dunite and serpentine, two federally listed species, four BLM sensitive species, and the serpentine buckbrush chaparral plant community. In addition, BLM's Sierra Resource Management Plan (2008) states that nonnative invasive weed control is a prioritized goal for the Red Hills ACEC. The Districts' study plan includes the Red Hills ACEC as part of its study area, but only proposes to study this area out to the project boundary only. However, project operations and maintenance can result in noxious weed introductions into the project area from well outside the project boundary, or weed dissemination from the project area to areas away from or adjacent to the project. In addition, special-status plant occurrences that extend outside the project boundary in the Red Hills ACEC may be impacted by the spread of noxious weeds, trampling from human disturbance, and ground and vegetation disturbance (e.g., vegetation management around project facilities, road maintenance and scheduled repair work). Therefore, the additional information would help to inform the development of license requirements that pertain to any protection, mitigation, and enhancement measures (PM&E) that would be necessary to further protect this environmentally sensitive area (study criterion 5).

We also agree with BLM that if botanical occurrences, noted by the surveys, are found within the study area, the study area for surveys should be expanded to the full

extent of the occurrence, or to one quarter mile outside the project boundary, whichever is less. The Districts' study plan would only expand the study area to the full extent of the occurrence, or the project boundary, whichever is less. As stated above, project operations and maintenance can result in noxious weed introductions into the project area from well outside the project boundary, or weed dissemination from the project area to areas away from or adjacent to the project. In addition, special-status plant occurrences that extend outside the project boundary may be affected by the spread of noxious weeds, trampling from human disturbance, and ground and vegetation disturbance (e.g., vegetation management around project facilities, road maintenance and scheduled repair work). Therefore, extending botanical surveys beyond the project boundary to one quarter mile where the botanical occurrence is located would help to determine the extent of an occurrence at the project and would therefore help to inform the development of license requirements that pertain to any PM&E or noxious weed control measures that would be necessary in that location (study criterion 5).

However, we do not agree with the BLM that the study area should be expanded out to 300 feet from BLM land onto private land wherever BLM land borders private lands, or out to at least 100 feet from the high water mark of the project reservoir wherever BLM land borders private lands. We also do not agree with the BLM that the study should be expanded out to at least 100 feet out from the high water mark of the project reservoir on BLM lands, or the project boundary, whichever is greater. By letter dated December 7, 2011, BLM states that indirect effects, such as noxious weed invasion along the reservoir shoreline due to water fluctuation levels, may affect rare plants, and therefore, BLM requires adequate baseline data on direct, indirect, and cumulative effects in order to conduct an environmental analysis on the relicensing of the Don Pedro Project. However, BLM did not provide a project effect nexus for studying BLM lands or private lands specifically, nor did BLM provide an explanation as to why these areas would require additional surveys when other areas along the project's reservoir, that also experience water fluctuations and other indirect effects, but are not within BLM land or private land, would not require those same surveys. Conducting additional botanical surveys on BLM and private land would only provide baseline data for those specific areas and would not provide baseline data for the rest of the project reservoir that may also experience indirect project effects. In addition, BLM did not provide an explanation for why the additional level of effort and cost would be necessary to include BLM land and private land specifically in the study area (study criterion 7). However, we note that if private lands occur in the approved study areas, the Districts should obtain permission from the owners of any such private lands before conducting studies.

Staff Recommendation

We recommend Studies TR-1 *Special-Status Plants Study*, TR-2 *ESA- and CESA-Listed Plants Study*, and TR-4 *Noxious Weed Survey*, be modified to include the following in the study areas:

- out to 300 feet or the project boundary, whichever is greater, within the high-use dispersed recreation areas identified in the Districts' three proposed study plans;

- out to 300 feet from the high water mark of the project reservoir, or the project boundary, whichever is greater, within BLM lands in the Red Hills Area of Critical Environmental Concern; and

- if botanical occurrences specified in the studies are found within the study area, the study area would be expanded to the full extent of the occurrence, or to one quarter mile outside the project boundary, whichever is less.

Study TR-3-- Wetland Habitats Associated with Don Pedro Reservoir Study

Applicants' Proposed Study

The Districts propose a study that would map and describe wetland habitats within the study area and characterize their functional condition. The proposed study area would consist of wetland habitats dominated by facultative or obligate wetland plants occurring in specific drainages that may be affected by the project, listed in 5.1 of the proposed study. The Districts propose to collect existing information relevant to wetland habitat, such as geology, topography, and soils, to refine the location of field studies. Non-wetland areas in these drainages would also be surveyed for special-status plants, invasive plants, and riparian vegetation, by performing transects to collect data on vegetation, which would extend upstream to the project boundary.

Comments on the Study

BLM submitted a revised version of the Districts' study plan. BLM's revisions pertain primarily to the Districts' proposed geographic extent of the study areas. The BLM recommends extending the study area to the Tuolumne River below the dam. The Districts disagree with this recommendation, stating that extending the wetland study area would represent a substantial and unwarranted expansion. The Districts further state that downstream habitat conditions are a function of non-project activities, and that the project boundary below the dam is a canyon and does not support wetlands. Specifically, the Districts cite Gasburg Creek below the spillway as being normally dry.

The BLM also recommends extending the area in which transects would be located to 125 meters upstream of the downstream extent of each wetland. The Districts propose that transects extend upstream only to the project boundary. BLM's proposed transects would capture species dominance, abundance, richness, ground and canopy cover, and lateral and horizontal complexity within the area dominated by wetland species. The Districts, however, do not believe that sampling beyond the project boundary is warranted, and comment that the BLM does not provide a project effects nexus for studying the area outside the project boundary or the dam.

Discussion

We agree with the Districts that extending the study area to the Tuolumne River below the dam would be a substantial addition to the study area, and without further explanation from the BLM, it is outside the scope of this study. It is unclear from the BLM what the geographic extent below the dam would entail, as the BLM does not specify how far below the dam the study should extend. Also the BLM does not provide a project effects nexus for studying this area (study criterion 5), or why the expansion of the study area warrants the additional level of cost and effort (study criterion 7).

The Districts comment that the BLM does not provide a project effects nexus for extending the wetland study area to include additional transects outside the project boundary or the dam. We agree with the Districts to the extent that if a wetland does not extend beyond 125 meters, or any distance for that matter, continuing to survey a non-wetland area for wetland resources would no longer fulfill the objectives of this study, which is to map and describe wetland habitats within the study area and to characterize their functional condition. In addition, these transects would only capture information pertaining to vegetation (species dominance, abundance, richness, ground and canopy cover, and lateral and horizontal complexity), and would not provide other direct wetland indicators such as soil composition and hydrologic condition. Therefore, the data obtained from these transects would not provide information on the extent of the wetland itself, where project effects relevant to goal of this study may occur (i.e. hydrologic changes from project operation and maintenance, recreation, and ground-disturbing activities). BLM states that baseline information about riparian vegetation is necessary in order to conduct an environmental analysis on the relicensing of the Don Pedro Project. However, BLM did not provide a project effects nexus for obtaining information about riparian areas where potential project effects or wetlands are not likely to occur (study criterion 5).

BLM further states that the transects would obtain additional information on the presence of noxious weeds and special-status plant species that may occur in riparian areas, and refers to potential project effects from project operation, ground-disturbing

activities, recreation, maintenance, and water level fluctuations that may affect these resources. However, noxious weeds and special-status plants at the Project will be evaluated separately in the Districts' studies TR-1 *Special-Status Plants Study*, TR-2 *ESA- and CESA-Listed Plants Study*, and TR-4 *Noxious Weed Survey*. BLM did not explain why the additional information obtained from the transects on noxious weeds and special-status plants in riparian areas outside the scope of these three studies (TR-1, TR-2, and TR-4) are necessary.

The Districts would only survey a wetland up to the project boundary. However, extending the area where transects are placed beyond the project boundary may be appropriate where wetlands extend beyond the project boundary. If project effects occur within existing wetlands in the study area, then those project effects may extend beyond the project boundary into the remainder of that wetland. Therefore, we recommend the Districts extend the wetland study area and place vegetation transects within the full extent of each wetland associated with the drainages specified in section 5.1 of the Districts' proposed study. The Districts do not clearly define wetlands in their proposed study, but state that lands dominated by facultative or obligate wetland plants within the specified drainage areas listed in 5.1 of the Districts' proposed study would be included in the study area. Because wetland indicators also include soil composition and hydrologic conditions, the Districts should also evaluate existing information on these parameters when refining the location of field studies and defining wetland areas.

The Districts did not specify a protocol or criteria that will be used to classify wetland function in their study plan reports. The Districts should include this information in their final study report.

Staff Recommendation

Study TR-3 *Wetland Habitats Associated with Don Pedro Reservoir Study* should be modified to include the full extent of each wetland surveyed during field studies. Vegetation transects should also be placed in the full extent of each wetland associated with the drainages specified in section 5.1 of the Districts' proposed study. When refining the location of wetlands surveyed during field studies, the Districts should evaluate existing information on soils and hydrology, as well as the presence of lands dominated by facultative or obligate wetland plants within the specified drainage areas. Lastly, the Districts should include in their final study report, the protocol or criteria that was used to classify wetland functions.

Study W&AR-2-- Project Operations/Water Balance Model

Applicants' Proposed Study

The Districts propose to develop a project operations computer model (Operations Model) that can be used by all relicensing participants to simulate current and potential future operations of the project. The objective of the study is to develop an Operations Model that simulates plant operations over the past 40 years with reasonable accuracy and can be used to simulate potential operations under a variety of proposed operating scenarios.

The Districts would use Microsoft Excel as the platform to develop the Operations Model. The model would simulate project operations for a multi-year period of water years 1971 through water year 2009. The proposed period of record includes both the driest (1977) and wettest (1983) water years since 1922. The model output would typically be mean daily flow at or below the project and selected non-project facilities, daily power production at the powerhouse, and end-of-day reservoir elevation.

Specific study objectives include:

- reproducing observed reservoir levels, reservoir releases, and hydropower generation, within acceptable calibration standards over a range of hydrologic conditions;

- providing output to inform other studies, analyses, and models;

- allowing simulation of changes in project operations to estimate effects on reservoir levels, reservoir releases and hydropower generation; and

- configuring the model for ease of use by relicensing participants.

The model study area would include the Tuolumne River from City and County of San Francisco's (CCSF) O'Shaughnessy, Cherry Valley, and Eleanor Dams to U.S. Geological Survey (USGS) Gage 11290000 – Tuolumne River at Modesto.

Comments on the Study

Mr. Hackamack made numerous comments on the details of the Districts' proposed operation model. In response to his comments, the Districts clarified how the model will handle the many parameters and what input and output features will be available for relicensing participants to use. Besides comments on the model details, Mr.

Hackamack asks the Districts to estimate how global warming will reduce inflows to the project so that relicensing participants can use the model to reduce inflows to simulate these effects. Mr. Hackamack also asks the Districts to provide a model node that relicensing participants can use to simulate the use of groundwater storage to manage basin runoff.

The Districts responded that they are not proposing to study the effects of global warming but say that relicensing participants' can reduce the unimpaired flows[4] to simulate these effects.

In comments on the revised study plan, the California State Water Resource Control Board (Water Board) asks that the study plan be revised to include: (1) a complete list of water right claims and a quantification of those claims; and (2) more information on the water bank operations.

Tuolumne River Conservancy (TRC) and Lower Tuolumne Farmers (LTF) both note that the Districts operate the project as if every year is a dry year. TRC requests a study of alternative operation strategies that would allow flexibility in flow management for restorations, temperatures, floodplain inundations, and other purposes. LTF says the Districts "every year is a dry year" assumption leads to management decisions that keep water levels in Don Pedro reservoir as high as possible for as long as possible. LTF says that during high inflows these high water levels result in more sudden releases, which cause flooding, property damage, and crop loss. LTF wants the relicensing process to consider other means—such as more frequent snow surveys, weather stations, personnel that can provide better information to the operator and, hopefully, improve the Districts' operation plan. LTF asks that this issue be evaluated both within the *Water Balance-Operations Model* (W&AR-02) and *Socioeconomics* (W&AR-15) Study Plans.

In response, the Districts say that several relicensing participants comment about the Districts have said they operate as "every year is a dry year." The Districts note that the proper way to interpret that statement is that the Districts do not make decisions based on early runoff forecasts. The project's operators wait until late enough in the water year so that they have more knowledge of the available water for the year.

The Districts say the socioeconomic effect on individual farms is not part of the proposed socioeconomic study but relicensing participants will be able to analyze alternative flow regimes with the proposed operation model.

[4] The unimpaired flow used as inflow to the Operations Model is the Tuolumne River streamflow above the CCSF reservoirs adjusted to account for the storage effects of those reservoirs.

The Conservation Groups agree with the daily time step of the Operations Model for the Don Pedro Project but express concern that the model's daily time step will not capture and describe flow fluctuations downstream of La Grange dam, or describe the function that La Grange dam plays in regulating power releases from the Don Pedro powerhouse. The Conservation Groups recommended that a dataset that is, at minimum, representative of hourly operations at and below La Grange be added to the hydrology dataset that will be used to develop the Operations Model.

In response to the Conservation Groups comments on including the operation of La Grange dam in the Operations Model, the Districts note that La Grange dam does not "regulate" power releases from the Don Pedro Project and the Districts consider the daily time step adequate to inform FERC regarding the development of license conditions.

The Conservation Groups and California Department of Fish and Game (CDFG) stated that a HEC-ResSim platform would be more versatile for the Operations Model than the Excel Platform proposed by the Districts.[5]

In response to the CDFG and the Conservation Groups comments, the Districts point out that Microsoft Excel is widely used and will provide FERC and relicensing participants with adequate information to evaluate baseline conditions and alternative future operating scenarios. They note that neither CDFG nor the Conservation Groups offer specific reasons why the chosen spreadsheet platform would not meet the needs of the study.

CDFG also requests that the model include discrete nodes for CCSF's Hetch-Hetchy, Lake Eleanor, and Lake Lloyd reservoirs. CDFG provided a suggested study plan that outlined in detail the modeling of the CCSF system, including specific modeling of tunnels and releases.

As also suggested by the Conservation Groups, CDFG recommends that the Districts and CCSF develop the unimpaired hydrology to be used to run the model through an early collaborative process with interested relicensing participants.

The Districts respond that the detailed modeling of project operations should not extend beyond the scope needed to develop license conditions for the project. The Districts say that in developing the hydrology, they think it is more efficient for the Districts to develop the initial package of hydrology and model logic before meeting with the relicensing participants. They say that the CCSF and the Districts will synthesize the

[5] CDFG alternative study CDFG-1 and the Water Board alternative study Water Board-13 also recommend the Districts use the HEC-ResSim platform to develop the model. We consider these alternative study requests in discussing these comments.

unimpaired flow to be used in the model as inflow to the CCSF reservoirs and the unregulated part of inflow to Don Pedro reservoir and point out that CCSF and the Districts have been developing the daily unimpaired flow data for the Tuolumne River for several decades.

The National Marine Fisheries Service (NMFS) made two study requests related to the Districts' W&AR-2 study plan (NMFS-2 and NMFS-4). NMFS-2 includes four study elements that are similar to those included in the Districts' study plan: develop a water balance/operations model (but using HEC-ResSim); develop water year types; validate the model; and develop the base case (how the Districts now operate the project). The NMFS-4 study is described in more detail below.

NMFS comments that the primary difference between NMFS-2 and the Districts' proposed operations model pertain to the downstream terminus of the model, the number of model nodes in the lower Tuolumne River, and collecting flow measurements to estimate accretion and depletion in the lower Tuolumne River. As described below under NMFS-4, NMFS maintains that flow measurements at about four locations need to be collected to estimate accretion and depletion in the lower Tuolumne River.

NMFS comments that the Districts' study plan does not substantially include the NMFS-4 elements, which include:

Element # 1: Data Development and Statistical Analysis

NMFS reiterates that besides developing a base case scenario, its request under Element #1 includes developing both a full unimpaired flow scenario and a partially unimpaired flow scenario. In NMFS' full unimpaired scenario, the model would operate assuming the CCSF, Don Pedro, and LaGrange facilities do not exist. In NMFS' partially unimpaired flow scenario, the CCSF facilities operate as they do in the existing conditions scenario but the Don Pedro facilities and La Grange facilities don't exist. NMFS Element #1 requests that all three scenarios be modeled to the Tuolumne River's confluence with the San Joaquin River.

NMFS states the Districts' *Project Operations Model Study Plan* W&AR-2 also does not propose to calculate any hydrological statistical analyses as requested in Element # 1, and thus NMFS considers this part of Element # 1 to be unfulfilled.

Element # 2: Additional Analysis of Tuolumne River below La Grange dam

NMFS states that the USGS gaging station "Tuolumne River below La Grange Dam near La Grange, CA (USGS #11289650)" represents the project's FERC

compliance point. However, NMFS says the La Grange facilities can release that flow arriving to this point from a number of conduits: the La Grange powerhouse, the MID canal spillway, the TID canal spillway, and the La Grange dam spillway. In Element # 2, NMFS requests additional analysis and breakdown of the flow conduits at La Grange dam.

Element # 3: Peak Flow Analysis

NMFS state that neither of these elements are addressed in the comments or proposed studies nor are these elements addressed by the proposed Operations Model. NMFS reiterates its request to have the project's effects on peak flows in the lower Tuolumne River assessed as well as a statistical analysis of rates of change in stage and flow below La Grange (see NMFS Study Request # 4 for detailed methodology).

Element # 4: Rate of Stage Change Analysis

NMFS states that neither of these elements is addressed by the proposed Operation Model. NMFS reiterates its request to have the project's effects on peak flows in the Lower Tuolumne River assessed as well as a statistical analysis of rates of change in stage and flow below La Grange dam (see NMFS Study Request # 4 for detailed methodology).

Element # 5: Quantify Lower Tuolumne Flow Accretion and Depletion

NMFS recommends a minimum of three discharge sites be located between the USGS gages near La Grange dam and Modesto, and an additional site located between the USGS gage at Modesto and the Tuolumne River confluence with the San Joaquin River. NMFS requests that the model extend all the way to the San Joaquin confluence because this stretch of river is an important migratory pathway for salmonids to reach their primary spawning reaches.

Element # 6: Evaluate Potential to increase Lower Tuolumne River Flood Capacity

NMFS recommends the Districts compile information on the limitations of full use of the outlet works at Don Pedro dam for environmental benefits.[6]

[6] In Water Board-14, the Water Board makes a similar request.

In response to NMFS-2, the Districts say that they do not agree that the HEC-ResSim platform would be more appropriate than the Microsoft Excel spreadsheet platform they propose to use. Responding to Element # 1, which includes more nodes in the lower Tuolumne River, the Districts agree to do one set of field measurements of accretions and depletions in this reach and tabulate any irrigation diversion that occur (Element # 5 of NMFS-4, which the Districts respond to below, also addresses accretions and depletions in the lower Tuolumne River).

In response to NMFS' concern about the downstream terminus of the model, the Districts say that the last Operations Model node in the proposed model is the Modesto gage at River Mile (RM) 16. Because the drainage area below this location is extremely small, with no perennial tributaries, the Districts conclude that the flow at the Modesto gage is representative of the flow at the mouth. However, to satisfy NMFS's concern about accretions and depletions in this reach, the District's agree to make accretion measurements below Modesto for one study year and identify riparian diversions.

Responding to NMFS-4, Element # 1 operational scenarios, the Districts note that daily data from the water operations model will be available for assembly and statistical analysis. The Districts say that NMFS can run the unimpaired flow scenario NMFS wants to see once the model is operational and that the Districts are willing to run any scenario. The Districts say that charting and data analysis for individual studies or for the comparison of studies will be developed as model development proceeds, test studies are performed, and parameters of interest are identified. The Districts intend to develop analysis and illustration tools that adequately describe parameters of interest and provide information necessary to evaluate potential license conditions within the limits of the data sources.

In response to NMFS Element # 2, the Districts say the La Grange release to the river will be reported as a single parameter inclusive of flows over La Grange dam or through TID facilities, and that this value will be provided to the river temperature model. The Districts indicate that subset analysis separate from the proposed operations model for Don Pedro, but consistent with the results of the model, can be estimated to provide flows passing La Grange dam as either spillway flows or powerhouse flows.

Responding to NMFS Elements # 3 and # 4, and to comments by the Conservation Groups, the Districts say the Operations Model will provide, as output, the mean daily flow under current Project operations and under alternative flow regimes. The Districts note that these output data will be available for other analyses and should provide the data needed to conduct evaluations of the peak flows in the Lower Tuolumne River. The Districts agree that the flow record at the existing La Grange gage can be examined to

characterize hourly flow fluctuations at the gage. The Districts suggest meeting with NMFS before undertaking such an analysis.

In response to Element # 5, the Districts agree to do one set of field measurements of accretions and depletions in this reach and tabulate any irrigation diversion that occur.

In response to Element # 6, the Districts have proposed to contact the U.S. Army Corps of Engineers (Corps) to see if they can increase peak flows above the flood protection level.

Discussion

Mr. Hackamack made numerous comments on the details of the Districts' proposed operation model that the Districts clarified in their response. In comments on the Revised Study Plan, Mr. Hackamack asks the Districts to modify the proposed Operations Model to include a simulated ground water storage node. Mr. Hackamack says that relicense participants could use such a model node to study how developing groundwater storage could help manage basin runoff. We don't agree such a model node is needed. Projects that would develop groundwater supplies are not part of the relicensing proceeding for Don Pedro and would not help inform the development of relicense conditions (study criterion 5).

The Water Board asked that water rights information be included in the study plan. Water rights are a state matter and therefore the most appropriate way for the Water Board to address the Districts' and CCSF's water rights is in the water certification process. That said, we recommend a section in the study report for W&AR-2 that details any existing licenses, agreements and contracts that are not part of the licensing proceeding but include any streamflow-related requirements (study criterion 4). As written, the proposed Operations Model will show a running balance for the water bank at the Don Pedro reservoir, which should provide the State Board with the information they have asked for.

In response to TRC and LTF's comments, the Districts' note that relicensing participants can run alternative flow regimes with the Operations Model as long as these regimes can be adequately expressed in terms of the modeling parameters. We agree with the Districts that the model has the flexibility that TRC is seeking. Though this flexibility should help relicensing participants evaluate proposals, given the current potential project effect for property damage and crop loss from sudden high streamflow releases, as noted by LTF, the Districts should evaluate the potential risks and rewards of other reservoir refill strategies. We recommend the operation study add a section that discusses the current refill operation the Districts use and evaluates whether better

hydrologic information or alternative strategies could improve operations (study criterion 5). We agree with the Districts that evaluating the effect of alternative refill strategies on individual farms should not be part of the socioeconomic study because of the broader scope of that study.

The Conservation Groups and CDFG believe that the HEC-ReSim would be a more appropriate operations model than the Districts' proposed Excel Platform. A variety of computer models can be used to simulate project operations, including spreadsheet models, such as Excel, and others such as HEC-ReSim, and CHEOPS. Developing a computer model to simulate project operations is difficult and each model has pros and cons. The important fact to note is that the Districts' revised study plan includes methodology to validate the model, configure it for current operations, and provide the model to the relicensing participants who want to simulate relicense proposals of interest to them (study criterion 6). After the Districts validate the model, the study plan provides for workshops with interested relicensing participants to review the model and see how the model evaluates alternatives. We conclude the study plan includes the needed steps to insure the model developed meets the needs of the relicensing participants including CDFG and the Conservation Groups.

The Conservation Groups express concern about whether an hourly time step might be needed to show the effects of La Grange dam operation. The goal of the study plan is to develop an Operations Model that represents the historical plant operations with reasonable accuracy for purposes of developing relicense conditions for the Don Pedro Project but not the non-project La Grange dam. We conclude a daily time step is adequate for the Operations Model and the model as proposed in the study plan should be able to provide the operation information need for the Don Pedro Project in a more cost effective manner (study criterion 7). In response comments, the Districts point out that they would be able to use hourly data to study the details of operation at La Grange dam, including changes in stage below the dam. We further discuss La Grange dam operation below in response to Element # 4 of the NMFS-4 study request.

The Conservation Groups and CDFG recommend that the Districts and CCSF develop the unimpaired hydrology for the Project through an early collaborative process. Instead, the Districts prefer to first develop the hydrology and model logic and then make the data available to the relicensing participants, followed by one or more workshops. The Districts approach will help to expedite the study process and still provide the Conservation Groups and CDFG with the collaborative process they are seeking.

We now turn specifically to the NMFS-2 (*Request for Information or Study Effects of the Project and Related Facilities Evaluated Through an Operation Model*) study request. The NMFS-2 study request and the Districts' operations model study plan differ

mainly in platform used to develop the model, the number of model nodes in the lower Tuolumne River, and where the models end. We discuss these differences and others below.

Both NMFS-2 and CDFG-1 Study Requests propose the Districts use HEC-ResSim to develop the Operations Model. We discuss the Districts' proposed model platform above in response to CDFG and Conservation Groups comments and conclude the study plan includes the needed steps to insure the model developed meets the needs of the relicensing participants.

In Element # 1 of the NMFS-4 Study Request, NMFS asks the Districts to run three flow scenarios: a base case scenario, full unimpaired flow scenario, and a partially unimpaired flow scenario. NMFS' partially unimpaired flow scenario is a theoretical scenario that assumes the CCSF facilities operate but the Don Pedro facilities and La Grange facilities don't exist. Element # 1 asks for several hydrological statistical analyses to be run for all three scenarios.

Of the three scenarios NMFS requests in Element # 1, we don't agree the Districts should run a partially unimpaired flow scenario. Given the coordinated manner in which the projects operate, the Districts would have difficulty trying to configure the model to simulate a theoretical operation of the CCSF facilities if Don Pedro and LaGrange didn't exist, and we don't see any practical use for such a scenario to inform license conditions (study criterion 5). While the Districts do not agree to run a partially unimpaired scenario, they state that the Operations Model, as planned, will be able to run a full unimpaired flow simulation as NMFS requests. We also do not agree that a full unimpaired flow simulation is necessary for our evaluation of project effects and are not recommending it (study criterion 5).

In Element # 1, NMFS also asks that the operations model provide seven statistical studies. The Districts say that as the development of the model proceeds the Districts may be better able to develop the tools needed to provide graphic or statistical output for the model to the relicensing participants. Though we understand the Districts' desire to develop output options as the model development proceeds, without proper forethought, the Districts may find it hard to modify the model to provide all of the kinds of information that the participants find most important. To ensure this, the workshops discussed in section 6.0 of the Districts' study plan should also discuss the graphical and statistical output the participants prefer, including the seven statistical studies NMFS requests (study criterion 6).

In NMFS Element # 2, NMFS asks for additional analysis and breakdown of the flow conduits at La Grange dam in order to study potential La Grange issues. The

Districts say that subset analysis outside of the daily operations model, but consistent with the model, can be done under the normal operations of La Grange to provide flows passing La Grange as either spillway flows or powerhouse flows.

Though La Grange is not part of the Don Pedro relicense proceeding, the operation of Don Pedro could affect areas downstream of La Grange (study criterion 5). The Districts' approach to use hourly data outside of the Operations Model is responsive to the NMFS request and the study plan should provide for this subset analysis.

In Element # 3 and Element # 4, NMFS asks for a statistical study of the Project's effects on peak flows in the lower Tuolumne River as well as a statistical analysis of rates of change in stage and flow below La Grange dam using 15-minute data. The Districts note output data from the Operations Model will be available for other analyses and should provide the data needed to evaluate peak flows in the lower Tuolumne River. As to stage changes, the Districts agree that the flow record at the existing La Grange gage can be examined to characterize hourly flow fluctuations at the gage. The Districts suggest meeting with NMFS, before undertaking such an analysis.

Again, the operation of the La Grange facilities is not part of the Don Pedro relicense proceeding. However, peak flows from Don Pedro could affect flows downstream of La Grange (study criterion 5). The Districts should include their proposal to provide the data NMFS requests in these elements in the study plan.

In Element # 5, NMFS requests additional data be provided on any flow accretions and depletions from La Grange dam to the San Joaquin River. NMFS says that if existing information is not available the Districts should make field measurements. NMFS says the Districts should consult with ILP particpants on the sampling but that NMFS anticipates that the Districts would have to sample at 4 sites, and the measurements would need to be taken at different discharge levels or time periods. We agree with the Districts that because of the extremely small increase in drainage area below the Modesto gage, the Operations Model results should be able to estimate flows down to the confluence with San Joaquin River by allowing for the small inflow between the gage and the mouth of the San Joaquin. The Districts' methodology to measure accretions and depletions for a year at four locations and provide information of any irrigation diversions in this reach would further refine any changes in streamflow that may occur below Modesto gage (study criterion 6).

We conclude that the Districts' plan to measure accretions and depletions for a year at four locations will provide enough information to further characterize the runoff in this small drainage. After the Districts obtain these measurements, they should use the

data to extend the Operations Model to the San Joaquin River confluence (study criterion 5).

In Element # 6, NMFS recommends the Districts compile information on the limitations of full use of the outlet works at Don Pedro dam for environmental benefits.[7] The Districts have proposed to contact the Corps of Engineers to see if they can increase peak flows above the flood protection level.

Because peak releases from the Don Pedro Project may affect river flow below La Grange dam, it's appropriate that the District contact the Corps of Engineers to discuss the possibility of giving the Districts more flexibility in releasing flood flows. If the Corps of Engineers is agreeable to the Districts increasing peak flows, then the Districts could use the Operations Model to evaluate potential proposal that could benefit downstream environmental resources.

Staff Recommendation

Study W&AR-2 should be modified as follows:

- a new section should be added to discuss the current refill operation the Districts use at Don Pedro reservoir and evaluate whether better hydrologic information or alternative strategies could improve operations;

- the proposed workshop(s) in section 6.0 should also discuss participant preferences for model output, including graphical and statistical output;

- a section should be added to the study plan that details any licenses, agreements and contracts that are not part of the FERC license but include streamflow-related requirements; and

- after measuring accretion and depletions in the lower Tuolumne River, the Districts should extend the Operations Model to the San Joaquin River confluence.

A new section should be added to the study plan to summarize any related operational studies to be done by the Districts, including the La Grange dam subset analysis and any analysis needed to meet NMFS-4 Study Request, Element # 4.

[7] The Water Board makes a similar request in alternative study request Water Board-14.

Study W&AR-3-- Reservoir Temperature Model

Applicants' Proposed Study

The Districts propose a reservoir temperature model that would simulate and characterize the seasonal water temperature dynamics in Don Pedro reservoir under current and potential future conditions. The model would:

- simulate reservoir temperatures resulting from current project operations;
- accurately reproduce observed reservoir temperatures over a range of hydrologic conditions; and
- provide output that can inform other studies, analyses, and models, and predict potential changes in reservoir thermal conditions under alternative future operating conditions.

The study area would encompass the area where inflows enter Don Pedro reservoir to the area of outflow from Don Pedro reservoir. The reservoir temperature model would interface with the W&AR-2 *Project Operations/Water Balance Model* and the recalibrated HEC-5Q W&AR-16 *Water Temperature Model of the lower Tuolumne River* extending from the impoundment of La Grange dam to the confluence with the San Joaquin River.[8]

The Districts would use a 3-D model MIKE3-FM for characterizing the thermal structure and dynamics of the Don Pedro reservoir under a wide range of reservoir water levels and meteorological conditions. The 3-D temperature model of the reservoir would be "linked" in a feed-forward mode to the W&AR-16 lower Tuolumne River temperature model. The model output would typically be mean daily flow at or below the project and selected non-project facilities, daily power production at the project powerhouse, and end-of-day reservoir elevation.

CDFG continues to collect monthly temperature profiles in Don Pedro reservoir and these data will be used as the primary data set for the 3-D model's calibration and verification. As part of this study, the Districts will collect reservoir temperature data concurrently with the bathymetric data to provide additional data for the model verification.

[8] The Districts have agreed to recalibrate the existing HEC-5Q model of the lower Tuolumne River as recommended in the March 2011 report submitted to FERC.

Comments on the Study

CDFG and the Conservation Groups prefer that the Districts use the two-dimensional CE-QUAL-W2 to model reservoir water temperatures because the simpler 2-D model would produce adequate results. These commenters believe that the 3-D model may be too complex to allow use by relicensing participants and to ensure the model's calibration by resource agency experts.

The Districts say a 3-D model was preferred over a two-dimensional (2-D) model for several reasons. The use of the CE-QUAL-W2 would require multiple branches to accurately represent the dendritic shape of Don Pedro reservoir and result in the loss of detail where branches overlap. Complete lateral mixing in the 2-D segments is assumed in the CE-QUAL-W2. Segment widths of Don Pedro reservoir in the middle, south and north bays of the 2-D model would exceed two miles at certain reservoir locations; the 2-D model assumes uniform parameters (i.e., velocity and temperature) throughout the width of the segment. Once it is recognized that a multi-dimensional model is needed, the geometry and complexity of the reservoir becomes the primary determinant in selecting the preferred model. In this case, Don Pedro reservoir has a complex structure, not only because of the presence of the old Don Pedro dam but also its unique shape. Further the Districts say that the 3-D model has the capability of modeling alternative future temperature management options that would increase the complexity of the reservoir, by specifying the model cells and vertical layers where the proposed structure would be located. Finally, the Districts say that the temperature of water releases for Don Pedro, under a full range of reservoir levels, is anticipated to be an important factor in the consideration of future operating scenarios.

Discussion

Water temperatures in Don Pedro reservoir have the potential to affect water temperatures in reaches of the Tuolumne River downstream of Don Pedro dam. The proposed reservoir temperature model would simulate the dynamics of the water temperature regime in Don Pedro reservoir and characterize the existing seasonal cold water storage volume. We support the Districts' choice of a 3-D temperature model based on the geometry and complex structure of Don Pedro reservoir, and the presence of the submerged Old Don Pedro dam (study criterion 6). We also support the Districts' plan to develop the model in a collaborative fashion along with all interested relicensing participants. The study plan states that the Districts would provide training and access to the 3-D model to all interested relicensing participants. The model will be installed on a server and relicensing participants would be allowed access to the model via the internet. While relicensing participants may not be familiar with this 3-D model, any perceived complexity would be dealt with through training for model users by the Districts.

Staff Recommendation

None.

Study W&AR-4-- Spawning Gravel Study Plan

Applicants' Proposed Study

The Districts' proposed spawning gravel study would examine gravel availability and spawning utilization as a means of determining the current spawning capacity and spawner/recruit relationships for Chinook salmon and *O. mykiss* in the Tuolumne River. Specific information obtained by this study will update information from prior studies in order to:

- characterize the current area, distribution, and use of spawning riffles in the lower Tuolumne River; and

- provide estimates of maximum spawning run sizes supported by the spawning riffles under current conditions.

The spawning gravel study would examine existing spawning gravel mapping and spawner count data in conjunction with updates to previous mapping efforts, followed by quantitative analysis of spawning use of the available areas to determine Chinook salmon spawning capacity in the lower Tuolumne River.

The study area includes the Tuolumne River from La Grange dam (RM 52) downstream to RM 29, which captures the majority of spawning activity documented in recent surveys.

In the revised study plan, the Districts amended their original proposed study to add the following study goal:

- develop average annual gravel transport rates from channel geometry and mapped changes in riffle areas in 1988 and 1999-2000.

The Districts also included new methodology to predict suitable spawning areas at other flows based upon the results of the ongoing Instream Flow Incremental Methodology (IFIM) study.

Comments on the Study

In its October 24, 2011 comments, NMFS stated that the proposed study plan did not include its request Element # 4 from its proposed study NMFS-5 *Request for Information or Study Effects of the Project and Related Facilities and Operations on Fluvial Processes and Channel Morphology for Anadromous Fish*. Specifically, NMFS requests a direct comparison of current spawning habitat data to habitat data collected between 1999 and 2001 as part of an existing study. In its revised study plan, the Districts indicated that it agreed with NMFS approach and included NMFS' requested historical spawning habitat comparison analysis into W&AR-4

The Districts also suggest that its revised methodology could be used to develop average sediment transport rates. In its December 7, 2011 comments, NMFS clarifies that its October 24, 2011 approach was not intended to produce sediment transport estimates. NMFS indicates that this approach would be unlikely to produce an estimate of sediment transport since the measured 2-D quantity would not provide the thickness or depth of change necessary to calculate a volumetric or mass flux necessary to calculate a sediment transport rates.

The Conservation Groups support the inclusion of NMFS' study Element 5 (quantify fine sediment storage in the lower Tuolumne River) and 7 (Develop coarse and fine sediment budgets for the lower Tuolumne River) from NMFS' requested NMFS-5 study. Additionally, the Conservation Groups indicate that the Districts' proposal to quantify existing available spawning habitat, limited to flows up to 300 cfs, will exclude existing potential spawning habitat at higher flows, both physically (along margins and floodplain terraces) and in terms of velocity and depth. The Conservation Groups request that the Districts evaluate flows of up to 500 cfs for fall-run Chinook and flows of up to 4,000 cfs for *O. mykiss*.

In its revised study plan, the Districts state that when combined with the results of the ongoing IFIM, its proposed study would define effects of flow levels on spawning habitat availability. However, the Districts disagree with the usefulness of examining *O. mykiss* spawning habitat at flows in excess of 4,000 cfs, as there is no evidence that such high flows do occur or could occur.

In its December 7, 2011 comments, NMFS states that in *Section 2, Collect New Data*, it is unclear why the Districts are proposing to delineate total riffle area and sediment texture *outside* of the low flow channel while not delineating riffle area and sediment texture *within* the low flow channel. NMFS requests clarification regarding this part of the proposed methodology. NMFS notes the Districts propose to compare habitat criteria developed through the ongoing IFIM study to those used in prior studies when

comparing results of this study to historical results of suitable spawning habitat. NMFS states that the Districts do not demonstrate or specify as to whether the existing (current) spawning habitat mapping will be done in a comparable fashion to facilitate direct comparison with previous spawning habitat surveys. NMFS further states, that if necessary, the Districts should add additional mapping layers to the existing spawning habitat mapping to be directly comparable to previous spawning habitat mapping efforts.

Finally, NMFS requests that all data related to riffle area, spawning habitat, and sediment transport calculations be provided to relicensing participants in tabular (spreadsheet) and geo-spatial (e.g. ArcGIS shapefiles) formats to allow relicensing participants to conduct individual analyses.

Discussion

We conclude that the modifications to study W&AR-4, recommended by NMFS and adopted by the Districts, should result in information that would effectively quantify available spawning habitat for anadromous fish in the lower Tuolumne River and provide information to describe changes to that habitat over time, thereby satisfying NMFS' study Element # 4. We agree with NMFS that the Districts' proposal to produce sediment transport rate estimates based upon changes in riffle areas presents conceptual difficulties, as such, an estimate would inherently involve a 2-D perspective, wherein typical estimates of sediment transport are described in 3-dimensional volume over time. We note that existing information from a previous study contains valid sediment transport rates for use in analyses (study criterion 4).

We agree with NMFS that the use of habitat mapping procedures identical to those previously performed would best facilitate comparison of results from the proposed study to those from existing studies. However, we disagree with the implication that the use of a different method would necessarily invalidate the comparison of results between studies. The Districts' study, as proposed, will provide results that will describe the difference in the current quantity and spatial position of spawning gravel habitat to that of surveys conducted in1988 and 1999-2001. As with any proposed study, we expect that any results be valid results and include an accompanying discussion of assumptions or uncertainty where appropriate. However, we conclude that in order for relicensing participants and others to best evaluate the validity of any comparisons made, the Districts disclose any differences between the methodology it proposes and the methodology of those studies which it proposes to perform comparative analyses (study criterion 6).

Given that one of the Districts' objectives of the proposed W&AR-4 study is to characterize the current area, distribution, and use of spawning riffles in the lower

Tuolumne River, we assume that the omission of language to delineate riffle area and sediment texture within the low flow channel is an oversight. However, to avoid confusion, modification of the language in the methodology to explicitly state that delineation of riffle area and sediment texture will occur within the low flow channel and outside the low flow channel to the approximate location encompassed by a 600 cfs flow is warranted.

As amended in the revised study plan, the Districts' proposed W&AR-4 study would provide for an evaluation of spawning habitat at a range of observed and modeled flows. However, an empirical evaluation of flows in excess of 4,000 cfs, as requested by the Conservation Groups, could result in potential flooding in downstream areas, and therefore is unadvisable. We note that the ongoing IFIM study should be able to model spawning habitat at such high flows (study criterion 6).

Finally, we agree with NMFS that providing relicensing participants with data would allow relicensing participants to perform individual analyses in order to critically evaluate the reported results from any study (study criterion 6).

Staff Recommendation

We recommend that the Districts omit its goal under section 3.0 *(Study Goals)* of the proposed W&AR-4 study, *develop average annual gravel transport rates from channel geometry and mapped changes in riffle areas since 1988 and 1999-2000*, and any methods pertaining to that goal.

We recommend that under section 5.3 (*Study Methods)* of the proposed W&AR-4 study, the Districts include a discussion in the study report of any differences between its proposed habitat mapping methodology and the methodology used in the studies proposed for comparison.

We recommend that the Districts modify language under step 2, section 5.3 of the proposed W&AR-4 study from:

> *Mapping will be performed using a combination of GPS and GIS of orthorectified aerial photographs to delineate total riffle area and sediment texture outside of the low flow channel and up the approximate location of the 600 cfs previously developed as a GIS layer…*

To read:

> *Mapping will be performed using a combination of GPS and GIS of orthorectified aerial photographs to delineate total riffle area and sediment*

*texture **from inside the low flow channel to** outside of the low flow channel and up the approximate location of the 600 cfs previously developed as a GIS layer…*

Finally, NMFS requests the inclusion of element Nos. 1, 5, and 7 from its NMFS-5 study request, and the Conservation Groups request the inclusion of element Nos. 5 and 7 from the NMFS-5 study request. We discuss NMFS' and the Conservation Groups' comments below under NMFS-5 *Request for Information or Study Effects of the Project and Related Facilities and Operations on Fluvial Processes and Channel Morphology for Anadromous Fish* and make further recommendations with regard to W&AR-4.

Studies W&AR-5, 6, & 10-- Salmonid Population Studies

The Districts propose to review and summarize existing information that is suitable to develop life-history based conceptual models of *Chinook salmon and O. mykiss*. The conceptual models would provide a foundation for the development of a quantitative study of *O. mykiss* and a quantitative model of Chinook salmon by describing how the populations function and the relative important sources of mortality for the population dynamics of each species in the lower Tuolumne River. Development of the model and study by the Districts involve three separate studies W&AR-5, 6, and 10, and we are considering all three studies together here, as they are interrelated.

Study W&AR-5-- Salmonid Population Information Integration and Synthesis

Applicants' Proposed Study

The Districts propose to summarize relevant available information regarding in-river and out-of-basin factors affecting Chinook salmon and *O. mykiss* production in the Tuolumne River. Objectives in meeting this goal include:

- collect and summarize available existing data on Chinook salmon and *O. mykiss* to characterize the watershed, project operations and issues affecting salmonid populations;

- develop hypotheses to understand potential impacts of contributing factors affecting salmonid populations; and

- inform and contribute to development/revision and parameterization of numerical in-river salmon population models.

The study would review and summarize existing information that is suitable to develop life-history based conceptual models of Chinook salmon and *O. mykiss*. Hypotheses about those in-river factors thought to be of greatest importance to salmonid population levels in the basin as well as the successful transitions from one-life stage to the next will be evaluated with existing data and literature. Workshops will be held with relicensing participants to discuss and review the information and data that will be used in the development of the models.

Specific data compiled from this study would be used in the development of both conceptual and quantitative in-river production models as part of interrelated relicensing studies, including the *Tuolumne River Chinook Salmon Population Model* (Study Plan W&AR-6) and the *O. mykiss Population Study* (Study Plan W&AR-10). The study area includes the Tuolumne River from the La Grange dam (RM 52) downstream to the confluence with the San Joaquin River (RM 0).

Again, the Districts propose several workshops with the relicensing participants to discuss and review the information and data that would be used in the development of the preliminary conceptual models and quantitative models regarding factors affecting in-river life-stages of Chinook salmon and *O. mykiss*.

Study W&AR-6-- Tuolumne River Chinook Salmon Population Model

Applicants' Proposed Study

The Districts also propose a Chinook salmon population model that would: (1) examine the relative influences of various factors on the life-stage specific production of Chinook salmon in the Tuolumne River; (2) identify critical life-stages that may represent a life-history "bottleneck;" and (3) compare relative changes in population size between alternative management scenarios. Specific information obtained by this study would be used to assess the extent to which the abundance of the Chinook salmon populations in the Tuolumne River is affected by in-river factors.

This new population model using a stock-production approach would rely upon existing literature and information, including previously conducted Tuolumne River studies, as well as interrelated relicensing studies in the development of both conceptual and quantitative population models to examine the relative importance of in-river factors affecting Chinook salmon production.

The study area includes the Tuolumne River from the La Grange dam (RM 52) downstream to the location of the rotary screw trap at Grayson River Ranch (RM 5) near the San Joaquin River confluence.

Study W&AR-10-- *Oncorhynchus mykiss* Population Study

Applicants' Proposed Study

Similar to W&AR-6, the Districts propose an *O. mykiss Population Study* that would: (1) examine the relative influences of various factors on the life-stage specific production of Chinook salmon in the Tuolumne River; (2) identify critical life-stages that may represent a life-history "bottleneck;" and (3) compare relative changes in population size between alternative management scenarios.

The Districts explain that, despite a growing body of monitoring data, little information is available regarding *O. mykiss* life-history and habitat use specific to the Tuolumne River. For this reason, the Districts note that there have been only limited attempts made to assess the relative importance of factors influencing the anadromous or resident forms of *O. mykiss* in the Tuolumne River. This study plan would rely upon existing literature and information, including previously conducted Tuolumne River studies, as well as interrelated relicensing studies in the development of both conceptual and possibly quantitative population models to examine the relative importance of factors affecting *O. mykiss* production and population levels.

The study area includes potential spawning and rearing habitat in the Tuolumne River from the La Grange dam (RM 52) downstream to Roberts Ferry Bridge (RM 39.5). The downstream extent of the study reach corresponds to the majority of *O. mykiss* observations documented in routine winter and summer *O. mykiss* surveys.

Comments on Studies W&AR-5, 6, and 10

CDFG says that the *Information and Integration Synthesis Study* (W&AR-5) does not include a path towards explaining the nexus between project operations and effects on Chinook salmon and *O. mykiss*. Instead, CDFG believes the plan proposes to assess out-of-basin habitat conditions, such as land use, water use and ocean conditions, and contributing factors unrelated to project operations. CDFG states that this study is not an adequate substitute for its recommended bioenergetics study (CDFG-5) and Chinook salmon survival studies (CDFG-6) which it believes will provide data and analyses necessary to identify project impacts and develop PM&E measures.

FWS also does not support a synthesis study like W&AR-5 that it believes is a data mining exercise which will attempt to explain inferences made from existing data sources from Tuolumne River monitoring activities. Also, it says it is unclear how the results of a synthesis will inform license conditions. Instead, FWS recommends the

Districts develop studies that evaluate biological or ecological response to water quality and quantity variables associated with project operations.

NMFS[9] states that it welcomes the concept of workshops as proposed by the Districts to discuss and review preliminary conceptual models, before refining them. NMFS says that it appears this study would identify factors to integrate into the Chinook salmon and *O. mykiss* models, but it believes the Districts need to provide more details of the methods for accomplishing that end. NMFS states that an assessment of project effects on Chinook salmon and *O. mykiss* populations in the context of factors outside the influence of the project, will require synthesis by incorporation into a model, as requested by its recommended study, NMFS-8, Salmon and Steelhead Full Life-Cycle models. NMFS notes that the Districts intend to rely on information available from previously conducted studies and ongoing data collection, and monitoring activities. NMFS points to statements in previous Commission orders on the existing license where staff concluded data were insufficient to reach any valid conclusions about effects of modified flow release and restoration efforts on fish resources in the lower Tuolumne River because monitoring efforts were improperly designed or executed. The Districts state that a full life-cycle model would have to address factors affecting out-of-basin life stages and due to issues of scale, would not allow discrimination of out-of-basin factors from in-basin factors for the purposes of informing future license requirements. The Districts also say that the workshops held to discuss and review the information and data used in the development of the preliminary conceptual models would document the most appropriate data for inclusion in W&AR-6 and W&AR-10.

With regard to all of the Districts' proposed modeling, the Conservation Groups are concerned that factors in the lower Tuolumne River influenced by instream flow will not be given sufficient weight when the models are developed. They recommend that during model development, causal mechanisms are established by which higher flows in the Tuolumne River improve juvenile migration and ultimately escapement. They state that the models must incorporate flow and evaluate the relative importance of other factors at differing flows. For example, the Conservation Groups state that mapping redds under the existing flow regime as part of W&AR-8 (Salmonid Redd Mapping Study) may not capture the carrying capacity of the Tuolumne River for redds at higher flows.

Concerning development of the models, the Conservation Groups say the process requires additional specificity regarding organization, collaboration, transparency, and peer review. The Conservation Groups recommend the Districts adopt guidelines from the Independent Workshop Panel's Report for Delta Science Program, June 14, 2011,

[9] NMFS filed an alternative study request, NMFS-8, and these comments are considered in that context.

Salmonid Integrated Life Cycle Models Workshop: Recommendations About Salmonid Life-Cycle Models:

- a standard glossary should be prepared and updated periodically;
- presentations and written documentation should be prepared and tailored to the audience;
- a peer review panel should be established to provide periodic feedback and advice;
- development of the new model should proceed as a series of iterative steps from the questions to the formulation of the new model;
- a transparent strategy that uses available data should be developed for calibration and validation; and
- a parallel effort of data synthesis should be started with the initiation of the modeling effort.

Concerning data inputs for the life-cycle models, the Conservation Groups say that the studies proposed by the resource agencies, including bioenergetics, salmon health, age and growth of *O. mykiss*, Chinook salmon egg viability, and Chinook salmon survival, would provide more site-specific, up-to-date information to populate these models.

Except for growth of *O. mykiss*, the Districts say that the comparable results of the studies requested by relicensing participants are either already available in the existing information or are not necessary to inform the models. The Districts believe that the Integrated Licensing Process (ILP) timeframe does not allow sufficient time for establishment of a scientific peer review panel, nor is one necessary.

CDFG notes that the Districts' proposed data inputs for the Chinook salmon model (W&AR-6) are not adequate and should include: (1) key component of non-fry juveniles to adult recruitment; (2) acknowledgement of the nexus of fry abundance to parr/smolt abundance (3) acknowledgement of the importance of both winter and spring flow level to fry abundance and hence both parr and smolt abundance; (4) acknowledgement of statistically significant relationship in lower Tuolumne River between flow and smolt survival; and (5) an accounting of the relationship between juvenile out-migration (fry, parr, and smolt) patterns and adult recruitment. Both CDFG and NMFS state that in-depth consultation with the resource agencies is a prerequisite in order to develop a

credible model sufficient to inform licensing. Given the missing data inputs, CDFG believes such consultation would require significant time and resource commitments from the Districts, interested resource agencies, and Commission staff.

FWS states that the Chinook salmon model needs to consider project effects on habitat availability and production of in-river life stages of Chinook salmon and it will provide specific comments on study plan during consultation and the collaborative workshop. FWS states they do not support the *O. mykiss* model as proposed because it is unclear how the results of a conceptual model will inform license conditions. FWS believes a model should identify potential density dependent and density independent factors affecting each in-river life stage of *O. mykiss* in the Tuolumne River. FWS recommends that the Districts' plan be modified to incorporate FWS-2 *Age and Growth Study of O. mykiss*, so accurate age and growth parameters are used in the production model. As part of the revised study plan, the Districts now propose to develop *O. mykiss* age and growth information as part of its draft W&AR-20 (*Draft Oncorhynchus mykiss Scale Collection and Age Determination Study*).

NMFS states that the Districts' proposed study area for the Chinook salmon model from La Grange dam to the confluence of the San Joaquin River is not adequate, as NMFS' study, NMFS-8, (*Request for Information or Study Salmon and Steelhead Full Life-Cycle Population Models to Assess the Effects of the Project and related Activities*) asks for a full life-cycle model to assess factors outside of the Tuolumne River, including the delta and ocean, as well as in-river influences. Without a broad evaluation, NMFS believes that assertions that Tuolumne River anadromous fish populations are most strongly influenced by factors outside of the Tuolumne River are likely to continue to be inadequately supported. NMFS states that the Chinook model study plan does not address smolts. NMFS supports use of information from several of the Districts' proposed studies including assessment of water temperature, spawning gravel, redd mapping, *O. mykiss* habitat study, and predation study. NMFS suggests more detail should be included in the plan on the process for model development and how information will be incorporated into the model. NMFS requests that the Districts make available sufficient information (on electronic media) that can be distributed for review prior to and during workshops.

The Districts state that the proposed modeling approach focuses upon ecologically relevant in-river factors affecting juvenile production of Chinook salmon and *O. mykiss*. The Districts believe that the inclusion of two modeling workshops with the relicensing participants would provide an open and transparent process allowing for examination and testing of alternative assumptions regarding the relative importance of in-river factors affecting Chinook salmon and *O. mykiss* production.

Discussion on W&AR-5, 6, and 10

We do not agree with the resource agency comments that the Districts models would not inform license conditions. Overall, the Districts propose to develop population models for Chinook salmon and *O. mykiss* in the lower Tuolumne River to evaluate limiting factors and identify project-related effects that would in fact, ultimately inform license conditions (study criterion 5). First however, conceptual models would be developed for each species using existing data from the long-term fisheries monitoring program conducted on the Tuolumne River and using newly acquired data from the study plans W&AR-1, 2, 3, 4, 7, 8, 11, 12, 16, and 20. The objective of the conceptual models is to provide a foundation for the quantitative models by describing how the populations function and the relative important sources of mortality for the population dynamics of each species. The conceptual model effort would provide an extensive analysis of life histories of Tuolumne River salmonids including those periods outside the river in limiting salmonid populations.

The proposed population model W&AR-6 and study W&AR-10 would follow the stock-production approach to population modeling to determine in-river factors affecting life-stages of both populations, rather than the approach requested by NMFS-8 for *Full Life-Cycle Models*, which would also include out-of-basin factors. We support the Districts' proposal to develop pertinent information concerning out-of-basin factors affecting Tuolumne River salmonids in the conceptual model, as that information would in part inform an effects analysis of out-of-basin factors for anadromous fish in the lower Tuolumne River. The objective for the quantitative models is to identify critical in-river life stages affected by the project and then allow an evaluation of appropriate PM&E's to inform license conditions. The model objective is not to predict the precise population size of any particular life-stage, as in a life-cycle model, but rather identify all in-river life stages affected by the project and then allow an evaluation of appropriate PM&E's.

Concerning data input to the models, we support consideration of the recommendations made by the CDFG, FWS, and the Conservation Groups. Selection of model parameters during workshops would be influenced by the detail and complexity of existing data and newly collected data that inform biological and biological-physical interactions. As proposed by the Districts, the conceptual models would provide a narrative description of the potential density-dependent and density-independent factors affecting each in-river life stage of Chinook salmon and *O. mykiss*. At a minimum, we support consideration of model parameters that address the association between flows, water temperature, changing habitat conditions, predation, and the population response for specific in-river life-stages including smolts for existing conditions and for potential future conditions in both the conceptual models and in the quantitative model and study. However, as proposed by the Districts, the model parameters would be selected

collaboratively along with the relicensing participants in several workshops. Collaboratively selecting the most appropriate data in W&AR-5 along with relicensing participants for inclusion in W&AR-6 and W&AR-10 would address NMFS concerns regarding data insufficient to reach any valid conclusions and would allow consideration at the model inputs suggested by CDFG and FWS (study criterion 6).

We agree with the resource agencies and the Conservation Groups that an efficient structure and process for consultation during model development as proposed by the Districts, is a prerequisite for developing credible models sufficient to inform licensing conditions. While there is merit in most aspects of the Conservation Groups recommendation to adopt guidelines for an adequate model development process from the June 2011 Salmonid Integrated Life Cycle Model Workshop, for such a process to be effective, it should be discussed and developed between the Districts and relicensing participants in an initial model development meeting, to include an agreement describing how interested participants and the Districts would achieve consensus. The Districts' proposed workshop concept is designed to provide an open and transparent process for participation by relicensing participants in model development. We recommend that the Districts make available sufficient information (on electronic media) that can be distributed for review prior to and during workshops. We also recommend that the Districts allow additional workshops if the relicensing participants determine more collaboration is necessary for adequate model development (study criterion 6). However, we agree with the Districts that establishment of a scientific review panel and any associated cost is not necessary, as participation by experienced biologists from NMFS, FWS, CDFG, the Conservation Groups, and Commission staff would ensure a rigorous scientific review (study criterion 7).

Staff Recommendation on W&AR-5, 6, and 10

We recommend studies W&AR-5 *Salmonid Populations Information Integration and Synthesis*, W&AR-6 *Tuolumne River Chinook Salmon Population Model*, and W&AR-10 *Oncorhynchus mykiss Populations Model* be modified to include: (1) consideration of model parameters that address the association between flows, water temperature, changing habitat conditions, predation, and the population response for specific in-river life-stages including smolts for existing conditions and for potential future conditions in both the conceptual models and in the quantitative model and study; (2) hold initial model development meeting(s) to discuss and establish an efficient structure for consultation during model development; (3) except for a peer review panel, adopt guidelines similar to the June 2011 Salmonid Integrated Life Cycle Model Workshop; (4) include an agreement describing how interested participants and the Districts would achieve consensus on all issues' (5) make available sufficient information (on electronic media) that can be distributed for review prior to and during workshops;

and (6) allow additional workshops if more collaboration is necessary for adequate model development.

Study W&AR-7-- Predation Study

Applicants' Proposed Study

The Districts propose a predation study that would provide information to increase understanding of the current effects of predation on rearing and outmigrating juvenile Chinook salmon and *O. mykiss* in the lower Tuolumne River. Specific information obtained by this study will update and supplement information from prior studies in order to:

- estimate relative abundance of predator fish species using typical sampling techniques for in-channel habitats (riffle, pool, and run) such as largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), Sacramento pikeminnow (*Ptychocheilus grandis*), and striped bass (*Morone saxitalius*);

- update estimates of predation rate using predation rate surveys (stomach content sampling during Chinook salmon outmigration) from previous surveys (e.g., TID/MID 1992); and

- determine relative habitat use by juvenile Chinook salmon and predator species with acoustic tag tracking at three study flows (less than 300 cfs, greater than 300 cfs, and greater than 2,000 cfs) and flow-related parameters (velocity, depth, temperature, and turbidity) encountered during the juvenile salmonid outmigration period.

The study area would include the Tuolumne River from the La Grange dam (RM 52) downstream to the confluence with the San Joaquin River (RM 0). As the majority of predators in the lower Tuolumne River are non-native and are most abundant downstream of approximately RM 31, predation study sites may be concentrated in this downstream reach.

Comments on the Study

The Water Board filed an alternative study request, WB-5, and these comments are considered in that context.

CDFG stated that its requested studies (CDFG-5 and -6) and FWS-4 focus on determining the feasibility of using license conditions to improve survival of out-migrant

salmonids by assessing the relationship of survival and predation. CDFG suggests radio tagging juvenile salmonids and tracking their responses during outmigration to variations in water quality and quantity. CDFG says the Districts' predation study plan instead focuses on estimating predator abundance, predation rate, and predator movement in response to changes in water temperature and velocity. CDFG notes that the first two objectives do not have a project nexus and will not inform licensing requirements, and the third objective appears reasonable and begins to address mitigation measures. CDFG suggests that the District should consider adopting the FWS' FWS-4 requested study of juvenile survival and expand the range of test flows to include floodplain inundation and water temperatures.

FWS says the Districts' predation plan only evaluates the relative predator abundance, potential predation rate, and relative habitat use by juvenile Chinook salmon and predator species at typical flows encountered during the juvenile outmigration period. Even though the Districts have incorporated some of the study elements from FWS-4 *Juvenile Chinook Salmon Survival* study into their predation study, FWS states that it is still unclear how the Districts will develop Chinook salmon smolt survival rates, identify areas of mortality, and relate them to habitat conditions. FWS notes that the Districts' sample size for acoustic tags is too small to be statistically and scientifically robust. FWS also recommends that scales be collected from predators to determine age of the fish and assess year-class spawning success of various predator species.

NMFS states that the plan calls for up to 225 hatchery-reared Chinook salmon to be fitted with acoustic tags but the size of the Chinook salmon to be tracked is not clear. NMFS says the purpose of the additional 600 hatchery reared fish of the same size to be released with the tagged fish is also not clear.

The Conservation Groups say that the Districts' predation study is focused on a predetermined theory that predation is a major limiting factor on salmonid survival, and in particular of salmon smolts. The Conservation Groups have significant concerns that the statistical methods will not yield defensible results given: (1) limited amount of sampling; (2) extrapolation to non-sampled areas in a river with substantial channel diversity and the irregularity of extensive gravel mining pits; (3) potential limited ability to electrofish; (4) seasonal differences in predator behavior and location if electrofishing is allowed only in summer; (5) high variability in number of juvenile fish from year to year; and (6) limited number of fish that will be included in the tracking element of the study.

The Conservation Groups also recommend that a third of the salmon fitted with tracking devices and a third of the coded-wire tagged salmon be released at a floodplain flow of 4,000 cfs. This additional tracking would provide a sense of the ability of high

flows to improve success in avoiding predation and will also provide important information concerning general patterns of juvenile salmon movement during floodplain inundation. They recommend the number of fish tracked be increased to 200 per year as in the FWS-4 study and that 800 juvenile salmon per year be coded-wire tagged and then released in a manner specified in the predation study or consistent with the mark/recapture element of the Districts' proposed Chinook salmon fry study.

The Districts suggest that additional study at 4,000 cfs is unnecessary as it is well documented that with floodplain inundation, there is less interaction between predator and prey, which results in reduced predation. In response to the Conservation Groups and FWS comments regarding sample size, the Districts increased the number of salmon smolts that would be tagged and monitored as noted below.

Discussion

The Districts propose to assess the potential effects of both project operations and predation on survival of juvenile Chinook salmon and *O. mykiss* in the lower Tuolumne River. Contrary to CDFG's opinion, the predation study would inform licensing requirements by examining habitat-specific predator density, predation rate, and the relative changes in predator and juvenile salmon distribution in response to river flow as influenced by project operations and other factors (study criterion 5). Results from previous survival studies in the lower Tuolumne River show the majority of in-river mortality to juveniles occurs in the mining pit reach and in the sand-bedded reach. We disagree with the Conservation Groups that predation is not a potential major limiting factor for juvenile salmonids in the lower Tuolumne River. Existing information indicates that both water temperature related effects and predation appear to be the main sources of juvenile mortality. This behavioral study would provide useful information on predation, and predator prey movement within specific habitat types at flows less than bank-full during the juvenile rearing and outmigration period, informing potential PM&E's related to flow, habitat enhancement, or predator reduction strategies (study criterion 5).

Existing behavioral information on predator/prey interaction at floodplain flows is adequate (study criterion 4). In study plan meetings, the Districts suggested that results of previous tracking studies indicate, in general, flows which create floodplain inundation in pool habitats result in less predation. Effectively, floodplain flows spread juveniles and smolts over a larger area. The Districts pointed to results of a study conducted for the Tuolumne River Trust in the lower Tuolumne River at Big Bend that showed fry and smolts were both present in the floodplain areas but smolts remained closer to the main channel near velocity breaks while the predators moved further into the floodplain near vegetation.

Instead of studying the known benefits of floodplain flows, as suggested by the Conservation Groups, the District' predation study proposes to evaluate predator prey interaction at lower flows that do not create floodplain inundation. Their proposed upper flow limit for the study would create bank-full flow prior to floodplain inundation for pool habitats. We agree with the Districts' decision to increase the number of salmon smolts that would be tagged and monitored, as requested by FWS. This improved methodology would include 10 to 20 predator fish captured and acoustically tagged from each study site and three groups of 50 to 75 juveniles acoustically tagged and released with an additional 200 hatchery reared juvenile fish, as requested by FWS to promote natural schooling behavior (study criterion 6).

Concerning NMFS' comment regarding the size of fish for acoustic tags, we recommend similar size criteria that was used for other acoustic studies of juvenile salmon conducted in the delta; with a goal to ensure the ratio of tag to fish weight is less than 5 percent (study criterion 6). Because the size of fish tagged will depend upon the size of available juveniles for tagging, the Districts should make a concerted effort to attain the 5 percent weight goal, and, if this cannot be attained, provide a rationale as to why it was not met. We recommend that the additional hatchery reared fish be coded-wire-tagged as requested by FWS, to provide some additional information on migration movements of those tagged fish (study criterion 6). The additional cost would be minimal and it is likely the hatchery reared fish would be coded-wire-tagged as a matter of practice by the hatchery personnel, according to FWS (study criterion 7). We also agree with the Districts' decision not to collect scales from predator fish, as the proposed method of using length measurements as an indicator of age and size relevant to piscivory will be sufficient (study criterion 6). For predator abundance, the technique proposed by the Districts to expand the sampled portions of the Tuolumne River to unsampled portions, using a ratio-type, two-phase regression estimator, is appropriate methodology (study criterion 6).

As agreed to by the Districts and relicensing participants, additional analysis may be needed to quantify the relationship of flow to floodplain inundation in the lower Tuolumne River, to better understand how floodplain inundation influences predation of juvenile salmonids. Based on comments made during study plan meetings, we understand FWS is participating in a GIS study that relates floodplain inundation with flows up to 8,400 cfs in the lower Tuolumne River, which will be completed in spring 2012. If the results of the predation study and the FWS study suggest that a second year of study may be needed, the Districts should propose such a study in its initial study report or explain why such a study is not needed.

Staff Recommendation

We recommend study W&AR-7 be modified to include the following provisions: (1) a goal to ensure the ratio of tag to fish weight is less than five percent. Because the size of fish tagged will depend upon the size of available juveniles for tagging, the Districts should make a concerted effort to attain the 5 percent weight goal, and if this cannot be attained, provide a rationale as to why it was not met; (2) any additional hatchery reared fish should be coded-wire-tagged, and (3) if the results of the predation study and the FWS's GIS floodplain inundation study suggest that a second year of study may be needed, the Districts should propose such a study in its initial study report or explain why such a study is not needed.

Study W&AR-8-- Salmonid Redd Mapping

Applicants' Proposed Study

The Districts propose a salmonid redd mapping study that would document the spatial distribution of Chinook salmon and *O. mykiss* redds and redd superimposition as a means of quantifying the current spawning capacity and redd/recruit relationships of the Tuolumne River. Specific information obtained by this study would:

- identify locations of Chinook salmon and *O. mykiss* spawning redds;
- document redd superimposition at current spawning population levels;
- model whether redd superimposition is currently limiting salmon production; and
- compare redd counts and densities at recent gravel augmentation sites and nearby control sites.

The salmonid redd mapping study would also update prior Chinook salmon redd mapping data with current redd mapping to document Chinook salmon and *O. mykiss* redd construction distribution patterns and any redd superimposition that may be occurring. The study approach would be based on actual field observation.

The study area would include the Tuolumne River from the La Grange dam (RM 52) downstream to RM 29, which captures Chinook salmon spawning activity in riffles documented in recent annual spawner surveys conducted by CDFG.

Comments on the Study

The Conservation Groups request that the study methodology require surveyors to catalogue the flow during surveys.

The Water Board states that plan would only quantify the *current* spawning capacity and redd/recruit relationships of the Tuolumne River. Therefore, the Water Board requests that this study should also assess how the system will respond to different flow schedules and evaluate how salmonid redd distribution and superimposition would be affected by changes in flow and gravel availability.

The Districts state that, although the Water Board's and the Conservation Groups' comments regarding the need to assess the effects of gravel availability and flow upon redd distribution were not specifically adopted, they believe that the study plan and the revisions to the *Spawning Gravel Study* (W&AR-4) are responsive to this information need. The Districts indicate that as designed, the redd mapping study would evaluate changes in river-wide redd distribution with time, as well as assessing available data from recent redd mapping activities conducted in the past several years. In addition to the 1-2 years of data collection included in this study plan, assessment of the effects of flow levels on redd distribution would be supplemented by historical survey results and the year-to-year flow variations that correspond to the applicable project flow schedules.

NMFS recommends that IFIM model predictions of redd locations be checked against the observations of this mapping study.

Discussion

Continued operation and maintenance of the project could affect the supply and recruitment of spawning-sized gravel in the lower Tuolumne River, thereby potentially affecting spawning gravel availability and redd distribution of Chinook salmon (study criterion 5).

We agree with the Conservation Groups that the collection of flow data during redd surveys would aid in the analysis of redd distribution as it relates to changes in flow. Such an addition to the proposed methodology would not result in significant increases in effort or cost (study criterion 7).

While the Districts state that changes to the W&AR-4 study are responsive to Water Board's and the Conservation Groups' information request, we note that the Districts do not specifically propose to synthesize the information from the proposed W&AR-4, W&AR-8, and ongoing IFIM studies. The Districts modified their W&AR-4

study to provide for estimates of changes suitable spawning area at other flows, in conjunction with the ongoing IFIM study. Furthermore, our recommended modifications to the W&AR-4 study noted earlier would provide information regarding coarse and fine sediment availability and mobility in the lower Tuolumne River, thereby also providing information regarding the potential project effects upon spawning substrate availability and mobility. We conclude that, overall, there should be enough information available for the Districts to produce a synthesized description of the effects of gravel availability and flows upon redd distribution and superimposition, as requested by the Water Board and the Conservation Groups. This information would be important to help determine the scope, necessity, and magnitude of any potential license conditions (study criterion 5).

Staff Recommendation

We recommend that the Districts modify their W&AR-8 study to include the collection of flow data during redd surveys.

We recommend that the Districts modify their W&AR-8 study to provide for an assessment of gravel availability and flow upon redd distribution and superimposition, using a synthesized analysis of results from proposed and staff-recommended modifications to proposed studies.

Study W&AR-9-- Chinook Salmon Fry Movement Study Plan

Applicants' Proposed Study

The Districts' *Chinook Salmon Fry Movement* study would examine the influence of flow modifications on emigration of fry from the lower Tuolumne River during the early stages of fry rearing. The Districts say that surveys of fry emigration and distribution indicate that fry survival to emigration in the Tuolumne River may be reduced, especially during below normal water years. The abundance of fry estimated to leave the river and the proportion of fry to larger juvenile emigrants varies relative to those conditions observed in other Central Valley streams where Chinook salmon adult escapement estimates are substantially higher. Specific information obtained by this study will update information from prior studies in order to:

- evaluate the opportunity to induce fry emigration by altering flows; and

- evaluate the potential benefits and risks of inducing fry to emigrate early in the rearing period potentially within "dry and critically dry" water years.

The study area would include the Tuolumne River from the upper rotary screw trap (RST) location at RM 29.8) to the existing downstream RST location at RM 5.2.

Comments on the Study

CDFG states that this is not a particularly informative study because there is no benefit to compel fry to leave the Tuolumne River in February compared to those that remain in the lower Tuolumne River until late March or early April. CDFG notes that timing of smolt migration depends upon the physiological state of the fish as well as environmental cues like hydrology and photoperiod. It suggests that, instead of seeking to make juvenile salmonids adapt to project operations, that the Districts should be looking at ways to adapt project operations to native salmonid life histories. CDFG says that the study should be modified to address a much broader and later time period to include further evaluation of how winter and spring flow levels contribute to fry abundance and development of fry into parr and smolt junvenile life histories. Absent such a modification, the study should not be conducted.

FWS states that conditions in the lower Tuolumne River, San Joaquin River, and the delta have changed so dramatically over the years due to land and water development projects that fry survival is very low. They point to preliminary results of a fry study in the Stanislaus River that shows poor survival of fry rearing in the San Joaquin River and the delta. FWS states that Study W&AR-11 *Chinook Otolith* will provide the necessary information to evaluate project effects on fry survival that rear in the delta and is more cost effective than the proposed Chinook Salmon Fry Study.

NMFS says the study plan needs to consider in-river development of fry to larger sizes, with smoltification occurring in the lower Tuolumne River. NMFS notes that Tuolumne River data shows emigration of fall Chinook juveniles extends into June.

The Water Board states that the study only examines benefits and costs of artificially inducing fry to emigrate early, and the Districts should evaluate the effects of artificially increasing flows on amphibians, benthic invertebrates, and other stream dependent resources.

The Conservation Groups say that the proposed study only collects evidence of a single theory; that in dry years the opportunity to successfully emigrate to and rear in the Delta is limited to Chinook salmon fry early in the season. The Conservation Groups request that flow manipulations, to encourage emigration of juvenile Chinook salmon in the late March through mid-April, be included in the study, in addition to the proposed timeframe of February through early March, as proposed by the Districts. They also recommend a range of flow manipulations be evaluated including rapid and gradual flow

increases of substantial magnitude, immediately followed by rapid and gradual flow decreases. The Conservation Groups also suggest increasing the sample size of marked fish to 800 per flow manipulation period, and renaming the study to Conservation Groups Chinook Salmon Flow Manipulation and Emigration. The Conservation Groups believe that flow management during the March-April timeframe may prove more beneficial than the Vernalis Adaptive Management experimental pulse flows that were released in the late April-May timeframe in past years to support emigration of juvenile Chinook salmon from the San Joaquin River.

The Districts continue to believe that flow manipulations that encourage fry to emigrate early from the lower Tuolumne River in dry years may increase their overall survival potential. The Districts recognize the concept that survival potential may increase with size and that the longer fish rear in the Tuolumne River, the larger they grow, and that the Vernalis Adaptive Management experiments appear to show that pulse flows in late spring did not demonstrably increase survival of juvenile Chinook salmon through the Delta. The Districts say that the Conservation Groups proposal is an entirely new request that would examine a different concept altogether than theirs.

Discussion

The Districts' proposed *Chinook Salmon Fry Movement Study* (W&AR-9) would examine the influence of flow manipulation on movements of fry from the lower Tuolumne River downstream to the San Joaquin River at the Delta during the early stages of fry rearing. The resource agencies and the Conservation Groups disagree with that basic concept, citing preliminary results from the Stanislaus River that show poor survival of fry in the San Joaquin River and the delta.

The Districts' proposed study is not an evaluation of project effects per se, but an evaluation of a dry-year PM&E measure to manipulate flows in February and early March and monitor the response of fry to move downstream. Also, the study does not propose to evaluate if such early movement of fry would improve their overall in-river survival. The Conservation Groups recommend evaluation of a similar but additional PM&E measure to manipulate flows in March and April and conduct an additional fry movement study. Therefore, both the Districts' proposed study and the Conservation Groups' requested modification to the study are premature evaluations of PM&E measures that do not address the nexus between project operations and effects (study criterion 5). We note that the Districts' proposed W&AR-11 *Chinook Salmon Otolith Study* will provide information to describe the relative historical contribution of fry and smolts to subsequent Chinook salmon escapement in the Tuolumne River. The results of W&AR-11 may be more useful in providing insight for considering the timing of appropriate pulse flow-related future PM&E measures for Chinook salmon outmigration.

Staff Recommendation

We do not recommend that the Districts conduct the W&AR-9 *Chinook Salmon Fry Movement Study*

Study W&AR-12-- *Oncorhynchus mykiss* Habitat Survey

Applicants' Proposed Study

The Districts proposed study would provide information on habitat distribution, abundance and quality in the lower Tuolumne River with a focus on habitat complexity related to large woody debris (LWD). An inventory of habitat quality and availability and use by salmonids, primarily juvenile *O. mykiss,* would be used to inform the evaluation of in-river factors that may affect the quantity and quality of habitat available for juveniles.

The study would rely upon existing broader habitat mapping to identify focal research areas where *O. mykiss* occur and then utilize a high-resolution CDFG habitat typing methodology to further characterize and evaluate these areas. CDFG identified four levels of typing, ranging from general broad habitat ID (Level I) to more detailed characterizations entailing 24 different potential habitat descriptors, (Level IV). This study would utilize the highest detail, which would allow for a strongly supported assessment of habitat for *O. mykiss* and other fish species.

A one-year habitat assessment would be conducted in the salmonid spawning and rearing reach below La Grange dam (RM 54) to RM 39 near Waterford.

Comments on the Study

In the proposed study plan, the Districts' proposed to count LWD at select habitat units under the proposed study. In its October 24, 2011 comments, NMFS[1] notes that the survey proposed by the Districts in its proposed study plan did not constitute a comprehensive LWD inventory in the lower Tuolumne River (as requested by NMFS-5 study Element # 6). Specifically NMFS stated that the study reach length proposed by the Districts (~150 meters) is not adequate to sufficiently sample LWD. NMFS noted that commonly accepted scientific protocol calls for a LWD sample reach to be approximately 20 times the bankfull width of the channel, where channel widths of the lower Tuolumne are often 40 to 60 meters. Additionally NMFS stated that the methodology proposed by the Districts is inadequate because the Districts only proposed

[1] NMFS filed an alternative study request, NMFS-5, and these comments are considered in that context.

to sample one diameter class and two length classes, therefore providing information that would not properly represent LWD in the study reaches.

In response to NMFS' comment, the Districts now state they will modify the proposed study to provide more detailed surveys of LWD within the study reach from RM 24 to La Grange dam, using methods "similar to those reported by Gerstein (2005), Moore et al. (2006), and Montgomery (2008)." Specifically, the Districts indicate that the amended survey will include an accounting of LWD, including size category, complexity, habitat association, and location.

In its December 7, 2011 comments, however, NMFS indicates that the amended methodology for the W&AR-12 study, proposed by the Districts is vague. Specifically, NMFS states that it interprets the Districts' modified methodology as providing two levels of LWD quantification in the lower Tuolumne River: (1) a focused, detailed assessment of LWD function at specific habitat assessment units (on average 150-meters-long); and (2) a more generalized reconnaissance level inventory of LWD loading in the lower Tuolumne River between RM 54 and 24 (believed to be the "LWD Distribution Survey" described by the Districts). However, NMFS notes that it is not clear as to whether the survey will be a complete census of the entire channel length or simply cover portions of the channel between RM 54 and 24. Regarding the Districts proposal to utilize methods "similar to those reported by Gerstein (2005), Moore et al. (2006), and Montgomery (2008)," NMFS indicates that the Districts do not specifically indicate which methods are being adopted, or where methods differ between the references. NMFS also notes that, while the proposed LWD distribution survey methods state that existing aerial photography and habitat mapping will be used in combination with field work, it is unclear which source of information will be used to measure LWD.

In its comments, the Conservation Groups state that as proposed, the W&AR-12 study contained in the proposed study plan would not satisfy their information request. Specifically, the Conservation Groups indicate that review of existing information, historical records, and data from the Tuolumne and other Central Valley rivers is needed to assist in determining the desired condition for LWD, as it pertains to potential mitigation or enhancement measures. The Conservation Groups indicate that inclusion of NMFS' study elements 2 and 6 from its NMFS-5 study request would result in the required information. The Conservation Groups further request to extend the scope of the W&AR-12 study 13 additional river miles downstream from its currently proposed terminus at RM 24 (to RM 11). The Conservation Groups indicate that because juvenile salmon emigrate in the lower reaches of the Tuolumne, the additional sampling area is justified.

In response to the Conservation Groups, the Districts indicate that the extension of the scope of the proposed study to RM 11 is not warranted, as there has been no evidence of *O. mykiss* use in the lower reaches of the Tuolumne, known as the sand-bedded reach.

Finally, in its December 7, 2011 comments, NMFS requests that all LWD survey data (both focused and distribution survey) and all other habitat unit data proposed to be collected in W&AR-12 be provided to relicensing participants in tabular (spreadsheet) and geo-spatial (e.g., ArcGIS shapefiles) formats.

Discussion

We agree with NMFS that the LWD survey methodology proposed by the Districts in its proposed study plan would only provide information that would be descriptive in nature, and would not be rigorous enough to produce valid scientific inferences as to LWD loading and distribution in the lower Tuolumne River (study criterion 6). In the revised study plan, the Districts propose what is presumably a more rigorous LWD survey methodology "similar to those reported by Gerstein (2005), Moore et al. (2006), and Montgomery (2008)." Although the Districts provide references to studies of which they intend to adapt methodology, the Districts fail to explicitly describe exactly how the proposed LWD survey would be implemented similar to those reported studies, how it proposes to incorporate aerial photography and habitat mapping techniques, or provide any specificity regarding its proposed methodology. Without this information, it is impossible to determine whether the Districts' proposed methodology conforms to generally accepted scientific practice, as required by study criterion 6, or whether its proposed methods would produce results that would allow for valid comparisons between studies. We agree with NMFS that a sampling reach length of 20 times the bank-full channel width is generally accepted scientific practice when sampling stream habitat variables. Therefore, to ensure that LWD surveys conform to generally accepted scientific practice (study criterion 6), and produce information suitable to provide reliable inferences regarding the loading of LWD and distribution in the lower Tuolumne, any survey conducted should conform to guidelines specified by NMFS in its June, 2011 study request # 5, Element # 6.

We also agree with NMFS that providing relicensing participants with data would allow relicensing participants to perform individual analyses in order to critically evaluate the reported results from any study.

Staff Recommendation

We recommend that the Districts amend the methodology in its proposed W&AR-12 study to include provision for field-based surveys of LWD in study sites where the sampling reach length is at least 20 times the bankfull channel width. Specifically, we recommend that any LWD survey methodology conforms to guidelines specified by NMFS in its June, 2011 study request # 5, Element # 6.

We recommend that the Districts amend the methodology in its proposed W&AR-12 study to specify how it intends to incorporate aerial photography and habitat mapping techniques with field-based surveys of LWD.

We recommend that the Districts modify section 8.0 (*Deliverables)* to include all LWD survey data (both focused and distribution survey) and all other habitat unit data proposed to be collected in W&AR-12 in tabular (spreadsheet) and geo-spatial (e.g., ArcGIS shapefiles) formats.

Finally, we recommend that after incorporating the above recommended modifications, the Districts file a revised W&AR-12 study within 90 days of the issuance of this determination for Commission approval. The revised study should include comments from NMFS, CDFG, and the Water Board.

We discuss LWD surveys further under NMFS-5 *Request for Information or Study Effects of the Project and Related Facilities and Operations on Fluvial Processes and Channel Morphology for Anadromous Fish* and make further recommendations with respect to W&AR-12 in that section.

Study W&AR-13-- Fish Assemblage and Population Between Don Pedro Dam and La Grange Dam

Applicants' Proposed Study

The Districts propose a study that would characterize the fish assemblage and populations of the Tuolumne River between Don Pedro dam and La Grange dam. The objectives of the study are to: (1) characterize fish species composition, relative abundance (e.g., catch per unit effort [CPUE]), and size length and weight) between Don Pedro dam and La Grange dam; (2) characterize the functional habitat in the reach as either riverine or lacustrine; (3) characterize fish size and condition factors; and (4) characterize age composition and growth of centrarchids and salmonids.

Comments on the Study

The Water Board filed an alternative study request, WB-1, and these comments are considered in that context.

FWS says that the scope of this study should also include the lower Tuolumne River because existing data sources from monitoring are inherently limited in the ability to accurately estimate population values for non-ESA species. FWS requests collection of empirical data in the lower Tuolumne River using the electro-fishing three pass method in a manner that captures the full spatial range of aquatic habitat types present within lower Tuolumne River to generate fish species population estimates. FWS also states that the existing information and ongoing data collection and monitoring do not specifically target Pacific lamprey and that the distribution and abundance of larval lamprey should be collected using sampling methodologies described by Torgersen and Close (2004).

Discussion

We do not support the request for additional sampling of non-ESA fish and Pacific lamprey in the Tuolumne River below La Grange dam. The existing information identified by the Districts collected over 15 years provides an adequate characterization of the non-ESA fish resources and Pacific lamprey for purposes of our analysis of project effects (study criterion 4). Detailed population and abundance estimates beyond the existing information are not necessary for evaluation of project effects. The existing information in the lower Tuolumne River and required studies would be sufficient to evaluate project-related and cumulative effects on aquatic habitat, geomorphic conditions, water quantity, water temperature, and other metrics which support all forms of aquatic life in the lower Tuolumne River, and inform development of license requirements.

Staff Recommendation

None.

Study W&AR-14-- Temperature Criteria Assessment (Chinook Salmon and *Oncorhynchus mykiss*)

Applicants' Proposed Study

The Districts propose a study that would develop information on the influence of temperature on the in-river life-stages of Chinook salmon and *O. mykiss*. The specific study objectives include the following:

- Identify life stage-specific fisheries population effects related to water temperature (e.g., effects on growth, disease susceptibility, predation risk, etc.);

- Identify life stage-specific water temperature evaluation parameters (i.e., effects associated with expected range of water temperatures);

- Assess and select an acceptable, informative approach to analyzing temperature regimes and their influences on Chinook salmon and *O. mykiss* in the lower Tuolumne River; and

- Evaluate the historical exceedance of identified water temperature criteria.

The study would use existing literature and information, including previously conducted studies and ongoing Tuolumne River monitoring to examine biologically relevant water temperature parameters for in-river life-stages of Chinook salmon and *O. mykiss*. Tasks in this study plan that address life stage-specific criteria for anadromous *O. mykiss* also would serve to address life stage-specific criteria for resident *O. mykiss* during freshwater life stages.

The study area would include the observed habitat use by Chinook salmon and *O. mykiss* in the Tuolumne River, extending from the La Grange dam (RM 52) downstream to the confluence with the San Joaquin River (RM 0). However, because this study plan addresses different Chinook salmon and *O. mykiss* life stages, these boundaries could vary by life stage.

Comments on the Study

CDFG, FWS, and NMFS do not support this study because it proposes to address a data gap with a literature review while declining to conduct studies that involve new analyses and collection of empirical data. In addition, these agencies believe that the proposed study cannot identify life stage-specific effects of temperatures in the lower Tuolumne River on Chinook salmon and *O. mykiss*. Instead, CDFG recommends the

Districts conduct its CDFG -5 *Bioenergetics Study* and CDFG-6- *Chinook Health Study* to gather and analyze just such empirical site specific data. FWS recommends an additional study, FWS-3, to evaluate the viability of Chinook salmon eggs affected by water temperature and gravel hyporheic conditions. The Conservation Groups state that the objective of a temperature study should instead focus on quantifying when water temperatures exceed EPA (2003) guidelines at different points in the lower Tuolumne River under existing and potential future flow conditions.

The Districts state that the water temperature criteria in EPA (2003) for various life-stages of salmonids may not strictly apply to salmonids in the lower Tuolumne River, when applying thermal criteria in an assessment of model generated alternatives. To consider effects associated with increasing water temperatures as they range from optimum to lethal, the Districts propose to use existing literature and information, including previously conducted studies and ongoing Tuolumne River monitoring to examine the EPA (2003) temperature parameters for in-river life-stages of Chinook salmon and *O. mykiss*. The Districts propose to focus on effects of water temperatures that are beyond the optimum conditions which serve the basis for the EPA (2003) criteria.

Discussion

CDFG and NMFS reference several documents that support use of EPA (2003) temperature criteria for all life stages of salmonids in the lower Tuolumne River. We have reviewed these documents and have determined that the existing information concerning the effects of water temperature on specific life-stages of salmonids is sufficient (study criterion 4). While the Districts' temperature criteria assessment may have the potential to inform W&AR-5 *Salmonid Populations Information Integration and Synthesis Study*, we will continue to rely upon the temperature criteria in EPA (2003) for our evaluation of project effects, unless empirical evidence from the lower Tuolumne River is provided that suggests different criteria are appropriate for salmonids in the lower Tuolumne River. As such, we see no need for the Districts to conduct this study. We address study requests CDFG-5 and CDFG -6, and FWS-3 noted above in detail later in this determination.

Staff Recommendation

We do not recommend that the Districts conduct the W&AR-14 *Temperature Criteria Assessment (Chinook salmon and Oncorhynchus mykiss)*.

Study W&AR-15-- Socioeconomic Study

Applicants' Proposed Study

The Districts propose to conduct a socioeconomics study. Potential changes in project operations may affect available water supplies and have the potential to directly affect the local and regional agricultural industry, consumptive water use, and recreational users of Don Pedro reservoir and the Tuolumne River.

The primary goals of the proposed study for socioeconomic resources are to quantify the baseline economic values and socioeconomic effects of the current project operations and to develop methods and a framework that can be used to evaluate the potential socioeconomic effects of any proposed changes to project operations that may be considered as part of the relicensing process, including scenarios affecting the availability of agricultural and urban water supplies.

Generally, the objectives of the study plan are to:

- characterize the economy in the regions served and affected by the project;
- assess the key factors influenced by project operations that generate economic activity in affected regions;
- estimate the economic value generated by the project's water storage in various uses, both consumptive (agriculture and urban) and non-consumptive (recreation); and
- measure the role and significance of the project in the economies of the regions, and use these findings to assess the socioeconomic impacts on affected groups and industries resulting from changes in project operations, including environmental justice considerations.

Comments on the Study

Comments on the study were filed by the Water Board, FWS, CDFG, and the Conservation Groups.[10] The Water Board says that because the plan can not capture the value of a healthy environment it would have limited benefit to them. CDFG is

[10] Besides comments, the Conservations Groups filed three alternative socioeconomic study requests (Conservation Groups-4, -5, and -6) and the Water Board filed alternative study request Water Board-15.

concerned that the proposed study will only analyze benefits and not costs and that the model will not be able to predict how people adapt to changes in water supply.

The Conservation Groups filed comments on both the study plan and the proposed IMPLAN model. FWS says it supports the Conservation Groups' comments. The Conservation Groups' comments are as follows:

- the economic study should value other uses like ecosystem services, commercial and recreational fisheries, and lower Tuolumne recreation;

- the model should also value effects on downstream residential property, and should analyze measures farmers could take to lessen the potential impacts of proposed mitigation; and

- the IMPLAN model will overstate benefits, provide false precision, and not model any adaptive behavior.

The Conservation Groups ask that the study address recreational and environmental services in and along the San Joaquin River, the Sacramento-San Joaquin Delta, and the San Francisco Bay. Therefore, the Conservation Groups say the Districts should expand the study area to include these areas.

In comments on the revised study plan, the Conservation Groups comment that they do not support the study plan because the study does not attempt to quantify the dollar value effect of the various consumptive and non-consumptive uses of project storage.

In response to CDFG's claim that the study would not consider both socioeconomic benefits and costs, the Districts note otherwise. The Districts state that farm production costs are considered when estimating agricultural water supply values. Also, the Districts say the proposed analysis does consider adaptations in economic behavior, for example, changes in cropping patterns and/or fallowing with changes in available irrigation supplies. Similarly, the municipal and industrial analysis will focus on how municipalities and their customers would react to changes in supplies, including changes in business operations, acknowledging that a long-term alternative water supply may not be available.

In response to the Conservation Groups' comment regarding effects on residential property values along the lower Tuolumne River as a result of increased instream flows, the Districts say that many factors influence residential property values, making it difficult to isolate the effects of additional instream flows. The Districts notes that part of

the value of residential land along the lower Tuolumne is already set by the substantial year-round instream flows, making it unlikely that one could measure and quantify the effect raising instream flow would have on the value of residential land.

In response to several comments on the technical merits of the IMPLAN regional economic model and claims that the model would overstate project benefits, the Districts point out that the changes in direct benefits of the project are estimated outside the model. The Districts clarify that IMPLAN is only used to estimate regional economic effects, measured by economic output, labor income, and employment in the local economy, associated with these changes in direct benefits. The Districts note that IMPLAN is a widely-accepted model and like all economic models it make simulations of the economy based on available data and is dependent on reliable estimates of model inputs, which are developed independently.

The Conservation Groups comment that the Districts should evaluate alternative conjunctive management strategies that could optimize surface and groundwater supplies. Regarding Section 4.1 of the socioeconomic study plan that the Conservation Groups reference, the Districts note that changes in project operations may alter both the quantity and reliability of irrigation water supply in the service area of the Districts. The Districts point out that irrigators in the Districts have no long-term and sustainable alternative water supplies, though some irrigators may be able to substitute available groundwater as a temporary supply. The Districts note that the quality and availability of groundwater makes it not an adequate long-run alternative.

Responding to the Conservation Groups' comments on the appropriate study area, the Districts clarify that the study area for the socioeconomic analysis is intended to capture the direct effects of project operations, as well as the larger functional economic area that considers inter-industry linkages among regions. The Districts note that the economic benefits and costs in the San Francisco Bay Area are being evaluated in a separate study prepared by CCSF[11] and potential socioeconomic effects from additional instream flows in areas downstream of Don Pedro reservoir will be considered as part of its cumulative impacts analysis in the Exhibit E of the Draft License Application.

Discussion

CDFG or the Conservation Groups question the Districts' proposed socioeconomic study because they say the proposed model will not be able to account for people's ability to adapt to changes, such as less water supply. However, neither CDFG

[11] On December 8, 2011, CCSF submitted its proposed Socioeconomics Study Plan for the San Francisco Bay Area for informational purposes.

nor the Conservation Groups offer any specific alternatives to consider adaptive behavior. It is clear that the Districts' study will attempt to simulate how water users might adopt to reduced water supplies. For example, the model would simulate how farmers might adopt by changes in cropping patterns and/or fallowing or how business operations might react to a long-term change in water supply. We consider the Districts' methodology for approach for analyzing adaptive responses to water supply changes appropriate for the study (study criterion 6).

We agree with the Districts that any economic effect changes in project operation would have on residential land value along the river would be extremely hard to predict and not likely to be significantly associated with project effects (study criterion 5). It's appropriate, in any study, to limit the scope of the modeling to resource effects that are likely to change with changes in project operation.

The Conservation Groups comment that the socioeconomic model should address other resources, such as effects on ecosystem services, which they define to include air quality, water quality, and habitat function. We don't agree with the Conservation Groups that effects on ecosystem service be can be accurately quantified in the model. In general, we have found that for non-power resources, such as aquatic habitat, fish and wildlife, cultural, and aesthetic values, the public interest cannot be evaluated adequately only by dollars and cents. Therefore, Commission staff's resource analysis consists of quantifying the effects on a resource for each proposal and then estimating either the economic cost of those resource effects or determining the significance of those effects. For developmental resources—power, irrigation, water supply, and flood control—we can usually calculate the economic cost of resource effects. For non-power resources, we determine how significant the effects of the proposals would be to the resource and to the public.

The Districts' proposed IMPLAN model has been widely used in several socioeconomic studies of Commission licensed projects, and we consider it a very good model for simulating effects on regional economies (study criterion 6). None of the commenters suggest an alternative economic model. Similar to the proposed Operations Model, the Districts' proposed study plan includes appropriate steps to validate the model, run it, and analyze and interpret the model results.

The Conservation Groups ask that the Districts include groundwater resources when evaluating alternative strategies to manage water supplies. Because the availability of groundwater supplies varies among irrigators and irrigators can not use groundwater supplies as a long-term alternative, we do not recommend an attempt to include these resources in either the project Operations Model or the Socioeconomic study (study criterion 5). As proposed, the socioeconomic study model will be designed to simulate

likely long term farm-level decisions for relicense proposals that result in unmet water demands.

Finally, the Conservation Groups ask the Districts to expand the study area. Given the resources that the proposed Socioeconomic Model will evaluate, we conclude that the study area for the direct and indirect socioeconomic effects to be analyzed in this study is appropriate (study criterion 6). As we've said above, we do not agree that the model should attempt to quantify project-specific operation changes in environmental services in and along the San Joaquin River, the Sacramento-San Joaquin Delta, and the San Francisco Bay because of the difficulty in assigning dollar values to these effects. That is not to say, however, that we will not consider cumulative socioeconomic effects in a broader context. In SD2, we set the geographic scope to assess cumulative effects on socioeconomic resources to encompass a broader region. As appropriate, our cumulative effects analysis will consider results from the Districts' and CCSF's socioeconomic studies and the results of the Districts' cumulative impacts analysis in the Exhibit E of the Draft License Application.

Staff Recommendation

None.

Study W&AR-16-- Lower Tuolumne River Temperature Model

Applicants' Proposed Study

The Districts propose a study that would recalibrate an existing river temperature model to simulate current and potential future water temperature conditions in the lower Tuolumne River from below Don Pedro reservoir to the confluence of the San Joaquin River.

The river temperature model would include simulation of river reaches below the project for a period of analysis that covers the range of normal variations in hydrology of the Tuolumne River. The following objectives apply to this proposed modeling study:

- accurately reproduce observed river water temperatures, within acceptable calibration standards over a range of hydrologic conditions;

- determine sensitivity of water temperatures to both flow and meteorological conditions;

- provide output to inform other studies, analyses and models; and

- predict potential changes in river temperature conditions under alternative future operating conditions.

The study area would include the lower Tuolumne River from the reservoir above La Grange dam to the confluence with the San Joaquin River.

Comments on the Study

CDFG, WB, and NMFS say that the ongoing water temperature modeling effort does not include Don Pedro reservoir, the lower Tuolumne River between Don Pedro reservoir and the La Grange facilities and does not extend downstream of the Tuolumne River into the San Joaquin River at Mossdale to encompass the complete area of potential project impact. CDFG states that the output of the Water Balance/Operations Model and the HEC5Q Water Temperature Model should be provided in a format appropriate for use as input into the existing CalFed San Joaquin River Basin Water Temperature Model.

NMFS states that, since the water temperature model required under the existing license did not calibrate properly, the flows required to maintain maximum water temperatures of 18 degrees Celsius downstream of La Grange dam to Roberts Ferry Bridge (RM 39.5) were never determined. NMFS requests that the flows necessary to meet the 7-day average of the daily maximum temperature as recommended by EPA (2003) be modeled in W&AR-16, and compare the results to the maximum weekly average temperature standard developed in Stillwater Sciences (2011). NMFS asks that all data used in calibration or validation of the model, as well as input files, be made available to the relicensing participants.

Discussion

The Districts propose to re-calibrate and validate the model as described in Steps 2 and 3 of the study methods. Existing water temperature data (summarized in Table 5.2.1-15 of the PAD Volume II) from the lower Tuolumne River and ongoing water temperature data collection at the Don Pedro powerhouse discharge and from a thermograph in La Grange reservoir are adequate for re-calibrating the existing HEC-5 model of the lower Tuolumne River. Model performance would be assessed using the temperature modeling goodness of fit as described in Stillwater Sciences' 2011 study using both 6-hour averaged (the minimum time-step of the HEC-5Q model) and daily averaged thermograph data. Also, the Districts propose to meet with interested relicensing participants to discuss and review the model, and then hold a series of workshops with interested relicensing participants to further discuss and refine the model if necessary.

The Districts' proposed model, which would simulate water temperatures in the Tuolumne River to the confluence of the San Joaquin River, is sufficient to describe the geographic extent of cumulative effects of the project on water temperature as there are existing data on temperatures further downstream. We will not require the Districts to simulate water temperature further downstream into the San Joaquin River at Mossdale, as requested by CDFG, as existing information from the water temperature models developed by other entities for the San Joaquin River may be used for that purpose (study criterion 4). We note that the results of the reservoir and river temperature models required by this study detemination would be useful for other interested entities when considering the existing HEC-5Q model for the San Joaquin River. We agree with CDFG, therefore, that the Districts should produce output from the water temperature model in a format appropriate for use as input into the existing CalFed San Joaquin River Basin water temperature model (study criterion 6). As we stated in the discussion under W&AR-14, we will continue to rely upon the temperature criteria in EPA (2003) for our evaluation of project effects, unless empirical evidence from the lower Tuolumne River is provided that suggests different criteria are appropriate for salmonids in the lower Tuolumne River. We support the NMFS' request to model the flows necessary to meet the 7-day average of the daily maximum temperature as recommended by EPA (2003), and compare the results to the maximum weekly average temperature standard developed in Stillwater Sciences (2011) (study criterion 6). The Districts should provide all data used in calibration or validation of the model in W&AR-16, as well as input files, to the relicensing participants (study criterion 6).

Staff Recommendation

We recommend study W&AR-16 be modified to include provisions to: (1) produce output from the water temperature model in a format appropriate for use as input into the existing CalFed San Joaquin River Basin water temperature model; (2) model the flows necessary to meet the 7-day average of the daily maximum temperature as recommended by EPA (2003), and compare the results to the maximum weekly average temperature standard developed in Stillwater Sciences (2011); and (3) provide all data used in calibration or validation of the model in W&AR-16, as well as input files, to the relicensing participants.

Study W&AR-17-- Reservoir Fish Population Survey

Applicants' Proposed Study

The Districts propose a study that would collect baseline information concerning the distribution and occurrence of the fish resources in Don Pedro reservoir. The objectives of the study are to:

- confirm the coldwater and warmwater fish assemblages and population composition, including relative abundance (e.g., catch per unit effort (CPUE)), age and size composition, occurrence in Don Pedro reservoir relative to extant reservoir operations and habitat conditions;

- characterize the influence of current operations on deterministic habitat conditions influencing the coldwater and warmwater fisheries in Don Pedro reservoir; and

- survey Don Pedro reservoir's fish populations using standard, reservoir sampling procedures to identify species composition and relative abundance, age, length and condition of predominant game fishes using two general sampling methods.

Comments on the Study

CDFG[12] states that the Districts' proposed study should accurately characterize the existing fish communities in Don Pedro reservoir and meet the following objectives by characterizing: (1) fish species composition, relative abundance, and size; (2) management of reservoir water surface elevations as it relates to available fish habitat including spawning and the potential for stranding; and (3) fish growth, condition factor, and age composition. CDFG proposed the CDFG-7 *Reservoir Fish Population Study* to accomplish these objectives.

CDFG believes that it is important to document the current tributary use for cold water fish spawning to predict how tributary access and spawning might be impacted by changes in potential reservoir operations contemplated in W&AR-2 *Project Operations/Water Balance Model*. They also request that the Districts identify locations of nests of spawning bass with surveys during March through May. They say that having knowledge of where bass are spawning would inform model runs in W&AR-2 of different reservoir operations. CDFG says this information would also guide the location for mitigation such as adding woody debris for overhead cover and structure. The Conservation Groups support this study with the addition of the element proposed by CDFG-7 *Reservoir Fish Population Study* including creel survey, tributary assessment and spawning habitat assessment.

FWS states that the W&AR-17 should be modified to include an evaluation of the effects of fish entrainment through the Don Pedro Project and into La Grange diversion canals, if and when Chinook salmon or *O. mykiss* are sampled near the diversions or water intakes. Specifically, FWS requests an analysis indicating whether or not existing

[12] CDFG filed an alternative study request, CDFG-7, and these comments are considered in that context.

project structures or operations prevent adequate downstream passage of landlocked Chinook salmon and *O. mykiss* through the Tuolumne River from Don Pedro dam, to the San Joaquin River to the San Francisco Bay/Delta and to the Pacific Ocean. FWS says this information is critical to their evaluation of relicensing and to their consideration of the downstream migration of *O. mykiss* and its prospective exercise of section 18 authority.

Discussion

In response to CDFG-7, the Districts subsequently proposed this W&AR-17 *Reservoir Fish Population Survey*, which includes most if not all of the elements requested in CDFG-7. The creel survey would be conducted as part of the Districts' proposed RR-1 *Recreation Facility Condition and Public Accessibility Assessment*. To address CDFG's request for a tributary and spawning habitat assessment, the Districts propose to first conduct a desktop assessment using the reservoir bathymetry data to determine the potential for isolation of tributary spawning habitat from the reservoir as a result of project operation. If evaluation of the bathymetry data shows the potential for isolation of tributary spawning habitat, then the Districts would conduct a field survey to assess the effects of such isolation on cold water fisheries habitat including tributary spawning and rearing habitat.

In addressing CDFG's concerns, we agree with the Districts that consideration of the bathymetry data along with the results of the *Project Operations/Water Balance Model* would allow analysis of effects of potential alternative project operations and fluctuating reservoir elevations on reservoir fish habitat and fish access to tributary habitat. If such an analysis shows the potential for isolation of tributary spawning habitat, then the Districts would conduct a field survey to assess the effects of such isolation on cold water fisheries habitat including tributary spawning and rearing habitat. We also agree with CDFG, that it would be important to document the GPS locations of bass nests with field surveys during the March through May spawning season. Knowing the bass nest locations and elevations would inform an effects analysis of fluctuating reservoir elevations on the success of bass spawning (study criterion 5).

We characterize the FWS request for the Districts to determine if project structures or operations prevent the adequate downstream passage of landlocked Chinook salmon and *O. mykiss* as a research effort for determining if the Chinook salmon and *O. mykiss* stocked in Don Pedro reservoir exhibit anadromy and contribute to the anadromous populations in the lower Tuolumne River. CDFG has stocked these salmonids in Don Pedro reservoir for many years for the sole purpose of supporting recreational angling, not to enhance or support in any manner anadromous fish populations. We conclude that such a research effort would not inform the development of license requirements (study

criterion 5). In addition, we do not recommend that the Districts evaluate entrainment of resident fish at the unlicensed La Grange dam and associated canals (study criterion 5).

The nexus between project operations and the potential movement of landlocked Chinook salmon and *O. mykiss* out of Don Pedro reservoir actually relates more to the status of the recreational fishery in the reservoir. For many years CDFG has managed the landlocked populations of Chinook salmon and *O. mykiss* in Don Pedro reservoir as a recreational fishery totally dependent upon hatchery stocked fish, not managed as self-sustaining coldwater fisheries. The existing information provided by the Districts indicates that the recreational fishery is popular and highly successful. Based upon this success, it is doubtful that movement of landlocked Chinook salmon and *O. mykiss* out of Don Pedro reservoir has had an adverse affect on those reservoir populations. It is also unlikely entrainment of *O. mykiss* and Chinook salmon occurs at the project, given that the location of the outlet is typically 300 feet below the reservoir surface. The fishery survey work conducted as part of this study will provide additional information to characterize the recreational fish populations in Don Pedro reservoir (study criterion 5).

Staff Recommendation

Study W&AR-17 should be modified to include a field survey of Don Pedro reservoir to document the GPS locations and elevations of bass nests during the March through May spawning season.

Study W&AR-18-— *Sturgeon Study*

Applicants' Proposed Study

In response to WB-11 *Sturgeon Study*, the Districts included in the revised study plan a new draft study W&AR-18 *Sturgeon Study*, proposing to complete a literature review of applicable studies and reports on green sturgeon life history and habitat requirements in the Central Valley and San Joaquin River Basin, and to evaluate potential for green sturgeon to be affected by the Project. The Districts would file study plan W&AR-18 *Sturgeon Study* with the Commission for approval within 30 days of the issued study plan determination

Comments on the Study

In WB-11 *Sturgeon Study*, the Water Board requests that the Districts perform a literature review of available studies and reports to determine the impacts of the Project upon green sturgeon habitat in the lower Tuolumne River.

Discussion

We support a literature review of applicable studies and reports on green sturgeon life history and habitat requirements in the Central Valley and San Joaquin River Basin, and to evaluate the potential for green sturgeon to be affected by the project. The information identified by the Districts in their bibliography in draft study plan W&AR-18 would provide an adequate characterization of green sturgeon for purposes of our analysis of project effects and provide the Water Board the information it is seeking (study criterion 4).

Staff Recommendation

We recommend that the Districts file W&AR-18 *Sturgeon Study* for Commission approval within 60 days after the issuance date of this Study Plan Determination, after consulting with NMFS, FWS, CDFG, and Water Board. We recommend that the Districts allow a minimum of 30 days for all relicensing participants to comment and to make recommendations before filing the study plan with the Commission. If the Districts do not adopt a recommendation, we recommend that the filing include the Districts' reasons, based on the Study Criteria set forth in section 5.9 of the Commission's regulations.

Study W&AR-19-- Lower Tuolumne Riparian Information and Synthesis Study

Applicants' Proposed Study

In response to WB-3 *Lower Tuolumne River Riparian Study*, the Districts included in the Revised Study Plan a new draft study W&AR-19 *Lower Tuolumne Riparian Information and Synthesis Study*, proposing to evaluate the potential project effects on riparian areas on the lower Tuolumne River. The Districts propose to develop a synthesis of existing studies and reports on riparian resources and habitats in the Lower Tuolumne River, and identify a list of literature and studies to be included. The Districts plan to file a complete study plan 30 days after the issuance date of this Study Plan Determination.

Comments on the Study

The study plan is a result of the Water Board's modification of its earlier study request to evaluate the potential project effects on riparian areas on the Lower Tuolumne River in a manner similar to that outlined in Study W&AR-5 *Salmonid Population Information Integration and Synthesis Study*. The Water Board comments that the study should evaluate existing information on riparian resources, provide tools to evaluate a

range of flow regimes on riparian habitat, and identify other limiting factors for riparian plants.

Discussion

We agree that this study is necessary and that additional information may be needed to analyze the relationship of flows to floodplain inundation and riparian vegetation in the Lower Tuolumne River.

Staff Recommendation

We recommend the Districts file, for Commission approval, a *Lower Tuolumne Riparian Information and Synthesis Study Plan,* with more detailed methodology, within 60 days after the issuance date of this Study Plan Determination. The study should include a synthesis of existing studies and reports on riparian resources and habitats in the Lower Tuolumne River, as well as a list of applicable literature and studies, and identify limiting factors on riparian vegetation. We recommend that the Districts allow a minimum of 30 days for all stakeholders to comment and to make recommendations before filing the study plan with the Commission. If the Districts do not adopt a recommendation, we recommend that the filing include the Districts' reasons, based on the Study Criteria set forth in §5.9 of the Commission's regulations.

Study W&AR-20-- *Oncorhynchus mykiss* Scale Collection and Age Determination

Applicants' Proposed Study

In response to FWS-2 *Age and Growth of O. mykiss in the Tuolumne River*, the Districts included in the Revised Study Plan a new draft study W&AR-20 *Oncorhychus mykiss Scale Collection and Age Determination,* proposing to collect *O. mykiss* by angling methods for collection of scale samples and subsequent microscopic analysis. The Districts propose to take scale samples from all captured *O. mykiss,* estimate the adult age class structure through length frequency analysis, and confirm this age class structure through scale analysis. The Districts would attempt to obtain an ESA Section 10 permit or 4(d) permit to collect *O. mykiss* data; however, the Districts explain that it is uncertain whether NMFS would issue this permit. The Districts would file the W&AR-20 study plan with the Commission for approval within 30 days of the issued Study Plan Determination.

Comments on the Study

The Districts initial proposal was to evaluate age and growth of *O. mykiss* based on existing length data. The Districts changed their proposal in the Revised Study Plan to include collecting *O. mykiss* by angling, to take scale samples for use in evaluating age and growth as recommended by FWS. In response to the Districts' Revised Study Plan proposal, FWS now recommends that the Districts collect scales from *O. mykiss* caught using a variety of sampling techniques, not just by angling, taking at least 5 fish per centimeter-length group or about 400 total fish, in the lower Tuolumne River downstream of La Grange dam.

Discussion

Information on growth of *O. mykiss* in the lower Tuolumne River is necessary for incorporation into the in-river production model developed in W&AR-10 *Oncorhynchus mykiss Population Study*. Knowledge of a species growth rate is necessary to understand the dynamics of a population, as growth is an important indicator of how well a population is functioning.

We do have a concern about developing age and growth data from length distributions absent scale data. Although an acceptable scientific technique, using length distributions can be confounded by differences in year-to-year growth, which may result from differences in water temperature, food availability, and species density. We recommend that the Districts collect *O. mykiss* data including scales to verify their age and growth (study criterion 6).

The Districts must obtain a permit from NMFS before collecting any federally-listed *O. mykiss* in the lower Tuolumne River. It is uncertain whether NMFS would issue a permit, or under what conditions the Districts could sample *O. mykiss* if a permit is issued. The Districts should attempt to either arrange to use CDFG's section 4(d) permit for collecting *O. mykiss* data, as was suggested by FWS in a study plan meeting, or obtain their own permit from NMFS. If the Districts are unable to obtain authorization to sample *O. mykiss* in the lower Tuolumne River, analysis of existing length distribution data will suffice.

Staff Recommendation

We recommend the Districts develop and collect *O. mykiss* growth information as proposed in draft W&AR-20, but only if the Districts are able to obtain authorization from NMFS to sample *O. mykiss* in the lower Tuolumne River. We recommend the districts file W&AR-20 for Commission approval within 60 days after the issuance date

of this Study Plan Determination, after consulting with NMFS, FWS, and CDFG. We recommend the Districts allow a minimum of 30 days for all relicensing participants to comment and to make recommendations before filing the study plan with the Commission. If the Districts do not adopt a recommendation, we recommend that the filing include the Districts' reasons, based on the Study Criteria set forth in section 5.9 of the Commission's regulations.

STUDY PLANS FILED BY RELICENSING PARTICIPANTS

In this section we explain staff's recommendations on studies requested by relicensing participants. Many of the provisions of these studies are addressed under the Districts proposed studies that relate to the same resource issues.

NMFS-1-- Effects of the Project and the Related La Grange Complex Facilities on Anadromous Fish (Inter-relationship of the Effects of the Project with those of the La Grange Complex on Tuolumne River Anadromous Fishes)

Agency or Other Entity's Recommended Study

NMFS, in its June 10, 2011 filing, requests that the Districts' provide detailed information concerning six general categories with respect to the La Grange complex (see enclosure F). NMFS requests this information to allow an evaluation of the inter-relationship of the effects of the Don Pedro Project with those of the La Grange Complex to inform: (1) ESA section 7 consultation; (2) Magnuson-Stevens Act consultation; (3) development of PM&E measures by NMFS under section 10(a) and 10(j) of the FPA; and (4) development of any fishway prescriptions or reservations under section 18 of the FPA.

The six general categories of this request are:

- a detailed description of existing facilities and components;
- a description of the current operations of the La Grange Complex;
- a description of the potentially affected environment in the vicinity of the La Grange Complex;
- a description of the relevant federal and state or tribal comprehensive waterway plans and relevant resource management plans;
- the license or exemption for the facilities and operations of the La Grange Complex; and
- a description of the resource impacts of the La Grange Complex.

Comments on the Study

The Districts' did not adopt this study request because: (1) La Grange dam is not part of the Don Pedro Project license; (2) La Grange dam and associated water delivery system is not subject to FERC's jurisdiction; and (3) evaluating the effects of the non-jurisdictional La Grange dam on resources does not meet ILP study criterion 5. The Districts do propose to provide relevant information on La Grange dam as it relates to anadromous fish to facilitate ESA consultation.

Discussion

As was noted in Scoping Document 2, the facilities associated with La Grange dam are not part of the existing license for the Don Pedro Project nor are they included within the project boundary of the existing license. However, the project's potential effects on resources when combined with the contributing effects of other non-project facilities such as La Grange dam would result in potential cumulative effects on anadromous fish resources.

Concerning category (1) and (2) of NMFS' request, to understand the contributing effects of La Grange dam (to the hydrology of the lower Tuolumne River), existing information (on the facilities that influence flow through La Grange) on water flow related facilities (that affect the flow of water into, through, and past) associated with the operation of La Grange dam and associated facilities would be useful and should be provided (study criterion 5).

Concerning category (3) and (6), our review of the information in the Commission record on the existing license, information in the PAD, published and non-published reports on anadromous fish in the Tuolumne River, water quality information that will be collected by the Districts, is adequate for Commission staff's consideration of La Grange dam and associated facilities in a cumulative effects analysis (study criterion 4).

Concerning category 4, the comprehensive plans included in Scoping Document 2 and those listed in section 5.12 of the PAD are adequate (study criterion 4).

Concerning category 5, La Grange dam and associated facilities are not licensed or exempted by the Commission (study criterion 5).

Staff Recommendation

The Districts should provide existing information that provides a detailed description of existing facilities which influence the manner in which flow is routed at La Grange dam as requested in 1(a through c) and 2 (a through iv).

NMFS-2-- Request for Information or Study Effects of the Project and Related Facilities Evaluated Through an Operations Model (Request for Information or Study on Effects of Project and Related Activities on Hydrology for Anadromous Fish)

Agency or Other Entity's Recommended Study

The request from NMFS includes the following four elements:

- Element # 1: Develop Don Pedro Hydroelectric Project Water Balance/Operations Model;
- Element # 2: Develop Water Year Types;
- Element # 3: Validate the Model; and
- Element # 4: Develop Base Case.

Comments on the Study

In its comment letter, NMFS reiterated the need for the Districts to address Elements 1 through 4. In response to NMFS-2, the Districts say that they do not agree that HEC-ResSim would be more a appropriate model platform than Excel. To extend the model as NMFS requests, the District's agree to make accretion and depletion measurements below the Modesto gage for one study year.

Discussion

Our discussion under Study Plan W&AR 2 addresses NMFS' study request and NMFS' comments in detail.

Staff Recommendation

For reasons noted in our discussion of W&AR 2, except for the Districts proposed use of a Microsoft Excel spreadsheet model platform, W&AR 2 adopts NMFS' Elements 1 through 4.

NMFS-3-- Request for Information or Study Effects of the Project and Related Activities on Fish Passage for Anadromous Fishes

Agency or Other Entity's Recommended Study

NMFS requests that the Districts conduct studies to provide information related to fish passage for all life stages of anadromous fish inhabiting the Tuolumne River, Central Valley spring-run Chinook salmon, and Pacific lamprey concerning the following facilities: (1) La Grange powerhouse tailrace; (2) La Grange powerhouse; (3) TID canal overflow spillway; (4) MID canal overflow spillway; (5) La Grange dam spillway; (6) La Grange dam; (7) La Grange reservoir; (8) Don Pedro dam spillway dishcharge channel; (9) Don Pedro powerhouse controlled outlet; (10) Don Pedro powerhouse jet valve outflow; (11) Don Pedro powerhouse; (12) Don Pedro dam; (13) Don Pedro dam spillway; (14) Don Pedro reservoir; (15) Don Pedro dam intake to the power tunnel; and (16) Don Pedro dam entrance to the controlled outlet.

NMFS requests this information to evaluate the effects of the Don Pedro Project and the facilities and activities related to the project, on the safety, timeliness, and effectiveness of fish passage. The results of the information will inform the decision-making of NMFS regarding: (1) ESA section 7 consultation; (2) MSA consultation; (3) development of PM&E measures by NMFS under section 10(a) and 10(j) of the FPA; and (4) development of any fishway prescriptions or reservations under section 18 of the FPA.

This request contains 5 specific elements:

- Element # 1: Information about Hydraulic Conditions and Bathymetry;
- Element # 2: Development of Conceptual-Level Fish Passage Alternatives;
- Element # 3: Investigation of Reservoir Fish Passage;
- Element # 4: Fish Passage Conditions in the Upper Tuolumne River; and
- Element # 5: Pilot Field Experiments for Anadromous Fish Reintroduction.

Comments on the Study

In response, the Districts' did not adopt this study request because: (1) NMFS did not provide any evidence that anadromous fish occur upstream of La Grange dam and below Don Pedro dam; (2) Don Pedro dam is not preventing the upstream migration of anadromous fish; (3) no anadromous fish are able to migrate above the tailwater of La Grange dam; (4) Don Pedro Project has no effect on anadromous fish because no anadromous fish are reaching Don Pedro dam; (5) studies of the effects of releases from facilities located at La Grange dam do not constitute an effect of Don Pedro Project operations; and (6) Elements 4 and 5 involve studies of fish barriers upstream of the Don Pedro Project and the project does not affect anadromous fish habitat conditions upstream of the project.

Discussion

As we stated in Scoping Document 2 in response to requests to consider project effects on fish passage, the Don Pedro Project does not block the upstream migration of anadromous fish because the upstream extent of anadromous fish in the Tuolumne River is currently limited to areas below La Grange dam.

La Grange dam is not a Commission-licensed facility under the FPA. Even though NMFS states they need to study all fish passage options now, the facts are clear. The unlicensed La Grange dam is the downstream barrier to the upstream migration of anadromous fish, and as a result, anadromous fish do not have access to areas upstream including to Don Pedro dam. Consequently, there is no nexus between the Don Pedro Project and direct effects on fish passage of anadromous fish.

NMFS has not shown that fish passage above La Grange dam would be reasonably certain to occur in the near future. Although there are many efforts underway that may ultimately result in fish passage, such as the draft Central Valley (Spring-Run) Recovery Plan, no specific fish passage plans have been developed, approved, or funded. Accordingly, it is unknown when fish passage might occur, how fish passage would be accomplished, or which part of the basin would be targeted. We conclude, therefore, that upstream fish passage studies at Don Pedro dam at this time is premature.

Consequently NMFS has failed to demonstrate a nexus between studying anadromous fish passage upstream of La Grange dam (study criterion 5). For these reasons, we do not adopt NMFS's fish passage study request.

Staff Recommendation

We do not recommend that the Districts conduct any of the elements of NMFS-3, Request for Information or Study Effects of the Project and Related Activities on Fish Passage for Anadromous Fishes.

NMFS-4-- Request for Information or Study Effects of the Project and Related Facilities on Hydrology for Anadromous Fish: Magnitude, Timing, Duration, and Rate of Change

Agency or Other Entity's Recommended Study

NMFS seeks information on the effects of the project on hydrology for anadromous fish. NMFS asks to have the information generated in response to six specific request Elements:

- Element # 1: Data Development and Statistical Analysis;
- Element # 2: Additional Analysis of Tuolumne River Below La Grange Dam (USGS #11289650);
- Element # 3: Peak Flow Analysis;
- Element # 4: Rate of Stage Change Analysis;
- Element # 5: Quantify Lower Tuolumne Flow Accretion and Depletion; and
- Element # 6: Evaluate Potential to Increase Lower Tuolumne River Flood Capacity.

Comments on the Study

The Districts say that they have substantially agreed to this study request as confirmed in its Section 3.0 for Study Plan W&AR-2 (the Districts response to comments).

Discussion

In our discussion of the W&AR-2 study, we discuss the elements of this study request and the Districts' plans to address these elements.

Staff Recommendation

For reasons noted in our discussion of W&AR-2, the Districts' proposed study substantially adopts NMFS Elements 2 through 6.

NMFS-5-- NMFS Request # 5 Request for Information or Study Effects of the Project and Related Facilities and Operations on Fluvial Processes and Channel Morphology for Anadromous Fish

Agency or Other Entity's Recommended Study

NMFS requested a study of the potential project effects upon fluvial processes and channel morphology for anadromous fish. The study request primarily centers on the investigation of coarse sediment and LWD in project-affected reaches. The study request contained eight elements, listed below:

- Element # 1: Quantify the volumetric flux of coarse and total sediment trapped in Don Pedro reservoir on an average annual basis;

- Element # 2: Quantify the frequency and volume of LWD trapped and removed from the riverine ecosystem on annual basis in Don Pedro reservoir;

- Element # 3: Quantify coarse sediment storage in the lower Tuolumne River;

- Element # 4: Quantify available spawning habitat for anadromous fish in the lower Tuolumne River;

- Element # 5: Quantify fine sediment storage in the lower Tuolumne River;

- Element # 6: Quantify the frequency and volume of LWD stored in the Tuolumne River channel downstream of Don Pedro dam to the confluence of the San Joaquin River;

- Element # 7: Develop coarse and fine sediment budgets and LWD budgets for the lower Tuolumne River; and

- Element # 8: Synthesize data from this study with other study requests to assess potential project effects on anadromous fish and their habitats.

Elements 1, 2, 3, 5, and 7 are discussed below. Element 4 is discussed above, under *Study W&AR-4--Spawning Gravel Study Plan*. Element 6 is discussed above, under *Study W&AR-12- Oncorhynchus mykiss Habitat Survey*.

Coarse Sediment (Element 1, 3, 5, 7)

Comments on the Study

The Districts did not adopt Elements 1, 3, 5, 6, and 7 of this study request saying that much of this information has previously been developed and is available in the Tuolumne River Restoration Plan (McBain & Trush 2000), the subsequent McBain and Trush 2004 Coarse Sediment Management Plan, and through the CalFed-funded Fine Sediment Management Project and related investigations of sediment sources from Gasburg and Dominici creeks.

In its October 24, 2011 comments, NMFS suggested an alternative approach for obtaining information requested by study Element # 1. Specifically, NMFS suggested that the Districts could obtain a sediment supply estimate by determining the difference between the current reservoir bathymetry and the as-built topography. NMFS indicates that since the Districts are already obtaining a highly detailed bathymetric survey of Don Pedro as part of Study W&AR-3, the additional data analyses required would not represent a substantial increase in cost and effort. In the revised study plan, the Districts agreed with NMFS and amended their proposed W&AR-4 study to include this information. In its December 7, 2011 comments, NMFS notes that while the Districts' state in the revised study plan that they agree to calculate the volume of sediments trapped by Don Pedro reservoir, they did not include this statement, intent, or any methodology for this task in any of their proposed study plans.

NMFS stated that the study plan did not incorporate its requested Element Nos. 3, 5, or 7. Specifically, NMFS states that existing information does not quantify coarse sediment storage within the active and semi-active channel of the lower Tuolumne River (Element # 3), that existing information from a survey of fine sediment storage in 2001 is no longer valid due to high flow events in 2005, 2006, and 2011 (Element # 5), and that the no existing information illustrates the relationship between sediment supply and transport capacity in the lower Tuolumne River (Element # 7). NMFS stated that these analyses would allow for assessment of the existing coarse sediment and spawning gravel resource, the project's effects to the resource and the likely trend of the resource over the duration of a potential new license.

In both its October 24 and December 7, 2011 comments, NMFS reiterates its request for coarse and fine sediment budgets in the lower Tuolumne River, which should

be calculated for existing conditions and no project effect conditions (i.e. without annual entrapment at project facilities). Specifically, NMFS recommends the following approach:

- an analysis of recent high flow events and the predicted sediment transport capacity of these events. These calculations could then be compared with measured changes in riffle area and spawning habitat since the previous surveys from 1999 to 2001 and 1986 to 1992;

- using existing sediment transport relations for the lower Tuolumne River, calculate the rate of coarse sediment export from La Grange dam (RM 52.0) to the Santa Fe Aggregates haul road bridge (RM 36.3); and

- compare sediment export rates with the volume of coarse sediment storage remaining in these reaches and predict how this volume will change over the potential length of a future license.

The Districts did not specifically address the items related to NMFS' requested Elements 3, 5, or 7. The Districts state that non-project effects, such as the presence of old Don Pedro dam, La Grange dam and the legacy of gravel mining operations in the lower Tuolumne River would necessarily obscure project effects as they relate to basin sediment yields and reservoir trapping estimates. However, the Districts state that they believe that the ultimate intent of NMFS' Element 1, 3, 4, 5, and 7 is to inform the Commission regarding effects on recruitment of suitable substrates to sustain habitats in the lower Tuolumne River, evaluate the need for gravel augmentation, and develop potential remediation efforts. The Districts indicate that the modifications incorporated in its W&AR-4 study should serve to satisfy the ultimate goal of NMFS' requested study Elements.

Discussion

By analyzing the change in reservoir bathymetry over time and developing an estimate of average annual sediment yield, the bathymetric approach modifications to studies W&AR-3 and W&AR-4, recommended by NMFS should result in information that adequately describes continuing project effects upon sediment supply, and therefore satisfy NMFS' study Element # 1. The Districts state on page 4-10 in the revised study plan that they adopt NMFS' requested bathymetric approach for analyzing potential project effects on annual sediment supply, however, we note that neither of the above proposed studies has been modified to reflect this adoption.

As both NMFS and the Districts state, the objective of the requested and proposed studies is to examine the potential project effects upon substrate as it relates to suitability for salmonid habitats.

In the revised study plan, the goals stated in the amended W&AR-4 study include:

- characterize the current area, distribution, and use of spawning riffles in the lower Tuolumne River;

- develop average annual gravel transport rates from channel geometry and mapped changes in riffle areas since 1988, and 1999–2000; and

- provide estimates of maximum spawning run sizes supported by the spawning riffles under current conditions.

The Districts' study, as proposed, would provide information on potential project effects to sediment storage, as it relates to annual loss of supply, due to the ongoing effects of Don Pedro dam and transport, as well as provide an estimate as to the amount of suitable spawning area. In the lower Tuolumne, the Districts study proposes to describe sediment storage and transport by attempting to correlate those variables to estimate the change in suitable spawning areas It may be possible to develop some inferences as to the distribution of coarse and fine sediment from estimates of spawning habitat suitability. However, without estimates of the total volume of coarse and fine sediment contained in project-affected reaches, as requested by NMFS in its study Elements 3 and 5, it would be extremely difficult to accurately determine the scope and proper implementation of any potential mitigation measures, such as gravel or flow augmentation (study criterion 5). As previously indicated, the Districts are not proposing to directly quantify the volume of coarse or fine sediment storage in the lower Tuolumne River.

The Districts do not propose to develop a sediment budget. While we agree with the Districts that many factors can influence sediment availability, we conclude that existing information is sufficient to establish a nexus between sediment availability in the lower Tuolumne and the ongoing cumulative project effects of sediment storage at Don Pedro dam (study criterion 5). Furthermore, existing information is also sufficient to establish a nexus between sediment transport in the lower Tuolumne and project effects due to project-related flow augmentation (study criterion 5). We note that the Districts proposed modifications to study W&AR-4 would provide estimates of annual sediment storage in Don Pedro reservoir and existing information would provide estimates of sediment mobility in the lower Tuolumne River. In concert with this information, information regarding the coarse and fine sediment storage in the lower Tuolumne River

would allow for the development of a sediment budget. A basic sediment budget could provide information useful for evaluating the longer-term trend of sediment flux in project-affected stream reaches. Such information could be used to determine the necessity, scope, and magnitude of any potential mitigation and enhancement measures, and thereby help inform potential license conditions (study criterion 5).

Staff Recommendation

The Districts state on page 4-10 of the revised study plan that they adopt NMFS requested bathymetric approach for analyzing potential project effects on annual sediment supply; however, we note that neither proposed W&AR-3 nor W&AR-4 studies have been modified to reflect this adoption. Therefore, we recommend that the Districts modify their proposed study plan to include methodology for the estimation of annual sediment storage at Don Pedro dam via comparison of reservoir bathymetry to maintain consistency with its statement in the second paragraph on page 4-10 of the revised study plan.

We recommend that the Districts modify their proposed W&AR-4 study to include the quantification of coarse and fine sediment storage in the lower Tuolumne River, as described by NMFS in their June 10, 2011 study request, study Elements # 3 and # 5.

Finally, we recommend that the Districts modify its proposed W&AR-4 to include a sediment budget for the purpose of determining the annual ongoing effect of the project upon sediment yield in project-affected stream reaches. Specifically, the sediment budget should describe the project cumulative effects of annual coarse sediment storage at Don Pedro dam, and project effects on coarse and fine sediment storage and mobility in the lower Tuolumne River as it relates to long-terms trends of sediment flux.

Large Woody Debris (LWD) (Element 2 and 7)

Comments on the Study

The Districts include an evaluation of project-related effects on LWD in its proposed W&AR-12 study (*Oncorhynchus mykiss* Habitat Assessment Study), related to NMFS' study request Elements 2, 6, and 7.

In its comments, NMFS indicates that the Districts' proposed study plan fails to provide methodology that would be suitable to quantify the frequency and volume of LWD lost in Don Pedro reservoir annually (study Element # 2). NMFS notes that existing information indicates that losses of LWD in Don Pedro reservoir during the

winter are a direct result of project operations. NMFS suggests that LWD disposed of at Don Pedro reservoir directly affects the amount of LWD available in the lower Tuolumne. In its December 7, 2011 comments, NMFS states that fluvially transported LWD would be able to transport over the crest of the La Grange dam in the absence of Don Pedro dam's effect during flood flows. In its revised study plan, the Districts do not specifically address the quantification of frequency and volume of LWD lost in Don Pedro reservoir annually. The Districts indicate that W&AR-12 will address current abundance of LWD relative to expected abundance of LWD (per a desktop review of similar stream systems), contribution of LWD to habitat complexity (including sizes, numbers and combinations of structure including LWD), and the functions that LWD provides in terms of fish habitat (e.g., cover, structure/morphology, food production, velocity refugia, etc.).

In its comments, NMFS reiterates its request for a LWD budget in the lower Tuolumne River downstream of Don Pedro dam (Element # 7). NMFS states that the LWD budget should be constructed to compare existing conditions and "no project effect conditions (i.e., without annual entrapment at project facilities). In its revised study plan, the Districts state that the development of a LWD budget is unwarranted as there is no proven scientific method of estimating the amount of LWD that would have made its way, intact, along the 24-mile river reach from the upper end of Don Pedro to the lower end.

Discussion

Existing information clearly indicates that LWD trapped at Don Pedro reservoir is removed and disposed of annually. Therefore, existing information is sufficient to infer a potential project effect upon LWD resources in the reach of the Tuolumne downstream of Don Pedro dam and upstream of La Grange dam (study criterion 5). However, we note that existing information also indicates that operation of the non-jurisdictional La Grange dam, which does not spill flows over its crest, would likely preclude LWD from passing from upstream to the lower Tuolumne downstream of La Grange dam. We do not agree with NMFS that the original construction of Don Pedro dam and its resultant effect upon flood flows (specifically, inhibiting spill flows over La Grange dam) establishes a nexus between project effects and current conditions.

The reach of the lower Tuolumne River, downstream of RM 24, is typically referred to as the sand-bedded reach. Existing information indicates that generally, the morphology of this reach has been highly impacted by non-project related activities, such as the legacy of mining operations, as well as the input of sediment from several tributaries. As such, existing information indicates that anadromous salmonids primarily utilize areas upstream of RM 25. For these reasons it is reasonable to infer that the

availability of LWD in this reach is not a limiting factor in salmonid utilization of this reach. Therefore the scope of LWD surveys as proposed should be suitable to characterize any potential project affects upon LWD dynamics in the reach of the Tuolumne primarily utilized by salmonids (study criterion 5).

We agree with the Districts that development of a LWD budget, as requested by NMFS, would necessarily entail the collection of data relating to variables, such as historical, current, and potential sources of LWD, such as land use characteristics, and potential influences on those sources, such as logging, that are not attributable to proposed project-related operations or maintenance effects. Therefore any such study lacks a project nexus, as required by study criterion 5. However, we conclude that the synthesis of information from the proposed study could provide a basic LWD budget that reflects potential project effects. Specifically, a description of the LWD budget as the quantity of LWD observed in study sites, estimated mean annual volume of wood trapped in project facilities (no longer available to downstream reaches), and estimated mean annual volume of wood passing over project facilities would provide information useful for informing the necessity, utility, and magnitude of any potential PM&E.

Staff Recommendation

We recommend that the Districts modify their proposed W&AR-12 study to include an evaluation of the frequency and volume of LWD trapped and removed from Don Pedro reservoir on an annual basis, as described by NMFS in their June 10, 2011 study request Element # 2.

We do not recommend that the Districts perform an LWD budget analysis as requested by NMFS. However, we do recommend that the Districts modify their W&AR-12 study to provide a basic LWD budget by providing a description of the quantity of LWD observed in study sites, and the estimated mean annual volume of wood trapped in project facilities (indicative of the cumulative project effect upon wood no longer available to downstream reaches).

NMFS-6-- Request for Information or Study Effects of the Project and Related Facilities and Operations on Water Temperature for Anadromous Fishes

Agency or Other Entity's Recommended Study

NMFS requests that the Districts develop a water temperature monitoring program and a water temperature model for anadromous fishes. NMFS seeks to have the information generated in response to four request elements:

- Element # 1: Interim Flows;
- Element # 2: Water Temperature Monitoring;
- Element # 3: Water Temperature Modeling; and
- Element # 4: Reservoir Temperature Modeling.

Comments on the Study

The Districts did not adopt element 1 because instituting interim minimum flows is not a study request. The Districts say they did adopt Elements 2, 3, and 4 by their proposed water temperature studies W&AR-3 and -16 because continued operation of the project may affect the temperature regime in the reservoir and the temperature of the lower Tuolumne River downstream of Don Pedro dam.

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Discussion

As discussed in W&AR-3 Reservoir Temperature Model, Elements 1 and 2 are requests for PM&E measures and are not study requests that address the nexus between project operations and effects (study criterion 5). We support Elements 3 and 4, which are included in the Districts W&AR-3 *Reservoir Water Temperature Model* and W&AR-16 *Lower Tuolumne River Temperature Model*.

Staff Recommendation

We recommend that the Districts do not adopt elements 1 and 2, and adopt Elements 3 and 4 in W&AR-3 and W&AR-16.

NMFS-7-- Request for Information or Study Effects of the Project and Related Facilities and Operations on Upper Tuolumne River Habitats for Anadromous Fishes

Agency or Other Entity's Recommended Study

NMFS requests that the Districts conduct studies to provide information related to anadromous fish habitat in the Tuolumne River upstream of the Don Pedro Project. NMFS says that the Don Pedro Project is interrelated and interdependent with the CCSF's Hetch Hetchy Project. They also say that the Don Pedro Project, along with interrelated facilities, have blocked upstream migration of anadromous fish, while the

Hetch Hetchy project operations directly impact the quantity and quality of habitat in the upper Tuolumne River.

NMFS requests this information to identify data gaps concerning potential salmonid habitat in the upper Tuolumne River. The data collected by these studies should apply to reintroduction of steelhead and spring-run Chinook salmon to the upper Tuolumne River watershed, as outlined in the conceptual recovery scenarios in MNFS Public Draft Recovery Plan (NMFS 2009). NMFS says fall-run Chinook salmon and Pacific lamprey should be considered.

This request contains 4 specific elements:

- Element # 1: Migration Barriers;
- Element # 2: Water Temperatures;
- Request Element # 3: Implement Monitoring Actions; and
- Request Element # 4: Salmonid Life-Cycle Model.

Comments on the Study

In response, the Districts did not adopt this study request because they all relate to obtaining information about anadromous fish habitats in the upper Tuolumne River not affected by the Don Pedro Project.

Discussion

As we stated in Scoping Document 2, the Hetch Hetchy System is not a Commission licensed facility, and it is not part of the Don Pedro Project. We also stated that the Don Pedro Project does not block the upstream migration of anadromous fish because the upstream extent of anadromous fish in the Tuolumne River is currently limited to areas below La Grange dam. Even though NMFS states, for reintroduction purposes, they need to study all potential anadromous fish habitat in the upper Tuolumne River above Don Pedro reservoir now, the facts are clear. La Grange dam is a barrier to the upstream migration of anadromous fish, and as a result, anadromous fish do not have access to areas upstream including to Don Pedro dam. Consequently, there is no nexus between the Don Pedro Project and effects on anadromous fish habitat in the upper Tuolumne River (study criterion 5). Also, the suitability of upstream habitat for anadromous salmonids, as it relates to recovery planning under NMFS guidelines, pertains to management decisions and actions which most appropriately fall under NMFS

jurisdiction. For these reasons, we conclude that a study of upriver populations and habitat is not warranted.

Staff Recommendation

We do not recommend that the Districts conduct any of the Elements of NMFS-7, Request for Information or Study Effects of the Project and Related Facilities and Operations on Upper Tuolumne River Habitats for Anadromous Fishes.

NMFS-8-- Request for Information or Study Salmon and Steelhead Full Life-Cycle Population Models to Assess the Effects of the Project and Related Activities

Agency or Other Entity's Recommended Study

NMFS, in its June 10, 2011 filing, requests that the Districts develop in consultation with FERC staff, an up-to-date, full life cycle model for fall-run Chinook salmon and Central Valley steelhead, capable of evaluating the relative influences of the project related freshwater factors on the Tuolumne populations, in the context of other environmental factors, both within and outside of the lower Tuolumne River. This request contains 2 specific elements:

- Element # 1: Fall-run Chinook salmon model; and
- Element # 2: Central Valley Steelhead Model.

Comments on the Study

The Districts propose to develop production population models for Tuolumne River Chinook Salmon and *O. mykiss* in W&AR-6 and W&AR-10.

Discussion

The Districts propose to develop two quantitative population models, one for Chinook salmon and one for *O. mykiss*, using all available data from the conceptual model information and newly collected data from the study determination. The models would follow the stock-production approach to population modeling to determine in-river factors affecting life-stages of both populations, rather than the approach requested by NMFS-8 for Full Life-Cycle models, which would also include out-of-basin factors. We support the Districts' proposal to develop pertinent information concerning out-of-basin factors affecting Tuolumne River salmonids in the conceptual model, but for the quantitative models the objective is to identify critical in-river life stages affected by the

project and then allow an evaluation of appropriate PM&Es to inform license conditions (study criterion 5). The model objective is not to predict the precise population size of any particular life-stage, but rather identify all in-river life stages affected by the project and then allow an evaluation of appropriate PM&E's, and inform the development of license conditions. We addressed this study request in further detail in W&AR-5, 6, and 10.

Staff Recommendation

We recommend that the Districts conduct model development as described in W&AR-5, 6, and 10 and do not recommend full life cycle models as in NMFS-8.

NMFS-9-- Request for Information or Study Effects of the Project and Related Activities on the Losses of Marine-Derived Nutrients in the Tuolumne River

NMFS requests that the Districts provide information (through desktop analysis) on the effects of project-related activities on the loss of marine-derived nutrients in the Tuolumne River. NMFS seeks to have the information generated in response to five request elements:

- Element # 1: Estimate a range of the historic mass of marine-derived nitrogen transported annually by Chinook salmon (all runs) to the Tuolumne River;

- Element # 2: Estimate the historic mass of marine-derived nitrogen transported annually by spring-run Chinook salmon to the upper Tuolumne River;

- Element # 3: Estimate the current annual mass of marine-derived nitrogen transported by fall-run Chinook salmon to the Tuolumne River;

- Element # 4: Estimate the annual loss, from historic to current levels of marine-derived nitrogen transported by fall-run Chinook salmon to the Tuolumne River; and

- Element # 5: Compare the difference of marine-derived nitrogen incorporated into periphyton and aquatic benthic macroinvertebrates collected in the upper and lower Tuolumne River.

Comments on the Study

In its proposed study plan, the Districts did not adopt this study request saying that it is intended to establish pre-project conditions related to the delivery of marine derive

nutrients to the upper Tuolumne River. NMFS states that passage of salmon to habitats upstream is impeded by the project. Since there are no anadromous fish immediately below Don Pedro dam, the Project is not acting as a barrier to anadromous fish.

In its comments, NMFS states that the Districts err in not distinguishing between fish passage impediments or partial blockages and total blockages of upstream anadromous fish in not adopting this study request. NMFS acknowledges that neither the Don Pedro Project facilities nor the La Grange facilities provide anadromous fish passage, and that the "project exerts fish passage effects at the La Grange complex facilities." Regarding its request for information related to the potential impairment of the lower Tuolumne River, NMFS indicates that the study is necessary to quantify the project's cumulative effects on the reductions of fall-run Chinook salmon returns. NMFS states that the intent of its proposed study is to collect information about the project's effects on the suitability of anadromous fish habitat within and above the project, including the nutrient status affected by the loss of marine-derived nutrients.

In the revised study plan, the Districts continue to not adopt this study request, stating that the loss/reduction of marine-derived nutrients to the upper Tuolumne River is the result of the original construction of Wheaton dam and La Grange dam and many other non-project effects, such as land management practices, in-channel mining and ocean over-harvesting. Regarding the lower Tuolumne River downstream of La Grange dam, the Districts maintain that the Don Pedro Project does not block upstream fish passage between the Pacific Ocean and La Grange dam and therefore it does not inhibit the delivery of marine-derived nutrients to the Tuolumne River.

In its December 7, 2011 comments, NMFS states that its study request seeks information about the potential impairment of the lower Tuolumne River, due to the project's effects on the reductions of fall-run Chinook salmon returns to the Tuolumne River attributable to thermal impairments, impairments to adult immigration, juvenile rearing and outmigration, and others, regardless of the project's effects on fish passage.

Discussion

NMFS' requested study is intrinsically linked to the subject of anadromous fish passage and project facilities. NMFS states that for the upper Tuolumne River, because fish passage is not provided at Don Pedro dam, there has been a loss of marine-derived nutrients in the upper watershed. As previously stated, based upon a wealth of existing information, we maintain that the Don Pedro Project does not block the upstream migration of anadromous fish because the upstream extent of anadromous fish in the Tuolumne River is currently limited to areas below La Grange dam, therefore the study

of marine-derived nutrients in the upper Tuolumne lacks projects nexus (study criterion 5).[13]

NMFS also requests information elements pertaining to the lower Tuolumne River. We note that the Don Pedro Project does not block upstream fish passage between the Pacific Ocean and La Grange dam and therefore it does not inhibit the delivery of marine-derived nutrients to lower Tuolumne River. NMFS does not indicate how its proposed study will have the capability to discern the attribution of, or even magnitude of, project-related effects and the effects of the multitude of non-project related independent variables that may influence salmon returns to the lower Tuolumne, including, but not limited to, naturally occurring oscillations in ocean productivity or climatological effects (study criterion 5). Additionally, we note that the requested study is primarily designed to inform NMFS management strategies (i.e. a decision to fertilize stream reaches) and not to address project-related effects or inform the development of license requirements (study criterion 5).

Staff Recommendation

We do not recommend that the Districts be required to conduct the requested study of losses to marine-derived nutrients in the upper or lower Tuolumne River.

FWS-1-- Instream Flow and Juvenile Chinook Salmon Floodplain Rearing Study

Agency or Other Entity's Recommended Study

FWS requests a study to evaluate the project effects on the total amount of available habitat for various life stages of fall-run Chinook salmon and *O. mykiss* to determine instream flows necessary to maximize production and survival throughout these species various life stages.

Specifically, FWS wants to determine: (1) the amount, inundation frequency, and inundation period of off-channel rearing habitats used by fry and juvenile salmonids; (2) amount of off-channel habitat created at different instream flows, for pre- and post-project flow regimes; (3) the inundation frequency and period of inundation of off-channel habitats, for pre- and post-project flow regimes; (4) potential threshold flows (i.e., flows that result in a large increase in the amount of habitat created with a small flow increase; and (5) potential restoration sites and methods, including water operation modification, that may be used to increase the availability of off-channel habitat that is inundated sufficiently to increase the growth and survival of fry and juvenile salmonids.

[13] See discussion under heading *NMFS-3* for further detail.

Comments on the Study

The Districts did not adopt this study in its proposed study plan. Under the existing license, the Districts are conducting an instream flow study on the lower Tuolumne River that includes an assessment of floodplain habitat, which will be completed in early 2012. The Districts believe the information provided by the ongoing IFIM study will address the information needs raised by FWS, except for the comparison of existing river conditions to pre-project conditions.

In its comments, FWS continues to assert that the approved, ongoing IFIM study is insufficient to assess juvenile salmonid rearing habitat at a range of flows. Specifically FWS states that 1) the ongoing IFIM study does not consider cover and adjacent velocity – rearing habitat parameters; 2) the ongoing 1-D study is inadequate to develop protection, mitigation and enhancement measures – the FWS instead requests a full 2-D study; 3) additional information is needed to evaluate the amount and frequency of floodplain inundation of off-channel habitats at various flows and potential stranding effects that may be caused by inundating off-channel habitats; and 4) additional elements should be added to the ongoing IFIM study to evaluate Pacific lamprey and splittail.

In its Revised Study Plan, the Districts state that the ongoing instream flow study on the lower Tuolumne River is designed as an assessment of the instream flows necessary to maximize fall-run Chinook salmon and *O. mykiss* production and survival through various life stages. The Districts state that both base flows and higher pulse flows are considered, including an assessment of floodplain habitat. Regarding the FWS' concern that the ongoing study requires more information on amount and frequency of floodplain inundation, the Districts state that the current IFIM can be supplemented by an analysis of available hydrologic data to evaluate inundation frequency and period. These data can be overlaid with available aerial photos, survey transects, and river hydraulic analysis to develop the necessary information to a suitable accuracy level. Regarding the potential project effects on Pacific lamprey and splittail, the Districts note that this is a new information request that was not detailed in the FWS' original study request and that the FWS fails to explain why existing information on Pacific lamprey is not adequate.

In its December 7, 2011 filing, FWS states that it did request a flow-habitat evaluation of splittail and Pacific lamprey in its June 9, 2011 filing in accordance with Commission regulations. FWS states that the conservation and enhancement of indigenous aquatic biota is an agency management goal related to its requested study (study criterion 2).

Discussion

The May 12, 2010 Commission Order modifying and approving the now ongoing flow-habitat study specifically states that the purpose of the study is to determine instream flows necessary to maximize *O. mykiss* and fall-run Chinook salmon production and survival throughout their various life stages.[14] The order further indicates that the flow study would examine potential responses of salmonid and predator species to spatial variations in inundation area, velocities, and depths in relation to the proposed pulse flows within both in-channel as well as temporarily inundated portions of the Tuolumne River floodplain.

We note that many of FWS' issues regarding the ongoing flow study were previously addressed in the Commission Order. Specifically, regarding FWS' concern that the ongoing flow study does not consider cover and adjacent velocity; we note that on page 19 of the Commission Order, staff indicate that the Districts should include measures of cover and adjacent velocity with other more standard habitat metrics. Regarding the FWS' concern over the use of 1-D modeling, we note that the Commission Order discusses the benefits and drawbacks of 1- and 2-D flow modeling, concluding that the techniques and methods of the approved flow study (1-D) are thorough and sound (study criterion 6).

We agree, however, with FWS that under the existing study, an analysis of floodplain inundation and frequency would be beneficial in identifying potential project effects upon potentially important salmonid rearing habitat (study criterion 5). We note that the Districts state that this information can be attained by utilizing the results of the ongoing flow study in conjunction with available hydrologic data. We note that ILP procedures allow for an evaluation of study results upon filing of the initial study report, and participants may request to amend an approved study or request a new study at that time. Therefore, should the FWS feel that the information produced in the results of the ongoing flow study are still not sufficient to meet its informational needs, it may request to amend the approved flow study at that time.

Finally we note that FWS' request for the inclusion of Pacific lamprey and splittail as species of interest in the ongoing flow habitat modeling was not included in its original study request, nor does this request for information conform to the Commission's regulations governing the content of a study request. FWS indicates that information on these species is needed because 1) Pacific lamprey population is in decline and 2) splittail is endemic to the California Central Valley. In the absence of the information required by the Commission's criterion for study requests, it is exceedingly difficult to evaluate

[14] 131 FERC ¶ 62,110 (2010)

the need for the information requested by the FWS. As results of the ongoing IFIM study are expected during the spring of 2012, any additional field data collection would require significant cost and effort. However, we note that additional desktop evaluation of flow-habitat for splittail and Pacific lamprey using existing, transferable, habitat suitability relationships would require significantly less effort and cost, and could provide useful information regarding potential projects effects upon those species (study criteria 5 and 7). If no appropriate habitat suitability relationships exist, we note that ILP procedures allow for an evaluation of study results upon filing of the initial study report, and participants may request to amend an approved study or request a new study at that time.

Recommendation

We recommend that the Districts modify their ongoing IFIM study to include an evaluation of splittail and Pacific lamprey if existing habitat suitability relationships are available.

FWS-2-- Age and Growth Study of *O. mykiss* in the Tuolumne River

Agency or Other Entity's Recommended Study

FWS requests a study to determine the population age structure and individual growth of *O. mykiss* populations upstream and downstream of La Grange dam and evaluate differences in growth and age structure caused by direct, indirect, and cumulative effects from Don Pedro dam. FWS requests collection of length, weight, and age data to develop length histograms for *O. mykiss*. FWS proposes to use this information to evaluate project effects on individual growth of *O. mykiss* and to determine if flow, habitat, or food productivity is affecting recruitment, age structure, or growth of fish downstream of Don Pedro dam.

Comments on the Study

The Districts propose to directly adopt a portion of FWS-2 *Age and Growth Study of O. mykiss in the Tuolumne River*, but have proposed methods differing from the FWS proposal to develop the remaining information.

FWS has indicated that age and growth assessments of *O. mykiss* in Don Pedro reservoir, as proposed in W&AR-17 (see Section 3.4) would meet its request to determine age and growth upstream of Don Pedro dam. The Districts would also conduct the age and growth study in W&AR-13, *Fish Assemblage and Population between Don Pedro Dam and La Grange Dam*. However, the Districts believe it would be inappropriate to compare age and growth of fishes in Don Pedro reservoir and the lower

Tuolumne River to evaluate project effects on growth and population dynamics. The Districts explain that population dynamics in a river would be expected to be different than population dynamics in a reservoir.

The Districts also propose to evaluate age and growth of *O. mykiss* in the lower Tuolumne River based on length data collected during previous surveys and to be synthesized as part of W&AR-5 *Salmonid Populations Information Integration and Synthesis Study* (see Section 3.4.5). To further accommodate the FWS request, the Districts included a new draft study proposal W&AR-20, *Oncorhychus mykiss Scale Collection and Age Determination,* in the revised study plan to collect *O. mykiss* by angling methods for collection of scale samples and subsequent microscopic analysis. The Districts propose to take scale samples from all captured *O. mykiss*, estimate the adult age class structure through length frequency analysis, and confirm this age class structure through scale analysis. The Districts would attempt to obtain an ESA Section 10 permit or 4(d) permit to collect *O. mykiss* data; however, the Districts explain that it is uncertain whether NMFS would issue this permit. The Districts would file the W&AR-20 study plan with the Commission for approval within 30 days of the issued Study Plan Determination.

In response to the Districts' revised study plan proposal, FWS now recommends that the Districts collect scales from *O. mykiss* caught using a variety of sampling techniques, not just by angling, taking at least 5 fish per centimeter-length group or about 400 total fish, in the lower Tuolumne River downstream of La Grange dam.

Discussion

Similar to the Districts, we have concerns regarding how the age and growth data of *O. mykiss* will be used. For example, it is known that reservoir fish will have faster growth rates than stream fish. A comparison of growth of *O. mykiss* in a reservoir environment to that in the lower Tuolumne River will not provide useful information to evaluate project effects (study criterion 5). In addition, as the Districts state, FWS provided no evidence to suggest that *O. mykiss* populations in the lower Tuolumne River are exhibiting growth problems or food abundance issues. As described by FWS, it is clear to us that such a comparison of *O. mykiss* in Don Pedro reservoir and in the lower Tuolumne River is actually a research program and would not inform the development of license requirements (study criterion 5).

However, information on growth of *O. mykiss* in the lower Tuolumne River is necessary for incorporation into the in-river production model developed in the Districts W&AR-10 *Onchorhynchus mykiss Population Study*. Knowledge of a species growth rate is necessary to understand the dynamics of a population, as growth is an important

indicator of how well a population is functioning (study criterion 6). The Districts now propose to develop *O. mykiss* age and growth information in draft W&AR-20. We discuss our concerns with this study plan under W&AR-20.

FWS recommends the Districts sample 400 *O. mykiss* using a variety of sampling techniques. As we discuss under W&AR-20, the Districts must obtain a permit from NMFS before collecting any federally-listed *O. mykiss.* Without knowing the type of sampling gear NMFS would allow as part of any issued authorization, it is premature to decide upon sampling gear types and the number of *O. mykiss* that would be sampled. Those details would be addressed during consultation with the resource agencies on the W&AR-20 study plan and filed with the Commission for approval. Therefore, we cannot adopt FWS's recommendation on sample size and sampling gear at this time.

Staff Recommendation

With the exception noted above with respect to sample size and sampling gear, we recommend FWS-2 be incorporated into the Districts' proposed W&R-20 study plan.

FWS-3-- Chinook Salmon Egg Viability Study

Agency or Other Entity's Recommended Study

FWS requests a study to evaluate the project effects on Chinook salmon eggs related to water temperature. Specifically, FWS wants to determine: (1) if egg survival is significantly different on a longitudinal gradient (compare survival in a downstream direction); (2) if hyporheic temperature and dissolved oxygen differs across all sites and how that impacts egg survival; and (3) if permeability across all sites differs significantly and that impacts egg survival.

Comments on the Study

The Districts did not adopt this specific study request, but said that much of the information requested would be developed by the instream temperature model that it will recalibrate. Egg survival to emergence has been extensively studied (TID/MID 1992; Stillwater Sciences 2007) and incubation temperature criteria are well established in the literature. FWS did not explain why existing information is not adequate.

The FWS, in its October 24, 2011 comments, have agreed with the Districts method of evaluating Chinook egg viability by focusing the study on water temperature effects through the application of the Districts temperature models. The FWS requests that the Districts incorporate the Chinook Salmon Egg Viability study directly into

W&AR-14, *Temperature Criteria Assessment*. The Districts have modified its W&AR-14 study plan accordingly.

Discussion

Egg survival to emergence has been extensively studied in the Tuolumne River (TID/MID 1992; Stillwater Sciences 2007). These studies indicate that poor spawning gravel quality, due to infiltration of fine sediment, is the primary cause for low survival-to-emergence rates in the lower Tuolumne River. Estimated survival was shown to range from 0 to 68 percent for Chinook salmon redds studied in 1988-89 (TID/MID 1992). A highly significant relationship between survival-to-emergence of Chinook salmon eggs and *in-situ* gravel permeability along with a highly significant relationship between survival and intragravel flow demonstrated in a study using artificial redds in 2002 (Stillwater Sciences 2007). Incubation temperature criteria are well established in the literature and can be assessed by examination of current or past results from continuous water temperature monitoring at various locations throughout the lower Tuolumne River dating back to 1986.

Further evaluating egg viability is not necessary to identify measures or conditions that might improve egg viability. We also note that the FWS proposed study would not distinguish between temperature-related and other contributions to reduced egg viability and, therefore, would not inform the development of license requirements related to temperature beyond that inferred through comparison of in-river temperatures with EPA (2003) guidelines (study criterion 5). Given that existing information indicates that the intrusion of fine sediments is a primary factor relating to egg viability, the FWS has not described the need for additional information (study criterion 4).

Staff Recommendation

We do not recommend the Districts conduct FWS-3 *Chinook Salmon Egg Viability Study*.

FWS-4-- Juvenile Chinook Salmon Survival Study

Agency or Other Entity's Recommended Study

FWS requests a study to identify and characterize limiting factors that affect out migrating fall-run juvenile Chinook salmon survival (and apply to *O. mykiss*) through the lower Tuolumne River, and to downstream reaches of the San Joaquin River, to the Bay-Delta, and to the Pacific Ocean. Specifically FWS wants to: (1) estimate survival rates, travel time, and identify areas of mortality in seven reaches in the lower Tuolumne River;

and (2) relate survival and movement behavior to habitat conditions, predation, and entrainment. FWS proposes a two-year study that would estimate survival with release of acoustically tagged and PIT-tagged hatchery Chinook salmon into the lower Tuolumne River at different experimental spring-time pulse flows or at different times during the smolt outmigration period.

FWS recommends that the tagged fish be tracked as part of a bioenergetics study, CDFG-5 and a health study, CDFG-6. FWS explains that its proposed tracking study is intended to identify particular flow ranges that result in reduced predation.

Comments on the Study

The Districts do not adopt this study request because it says FWS does not indicate why existing information is not adequate to address information needs or inform the development of license conditions. The Districts state that between 1986 and 2002, 12 coded-wire-tag smolt survival studies were conducted in the lower Tuolumne River between La Grange dam (RM 52) and the confluence of the San Joaquin River over a range of flows with recaptures at the Mossdale trawl and other downstream locations (TID/MID 2005). In addition, the Districts state that multiple-mark-recapture study designs were used to assess survival in three sub-reaches of the lower Tuolumne River. The Districts explain that these studies are extensive and provide large amounts of useful data, with results showing generally lower survival in the downstream gravel mining reach and sand-bedded portions of the river than the upstream primary spawning reach.

Discussion

Our review of the existing information on smolt survival studies in TID/MID (2005) confirms the Districts' decision not to adopt CDFG-5. The Tuolumne River Technical Advisory Committee conducted a series of experiments to quantify the relationship between Chinook salmon smolt survival and flow in the Tuolumne River. These studies produced smolt survival indices, including river-wide and reach-specific indices. In general, the river-wide indices are variable, but trend from relatively low survival (less than 0.7) with low flows (less than 700 cfs) to relatively high survival (greater than 0.6) with flood flows (greater than 4,000 cfs). Results with medium flows (1,300 – 3,000 cfs) ranged from low to high, but with a majority of indices in an intermediate range of 0.35 to 0.75. The estimated reach-specific survival indices were consistently near 100 percent in the upstream spawning reach, 7 – 100 percent in the middle mining reach, and 6 – 63 percent in the lower sand-bedded reach.

A critical review by a subcommittee of the Tuolumne River Technical Advisory Committee noted that a key, but uncertain, assumption is that flow is considered in these

studies as a surrogate for all other factors that may affect relative smolt survival, such as predator populations, predation rates, food availability, smolt condition and behavior, and water temperature. They also point out that these factors vary from year to year and are independent from flow. They explain that, other than temperature, these factors are generally unknown and further complicate the assessment of study results regarding the relative survival of tagged hatchery salmon related to flow.

FWS does not explain why this existing information is not adequate for its needs, other than saying it remains unclear how the Districts would develop Chinook salmon smolt survival rates, identify areas of mortality, and relate them to habitat conditions (study criterion 4). Our review indicates that this existing information on relative smolt survival in the lower Tuolumne River provides an adequate information base for our evaluation of project effects concerning river-wide and reach specific mortality of juvenile salmonids. Other existing information also suggests that water temperature effects and predation are most likely responsible for the relatively high levels of juvenile mortality in the mining reach of the lower Tuolumne River downstream of the spawning reach (study criterion 4). The information developed as part of the Districts' *Predation Study* W&AR-7, as modified, should lead to a better understanding of how juvenile mortality relates to habitat, flow, and predation in the mining reach. Water temperature would be considered through the water temperature modeling along with Chinook salmon and *O. mykiss* age and growth data used to model growth rate as a function of temperature as part of the interrelated *Tuolumne River Chinook Salmon Population Model* (Study Plan W&AR-6) and the *O. mykiss Population Study* (Study Plan W&AR-10).

Staff Recommendation

We do not recommend that the Districts conduct FWS-4 *Juvenile Chinook Salmon Survival Study*.

FWS-5-- Genetics of Chinook Salmon in the Upper Tuolumne River

Agency or Other Entity's Recommended Study

FWS requests a genetic study of the landlocked anadromous fish (adfluvial, self-sustaining Chinook salmon) population upstream of Don Pedro dam. FWS says that such a study on landlocked anadromous fish would provide information on the relationship between anadromous fish populations upstream and downstream of the Don Pedro Project.

Comments on the Study

The Districts adopted this study request in part, saying it is intended to determine the genetic composition of Chinook salmon and apparently *O. mykiss* in the upper Tuolumne River watershed upstream of the project. The Districts state that the genetics of Chinook salmon and *O. mykiss* planted in Don Pedro reservoir is a function of the CDFG hatchery program, which is unrelated to a project effect. The Districts have agreed to take fin clips of Chinook salmon and *O. mykiss* in Don Pedro reservoir and in the Tuolumne River upstream of La Grange dam, as part of the fish resources surveys in W&AR-13 and-17. FWS commented that taking fin clips of salmonids as part of the reservoir fishery surveys would satisfy the genetic study in FWS-5.

Discussion

FWS says that most of the Tuolumne River genetics research has focused on fall-run Chinook salmon management in the lower Tuolumne River. FWS also says that a management decision can not be made without an understanding of the genetics of the landlocked population of Chinook salmon in Don Pedro reservoir. We agree with FWS that this request for the Districts to study the genetic makeup of landlocked Chinook salmon is actually a research effort for determining the genetic makeup of Chinook salmon stocked in Don Pedro reservoir. While such a research effort may be needed for research to make fishery management decisions, it will not inform licensing requirements (study criterion 5).

Staff Recommendation

We recommend that the Districts take fin clips of salmonids as part of the fish resources surveys in W&AR-13 and-17, but we do not recommend that the Districts conduct any other parts of FWS-5 *Genetics of Chinook Salmon in the Upper Tuolumne River.*

Bureau of Land Management-- CESA-Listed Wildlife (Bald Eagle)

Agency or Other Entity's Recommended Study

The BLM requests the Districts conduct a study of the likely effects of project operation and maintenance on bald eagle nesting activity. The objectives of the study are to: (1) identify and map the location of bald eagle nesting sites; (2) document the presence of bald eagles when surveys are performed; (3) identify important bald eagle roosting or hunting perches; and (4) compile incidental observations of osprey observed while conducting the study.

The study would use existing data on wintering eagles and known nesting locations at the project, which would inform the Districts about known eagle occupancy and territories. Nesting surveys would be conducted according to the 1999 CDFG Bald Eagle Breeding Survey Instructions in order to determine and confirm the location of active nesting sites. BLM comments that this information will help inform any licensing conditions that would protect these nests that may be affected by project operation, maintenance, and human disturbance from recreation. Data collected at each site would consist of observations of: (1) the presence of adults; (2) courtship behavior; (3) nest repair or construction; (4) incubation; (5) observation of old nests; and 6) identification of any new nests. The proposed study area in BLM's study plan filed on October 24, 2011 would consist of a one-mile area around the project reservoir and the section of the Tuolumne River within the project boundary. In BLM's comments filed on December 7, 2011, the study area was revised to a 1,000-foot area around project facilities, the project reservoir, and the section of the Tuolumne River within the project boundary.

Comments on the Study

The FWS also recommends this study be conducted. The Districts comment that the BLM's recommended bald eagle study plan does not identify a need for the study or make an inference to project effects on bald eagle resources at the project. Further, the Districts comment that the study does not meet study criterion 5 because there is no evidence showing that the project is harming bald eagles.

In addition, the Districts disagree with the need for a bald eagle study as recommended by the BLM, because: (1) a one-mile study area is in excess of any possible nexus between the project and bald eagle nesting; and (2) nest-success data will not meaningfully inform license conditions. The Districts note that Section 3 of the BLM's recommended study does not identify any license conditioning that would require nest-success data to develop.

However, the Districts agree that general information on bald eagle nest locations will benefit the Commission staff's environmental analysis, and agree to provide this information in the Districts' Draft License Application (PAD). The Districts also agree to participate in nest-location surveys in 2012, and state that bald eagle nest locations will be recorded as incidental observations during the Districts' relicensing studies.

In response to the Districts' comments that a one-mile study area is in excess of any possible nexus between the project and bald eagle nesting, BLM revised its study area in its December 7, 2011 comments to a 1,000-foot area around project facilities, the project reservoir, and the section of the Tuolumne River within the project boundary.

Discussion

The Districts comment that the BLM-recommended bald eagle study plan did not identify a need for the proposed study or make an inference to project effects on bald eagle resources at the project. However, the BLM's bald eagle study plan has merit, as it addresses a need for information that the Districts' PAD did not provide. The PAD provides winter use data for bald eagles at the project, but does not provide data pertaining to nesting locations relevant to project features. In addition, the PAD identifies recreation areas where bald eagles have been observed, and recreation and human activity can cause disturbance to eagle nesting activity (FWS, 2007).

This Districts comment that a one-mile study area is in excess of any possible nexus between the project and bald eagle nesting. BLM's revised study area would be sufficient for this study, as buffer distances provided in the 2007 FWS Bald Eagle Management Guidelines for various categories of human activities and actions that may disturb nesting sites can range up to 1,000 feet. Therefore, certain project related activities may disturb nesting eagles up to 1,000 feet outside the project boundary. Activities and required buffers necessary around nest sites listed in the 2007 FWS Bald Eagle Management Guidelines that are applicable to the project may include off-road vehicle use, non-motorized recreation, and general human entry.

The Districts comment that BLM's proposed study does not explain how nesting information at the project will help inform licensing conditions (study criterion 5). However, section 3.0 of BLM's proposed study states that study results will help inform protection, mitigation, and enhancement measures that would protect these nests that may be affected by project operation, maintenance, and human disturbance from recreation. We also note that the 2007 FWS Bald Eagle Management Guidelines provide clear buffer distances for various categories of human activities and actions that may disturb nesting sites that may be necessary to implement around active nesting sites at the project.

Staff Recommendation

We recommend that the Districts conduct BLM's CESA-Listed Wildlife Study (Bald Eagle) as outlined in BLM's revised study plan filed December 7, 2011.

CDFG-1 and WB-13-- Water Balance/Operations Model

Agency or Other Entity's Recommended Study

CDFG and the Water Board request a study to develop a water balance/operations model using HEC-ResSim that can be used to simulate current and potential future operations of the Project. The objective of the study is to develop the model in a fashion that results in all interested relicensing participants agreeing the model is reasonably reliable for the purposes of relicensing, and agreeing to use this single water balance/operations model to make relicensing recommendations.

Study objectives include developing a model that simulates project O&M for a period of analysis that covers a range of hydrologic conditions. The water operations model should also address operational decisions made during project O&M including: (1) flood control; (2) water supply; (3) recreation; (4) stream flows; and (5) hydropower generation. Objectives also include:

- accurately reproducing observed reservoir levels, reservoir releases, and hydropower generation, within acceptable calibration standards over a range of hydrologic conditions;

- providing output to inform other studies, analyses, and models; and

- allowing simulation of changes in project O&M to determine effects on reservoir levels, reservoir releases, and hydropower generation.

Comments on the Study

The Districts comment that its modeling consultant has used Excel-based platforms for such modeling extensively and points out that CDFG offers no specific reasons why the chosen platform would not meet the needs of the Operations Model study.

The Districts also disagree with the CDFG's request for nodes which would model the operation of CCSF facilities, which the Districts consider beyond the scope and need of FERC to develop license conditions for the Project.

Discussion

Our discussion under Study Plan W&AR 2 addresses the CDFG and the Water Board study request in detail.

Staff Recommendation

We recommend that the Districts develop the operations model as requested by the CDFG and the Water Board as part of W&AR-2, but we do not recommend that the Districts modify W&AR-2 to include the elements discussed above.

CDFG-2 and WB-9-- Water Temperature Model – Modification of Ongoing Study

Agency or Other Entity's Recommended Study

CDFG and the Water Board request a study to develop water temperature models that can be used to simulate reservoir and stream water temperatures resulting from project O&M. The water temperature models will include simulation of the project reservoir and stream reaches below the project for a period of analysis that covers the range of normal variations in hydrology of the Tuolumne River. The following is a list of objectives that apply to this study:

- accurately reproduce observed reservoir and stream water temperatures, within acceptable calibration standards over a range of hydrologic conditions; and

- determine sensitivity of water temperatures to both flow and meteorological conditions.

Comments on the Study

The Districts adopted the study request, in part, as they will develop a water temperature model to include Don Pedro reservoir, the lower Tuolumne River between Don Pedro dam and La Grange dam, and the lower Tuolumne River to the confluence of the Tuolumne River and the San Joaquin River.

Discussion

We addressed this requested study in the Districts' W&AR-16 *Lower Tuolumne River Temperature Model.*

Staff Recommendation

In W&AR-16 we recommend that the Districts model water temperatures in the lower Tuolumne River to the confluence of the San Joaquin River as the Districts propose. We do not recommend that the Districts model water temperature into the San Joaquin River at Mossdale, as requested in CDFG-2. We do recommend as part of

W&AR-16 that the Districts produce output from the water temperature model in a format appropriate for use as input into the existing CalFed San Joaquin River Basin water temperature model, as requested in CDFG-2.

CDFG-3-- Reservoir Water Temperature Management Feasibility

Agency or Other Entity's Recommended Study

CDFG requests a study to evaluate the feasibility of engineering alternatives for water temperature management and the selective withdrawal of cold water from Don Pedro reservoir. "Feasible" means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social and technological factors. In a study plan meeting, CDFG noted that water temperature criteria are violated in the lower Tuolumne River.

Objectives to achieve this goal include:

- identify engineering alternatives for water temperature management and the selective withdrawal of cold water from project reservoirs;

- develop conceptual engineering plans for selective withdrawal facilities; and

- evaluate the potential effectiveness and engineering and biological feasibility of the various temperature control alternatives, and rank their relative effectiveness for accessing the cold water pool and delivering cold water to the lower Tuolumne River.

Comments on the Study

The Districts did not adopt this study request saying that the existing project facilities should be capable of meeting water temperature and instream flow objectives in the lower Tuolumne River. The Districts say this request is to evaluate a PM&E measure. The Conservation Group said that a second year study may be necessary if the water temperature models suggest further study is needed. They also commented that an incremental improvement in water temperature should be considered along with consideration of the Environmental Protection Agency (2003) temperature criteria.

Discussion

We agree with the Districts that the proposed Reservoir Water Temperature Management Feasibility study represents an assessment of potential PM&E measures.

This assessment is premature as it has not been established that this type of PM&E measure is needed or feasible. Therefore this requested study does not address the nexus between project operations and effects (study criterion 5). Information gathered in the proposed Water Temperature Modeling studies, both of the thermal dynamic structure of the reservoir and of the lower Tuolumne River, will provide information concerning the project effects on water temperature. However, we do agree with CDFG that the results of the proposed water temperature modeling may indicate a need for a reservoir water temperature management plan, including analysis of a temperature control device. If the results of the Water Temperature Modeling studies indicate such a need, relicensing participants, including Commission staff, may request the study under sections 5.15(d) and 5.15(e) of the regulations, in the second year of study.

Staff Recommendation

We do not recommend that the Districts conduct CDFG-3 *Reservoir Water Temperature Management Feasibility* at this time.

CDFG-4-- Instream Flow Study – Modification of Ongoing Study

CDFG requests additional consultation with the Districts about the ongoing IFIM study under the existing license to refine and improve the scientific rigor underlying the relationships between flow releases from Don Pedro reservoir and downstream resources and habitat in the lower Tuolumne River. Objectives to achieve this goal include:

- develop and implement an Instream Flow Incremental Method utilizing both one dimensional Physical Habitat Simulation (PHABSIM) and two dimensional River 2D modeling for the project affected reaches of the lower Tuolumne River; and

- use the model results to determine instream flow regimes necessary to maximize fall-run Chinook salmon and steelhead production and survival throughout their various lifestages in the lower Tuolumne River.

Comments on the Study

The Districts did not adopt this study. The Districts note that under the existing license, it is currently conducting an instream flow study on the lower Tuolumne River, which will be completed in early 2012. The Districts propose to include the IFIM study in its Initial Study Report to be filed with FERC in January 2013.

In its October 24, 2011 comments, CDFG clarifies that the intent of its original study request was to incorporate the ongoing instream flow study into the suite of

relicensing studies by providing opportunities for consultation with the relicensing parties and committing to a timely schedule of completing work. CDFG comments that the ongoing flow study was designed as potential interim flow releases prior to relicensing; not a flow regime to protect, mitigate and enhance the impacts of a new 30+ year license (study criterion 5). However, CDFG states that it does not advocate designing a new study, but rather recognizes that there will be opportunities to modify the ongoing study at other times in the relicensing process.

Discussion

After review of CDFG's October 24, 2011 comments, it appears as though no disputes regarding the ongoing IFIM study remain at this time. We note that, pursuant to Commission regulations, the Districts will be required to present results of the ongoing IFIM study in its Initial Study Report. If CDFG believes additional information is needed at that time, a study modification can be requested within the ILP criteria.

Staff Recommendation

We do not recommend modification of the ongoing IFIM study at this time.

CDFG-5 and WB-2-- Bioenergetics Study

Agency or Other Entity's Recommended Study

CDFG and the Water Board request a study to provide information concerning the effects of Don Pedro Project on the key variables of water temperature and food and how this impacts salmonid growth and habitat. The objectives of the study are to:

- Determine factors limiting salmonid growth (food and/or water temperature); and
- Predict the effects of changes in water temperature and food availability on salmonid growth and habitat.

CDFG states that, for the past 25 years, the Districts have conducted annual seining surveys in the lower Tuolumne River. These surveys include growth data for sampled salmonids. The Districts have also sampled the macroinvertebrate communities of the lower Tuolumne River as part of the current license. Finally, there is a long-term database of water temperature and flow data readily available to the Districts. There are salmonid bioenergetics models available (e.g. Hanson, 1997; Elliott and Hurley 1999; From and Rasmussen, 1984; From and Rasmussen, 1991) to analyze growth and water

temperature relationships. There is a need to utilize the existing data to model and analyze the bioenergetic relationships of these variables.

Comments on the Study

The Districts did not adopt this study, saying that their proposed reservoir and river temperature models, and the synthesis study of existing information on Tuolumne river salmon included in W&AR-9 would address the overall goals of the CDFG study, at considerably less cost. The Districts believe that the proposed bioenergetics model to predict growth of salmonids for unimpaired flows and water temperatures is an attempt to recreate pre-project conditions is highly speculative, and would not inform license conditions. The Districts believe that CDFG-cited sources of data do not indicate a conclusion that salmonids in the lower Tuolumne River have impaired growth rates or that macroinvertebrate production is otherwise impaired.

Discussion

CDFG states there is a need to use the bioenergetics relationships to analyze alternative instream flow/temperature regime effects on juvenile salmonid growth and relate the information to abundance and survival. Such analyses may help identify the instream flow/water temperature regimes that provide for optimal growth of juvenile salmonids in the lower Tuolumne River and guide development of PM&E measures. For example, understanding the site-specific bioenergetic relationships would allow resource managers to evaluate when and where potential alternatives to EPA water temperature benchmarks might be justified. CDFG suggested review of the 2011 Bioenergetics Technical Study Report that was completed for the Middle Fork American Project (FERC No. 2079).

We reviewed the bioenergetics report of the Middle Fork American Project and the subsequent license application filed with the Commission. While the report provided some interesting ecological research information, our preliminary review suggested that the results were inconclusive. We also reviewed the license application for the Middle American Fork project, and it appears all of the instream flow recommendations rely primarily on the results of a PHABSIM time-series analysis. We did not find any reference to the bioenergetics study results, and in the conclusions made on fish abundance and productivity, other non-bioenergetics studies from the literature were cited.

We also agree with the conclusion of Peterson et al (2008) that bioenergetic models that predict individual growth or consumption are not designed to explore the types of limiting factors for many fish species associated with lack of suitable spawning

or rearing habitat or insufficient instream flows. Density-dependence and habitat selection, often critical elements in fish population recovery, can be explored more effectively in individual-based and spatially-explicit models than with simple size-structured bioenergetics models that disregard density and assume random mixing of individuals.

The Districts have stated that the conceptual model will rank the relative importance of all factors, including water temperature and growth, that affect various life stages, and this information will inform the quantitative models for fall Chinook salmon and *O. mykiss.* Those models along with the studies required by this determination would provide sufficient information on flows, water temperature, habitat, and predation as they relate to project effects on the various life history stages of fall Chinook salmon and *O. mykiss* in the lower Tuolumne River (study criterion 5).

Staff Recommendation

We do not recommend that the Districts conduct CDFG-5 and WB-2 *Bioenergetics Study*.

CDFG-6-- Chinook Health Study

Agency or Other Entity's Recommended Study

CDFG requests a study to provide information concerning the effects of the Don Pedro Project O&M on environmental conditions (e.g. flow and water temperature), and these conditions' influence upon fish health (e.g. presence and prevalence of disease, contaminant exposure, and level of fish stress) of juvenile fall-run Chinook salmon abundance and survival in the lower Tuolumne River.

The objectives of the study are to:

- determine the incidence and severity of infection for external and internal parasites including *Tetracapsuloides bryosalmonae*, systemic viral and bacterial infections (including *Renibacterium salmoninarum* that causes bacterial kidney disease in salmonids) in juvenile Chinook salmon (fry through smolt stages, January – June);

- determine the energy reserves of juvenile Chinook salmon (whole body content of triglyceride, visceral fat scores) and growth (muscle RNA:DNA ratio). Examine temporal trends of these measurements in fry, parr, and smolts;

- monitor gill Na-K- Adenosine Triphosphatase, plasma thyroxine, plasma glucose, liver glycogen, plasma cortisol, and hematocrit activity in smolts to estimate smolt development;

- evaluate fish stress by monitoring plasma glucose and cortisol;

- examine sections of gill, liver and kidney for abnormalities associated with toxic insult and parasite infection. Determine if peripheral blood leukocyte composition is abnormal;

- monitor biomarkers for temporal and spatial indications of contaminant exposures (liver lipid peroxide, brain acetyl cholinesterase);

- refine physiological fish health (e.g. smoltification and stress) indicators; and

- identify linkage between environmental conditions (e.g. flow and water temperature level), as measured via study 1.b Water Temperature Modeling, and juvenile fish health and abundance.

Comments on the Study

The Districts did not adopt this study request because it is considered a research effort and is not likely to inform license requirements. The Districts also note that: (1) the project does not discharge contaminates; (2) a prior study indicated that smolt condition in the lower Tuolumne River was as expected for a healthy Chinook salmon population; (3) water temperature is not a cause of disease but rather contributes to disease; (4) there is no agreed upon quantitative method to relate temperature to disease; and (5) FWS plans to perform a study to address Chinook salmon health.

In response to the Districts reasons' for not adopting this study, CDFG states: (1) release of contaminants is irrelevant for the study objectives; (2) the prior study results are inconclusive for the smolt population in that year because the study was conducted when releases below La Grange dam were higher than normal, resulting in cooler water temperatures in the lower river; (3) peer-reviewed literature actually documents the relationship of water temperature to disease; (4) the Districts are responsible for this study, and we are not aware of a future disease study by FWS; and (5) the need for understanding the mechanisms by which juvenile health is affected by elevated water temperature is not as critical if the Districts provide instream flows necessary to achieve the EPA (2003) temperature criteria during the annual juvenile out-migration period from March 15 through June 15.

Discussion

We reviewed Nichols and Foott (2002), which reported on the results of an investigation concerning the health of hatchery and natural fall-run Chinook salmon juveniles in the San Joaquin River and tributaries. While PKD pathogens were found in fall Chinook juveniles in the lower Tuolumne River, there was no suggestion that juveniles experience poor health as a result of the presence of pathogens. In fact, no pathogens were found in May-sampled juveniles and only 10 percent of the April-sampled juveniles exhibited early stage infection having relatively few parasites and no associated lesions, and likely not having impaired kidney function. The results are similar for BKD pathogens. None were found in the May-sampled juveniles and only 12 percent of April-sampled juveniles exhibited low level infections with no gross clinical signs of BKD.

The relationship between incidence of disease in juvenile salmonids and water temperature is documented in the literature. There is also evidence that elevated water temperatures in the lower Tuolumne River, along with other factors, are affecting the survival of juvenile salmonids. Instead of studying the mechanisms of juvenile health related to water temperature, we recommend development of information to identify water temperature effects related to the project as in W&AR-1, -2, -16, then if appropriate, evaluate alternative project structures or operations that will allow improvement of downstream water temperatures to benefit juvenile salmonids and reduce potential prevalence of disease (study criterion 5). CDFG, by its own admission, acknowledges that it is not truly interested in the relationship between disease and water temperatures in the lower Tuolumne River as a long as project effects on temperature are mitigated.

The results of the water temperature models developed by the Districts will provide information regarding potential project effects upon water temperature in the lower Tuolumne River. Results of the *Project Operations/Water Balance model* and of the water temperature models can be used to evaluate various operating alternatives for the purpose of examining potential mitigation measures, including but not limited to, downstream water temperature conditions that would be unfavorable to the proliferation of PKD and BKD. Such an assessment will inform development of license requirements, while understanding the mechanisms by which juvenile health is affected by elevated water temperature as proposed in CDFG 6 would not (study criterion 4).

Staff Recommendation

We do not recommend that the Districts conduct CDFG-6 *Chinook Health Study*.

CDFG-7-- Reservoir Fish Population Study

Agency or Other Entity's Recommended Study

CDFG requests a study to provide baseline information on the distribution and occurrence of fish in Don Pedro reservoir. The objectives of the study include characterizing: (1) fish species composition, relative abundance, and size; (2) management of reservoir water surface elevations as it relates to available fish habitat under existing and potential project operations; (3) flow fluctuations as it relates to possible fish stranding; (4) timing of flow fluctuations in relation to spawning periods; and (5) fish growth, condition factor, and population age structure.

Comments on the Study

In response to CDFG-7 *Reservoir Fish Population Study*, the Districts subsequently proposed W&AR-17 *Reservoir Fish Population Survey* including most, if not all, of the elements requested in CDFG-7.

Discussion

As discussed in W&AR-17, we agree that the Districts' proposed study which is based on CDFG-7, will provide sufficient information of the fish resources in Don Pedro reservoir.

Staff Recommendation

We recommend that the Districts conduct W&AR-17 *Reservoir Fish Population Survey* as proposed, which meets the objectives of CDFG-7.

Water Board-1-- Fish Assemblage and Population Study between Don Pedro Dam and La Grange Dam

Agency or Other Entity's Recommended Study

The Water Board requested a *Study of Fish Assemblage and Population between Don Pedro dam and La Grange dam*, similar to the Districts W&AR-13 *Fish Assemblage and Population between Don Pedro dam and La Grange dam Study*, but the Water Board did not recommend any particular methodology.

Comments on the Study

The Districts propose a Predation Study in W&AR-13.

Discussion

We addressed this requested study in the Districts W&AR-13 *Predation Study*.

Staff Recommendation

See discussion in W&AR-13.

Water Board-3-- Lower Tuolumne River Riparian Study

Agency or Other Entity's Recommended Study

The Water Board requests a study to evaluate the potential project effects on riparian areas on the lower Tuolumne River in a manner similar to that outlined in Study W&AR-5 *Salmonid Population Information Integration and Synthesis Study*. The study would evaluate existing information and provide tools to evaluate a range of flow regimes on riparian habitat. The study would also identify other limiting factors for riparian plants.

Comments on the Study

The Districts comment that this study plan is a result of the Water Board's modification of its earlier study request. The Districts now agree to adopt WB-3 *Lower Tuolumne River Riparian Study* and propose to further develop a synthesis of existing studies and reports on riparian resources and habitats in the lower Tuolumne River. The Districts would also identify a list of literature and studies to be included. The Districts plan to file a complete study plan 30 days after the issuance date of this study plan determination.

Discussion

The Districts say that this study plan is a result of the Water Board's modification of its earlier study request. The Districts agree to adopt this modified study, and propose to further develop a synthesis of existing studies and reports on riparian resources and habitats in the lower Tuolumne River, and would identify a list of literature and studies to be included. The Districts plan to file a complete study plan 30 days after the issuance date of this study plan determination.

Staff Recommendation

The Water Board's requested study, WB-3, should be included in the Districts' final study plan W&AR-19 *Lower Tuolumne Riparian Information and Synthesis Study Plan.*

Water Board-4-- Lower Tuolumne River Freshwater Mussel Survey

Agency or Other Entity's Recommended Study

The Water Board requests a study that involves timed surveys of preferred habitat as has been conducted for a number of other relicensings.

Comments on the Study

The Districts did not adopt this study request saying their studies conducted in the lower Tuolumne River from 1987 to 2009 have found only one mussel species (*Corbicula* spp.) The Districts believe that existing data collected over the last 22 years provides adequate information on mussels in lower Tuolumne River.

Discussion

We do not support the request for additional sampling of mussels in the lower Tuolumne River. The existing information identified by the Districts collected over a 22 year period provides an adequate characterization of the mussel resources for purposes of our analysis of project effects (study criterion 4). Detailed population and abundance estimates beyond the existing information are not necessary for evaluation of project effects. The existing information in the lower Tuolumne River and required studies would be sufficient to evaluate project-related and cumulative effects on aquatic habitat, geomorphic conditions, water quantity, water temperature, and other metrics which support all forms of aquatic life in the lower Tuolumne River, and inform the development of license requirements.

Staff Recommendation

We do not recommend that the Districts conduct Water Board-4 *Lower Tuolumne River Freshwater Mussel Survey.*

Water Board-5-- Lower Tuolumne River Predation Study

Agency or Other Entity's Recommended Study

The Water Board requested a *Predation Study*, similar to the Districts W&AR-7 *Predation Study*, but they did not recommend any particular methodology.

Comments on the Study

The Districts propose a *Predation Study* in W&AR-7.

Discussion

We address this requested study in the Districts W&AR-7 *Predation Study*.

Staff Recommendation

See discussion in W&AR-7.

Water Board-6-- Sediment Transport

Agency or Other Entity's Recommended Study

The Water Board requests a study to quantify the amount of sediment trapped by Don Pedro reservoir and no longer available to the lower river, and an analysis of the sediment yield of the watershed above Don Pedro dam. The study should re-evaluate the sediment yield estimates provided by Brown and Thorp in 1947.

Comments on the Study

Districts did not adopt this study request in the Proposed Study Plan, saying that determining the amount of sediment in or entering Don Pedro reservoir will not inform the development of license requirements. The Districts also state that the existing information included in the existing Tuolumne River Restoration Plan provides the data requested by this study request.

The Districts state that while it has not adopted the Water Board's study request, it has modified its proposed W&AR-4 study to include a bathymetric approach, recommended by NMFS, for estimating gravel loss and potential gravel augmentation needs. Specifically the Districts state that the amended study will utilize comparisons of historical spawning gravel area assessments with current conditions, in conjunction with

existing or updated sediment transport relationships developed as part of an existing Coarse Sediment Management plan. The Districts suggest that in addition to existing information included in the existing Tuolumne River Restoration Plan, this study plan addition should provide the data requested by the Water Board.

Discussion

As discussed above, under the heading W&AR-4, we conclude that the bathymetric approach modifications to studies W&AR-3 and W&AR-4, recommended by staff should result in information that adequately describes continuing project effects upon sediment supply, and therefore satisfy the information requested by the Water Board (study criterion 5).

Staff Recommendation

The recommend studies W&AR-3 and -4 would result in information that adequately describes continuing project effects of Don Pedro dam upon sediment supply and addresses the information requested by the Water Board.

Water Board-7-- Spawning Gravel Study

Agency or Other Entity's Recommended Study

The Water Board requests ground surveys and aerial photo's to quantify the amount of spawning gravel available and determine what quantity of gravel is necessary to off-set the spawning gravel trapped by Don Pedro dam.

Comments on the Study

In its Revised Study Plan, the Districts state that its amended W&AR-4 study incorporates direct measurements of depth and velocity at flows occurring at the time of study that would be used to determine suitable spawning areas, with estimates at other flows based on the results of the ongoing IFIM study. The Districts note that if IFIM study predictions of optimum spawning flows differ greatly from the flows at which direct mapping occurred, a second year study may be considered to re-map spawning areas at the identified flows.

The Districts also state that it has amended study W&AR-4 to incorporate an approach to estimating gravel loss and potential gravel augmentation needs. Specifically, the Districts state that the amended approach will include comparisons of historical spawning gravel area assessments with current conditions used in conjunction with

existing or updated sediment transport relationships developed as part of an existing Coarse Sediment Management plan. The Districts further state that in addition to existing information included in the Tuolumne River Restoration Plan, this study plan addition should provide the data requested by the Water Board (study criterion 5).

Discussion

We note that as amended in the Revised Study Plan, the Districts proposed W&AR-4 study will provide for an evaluation of spawning habitat at a range of observed and modeled flows, as requested by the Water Board. Should the results of the ongoing IFIM study indicate spawning flows that are significantly different that those mapped flows, the ILP process will allow for stakeholders to request a modification or request a new study upon filing of the Districts' Initial Study Plan.

As previously discussed above, under the heading W&AR-4, we conclude that our recommended modifications to study W&AR-4 should result in information that effectively quantifies available spawning habitat for anadromous fish in the lower Tuolumne River, and therefore satisfy the information requested by the Water Board.

Staff Recommendation

The recommended W&AR-4 study would result in information that adequately describes continuing project effects upon sediment supply and mobility in the lower Tuolumne and addresses the information requested by the Water Board.

Water Board-8-- Large Woody Debris Study

Agency or Other Entity's Recommended Study

The Water Board requests a study to determine the amount of woody debris trapped in Don Pedro reservoir using surveys of tributaries and measurement of the amount of woody debris floating or submerged in Don Pedro reservoir.

Comments on the Study

In its Proposed Study Plan, the Districts did not adopt this study request saying that determining the amount of LWD trapped by Don Pedro reservoir for the purpose of investigating whether the lower Tuolumne River is being impacted by such loss will not inform the development of license requirements and there's no reliable methodology to provide reliable estimates of LWD quantities. The Districts are proposing a study of

existing habitat conditions for *O. mykiss* that will quantify structural habitat complexity due to LWB (W&AR-12).

In its October 24, 2011 comments, the Water Board states, as currently proposed, the Districts' W&AR-12 study only evaluates effects of current operations upon *O. mykiss* habitat. In order to accurately inform licensing conditions, the study should also examine how *O. mykiss* habitat and LWD recruitment will be affected during high flow events and how that effect would vary depending upon the magnitude and duration.

In the Revised Study Plan, the Districts state that it has now amended W&AR-12 to include a conceptual discussion of the relationship among LWD recruitment and high flow events as it likely influences LWD and related habitat conditions within the lower Tuolumne River.

Discussion

As discussed above under the heading *W&AR-12*, we note that the proposed study, as amended by the staff recommendations would evaluate project-affected losses of LWD material at Don Pedro dam, as well as current distribution and abundance of LWD in the lower Tuolumne River, and therefore satisfy information requested by the Water Board (study criterion 5).

Staff Recommendation

The recommended W&AR-12 study would result in information that adequately describes project-affected losses of LWD material at Don Pedro dam, as well as current distribution and abundance of LWD in the lower Tuolumne River and addresses the information requested by the Water Board.

Water Board-10-- Impact of Water Levels on Recreational Uses in Don Pedro Reservoir

Agency or Other Entity's Recommended Study

The Water Board requests the Districts evaluate the impacts of a range of reservoir elevations on recreational uses at the project by using similar methodology that was used in Pacific Gas and Electric Company's recently completed reservoir elevation and use study for Pinecrest reservoir (Spring Gap-Stanislaus project, 2130). It states the purpose of this study is to obtain information on recreational uses at various reservoir elevations in order to make resource management decisions and to inform the environmental review processes (study criterion 5).

Comments on the Study

The Water Board states that changes in project operations and increased diversions could have an impact on recreational uses of Don Pedro reservoir.

The Districts did not respond to comments on the requested study.

Discussion

The Districts propose to develop an Operations Model in Study W&AR-2--*Project Operations/Water Balance Model* that would represent existing operations, including reservoir levels, and can be used to simulate potential future operations under a variety of operating scenarios at the project. This information could be used to evaluate the impacts of a range of reservoir elevations on recreational uses at the project.

Staff Recommendation

We recommend that the Districts conduct Study W&AR-2 *Project Operations/Water Balance Model* and in the Draft License Application use the results to evaluate impacts on reservoir recreational uses of potential changes to project operations, as described in the Water Board's study request.

Water Board-11-- Sturgeon Study

Agency or Other Entity's Recommended Study

The Water Board requests that the Districts perform a literature review of available studies and reports to determine the impacts of the project upon green sturgeon habitat in the lower Tuolumne River.

Comments on the Study

The Districts propose to adopt the Water Board's study request. The Districts included a new draft study plan, W&AR-18, in the Revised Study Plan Proposal to complete a literature review of applicable studies and reports on green sturgeon life history and habitat requirements in the Central Valley and San Joaquin River Basin, and to evaluate potential for green sturgeon to be affected by the Project. As noted earlier, the Districts would file study plan W&AR-18 *Sturgeon Study* with the Commission for approval within 30 days of the issued study plan determination

Discussion

We support a literature review of applicable studies and reports on green sturgeon life history and habitat requirements in the Central Valley and San Joaquin River Basin, and to evaluate the potential for green sturgeon to be affected by the project. The information identified by the Districts in their bibliography in draft study plan W&AR-18 would provide an adequate characterization of green sturgeon for the purposes of our analysis of project effects and provide the Water Board the information it is seeking (study criterion 5).

Staff Recommendation

The Water Board's requested study, Water Board-11, should be included in the Districts' final study plan W&AR-18, *Sturgeon Study*.

Water Board-12-- Pacific Lamprey Study

Agency or Other Entity's Recommended Study

The Water Board requests a study of the impact of project operations on all life stages of Pacific lamprey in the lower Tuolumne River including abundance and distribution.

Comments on the Study

The Districts did not adopt this study request saying it is a presence/absence study and there is no evidence that project operations are affecting these species. The Districts say that Pacific lamprey have been routinely detected in the lower Tuolumne River since rotary screw trap operations began in 1996, and that existing data provides adequate information.

Discussion

We do not support the request for additional sampling of Pacific lamprey in the Tuolumne River below La Grange Dam, as is discussed in W&AR-13.

Staff Recommendation

We do not recommend that the Districts conduct Water Board 12 *Pacific Lamprey Study.*

Water Board-14— *Lower Tuolumne River Flood Capacity*

Agency or Other Entity's Recommended Study

The Water Board requests a study to evaluate existing flood capacity information and identify flood control projects that are necessary to increase the flow capacity of the Tuolumne River to 15,000 cfs above Dry Creek and 20,000 cfs below Dry Creek without causing damage to property on the Lower Tuolumne River. The objective of the Water Boards request is to have the Districts evaluate existing information and develop a list of projects that are necessary to increase the flow capacity to 15,000 cfs.

Comments on the Study

Districts did not adopt this study request for an evaluation of the potential to increase lower Tuolumne River flood capacity because flood control protection is established by the Corps of Engineers and neither the Districts nor the Commission would be able to unilaterally adjust this flood protection flow. Districts also say such a study would not inform the development of license conditions. As part of the Revised Study Proposal the Districts now agree to contact the Corps of Engineers to request that the Districts be allowed to increase the magnitude of peak flows above the current flood control protection flow established by the Corps of Engineers.

Discussion

The Water Board is requesting that the Districts consider increasing the magnitude of peak flows above the current flood control protection flow established by the Corps of Engineers for the lower Tuolumne River. The Districts had previously discussed possible changes in the Project flood control manual with the Corps of Engineers as part of the 1996 Settlement Agreement. At that time, the Corps of Engineers was not receptive to such a request saying it was inconsistent with agency management goals established for flood protection in the lower Tuolumne River.

We agree with the Districts' proposal to initiate discussions with the Corps of Engineers concerning changes to the current flood control requirements as part of the relicensing process. Because of the necessary involvement of the Corps of Engineers, the Water Board's proposed study Water Board-14 may be premature. If, however, the Corps of Engineers is agreeable to the Districts increasing peak flows above the current level, then we agree that the Districts should begin evaluating potential options. Therefore, the Districts should add a section to their proposed W&AR-2 study that includes a discussion of the current flood control operation of the Project, a schedule for evaluating potential options for changing flood control operation if the Corps of

Engineers approves the Districts' request, the Districts' proposed plans for discussing the ability to increase peak flows with the Corps of Engineers, and the opportunities to involve other interested relicense participants in these discussions (study criterion 5).

Staff Recommendation

We do not recommend that the Districts conduct Water Board-14 *Lower Tuolumne River Flood Capacity* at this time. However, in the W&AR-2 study plan, we recommend adding a section that discusses current flood control operations at the Project, and a schedule for evaluating potential options for changing flood control operation if the Corps of Engineers approves the Districts' request.

Water Board-15-- Socioeconomic Study

Agency or Other Entity's Recommended Study

The Water Board requests a model that will quantify the reduction in consumptive water supply and evaluate the impacts of the reduced water supply on consumptive water users. The model should integrate with the operations model.

Comments on the Study

The Districts comment that W&AR-15 *Socioeconomic Study* Plan is consistent with the Water Board's proposed study.

Discussion

We address the need for a socioeconomic study in W&AR-15, where we discuss several comments by relicense participants on the Districts' proposed socioeconomic study.

Staff Recommendation

We do not recommend adopting this study. The Districts W&AR-15 *Socioeconomic Study* Plan that we recommend adopting is consistent with the Water Board's proposed study plan.

Conservation Groups-1-- Upper Tuolumne River Anadromous Fish Habitat Recovery

Agency or Other Entity's Recommended Study

The Conservation Groups request a study to provide information concerning current and potential future recovery of salmonid habitat above La Grange, Don Pedro, Early Intake dams and reservoirs. The geographic scope of the study would include the upper Tuolumne River and major tributaries from Preston Fall to below the La Grange dam.

The request includes aquatic habitat mapping to: (1) describe the distribution, frequency, and/or length of coarse scale habitat types (e.g., pool, riffle, run) of the upper Tuolumne River; (2) characterize various coarse scale habitat parameters (e.g., unit dimensions, dominant substrate type, etc.); (3) collect reach-scale temperature information; and (4) record coarse scale stream habitat features such as potential migration barriers to fish, large woody debris, and locations of tributaries or other important features.

The study would also identify various fish passage concepts that would enhance fish passage at three dams over a range of operating conditions: Early Intake (Hetch Hetchy), Don Pedro, and La Grange. It will include conceptual designs of preferred fish passage alternatives and develop the rationale for the selection of the preferred alternatives.

Comments on the Study

The Districts did not adopt this study request because all aspects relate to obtaining information about anadromous fish habitats and migration barriers in the upper Tuolumne River not affected by the Don Pedro Project. The Conservation Groups did not provide any evidence that anadromous fish occur upstream of La Grange dam, that Don Pedro dam is preventing the upstream migration of anadromous fish, or that the anadromous fish habitat above Don Pedro dam is affected by the project.

Discussion

As discussed in NMFS-7, there is no nexus between the Don Pedro Project and effects on anadromous fish in the upper Tuolumne River (study criterion 5).

Staff Recommendation

We do not recommend that the Districts conduct CG-1 *Upper Tuolumne River Anadromous Fish Habitat Recovery*.

Conservation Groups-2-- Upper Tuolumne River Steelhead/Rainbow Trout Genetics Evaluation

Agency or Other Entity's Recommended Study

The Conservation Groups request a genetics study of *O. mykiss* to provide information concerning current and potential future recovery of salmonid habitat in the upper Tuolumne River above Don Pedro reservoir. The geographic scope for the study is the upper Tuolumne River and major tributaries from Preston Fall to Don Pedro reservoir.

The objectives of the genetics study are to: (1) conduct a fine-scale genetic evaluation of the upper Tuolumne River and major tributaries to evaluate the wild populations of endemic trout of unknown or puzzling evolutionary lineages; (2) conduct a genetic replacement or population gene pool "flooding" modeling study to evaluate management options for recovery of Tuolumne River steelhead trout populations; and (3) conduct monitoring of genetic replacement in Upper Lower Tuolumne River steelhead.

Comments on the Study

The Districts did not adopt this study request because the Don Pedro Project is not a barrier to anadromous fish and anadromous fish have not had access to the Tuolumne River above La Grange dam since 1893. The Districts also point out that the genetics of *O. mykiss* have been studied by Nielsen et al. 2005, Garza and Pearse, 2008.

Discussion

As discussed in FWS-5, this request is a research effort for determining the genetics of *O. mykiss* in Don Pedro reservoir and it would not inform the development of license requirements (study criterion 5).

Staff Recommendation

We do not recommend that the Districts conduct CG-2 *Upper Tuolumne River Steelhead/Rainbow Trout Genetics Evaluation.*

Conservation Groups-3-- Economic Value and Activity Associated with a Restored Fishery

Agency or Other Entity's Recommended Study

The Conservation Groups propose a study to quantify the economic value associated with effects on fish populations due to alternative reservoir management and instream flow regimes. The study would analyze estimates of potential fish population responses to management alternatives, identify and quantify the economic demands for any identified changes, and estimate monetary values for these changes in goods and services.

Comments on the Study

In response to the proposed study, the Districts point out that change in project operation to improve fish populations don't always result in increased quantity and/or quality of recreational or commercial fisheries. Further, the Districts say it has been FERC's policy that it does not need economic value information to determine a proper balance between project and non-project resources. They add that information required to implement this study request would be difficult to generate and highly speculative, and the study results would not inform the development of license requirements.

Discussion

As we have stated previously, the effects of changes in project operation on non-power resources are not best expressed in dollars. We discuss this matter in more detail in the discussion section of the Districts W&AR-15 Socioeconomic Study. We conclude that the Conservation Groups proposed study would not inform the development of license requirements (study criterion 5).

Staff Recommendation

For the above reasons, we do not recommend adopting this study plan.

Conservation Groups-4-- Economic Value and Activity Associated with Improved Recreation

Agency or Other Entity's Recommended Study

The objective of the Conservation Groups study is to evaluate the dollar change associated with effects on recreation opportunities due to alternative reservoir management and instream flow regimes. The study would attempt to quantify the economic benefits of any environmental measures that increase recreation opportunities such as kayaking and canoeing, wildlife viewing, rafting, camping, swimming, motorized boating, and hunting.

Comments on the Study

In response to W&AR-15 comments asking the Districts to quantify the effects on Lower Tuolumne river property from changes in operation, the Districts point out that because the river already has a sizable base flow, it is unlikely that one could measure and quantify the effect raising instream flow changes would have on the value of residential land.

The Districts note that they are proposing to evaluate the boatability of the lower Tuolumne River at current minimum flow levels for non-motorized recreation boaters to determine the lowest flow that can accommodate boating.

Discussion

As with quantifying how raising instream flow would affect residential property values in the Lower Tuolumne river, the sizable base flow makes it difficult to measure the changes on some recreational resources—such as wildlife viewing, camping, swimming, hunting.

In the Districts' proposed study plan W&AR-15, we discuss assigning dollar values to a project's effects on non-power resources. In general, we have found that for non-power resources, such as aquatic habitat, fish and wildlife, cultural, and aesthetic values cannot be evaluated adequately only by dollars and cents. Therefore, we do not think the Conservation Groups study would inform the development of license requirements (study criterion 5).

Staff Recommendation

We do not recommend adopting this study.

Conservation Groups-5-- Economic Value and Activity Associated with Improved Ecosystem Services

Agency or Other Entity's Recommended Study

In this study, the Conservation Groups, proposed to quantify the dollar value associated with effects on ecosystem services due to alternative reservoir management and instream flow regimes. The Conservation Groups define ecosystem services to include resources such as water quality, air quality, and general habitat function.

Comments on the Study

In response to the study, the Districts point out the ecosystem health is affected by multiple factors, not only instream flows; therefore, it is a cumulatively-affected resource that does not warrant detailed analysis in the proposed study plan.

In addition, the Districts do not believe that economic value information is needed by FERC to make resource balancing decisions and therefore would not inform the development of license requirements.

Discussion

In Conservation Groups-4, we discuss our views on dollar valuation of non-power resources. We conclude the Conservation Groups proposed study would not inform the development of license requirements (study criterion 5).

Staff Recommendation

We do not recommend adopting this study.

Conservation Groups-6-- Economic Value and Activity Associated with Modified Water Supply Allocations to Urban, Agricultural, and Environmental Uses

Agency or Other Entity's Recommended Study

The objective of this Conservation Groups study is to understand the economic value associated with effects on water supply due to alternative reservoir management and instream flow regimes. The primary objective of this study is to estimate the change in economic value and economic activity for out-of-stream uses associated with project alternatives. The proposed study would include an estimate of marginal changes in economic value and activity for out-of-stream water consumption through conservation,

trading, Best Management Practices, coordination, crop selection, technological and efficiency tools, and other innovative approaches to water scarcity to maintain economic value and activity with reduced water availability.

Comments on the Study

In response to the study, the Districts note that the study request is intended to supplement its proposed socioeconomic study by requesting that specific future potential actions by the Districts and their individual water customers in response to reduced water supplies be considered in this study. The Districts state that its *Socioeconomics Study* W&AR-15 is intended to evaluate project effects on socioeconomic conditions; which will provide the framework to analyze the impact of reduced project water being available to the Districts' customers under relicensing conditions.

The Districts think that it is likely that farmers will adapt certain farm practices, such as crop selection, in response to reduced water supplies, which is being considered in the context of agricultural water use impacts. Existing information on the Districts' water management practices and the availability and sustainability of groundwater supplies is adequate to address this study request in the context of FERC relicensing.

Discussion

The focus of the proposed study is on potential ways the Districts and their water users can better manage their water supply, including any loss is water supply that might result from new conditions in any license the Commission issues for the Project.

In this relicense proceeding, the Commission staff is required to develop a complete record on how any proposal to change project operation affects power and non-power resources. This complete record helps the Commission to decide among these proposals.

The Conservations Groups proposed study plan goes beyond analyzing the effects of changes to project operations and instead would have the Districts develop a management strategy that may involve operations and structures not under Commission jurisdiction to respond to any loss in water supply (study criteria 5). Therefore, we do not think the Conservation Groups study would inform the development of license requirements.

Staff Recommendation

We do not recommend adopting this study.

Conservation Groups-7-- Effects of the Project and Related Activities on Large Wood and Microhabitat Structures for Anadromous Fish

Agency or Other Entity's Recommended Study

The Conservation Groups request a study to evaluate the project effects on large woody debris and microhabitat structures by assessing the quantity, size, and other relevant information about large woody debris trapped by the Project, while also assessing the amount of large woody debris currently found along the river below La Grange dam, and assessing the available sources of large woody debris below La Grange dam.

Comments on the Study

The Conservation Groups indicate that the adoption of NMFS' study Elements Nos. 2 and 6 from its NMFS-5 study request would result in information that would satisfy the Conservation Groups study requests

Discussion

We discuss NMFS study request 5, Element 2 above, under the heading NMFS-5, and NMFS study request 5, Element 6 above, under the heading W&AR-12. As discussed under W&AR-12, with modifications recommend by staff, the Districts' proposed study should provide information regarding the projects potential effects upon LWD abundance, distribution and recruitment in the lower Tuolumne River, thereby satisfying the information requested by the Conservation Groups (study criterion 5).

Staff Recommendation

The recommended W&AR-12 study would result in information that adequately describes project-affected losses of LWD material at Don Pedro dam, as well as current distribution and abundance of LWD in the lower Tuolumne River and addresses the information requested by the Conservation Groups.

Conservation Groups-8-- Effects of the Project and Related Activities on Coarse Substrate for Anadromous Fish; Sediment Distribution, Transport, and Storage

Agency or Other Entity's Recommended Study

The Conservation Groups request a study is to evaluate the effects of the Don Pedro Project on fluvial processes and channel morphology, particularly with regards to

sediment mobilization, transport, and distribution of coarse substrate material. The Conservation Groups state that this information is particularly important for the design and implementation of any coarse sediment augmentation program that may be proposed as a project condition.

The Conservation Groups explain that the results of the study would be used to refine the understanding of coarse gravel distribution and mobility, determine if refinements to the coarse gravel management plan are warranted, and recommend additional coarse sediment protection, mitigation, and enhancement measures in the Lower Tuolumne River corridor that could be implemented.

Comments on the Study

In its comments on the Districts' study plan, the Conservation Groups direct their comments on the Districts' proposed W&AR-4 study as it relates to their original study request. Specifically, the Conservation Groups support the inclusion of NMFS' study elements Nos. 5 and 7 from NMFS' requested NMFS-5 study.

Discussion

We discuss NMFS study request 5, Elements 5 and 7 above, under the heading NMFS-5. As discussed under W&AR-4, with modifications recommend by staff, the Districts' proposed study should provide information regarding the projects potential effects upon sediment mobilization, transport, and distribution in the lower Tuolumne, thereby satisfying the Conservation Groups' information request (study criterion 5).

Staff Recommendation

The recommended W&AR-3 and -4 studies would result in information that adequately describes continuing project effects of Don Pedro dam upon sediment supply, as well as sediment supply and mobility in the lower Tuolumne and addresses the information requested by the Conservation Groups.

Conservation Groups-9-- Effects of the Project and Related Activities on Recruitment of Cottonwoods and Other Native Riparian Vegetation

Agency or Other Entity's Recommended Study

Similar to WB-3 *Lower Tuolumne River Riparian Study*, the Conservation Groups request a study to evaluate the potential effects of project flow regimes on recruitment of cottonwoods and other riparian vegetation along the lower Tuolumne River. The

Conservation Groups comment that the near elimination of large floods has allowed riparian stands in some areas to mature into even-aged stands, and there is little evidence of the recruitment of younger seedlings.

The request includes the use of the recruitment model developed by Stella et al. (2006) and Stillwater Sciences (2006) for cottonwoods and willows on the lower San Joaquin River Watershed, and the determination of recruitment pulse flows for the Tuolumne River downstream of La Grange Dam. Additionally, channel and floodplain geometry data would be obtained from its proposed coarse sediment enhancement study (CG-8 *Effects of the Project and Related Activities on Coarse Substrate for Anadromous Fish; Sediment Distribution, Transport, and Storage*), and climate data from the Modesto Airport weather station would be incorporated into the cottonwood and willow seed dispersal relationships developed by Stella et al. (2006). Lastly, flow regimes for different water year types would be developed for the lower Tuolumne River based on guidance provided in Stella et al. (2006).

Comments on the Study

The Districts have not adopted this study and comment that riparian recruitment has been extensively studied (Mahoney and Rood 1998) and has been shown to be related to inundation timing and the rate of recession of the Tuolumne River hydrograph (Stella et al. 2006). The Districts further state that existing information is adequate to describe the resource and potential project effects and will be synthesized in its Study W&AR-19, *Lower Tuolumne Riparian Information Integration and Synthesis*. Additionally, the Districts comment that management of high flow levels at the project is in accordance with the Corps Flood Control Manual and Corps of Engineers approval. However, the Districts note that they have agreed to consult with the Corps to discuss increasing allowable flood management flows from the currently recommended 9,000 cfs to 15,000 cfs.

In addition, the Districts comment that the information requested by the Conservation Groups has previously been developed and is available in the Tuolumne River Restoration Plan (McBain & Trush 2000), the subsequent McBain and Trush 2004 Coarse Sediment Management Plan, and through the CalFed-funded Fine Sediment Management Project and related investigations of sediment sources from Gasburg and Dominici Creeks.

The Conservation Groups comment that the existing information provided in McBain and Trush (2000) and Stella et al. (2006) is not adequate because it provides only general conclusions about seed release relative to peak and spring runoff. The Conservation Groups explain that these studies do not identify specific flow regimes that

would optimize seed release, dispersion, and recruitment along the flood terraces of the lower Tuolumne River. Further, the Conservation Groups believe that the objective of this proposed study can be accomplished within the management criteria set by the Corps Flood Control Manual. In response to other requested studies that a flood control protection is established by the Corps, the Districts comment that neither the Districts nor the Commission would be able to unilaterally adjust this flood protection flow.

Discussion

Additional information may be needed to analyze the relationship of flows to floodplain inundation and riparian vegetation in the lower Tuolumne River. Based on comments made during study plan meetings, we understand FWS is participating in a GIS study that relates floodplain inundation with flows up to 5,000 cfs in the lower Tuolumne River, which will be completed in spring 2012. As a part of the W&AR-7 *Predation Study*, we recommend that the Districts consult with the relicensing participants and review the results of the GIS study and the results of the IFIM study for the Don Pedro Project to determine the need for a second-year study concerning the physical habitat relationship between flow and floodplain inundation in the lower Tuolumne River. We also note that under the existing license, the Districts are conducting an instream flow study on the lower Tuolumne River that includes an assessment of floodplain habitat, which will be completed in early 2012.

In addition, the Districts agree to adopt and further develop the Water Board's proposed *Lower Tuolumne River Riparian Study Modified Study*, which would consist of developing a synthesis of existing studies and reports on riparian resources and habitats in the Lower Tuolumne River, and would identify a list of literature and studies to be included. The Districts plan to file a complete study plan 30 days after the issuance date of this study plan determination.

Staff Recommendation

We do not recommend that the Districts conduct the Conservation Groups-9 *Effects of the Project and Related Activities on Recruitment of Cottonwoods and Other Native Riparian Vegetation*. We do, however, recommend the Districts consult with the relicensing participants and review the results of the GIS study and the results of the IFIM study for the Don Pedro Project to determine the need for a second-year study concerning the physical habitat relationship between flow and floodplain inundation in the lower Tuolumne River.

Additionally, we recommend the Districts file, for Commission approval, a *Lower Tuolumne River Riparian Study Plan,* with more detailed methodology, within 30 days

after the issuance date of this study plan determination. The study should include a synthesis of existing studies and reports on riparian resources and habitats in the Lower Tuolumne River, as well as a list of applicable literature and studies, and identify limiting factors on riparian vegetation. We recommend that the Districts allow a minimum of 30 days for all stakeholders to comment and to make recommendations before filing the study plan with the Commission. If the Districts do not adopt a recommendation, we recommend that the filing include the Districts' reasons, based on the study criteria set forth in §5.9 of the Commission's regulations.

Conservation Groups-10-- Don Pedro Reservoir Water Supply (Dead Storage) Management Feasibility

Agency or Other Entity's Recommended Study

The Conservation Groups request a study to evaluate the feasibility of engineering alternatives for managing the "dead storage" in the Don Pedro reservoir to increase the effective storage capacity of Don Pedro reservoir by 309,000 ac-ft and thus increase flexibility in water supply allocations for agricultural, urban, and environmental uses.

The objectives of this study include:

- identify engineering alternatives for utilizing the dead storage pool in the Don Pedro reservoir and rank their effectiveness for providing additional water while meeting other project goals; and

- develop conceptual engineering plans for selective engineering solutions.

Comments on the Study

The Districts did not adopt this study request at this time because it is a study of a potential PM&E measure, and no evidence exists at this time to suggest the dead storage would be needed or be useful.

Discussion

We agree with the Districts that the proposed *Don Pedro Reservoir Water Supply (Dead Storage) Management Feasibility* study represents an assessment of potential PM&E measures. This assessment is premature as it has not been established that this type of PM&E measure is needed or feasible. Therefore, this requested study does not address the nexus between project operations and effects (study criterion 5). Information gathered in the proposed Project Operations/Water Balance Model, Water Temperature

Modeling studies, Socioeconomics Study, and Population Models will provide information concerning the project effects on water supply in the lower Tuolumne River. However, if the results of these studies indicate a need to consider the feasibility of accessing and managing the dead storage volume in Don Pedro reservoir, relicensing participants including Commission staff, may request the study under sections 5.15(d) and 5.15(e) of the regulations, in the second year of study.

Staff Recommendation

We do not recommend that the Districts conduct at this time CG-10 *Don Pedro Reservoir Water Supply (Dead Storage) Management Feasibility.*

Western Strategic Solutions-- Impacts of Flow Releases from Don Pedro Dam on Riparian Brush Rabbit and Aleutian Cackling Goose

Agency or Other Entity's Recommended Study

Western Strategic Solutions requests a study to provide information concerning direct and indirect impacts from project operations to the riparian brush rabbit and the Aleutian cackling goose within the project boundary.

The request includes aquatic habitat mapping to: (1) identify and map the location of the riparian brush rabbit and Aleutian cackling goose feeding and habitat areas; (2) identify direct and indirect aspects to the wildlife species and their dependent habitat by excessive flooding as a result of the Don Pedro dam operations; and (3) document the presence or absence of the riparian brush rabbit and Aleutian cackling goose when surveys are performed and assess the cost of mitigating the project effects on the species based on the impacts and changes of water surface elevations caused by the inconsistent Don Pedro dam releases.

Comments on the Study

The Districts did not adopt this study request, nor did they provide comments on this study.

Discussion

Western Strategic Solutions failed to identify a nexus between the Don Pedro Project and effects on riparian brush rabbit and the Aleutian cackling goose (study criterion 5). We are also unable to identify a nexus to the project, as these two species

are not reported by FWS to occur within the project boundary or in Tuolumne County where the project exists.

Staff Recommendation

We do not recommend that the Districts conduct Western Strategic Solutions-*Impacts of Flow Releases from Don Pedro Dam on Riparian Brush Rabbit and Aleutian Cackling Goose*.

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