

**BEFORE THE
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION**

Modesto and Turlock Irrigation Districts)	
Don Pedro Project)	P-2299-075

**COMMENTS OF CONSERVATION GROUPS REGARDING LICENSEE PROPOSED
STUDY PLAN, AND STUDY REQUESTS FOR THE DON PEDRO PROJECT**

Pursuant to 18 C.F.R. § 5.12, 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”) provide these comments on Modesto and Turlock Irrigation Districts’ (collectively, “Districts”) Proposed Study Plan for the relicensing of the Don Pedro Project (P-2299). The information gathered under the study plan, once approved by the Director of the Office of Energy Projects (“OEP”), must provide a sound evidentiary basis on which the Commission and other participants in the process can make recommendations and provide terms and conditions. We request that OEP Staff adopt the Conservation Groups’ recommended proposals and revisions to the Proposed Study Plan in its study plan determination as we believe our recommendations will provide the necessary evidentiary basis to support a new license that is best suited to a comprehensive plan of development and in the public interest as required by Federal Power Act (“FPA”) section 10(a)(1).¹

The Districts first issued the Proposed Study Plan (“PSP”) on July 25, 2011.² The Districts issued an Updated Proposed Study Plan (“Updated PSP”) on October 14, 2011.³ Unless otherwise noted, our comments go to the most recent versions of studies as proposed in the Updated PSP. We highlight and explain very important, specific changes (especially improvements) that have been made during the three-month informal study dispute resolution period.⁴

Our comments are organized as follows. Section I states our comments and recommendations regarding the study process. Section II states our overarching comments on studies proposed by the Districts, and on study requests the Districts have rejected in whole or

¹ 16 U.S.C. § 803(a)(1).
² See eLibrary no. 20110725-5097.
³ See eLibrary no. 20111014-5077.
⁴ 18 C.F.R. § 5.11.

part. Section III states our specific comments on individual studies proposed by the Districts. Section IV states our comments on study requests not adopted by the Districts. Section V includes our proposal for an additional study recommended by Conservation Groups.

In order to assist OEP Staff in evaluating our comments and recommendations, Conservation Groups have included tables to indicate our support, or lack thereof, and recommendations for studies proposed by the Districts and other study requests as Attachment 1.⁵ Both in our tables and within the narrative of our comments, we attempt to define where elements of the study requests could be productively incorporated into studies proposed by the Districts.⁶

I. **Comments on Process**

A. Process to Date

Conservation Groups thank OEP Staff for its active and productive participation in the initial stages of the licensing process. Staff lead, Mr. Jim Hastreiter, has been present at almost every relicensing meeting held to date, both during meetings called by the Districts prior to issuance of the Pre-Application Document (“PAD”) and during informal study dispute resolution. In addition to providing direction on specific questions and issues, his presence has helped to create an atmosphere of efficiency and fairness in which relicensing participants have made significant progress. As discussed below, we urge OEP Staff to actively participate in study implementation.

Conservation Groups also thank the Districts and their consultants for their positive approach to study development. First, the Districts responded affirmatively to a general theme in resource agencies’ and Conservation Groups’ comments on scoping and the PAD, by proposing a suite of studies that concern the salmon and *O. mykiss* fisheries downstream of the La Grange Complex. Second, the discussions during informal study dispute resolution have been productive, resulting in substantive and procedural improvements to many of the proposed studies. Where the Districts have not immediately agreed to recommended changes, they have tracked recommendations and responded promptly. Where the Districts did not completely capture or incorporate recommendations, they have been willing to respond, in many cases affirmatively, following further clarification. Additionally, the Districts have attempted to describe how and where elements of studies proposed by others are covered or included in their proposed studies. While disagreements remain, the process has been efficient and professional, and has improved many of the proposed study plans.

⁵ This format is similar to the table recently provided in the Study Determination for the relicensing of the Yuba River Development Project (FERC No. 2246). See eLibrary no. 20110930-3051, Appendix B, p. 63 of appendices.

⁶ For studies proposed by the California Department of Fish and Game, we use the numeration it employs in its comments on the PSP. For studies proposed by the U.S. Fish and Wildlife Service, by the National Marine Fisheries Service, and by Conservation Groups, we use the numeration employed by these entities in their respective comments on Scoping Document I and the Pre-Application Document.

Finally, Conservation Groups thank the City and County of San Francisco (“CCSF”) for its consistent presence and active participation in relicensing meetings. In particular, we thank CCSF for its willingness to allow the Districts to model in some detail the operations of the City’s Hetch Hetchy system upstream of the project.

B. Process Recommendations Going Forward

1. Procedure for Consultation Regarding Study Implementation

During the informal study negotiations the Districts included procedures for consultation and collaboration with relicensing participants in several study plans. We support opportunities for consultation and collaboration in implementation of the studies, although we mention concerns with several specific studies below. Given the extensive consultation required under several proposed study plans, Conservation Groups recommend that the Commission adopt a global process for disagreements that occur after consultation occurs. Such a process was recently defined in Appendix A of the Study Determination of the relicensing of the Yuba River Development Project.⁷

Consultation and close coordination during study implementation is very important given that several modeling efforts will build on information developed in the course of other studies. For example, several of the Districts’ proposed studies, *e.g.*, W&AR 7 (Predation) and W&AR 8 (Salmonid Redd Mapping), will inform the fish life-cycle modeling studies (studies W&AR 5, 6 and 10). Any inappropriate decisions or assumptions made in studies to gather data for modeling will thus be carried over into the models, thus potentially compromising what may become fundamental decision-making tools.

In addition, there will be a number of critical decisions to be made regarding the development of the models themselves. Decisions made by the Districts that are not supported by Commission Staff,⁸ the resource agencies and other stakeholders will significantly undermine

⁷ See eLibrary no. 20110930-3051, *Ibid*, Appendix A, p. 1 (internal notes omitted):

...where YCWA specifies in the revised study plan that it would collaborate with certain entities in its revised study plan, it must consult with the participating entities and, if a consensus with specified resource agencies is not reached, YCWA must file its proposal with the Commission for approval. Further, where we require consultation on study plan modifications, YCWA must allow a minimum of 30 days for the parties to provide written comments and recommendations. In each scenario, the filing must include YCWA’s proposed action, a description of the dispute including copies of any comments and recommendations received, and a discussion of how the collaborating/consulted parties’ comments and recommendations have been considered. If YCWA does not adopt a recommendation, the filing must include its reasons, based on project-specific information.

⁸ We strongly agree with the National Marine Fisheries Service’s comment in its proposal for life-cycle modeling of salmonids, that such a model(s) should be developed “in close consultation with FERC staff.” See eLibrary no. 20110610-5160, NMFS Study Request #8, p. 194 (pdf pagination).

the value of the modeling results. For example, studies W&AR 2, 3, 5, 6, and 10 all involve modeling of water or of fish. Most of these studies have been revised to contain explicit processes for consultation, generally in the form of “workshops” held at milestones during model development. It is our understanding that the number of workshops presently provided in the study plans is a floor and not a ceiling. However, on reflection, Conservation Groups recommend that greater precision in defining a *process* of consultation and collaboration would be beneficial. We recommend that, on a global basis, each study plan specify that technical meetings with interested relicensing participants are part of study development.

2. Procedure to Reopen Study Plan

As discussed below, the Districts have rejected or limited study of the La Grange Complex and its impacts on project and non-project resources. However, there is a proceeding underway to determine whether the Commission should exert jurisdiction over the La Grange Complex. If the Commission determines it has jurisdiction it will affect the scope of relicensing, including the appropriate scope of studies.

If the Commission determines that the La Grange Complex should be licensed as part of the Don Pedro Project, it will likely make this decision upon issuing a new license for the Project. The Commission also has discretion to consider La Grange under a separate license on its own schedule. Given the interrelatedness of the jurisdictional question and the Don Pedro study plan process, we request that the Commission issue a decision regarding jurisdiction that, while perhaps not final for purposes of appeal, is sufficiently definitive to allow the study plan to proceed with some certainty.⁹ The approved study plan should bring pre-filing finality to the issue of what information gathering and studies will be required by the Commission to provide a sound evidentiary basis on which the Commission and other participants in the process can make recommendations and provide terms and conditions.¹⁰ Thus, the approved study plan should provide study results that are consistent with the jurisdictional determination, whatever it is. If the Director of OEP issues a study determination prior to any resolution of the jurisdictional proceeding, we request that he include a provision for reopener of the study plan out of the ordinary Integrated Licensing Process (“ILP”) sequence that will be triggered if the Commission determines that La Grange is jurisdictional during study implementation.

⁹ “The purpose of an approved study plan is to bring, to the extent possible, pre-filing finality to the issue of what information gathering and studies will be required by the Commission to provide a sound evidentiary basis on which the Commission and other participants in the process can make recommendations and provide terms and conditions.” Dep’t of Energy, *Hydroelectric Licensing Under the Federal Power Act; Final Rule*, 68 Fed. Reg. 51070, 51078 (Aug. 25, 2003).

¹⁰ Dep’t of Energy, *Hydroelectric Licensing Under the Federal Power Act; Final Rule*, 68 Fed. Reg. 51070, 51078 (Aug. 25, 2003).

II.

Overarching Comments on Proposed Aquatics Studies

We provide specific comments and recommendations for revisions to the individual study plans and requests for OEP Staff's consideration in Section III, *infra*. We provide these comments by way of orientation to describe concerns that run to all if not most of the proposed aquatics studies, and which inform our specific recommendations for those studies.

A. Life-Cycle Modeling

1. Modeling Flow and the Relationship of Alternative Flows to Other Factors

We are concerned that factors influenced by flow will not be given sufficient weight when life-cycle models are developed. We are also concerned that the causal mechanisms by which higher flows in the Tuolumne improve juvenile emigration and ultimately escapement will not be established in the life-cycle models proposed by the Districts.

The Districts' "Salmonid Population Information Integration and Synthesis Study Plan" states:

Review of Chinook salmon run estimates since 1960 and the decades following completion of the New Don Pedro Project in 1971 indicates that similar cyclical patterns of high and low spawning returns have occurred in the lower Tuolumne River and the other San Joaquin Basin tributaries both before and after 1971. This pattern has been shown to be correlated with large variations in San Joaquin Basin outflow corresponding to drier and wetter water year types (TID/MID 2005; Mesick et al. 2008). However, estimates of Chinook salmon spawning escapement in the Tuolumne River since implementation of the 1996 Article 37 flow schedule have been variable with both high and low escapements following high flow years, so other factors are known to have significant effects on the salmon population.¹¹

While we recognize the opinion of the Districts and CCSF that non-flow factors may have significant effects on the salmon and *O. mykiss* populations, we in turn are concerned that flow will be lost in evaluation of these "other factors." The models must incorporate flow and evaluate the relative importance of other factors at differing flows. For example, mapping of redds under the existing flow regime (Study W&AR 8) may not capture the carrying capacity of the Tuolumne River for redds at higher flows.

2. Life-Cycle Modeling Process

The life history models, as proposed in Studies W&AR 5, 6 and 10, require additional specificity regarding organization, collaboration, transparency and peer review. We recommend

¹¹ Study Plan W&AR-5, p. 3.

that the Districts adopt the guidelines stated in the Independent Workshop Panel’s Report for the Delta Science Program’s June 14, 2011, Salmonid Integrated Life Cycle Models Workshop.¹² In relevant part, the Panel made the following recommendations about salmonid life-cycle models:

- (4) A standard glossary should be prepared and updated periodically.
- (5) Presentations and written documentation should be prepared and tailored to the audience.
- (7) A peer-review panel should be established to provide periodic feedback and advice.
- (8) Development of the new model should proceed as a series of iterative steps from the questions to the formulation of a new model.
- (9) A transparent strategy that utilizes available data should be developed for calibration and validation.
- (12) A parallel effort of data synthesis should be started with the initiation of the modeling effort.

We do not oppose the study plans as drafted for these proposed models, but we remain concerned that the plans leave a great deal of discretion to the Districts in development of these models and the selection of the data that will inform them. We cannot discern, on the basis of the study plans alone, substantive differences, for example, between the life-cycle model proposed by the National Marine Fisheries Service (“NMFS”),¹³ and those proposed by the Districts. It is in implementation that the rubber will meet the road. Absent clear process, the models are far less likely to be defensible and will in any case lack stakeholder buy-in and support.

3. Life-Cycle Modeling Inputs

The Districts propose to address the key fisheries issues in the lower Tuolumne River primarily through the construction of three salmonid life-cycle models, as described in Studies W&AR 5, 6 and 10. Many of the studies proposed by resource agencies would provide site-specific, up-to-date information to populate these models. These studies include:

- California Department of Fish and Game (“CDFG”): Study 2b: Bioenergetics Study; Study 2c: Salmon Health Study.¹⁴

¹² The report is available at http://www.deltacouncil.ca.gov/sites/default/files/documents/files/Salmonid_ILCM_workshop_final_report.pdf (last checked Oct. 22, 2011). This report was reproduced in a letter from Mr. Tim O’Laughlin, attorney for the San Joaquin River Group Authority (which includes the Districts) to the SWRCB. See letter from Tim O’Laughlin to SWRCB (Aug. 3, 2011), available at http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/docs/sjrf_spprtinfo/080311sjrga_ltr.pdf (last checked Oct. 22, 2011). Mr. O’Laughlin recommended that the SWRCB incorporate the recommendations of the Panel into its environmental analysis of “the San Joaquin River Basin Plan.”

¹³ See NMFS comments on scoping and PAD, and study requests, eLibrary no.20110610-5160, Study Request #8.

¹⁴ Numeration for CDFG studies is the numeration CDFG employs in studies proposed as part of its comments on the PSP.

- U.S. Fish and Wildlife Service (“FWS”): Study FWS-2: Age and Growth Study of *O. mykiss* in the lower Tuolumne River; Study FWS-3: Chinook Salmon Egg Viability Study; Study FWS-4: Chinook Salmon Survival Study.¹⁵
- NMFS: Study NMFS-05: Fluvial Processes and Channel Morphology for Anadromous Fishes.¹⁶

Conservation Groups recommend the adoption of each of the studies cited above. Each of these studies includes essential element(s) needed for the proposed life-cycle models. Existing information for these issues is not adequate for use in these models.

In their Updated PSP, the Districts have added language regarding some of these elements. However, that language simply acknowledges an outstanding issue; it does not clarify how that issue will be addressed. For example, the Districts have acknowledged the importance of growth rates in their revisions of Study W&AR 6 and Study W&AR 10, in Section 5.3, Step 2 of the respective studies. However, the Districts’ description of how this will be captured in the proposed life-cycle model is vague. When the Districts proposals are compared with the measures proposed in CDFG’s Bioenergetics Study and in FWS’s Age and Growth Study for *O. mykiss*, the resource agencies’ proposals are superior.

The Districts’ proposed studies only selectively address the data gaps identified by the resource agencies. For example, the Districts propose to address predation but not fish health, despite lack of evidence that the former is more of a factor than the latter. Moreover, the Districts propose to study predation only selectively: predation may in part be flow dependent, but the Districts have declined to study predation at flows greater than 2000 cfs. Flows greater than 2000 cfs might reduce predation, and should be studied to the degree that it is technically feasible to do so.

Most of the key issues for fisheries in this relicensing are related to the need to increase successful outmigration of salmon and steelhead juveniles from the Tuolumne River, and to increase the likelihood that successful outmigrants will be in a condition to successfully become ocean-going adults. The FWS’s proposed Chinook Salmon Survival Study (FWS-4) provides a framework to collect the empirical information that is lacking to make improvements in the quantity and quality of emigrating salmonids. The other studies (W&AR-7 Predation, CDFG-2c Salmon Health) requiring tracking or mark/recapture can be integrated into this study.

In their flow recommendations in the 2009 Proceeding on Interim Measures for the Don Pedro Project, the fisheries agencies recommended flows that would inundate floodplains.¹⁷ The

¹⁵ Numeration for studies proposed by FWS is the numeration employed by FWS in studies proposed as part of comments on scoping and the PAD. See eLibrary nos. 20110610-5081 and 20110610-5082.

¹⁶ Numeration for studies proposed by NMFS is the numeration employed by NMFS in studies proposed as part of comments on scoping and the PAD. See eLibrary 20110610-5160.

¹⁷ See FWS-NMFS-DFG Exhibit #1.

agencies recommended brief inundation (to evaluate benefits of food washing into river) even in Dry and Critically Dry years. In 2008, Mesick et al. hypothesized that juvenile rearing is the bottleneck for Tuolumne River salmon production, and lack of floodplain inundation is the principle causal mechanism (food availability, and perhaps predator avoidance).¹⁸ In 2010, Mesick hypothesized that water temperature is determinative.¹⁹ Mesick (2008) proposed study to better understand why floodplain inundation improved juvenile salmon survival. NMFS, in its comments on SD1 and the PAD in the present proceeding, recommended adopting this proposed interim flow schedule in order to better understand causation of why increased flow improves successful salmonid outmigration.²⁰

The Districts and CCSF have consistently declined to collect empirical evidence of fish behavior during floodplain inundation, yet have questioned the causal mechanisms for increased success of outmigration in years of high floodplain inundation. Mr. Ron Yoshiyama, outside fisheries biologist for the San Francisco Public Utilities Commission, posed these questions to the State Water Resource Control Board (“SWRCB”) in its ongoing proceeding regarding San Joaquin River flow and salinity:

17-The CDFG’s graphical analysis of the amounts of river surface area versus flows for the San Joaquin basin tributaries indicated the possible absence of accessible floodplain habitat on the Stanislaus River, based on the linear appearance of the plot in the CDFG’s Figure 8 (CDFG Comments on the Draft Technical Report). Previous analysis by the USFWS (Mesick 2009) has inferred that floodplain habitats exist on the Stanislaus River (and Tuolumne River) and have a pivotal role in enhancing juvenile salmon production and survival.

a-What direct evidence exists that shows the current presence of ecologically functional and beneficial (to juvenile salmon) floodplains on the Stanislaus and Tuolumne rivers?

b-Perhaps the existence of inundated floodplains that serve as rearing habitats on the Stanislaus and Tuolumne rivers is not the main reason why juvenile salmon production and survival are evidently enhanced (or at least associated with) high winter and spring flows. If inundation of floodplains is not the key mechanism,

¹⁸ Carl Mesick et al, *Draft Limiting Factors Analysis and Recommended Studies for Fall-Run Chinook Salmon and Rainbow Trout in the Tuolumne River*, 2008. Exhibit DFG-17 in the 2009 FERC Proceeding on Interim Measures for the Don Pedro Project.

¹⁹ Carl Mesick, *The High Risk of Extinction for the Natural Fall-Run Chinook Salmon Population in the Lower Merced River Due to Insufficient Instream Flow Releases*. California Sportfishing Protection Alliance, 2010. Submitted as an appendix to comments on water temperature standards by the California Department of Fish and Game in the Merced River relicensing,. See eLibrary no. 20110708-5013, pp. 36 ff (pdf pagination).

²⁰ See eLibrary no. 20110610-5160NMFS Study Request #6, Element 1, p. 152 (pdf pagination).

then what other mechanisms might explain why the higher winter and spring flows benefit juvenile salmon?²¹

In spite of Mr. Yoshiyama's pertinent questions, the Districts have consistently refused in the present proceeding to collect evidence to better understand why flow works. By adopting the study modifications proposed by Conservation Groups and the resource agencies' study requests as described in these comments, the Commission can advance this understanding consistent with its comprehensive planning and public trust obligations under Federal Power Act section 10(a)(1).

B. La Grange Complex

The Districts reject or limit studies²² of the Project's impacts on anadromous fish on the basis that the La Grange Complex is an intervening cause of the decline of anadromous fish in the Tuolumne, and the Commission does not have jurisdiction over the La Grange Complex.

First, Don Pedro has direct and cumulative effects on aquatic resources in the Lower Tuolumne. All the water that enters the Tuolumne River downstream of La Grange Dam, except during spill, is stored by the Project. Project releases determine flow in the lower Tuolumne River, and are primary determining factor in the non-irrigation season. According to NMFS, the Don Pedro Project and La Grange Complex "also appear to jointly act to exert direct effects on lower Tuolumne flows, temperatures, sediments, large wood, and other conditions that could affect anadromous fishes (including ESA-listed species)."²³ In its comments on SD1 and the PAD, the SWRCB stated: "[n]otwithstanding the license status of the [La Grange] Powerhouse, there is a cumulative impact with the operation of the two projects that must be considered in the NEPA analysis. The two projects are hydrologically connected and compliance for the Project is met through releases at La Grange."²⁴

Second, while the existing license does not include the La Grange Complex, that does not mean the new license cannot include it, or that the Commission cannot issue a separate license for it. NMFS, SWRCB and the Conservation Groups have requested that Commission Staff investigate whether the La Grange Complex is subject to the Commission's mandatory licensing jurisdiction.

On July 26, 2011, Commission Staff sent TID a letter requesting information regarding the La Grange Complex to assist in Staff's review of the Commission's authority over La Grange. The Turlock Irrigation District ("TID") filed its response on October 11, 2011.²⁵ On

²¹ Ronald Yoshiyama, *Questions for the Panel Discussion State Water Resources Control Board Draft Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives* (October 29, 2010), (Dec. 21, 2010), p. 5.

²² See, e.g., PSP, *supra*, Section 4.3.1.1, esp. pp. 4-3 to 4-5 regarding proposed studies NMFS-01, NMFS-03 and NMFS-07.

²³ See eLibrary no. 20110610-5160, NMFS Study Request #1, Section 3.0, p. 78 (pdf pagination).

²⁴ See eLibrary no. 20110609-5036, pp. 1-2.

²⁵ See letter from John A. Whittaker, IV to Kimberly D. Bose (Oct. 11, 2011).

October 18, 2011, NMFS filed information relevant to the Commission Staff's review.²⁶ NMFS stated that the La Grange Complex is jurisdictional because:

1) the La Grange Project occupies Federal lands or reservations; 2) the La Grange Project is located on a navigable waterway, and 3) if evidence of navigability is insufficient, evidence warrants a finding that the La Grange Project affects interstate commerce and has undergone project construction or modifications other than routine maintenance on or after August 26, 1935.²⁷

If the La Grange Complex satisfies any one of these criteria, it is jurisdictional. Thus, La Grange is subject to licensing, regardless of construction history, if it occupies federal lands. TID has stated that its internal mapping shows that the reservoir stops 400 feet (laterally) short of Bureau of Land Management ("BLM") lands. NMFS has Google-mapped the reservoir as extending onto those lands. The Commission should instruct TID to arrange for a cadastral survey by BLM of its lands adjacent to/occupied by La Grange.²⁸ Absent such survey, TID's internal mapping does not resolve the issue.

La Grange also is subject to licensing as part of the Don Pedro Project if it is used and useful to the Project. Under FPA section 4(e),²⁹ the Commission licenses hydropower "project works," which are defined in Section 3(12) of the FPA as the physical structures of a "project," which in turn is defined in Section 3(11) of the FPA as a "complete unit of improvement or development" including:

All dams and appurtenant works and structures (including navigation structures) ... and all storage, diverting or forebay reservoirs ... all miscellaneous structures used and useful in connection with said unit or any part thereof, and all water rights, rights-of-way, ditches, dams, reservoirs, lands, or interest in lands the use and occupancy of which are necessary or appropriate in the maintenance and operation of such unit³⁰

The Commission must license any work that is related to and necessary for project operation.³¹ Because the licensing of appurtenant works that meet the statutory definition is a mandatory statutory requirement, it cannot be waived.³²

The original license and the 1996 license amendment require the Districts to make minimum fish flow releases. Compliance with this requirement is measured downstream of the La Grange Complex. The Districts operate La Grange in a manner that passes these minimum flows. The La Grange facilities do not provide just a passive flow-through; the Districts exert

²⁶ See eLibrary no. 20111018-5030.

²⁷ Letter from Steve Edmondson, NMFS to Kimberly D. Bose, eLibrary no. 20111018-5030, p. 2.

²⁸ See <http://www.blm.gov/wo/st/en/prog/more/cadastralsurvey.html> (last checked Oct. 22, 2011).

²⁹ 16 U.S.C. § 797(e).

³⁰ 16 U.S.C. § 796(11).

³¹ See *Big Bear Area Regional Wastewater Agency*, 33 F.E.R.C. ¶ 61,115, 61,245 (1985).

³² See *N.Y. State Elec. & Gas Corp.*, 56 F.E.R.C. ¶ 61,144, 61,528 n.14 (1991).

affirmative control to release the flows through La Grange, as described below.

According to TID's "Report of Turlock Irrigation District to the Federal Energy Regulatory Commission on the La Grange Project," ("TID's La Grange Report"),³³ the La Grange Complex is used by the Districts to release fish flows required by the Don Pedro License (as amended in 1996) for the benefit of the lower Tuolumne:

In 1996, FERC approved the Don Pedro Project Settlement Agreement ... for the upstream Don Pedro Project ... wherein the Districts agreed, as part of its Don Pedro Project operations, to provide increased flows in the lower Tuolumne River to be measured at a location downstream of the La Grange Dam. These fishery flows are normally bypassed at La Grange Dam through the TID intake and tunnel, then via the penstocks and powerhouse. Turbine discharges at the La Grange powerhouse flow into a tailrace that joins the lower Tuolumne River about one-half mile below La Grange Dam. The two sluice gates in the canal forebay can also discharge flows into the tailrace.

The flows under the Settlement Agreement are normally discharged to the river at La Grange via the La Grange powerhouse and turbines....³⁴

Because the Districts affirmatively operate the facilities at La Grange to make flow releases required by the terms of their license for the Don Pedro Project, the La Grange Complex is used and useful to operation of the Don Pedro Project, and indeed an integral part to the "complete unit of development." As such, it is subject to the Commission's mandatory licensing authority.

The La Grange Complex is also used by the Districts to regulate peaking flows resulting from power operations at the Don Pedro Project. Based on our review of flow discharge data at MID's canal, TID's canal, and the Tuolumne River at La Grange it appears that the Districts manipulate the gates to the canals at La Grange, and Turlock and Modesto reservoirs to regulate peaking flows, as shown in the tables below.³⁵

³³ See letter from John A. Whittaker, IV to Kimberly D. Bose (Oct. 11, 2011).

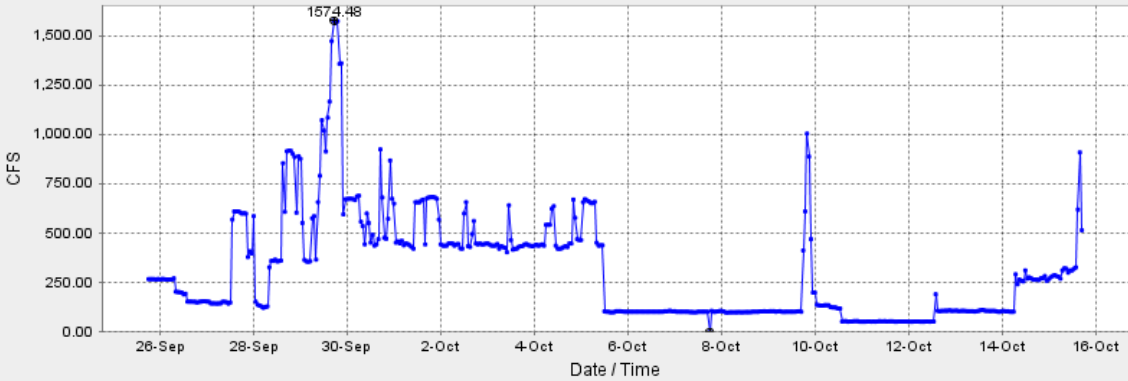
³⁴ TID La Grange Report, pp. 5-6.

³⁵ Graphs generated from California Department of Water Resources, California Data Exchange Center website, available at <http://cdec.water.ca.gov/river/tuol2Stages.html> (last checked Oct. 22, 2011).

MID CANAL AT LA GRANGE (MID)

Date from 09/25/2011 17:55 through 10/15/2011 17:55 Duration : 20 days

Max of period : (09/29/2011 17:00, 1574.48) Min of period : (10/07/2011 18:00, 0.0)

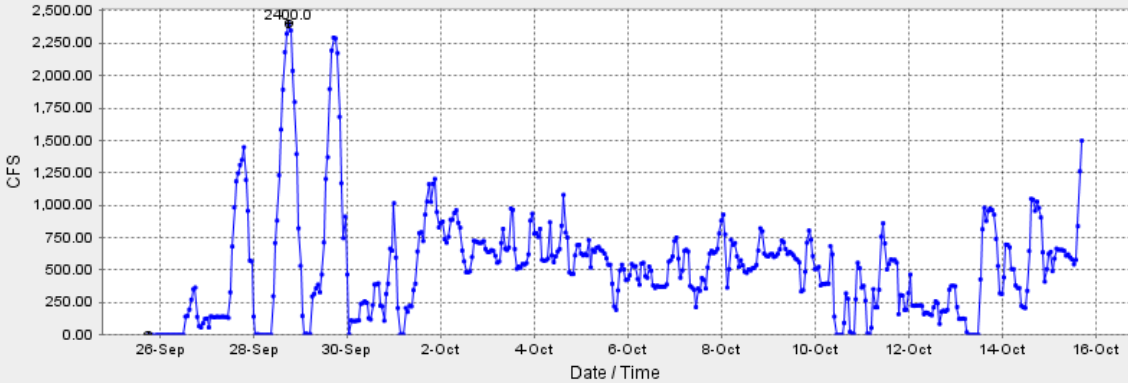


— FLOW, RIVER DISCHARGE - CFS (7550)

TID CANAL AT LA GRANGE (TIL)

Date from 09/25/2011 17:57 through 10/15/2011 17:57 Duration : 20 days

Max of period : (09/28/2011 18:00, 2400.0) Min of period : (09/25/2011 18:00, 0.0)

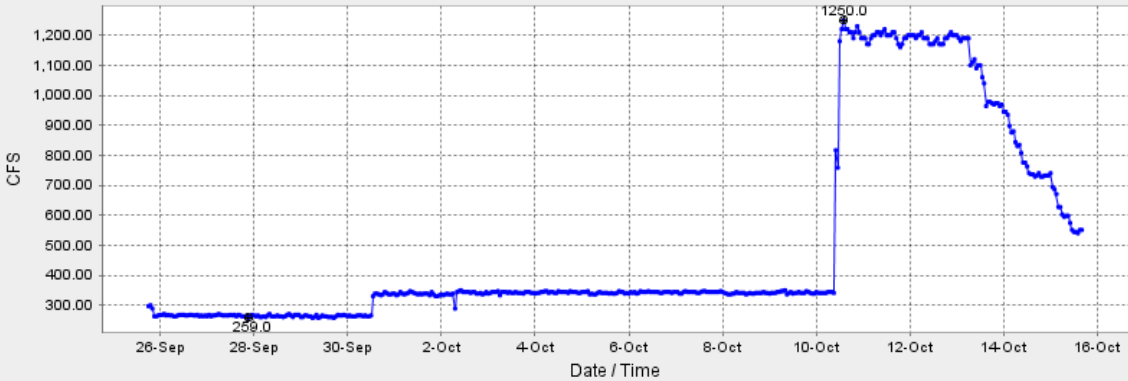


— FLOW, RIVER DISCHARGE - CFS (7551)

TUOLUMNE R BLW LA GRANGE DAM NR LA GRANG (LGN)

Date from 09/25/2011 17:58 through 10/15/2011 17:58 Duration : 20 days

Max of period : (10/10/2011 14:00, 1250.0) Min of period : (09/27/2011 21:00, 259.0)



— FLOW, RIVER DISCHARGE - CFS (6812)

It does not appear the Districts can regulate peaking flows from Don Pedro without the La Grange facilities. This makes the La Grange Complex used and useful to the Don Pedro Project, and as such it should be licensed as part of the complete unit of development for the Don Pedro project.

As stated in Section I.B.2, *supra*, we request that the Commission resolve the issue of its jurisdiction over La Grange Dam as soon as possible given that this issue is central to the relicensing, including the OEP Director's study plan determination. Even if the Commission is unable to reach an ultimate decision on jurisdiction in the next several weeks, we request that it make a decision that is sufficiently definitive to allow the study plan to proceed with some certainty. At the very least, any study determination made prior to decision on whether La Grange is jurisdictional should provide for specific reopener of the study plan to address such decision once it is made.

C. Socioeconomic Impacts on Non-Project Uses³⁶

The Districts' propose to study the socioeconomic impacts of changes to water supplies:

Potential changes in operations may affect available water supplies and have the potential to directly affect the local and regional agricultural industry, a critical economic engine that supports job creation both locally and in the Bay area and community well-being in the region.... Just as changes to flows below the Project are reviewed in terms of direct impacts to fish habitat, these same potential changes to flow and water supplies must be assessed in terms of direct and indirect impacts to the human environment, including potential costs and benefits to water users and the regional economy (e.g., job retention and creation).³⁷

Water supply is not a licensed function of the Don Pedro Project. As a general matter of law, water supply is outside of the Commission's jurisdiction. The Commission does not regulate water supply or operations related to water supply. Thus, the study results will not inform the development of license conditions. Nevertheless, the Districts propose to study water supply because it is one of the non-licensed, project benefits.

We support the study of socioeconomic impacts of changes to water supply for purposes of environmental analysis under federal and state law, regardless of whether the study will inform license conditions. However, we disagree with the Districts' position that it is appropriate to study the socioeconomic impacts on water supply, but not appropriate to study the socioeconomic impacts of the proposed action and alternatives on other non-project uses or to study mitigation of such impacts.³⁸

³⁶ We use this term to describe project benefits that are not actually licensed functions of the Project.

³⁷ Study Plan W&AR-15 (Oct. 2011), p. 1.

³⁸ In their initial response to our request, the Districts' cited criterion 5 of the ILP's study request criteria – "[e]xplain ... how the study results would inform the development of license requirements" (*see* 18 C.F.R. § 5.9 (b)(5)) – as the basis for not including study of potential actions by the Districts' or their customers to mitigate the adverse effects of reduced water supply. *See* PSP, p. 4-11. While the Districts' have softened their position

The Districts' logic for studying socioeconomic impacts to water supply, as quoted above, should extend to (1) studying the socioeconomic impacts of the proposed license and alternatives on other non-project uses like ecosystem services, the commercial and recreational fisheries, and recreation in the lower Tuolumne; and (2) studying measures to mitigate the potential impacts, including the study of potential responses by the Districts and CCSF,³⁹ and all of their respective customers to mitigate the impacts of reduced water supply.⁴⁰ As discussed in more detail in Section III.O., *infra*, the proposed study is inadequate because it focuses only on non-project uses sure to receive benefits from unchanged project operations, and the Districts' modeling approaches, i.e., IMPLAN, are likely to grossly overstate these benefits. For example, recreation is seen as predictable and quantifiable on the reservoir, but not below or above the reservoir. Property values for farmland where water would be applied are within the scope, but potential residential or recreational areas below the reservoir are not, even though residential land values are capable of increasing much more dramatically than agricultural. Residential property values can show high premiums for aesthetic and recreational amenities, both of which are improved with instream flows. The Districts' proposed methodology is inconsistent with federal guidance for socioeconomic analysis.⁴¹

OEP Staff has stated that it will prepare an EIS for this relicensing. Under the National Environmental Policy Act ("NEPA") and the Council for Environmental Quality's ("CEQ")

somewhat by proposing to study alternative responses at the farm-level (*see* Study Plan W&AR-15, p. 10), we presume their omission of potential mitigative responses by the Districts or municipal and industrial customers is based on their previous argument that such study will not inform license conditions. The Districts similarly refused to study socioeconomic impacts of the proposed action and alternatives on recreational and commercial salmon fisheries: "[t]he information developed by this study request would be highly speculative and would not inform development of license requirements." *Id.*, p. 4-12.

³⁹ The Districts propose to focus the study area on Stanislaus, Merced, and Tuolumne counties. They state that CCSF will be conducting an independent evaluation of potential economic impacts to CCSF and its water purchasers in the Bay Area. CCSF has not distributed its proposed study yet. To the extent that the District's study plan proposes to rely on the results of the CCSF's study, we request that CCSF distribute its proposed study plan for public review and comment as soon as possible.

⁴⁰ The Economic literature includes many peer-reviewed studies on non-market and ecosystem valuation. Loomis, J. 1987. "Balancing Public Trust Resources of Mono Lake and Los Angeles' Water Right: An Economic Approach." *Water Resources Research* 23: 1449-1456. August; Loomis, J. 1997. Use of Non-Market Valuation Studies in Water Resource Management Assessments. Colorado State University; Duffield, J. 2010. *Valuing Ecosystem Services in River and Lake Systems: Methods and Western U.S. Case Studies*. Presentation, Salt Lake City, April 28; Daily, G.C. (ed). 1997. *Nature's Services: Societal Dependence on Natural Ecosystems*. Washington, D.C.: Island Press; Blomquist, G.C. and D.R. Johnson. 1998. "Resource Quality Information and Validity of Willingness to Pay in Contingent Valuation." *Resource and Energy Economics* 20:179-196; Loomis, J., T. Brown, and J. Bergstrom. 2007. "Defining, Valuing, and Providing Ecosystem Goods and Services," *Natural Resources Journal* 47: 329-376.

⁴¹ *See, e.g., e.g.* Colby, B., and S. Wishart. 2002. Riparian areas generate property value premium for landowners. *Agricultural and Resource Economics, University of Arizona, Tuscon, Arizona.*; Loomis, J., P. Kent, L. Strange, K. Fausch, and A. Covich. 2000. Measuring the total economic value of restoring ecosystem services in an impaired river basin: results from a contingent valuation survey. *Ecological Economics* 33 (1):103-117.; Wilson, M.A., and S.R. Carpenter. 1999. Economic valuation of freshwater ecosystem services in the United States: 1971-1997. *Ecological Applications* 9 (3):772-783.

regulations implementing NEPA,⁴² an EIS must demonstrate that the Commission took a “hard look” at environmental consequences” of the proposed action and alternatives.⁴³ It is also required to consider measures to mitigate those impacts.

The requirement that an EIS contain a detailed discussion of possible mitigation measures flows both from the language of the Act and, more expressly, from CEQ's implementing regulations. Implicit in NEPA's demand that an agency prepare a detailed statement on “any adverse environmental effects which cannot be avoided should the proposal be implemented,” 42 U.S.C. § 4332(C)(ii), is an understanding that the EIS will discuss the extent to which adverse effects can be avoided. See D. Mandelker, *NEPA Law and Litigation* § 10:38 (1984). More generally, omission of a reasonably complete discussion of possible mitigation measures would undermine the “action-forcing” function of NEPA. Without such a discussion, neither the agency nor other interested groups and individuals can properly evaluate the severity of the adverse effects. An adverse effect that can be fully remedied by, for example, an inconsequential public expenditure is certainly not as serious as a similar effect that can only be modestly ameliorated through the commitment of vast public and private resources. Recognizing the importance of such a discussion in guaranteeing that the agency has taken a “hard look” at the environmental consequences of proposed federal action, CEQ regulations require that the agency discuss possible mitigation measures in defining the scope of the EIS, 40 CFR § 1508.25(b) (1987), in discussing alternatives to the proposed action, § 1502.14(f), and consequences of that action, § 1502.16(h), and in explaining its ultimate decision, § 1505.2(c).⁴⁴

The Commission requires that the license applicant provide information necessary to comply with NEPA regulations,⁴⁵ and “[c]onduct any studies that the Commission staff considers necessary or relevant to determine the impact of the proposal on the human environment and natural resources...”⁴⁶ So, regardless of whether study of socioeconomic impacts of the proposed action and alternatives on non-project resources, and measures that the Districts and third parties⁴⁷ can implement to mitigate these impacts, will inform license conditions, such study will yield information that the Districts are required to provide the Commission for purposes of compliance with NEPA. The Commission should require the Districts to gather this information now.

⁴² “The Commission will comply with the regulations of the Council on Environmental Quality except where those regulations are inconsistent with the statutory requirements of the Commission.” 18 C.F.R. § 380.1.

⁴³ *Robertson v. Methow Valley Citizens Council*, 490 U.S. 350 (1989) (quoting *Kleppe v. Sierra Club*, 427 U.S. 410, n. 21 (1976)); see also 40 C.F.R. § 1502.16.

⁴⁴ *Id.* at 351-52.

⁴⁵ 18 C.F.R. § 380.3.

⁴⁶ *Id.* at § 380.3(b)(2).

⁴⁷ The fact that the Commission cannot order third parties to implement mitigation measures does not mean that actions by third parties may not be considered in the EIS’s discussion of mitigation. See *Robertson, supra*, 490 U.S. at 352 – 353.

The Districts must obtain a water quality certification from the SWRCB pursuant to CWA section 401, 33 U.S.C. § 1341, so the proposed new license must also be reviewed under the California Environmental Quality Act (“CEQA”). Similar to NEPA, CEQA requires evaluation of environmental consequences and mitigation measures. Unlike NEPA, CEQA requires that agencies not approve a project if there are feasible alternatives or mitigation measures that would lessen the environmental impact:

The Legislature finds and declares that it is the policy of the state that public agencies should not approve projects as proposed if there are feasible alternatives or feasible mitigation measures available which would substantially lessen the significant environmental effects of such projects, and that the procedures required by this division are intended to assist public agencies in systematically identifying both the significant effects of proposed projects and the feasible alternatives or feasible mitigation measures which will avoid or substantially lessen such significant effects....⁴⁸

In addition, study of mitigation measures may support a potential term in the water quality certification, which would then be incorporated into the new license.⁴⁹ Thus, this information is necessary to the certification proceeding.

III.

Specific Comments on Individual Studies Proposed by the Districts

A. W&AR 1: Water Quality

Conservation Groups support this study provided that the Districts adopt any modifications recommended by the SWRCB.

B. W&AR 2: Operations Model

Conservation Groups support this study as it has been improved in several areas. The Districts have provided for consultation with relicensing participants on the development of the unimpaired hydrology database. It is essential that the hydrology be agreed on by all relicensing participants. The Districts also have provided consultation with relicensing participants on model development, though we recommend further refinement and description of a collaborative *process*, as opposed to the series of “workshops” as the Districts have framed it. Substantively, irrigation deliveries will be a variable in the model, rather than a fixed value. Perhaps most importantly, the operation of CCSF’s Hetch Hetchy system will be integrated into the model in a

⁴⁸ CA Pub. Resources Code § 21002.

⁴⁹ The SWRCB may impose other limitations on the activity as a whole to assure compliance with various provisions of the CWA and with any other appropriate requirement of state law. See *PUD No. 1 of Jefferson County v. Washington Dept. of Ecology*, 511 U.S. 700, 711-712 (1994).

disaggregated form, rather than as simply an input at the top of Don Pedro Reservoir. The inclusion of CCSF's operations in the model will allow the Commission and relicensing participants to evaluate impacts to the CCSF's operation of alternative flow conditions; this will aid both in evaluation of possible license terms and in the development of the EIS for the proceeding.

Conservation Groups agree that the daily timestep of the model is appropriate. However, we are concerned that this will not capture and describe daily flow fluctuations downstream of La Grange Dam, or describe the function that La Grange Dam plays in regulating power releases from Don Pedro Powerhouse. Conservation Groups recommend that a dataset that is at minimum representative of these hourly operations at and below La Grange be added to the hydrology dataset that will be used to develop the operations model. Flow fluctuations downstream of La Grange were significant enough to warrant a section in the 1996 Settlement Agreement that required the Districts to "minimize abrupt or daily flow fluctuations in the Tuolumne River during salmon spawning, incubation, and fry rearing"⁵⁰ The PAD provides only a very general description of the daily peaking operation of Don Pedro Powerhouse, and does not provide information on how this affects flow fluctuations in the Tuolumne River downstream of La Grange Dam.

Conservation Groups agree with CDFG that a HEC-ResSim platform would be more versatile for the Operations Model than the Excel Platform proposed by the Districts.

C. W&AR 3: Reservoir Temperature Model

Conservation Groups agree that the study plan as proposed will allow development of a tool to model water temperature. We share CDFG's serious concern that this tool will be too complex to allow use by relicensing participants. As such, it may not fulfill the requirements of Study Criterion 5, in that it may not be useful in the development of license conditions. We also share CDFG's concern that resource agency technical experts may not be able to QA/QC the model's calibration. We continue to support CDFG's recommendation that the Districts use a two dimensional, CE-QUAL-W2 model to model temperature in Don Pedro Reservoir.

While we are concerned that many relicensing participants will not have the capacity to run this model, we appreciate the Districts' offer to make the water temperature model for Don Pedro Reservoir available until a new license for the project is issued, and to provide training in the use of the model to interested relicensing participants. We also appreciate the Districts' commitment to use the model to explore various operational scenarios as the ILP process goes forward. These steps will be essential, regardless of what model is chosen.

⁵⁰ See New Don Pedro Proceeding P-2299-024 Settlement Agreement, eLibrary no. 19960207-0246, Section 16, p. 13.

D. W&AR 4: Spawning Gravel

Conservation Groups are concerned that the study as proposed will not provide understanding of the total coarse sediment stored within the spawning reaches of the Tuolumne River.

While McBain and Trush (2004) document that the total loss of spawning habitat between pre-dam and post-dam times was 73%, they do not document total loss of coarse sediment stored in the lower Tuolumne. To better understand total coarse sediment stored and the change in coarse sediment stored in the lower Tuolumne River, the Districts should incorporate Study NMFS-05 (Fluvial Processes and Channel Morphology), Element 3 into the proposed study (quantify coarse sediment storage in lower Tuolumne River). With this information in hand, the Districts should develop a coarse sediment budget, per Study NMFS-05, Element 7.⁵¹

Additionally, we are concerned that the Districts' proposal to quantify existing available spawning habitat will be limited to flows up to 300 cfs, which will exclude existing potential spawning habitat at higher flows, both physically (along margins and floodplain terraces) and in terms of velocity and depth. The Districts should examine spawning habitat at a broader suite of flows in order to account for potential spawning habitat. The Districts should evaluate flows up to 500 cfs for fall-run Chinook. The Districts should evaluate flows up to 4000 cfs, for *O. mykiss*, which spawn in the spring when flood flows are likely in wet years. Special attention in the *O. mykiss* evaluation should be paid to locations where physical channel improvements have been implemented,

The proposed study will not refine the sediment transport curve, which currently lacks data for flows over 6,800 cfs. The Districts should characterize gravel movement at up to 5 year flow events in order to provide understanding of how spawning gravel moves and changes.

In Study W&AR 8 (Salmonid Redd Mapping), the Districts propose to compare field data collected under that study with the results of previous studies performed on the lower Tuolumne River. The Districts should include a similar exercise in the proposed Spawning Gravel study, in order to consider trends following several high flow events that have occurred since previous studies (1986, 1999) were conducted.

Finally, the District's proposed study does not attempt to analyze the potential spawning habitat that could reasonably be created through a coarse sediment supplementation program. This estimate will be important to consider in conjunction with the salmon population models; by increasing spawning habitat there is potential to increase production of fry in the river.

⁵¹ See eLibrary no. 20110610-5160, pp. 135 ff., (pdf pagination).

E. W&AR 5: Salmonid Population Information and Integration

Conservation Groups support this study, but have significant concerns regarding implementation, as noted in our overarching comments about consultation and collaboration, and modeling, above. This study will gather existing information for salmonids in the Tuolumne River, and will also gather information relating to portions of life histories of Tuolumne River salmonids that take place outside the Tuolumne River.

It is unclear to Conservation Groups whether figure 5.3.1 in the proposed study is intended strictly as an example, or whether the study will include construction of a salmonid life-cycle model or models including portions of salmonid life histories that are outside the Tuolumne River. We believe there is value in construction of such a model, or at least in extensive analysis of life histories of Tuolumne River salmonids including those periods outside the river. This is particularly pertinent since a substantial part of the Districts' and CCSF's arguments in 2009, and an expressed concern of the Commission, dealt with the role of factors outside the river in limiting salmonid populations. Conservation Groups explicitly requested such analysis in our comments on SD1.⁵²

We recommend that a peer review process be added to this study plan.

F. W&AR 6: Chinook Salmon Population Model

Conservation Groups support this study, but have significant concerns about its implementation, as noted in our overarching comments about consultation and collaboration, and modeling, above.

We recommend that a peer review process be added to this study plan.

G. W&AR 7: Predation

As a general matter, Conservation Groups note that Study W&AR 7 as proposed seeks to valorize a predetermined theory by the Districts that predation is a major limiting factor on salmonid survival, and in particular on the survival of salmon smolts.

In a letter to the SWRCB, Mr. Tim O'Laughlin, attorney for the San Joaquin River Group Authority (which includes both licensees and CCSF), defined the Districts' position: **"The reason the salmon smolts are dying in the South Delta is: PREDATORS ARE EATING THE SMOLTS."**⁵³

He further stated:

⁵² See Conservation Groups comments on scoping and the PAD, eLibrary no. 20110610-5198, pp. 26-27.

⁵³ Letter from Tim O'Laughlin to SWRCB (Feb. 8, 2011), available at http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/docs/sjrf_spprtinfo/02082011sjrga.pdf, p.2 (emphasis in original) (last checked Oct. 22, 2011).

Rather than increasing San Joaquin River flows to reduce predation, which, to date, has not been proven successful, predation can be addressed immediately by eliminating the sport-fishing regulations which currently protect the non-native piscivorous fish. Thus, predation by non-native species can be reduced effectively and inexpensively by allowing more of these non-native species to be taken by anglers.⁵⁴

During the informal resolution of study issues in the present proceeding, the Districts acknowledged that this study was undertaken under their own initiative, and might not fulfill the requirement that it be able to inform license conditions. However, a consultant for the Districts offered the opinion that demonstration of predation might support a position that flow increases to improve successful outmigration of salmon and *O. mykiss* juveniles might not be warranted.

In response, Conservation Groups challenged the Districts to demonstrate two basic things: first, that reduction of predation in the Tuolumne River could have a statistically defensible population level effect on the improvement of successful salmonid outmigration; and, second, that there are feasible measures that can be taken to reduce predation in the Tuolumne river to achieve such a population level improvement. Conservation Groups proposed that the Districts add an element to the predation study that will establish a statistically defensible level of predation, and that this level of predation then be used to establish a statistically defensible population level effect. Conservation Groups also proposed the Districts add to the study an element that surveys and analyzes previous efforts to reduce predation, and demonstrates a feasible means of reducing predation on salmonids in the Tuolumne River.

The Districts have added language to the study plan to describe proposed statistical analysis of predation rates and to include a survey of previous successful efforts to reduce predation on salmonids. Conservation Groups have significant concerns that the statistical methods described will not yield defensible results, given the limited amount of sampling, the planned extrapolation to non-sampled areas in a river with substantial channel diversity and the irregularity of extensive gravel mining pits, potential limited ability to electrofish, seasonal differences in predator behavior and location if electrofishing is allowed only in summer, high variability in number of juvenile fish from year to year, and limited number of fish that will be included in the tracking element of the study.

We are also concerned that the proposed literature review will not yield results that lead to feasible predator reduction measures. Efforts to eradicate or significantly reduce the population of pikeminnow (native to California, but not to the Eel River) in the Eel River downstream of facilities of the Potter Valley Project (FERC No. 77) have proven largely unsuccessful, to the point that they have been all but abandoned by licensee Pacific Gas & Electric Company with the approval of NMFS and the Commission.⁵⁵

⁵⁴ *Ibid.*

⁵⁵ See eLibrary 20110603-5268, Attachment 1, p. 3:

As proposed, the Districts would track a limited number of predators (probably about ten) and 75 juvenile salmon. The juveniles would be tracked at flows of about 300 cfs and 2000 cfs. Conservation Groups recommended that the juveniles could be tracked one dimensionally (how far they move downstream) during flows higher than 2000 cfs, to gain a sense of rate of movement during floodplain inundation. The Districts stated during informal study resolution that, while lateral movement in the river would be difficult to track during periods of floodplain inundation, movement downstream could be tracked without handheld tracking devices. We therefore recommend that a third of the salmon fitted with tracking devices, and a third of those coded-wire tagged or marked, be released at a flow of 4000 cfs. This additional tracking will 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.

We further recommend that the number of fish tracked be increased to 200 per year, as recommended in the FWS's proposed Juvenile Salmon Survival Study (Study FWS-4).⁵⁶ We expect that the additional cost for this study element would be less than a proportional cost for the number of samples proposed by the Districts, since the equipment and set-up will already have taken place.⁵⁷ Since this is a seminal issue and point of disagreement that has been repeatedly raised by the Districts themselves, we respectfully submit that the extra expense would be worth the cost. Moreover, if the tracking and marking were used for analysis in other proposed studies, such as the Salmon Health Study, additional cost savings and economy of effort could be achieved.

Finally, we recommend, again consistent with Study FWS-4, that 800 juvenile salmon per year be coded-wire tagged, or else marked, and then released, in a manner specified in the Districts' proposed study Predation Study, and/or consistent with the mark/recapture element of the Districts' proposed Chinook Fry Study.

After evaluation of gillnetting data from the summer of 2006, NMFS, CDFG, and RVIT concluded that these suppression efforts had a detrimental impact on rearing steelhead, an ESA-listed species. Accordingly, NMFS, in an email communication to PG&E dated May 15, 2007 (Enclosure 3 of PG&E's May 30, 2007 submittal to FERC of the 2006 Pikeminnow Monitoring and Suppression Annual Report), requested that PG&E not conduct gillnetting in 2007, pending further investigation into other less harmful methods of suppressing pikeminnow. Then, NMFS, in a letter dated April 15, 2008 (Enclosure 3 of PG&E's May 28, 2008 submittal to FERC of the 2007 Pikeminnow Monitoring and Suppression Annual Report), stated that pikeminnow suppression activities would not need to be implemented during 2008, nor in future years, unless an alternate suppression method was submitted for consideration. No alternate pikeminnow suppression methods have been identified. Thus, no pikeminnow suppression activities were conducted during 2010.

⁵⁶ Study FWS-4 proposes two years of field data collection.

⁵⁷ When the Districts provide their cost estimate for this element in the Revised Study Plan, we will provide our cost estimate for the addition.

H. W&AR 8: Salmonid Redd Mapping Study Plan

Conservation Groups support this study. An empirical evaluation of past and present redd location will provide important information. However, we have concerns about several study elements. We question timing of *O. mykiss* spawning, which likely extends into April (*see* section 5.3, Step 2). We recommend that surveys for *O. mykiss* continue through April.

The Districts should revise the study to require surveyors to catalogue the flow during their surveys. We are concerned that the surveys will have less value than they might because they may be limited to baseflows under the current flow schedule. The potential extent of redds will not be captured by surveying at existing baseflows. On the other hand, we are also concerned that the extent of *O. mykiss* redds may not be captured if 2012 is a relatively wet year. The study plan should address how surveys will be conducted to be as effective as possible should high flow conditions exist.

The comparison with historic mapping has value, particularly since previous years when surveys occurred were in some cases wet years. An effort should be made to research and document the flows during previous surveys, if such information is not already presented in existing information.

This study will not address the gravel and flow needs of salmonids, nor the amount of potential habitat available. While useful as a survey, this study will have limited use in establishing a sediment budget or in setting other non-flow PM&E measures that might improve spawning conditions. Therefore, we recommend that proposed study NMFS-5 (Fluvial Process and Channel Morphology) be adopted in addition to this study.⁵⁸

I. W&AR 9: Chinook Salmon Fry Study Plan

Conservation Groups provide a redline of this study for consideration by the Commission as Attachment 2. Essentially, the redline requests that flow manipulations to encourage emigration of juvenile salmon be added in the late March through mid-April time period, in addition to those proposed in the Districts' study for February and early March. We have re-titled the study plan as the *Chinook Salmon Flow Manipulation and Emigration Study Plan*, and provided additional background and rationale for why adding flow manipulations during this period may be beneficial. We also recommend increasing the sample size of marked fish to 800 per flow manipulation period (one period in February-March and one period in March-April in each year).

The Chinook Salmon Fry Study Plan as presented by the Districts is a study to gain evidence in support of a single theory: “[i]t is likely that during dry water years, opportunity to successfully emigrate to and rear in the Delta is limited to fry emigration in the early season. Flow manipulations that encourage fry to emigrate from their natal reaches during such dry years

⁵⁸ See eLibrary no. 20110610-5160, pp. 135 ff., (pdf pagination).

may increase their survival potential.”⁵⁹ As proposed, the study assumes the value of a particular Protection, Mitigation & Enhancement (“PM&E”) measure, without gathering evidence to support other PM&E measures that may be equally or more effective.

Current conditions in the Delta are generally not favorable to successful rearing of Chinook salmon juveniles. In the 2009 proceeding on Interim Measures, Noah Hume, outside consultant to the Districts, testified: “[a]bsent major reductions in export levels, however, it is unlikely that predator habitat suitability and predation levels in the Delta will markedly improve.”⁶⁰

Dr. Peter Moyle, outside consultant to the CCSF, testified that moving juvenile salmon through the Delta quickly might improve their survival:

However, once the juvenile salmon leave the river, transported by winter flows, they mostly die. In the past, prior to extensive habitat loss and alteration in the Delta and San Francisco Estuary, salmon fry and juveniles probably were able to survive and rear in areas downstream of the Tuolumne River, in extensive marshes and shallows (Moyle et al. 2008). Today few of these small juveniles survive to come back as adults. The best survival appears to be of fish that have become smolts in the river and move rapidly out to sea, spending little time in the Delta. Highest survival occurs during wet years, when there are high flood flows simultaneously coming from the Merced, Tuolumne, and Stanislaus rivers (Mesick and Marston 2007; Moyle et al. 2008).⁶¹

In the SWRCB’s ongoing San Joaquin Flow and Salinity proceeding, Dr. Carl Mesick, outside consultant to the California Sportfishing Protection Alliance, recommended: “[i]nstead, it would be more beneficial, particularly during Critical and Dry years, to focus the flow requirements on temperature management in March and April, when flow releases can best control water temperatures.”⁶²

As proposed, the PM&E measure that would be informed by the Districts’ study would likely require small amounts of instream flow in the spring of drier years. In spite of extensive discussions during informal study resolution, the Districts have continued to decline to study flow manipulations that might inform actions based on a competing theory. This competing theory might result in the use of relatively more water than the approach promoted by the

⁵⁹ Study W&AR 9, p. 3.

⁶⁰ Exhibit DIS-15, p. 17. Dr. Hume’s testimony relates numerous factors that make conditions in the Delta contribute to low likelihood of survival for fish rearing there or migrating through.

⁶¹ Exhibit CSF-1, p. 11.

⁶² Carl Mesick, *Comments on the Draft Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives*, submitted on behalf of the California Sportfishing Protection Alliance, December 3, 2010. The formal name of the proceeding is: Update to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary: Water Quality Objectives for the Protection of Southern Delta Agricultural Beneficial Uses; San Joaquin River Flow Objectives for the Protection of Fish and Wildlife Beneficial Uses; and the Program of Implementation for Those Objectives. In these comments, we use “San Joaquin Flow and Salinity Proceeding.”

Districts. However, it might also be more effective in promoting successful migration of juvenile salmon to the ocean. Moreover, as proposed by Conservation Groups, flow management during the March – April timeframe may prove more beneficial than the previous Vernalis Adaptive Management Program experiments, which initiated pulse flows in the late April – May timeframe to support emigration of salmon from the San Joaquin River watershed.

Conservation Groups do not suggest that the Districts' theory be discarded. As we said in informal study resolution discussions, future conditions in the lower San Joaquin River, the South Delta, and the Delta as a whole, may improve, and juvenile rearing of salmonids in the lower San Joaquin and in the Delta may over the term of the new license become more viable. At present, however, there are conflicting visions of the value of fry emigration in February and early March of below normal and drier water years. The Districts and OEP Staff should consider alternative approaches based on a temporal modification of this study proposal. We also point out that increased flows from the Tuolumne River during the February through June time period are likely to be required by the SWRCB as part of the San Joaquin Flow and Salinity Proceeding.⁶³ Finally, the resource agencies in this proceeding have expressed the opinion that encouraging juvenile salmon to emigrate from the Tuolumne River in the fry stage is counter-productive. Indeed, the dismal conditions for juvenile salmonids in the Delta were cited repeatedly by the Districts and CCSF in the 2009 Proceeding on Interim Measures.

Conservation Groups, *see* redlined study attached, have proposed study flow values for the March 20 to April 20 time period. However, we recommend that there be consultation and discussion among relicensing participants to consider alternative flow values for the flow manipulations proposed for this study after the specified literature is collected and made available for review.

J. W&AR 10: *O. mykiss* Population Study

Conservation Groups support this study, but have significant concerns regarding its implementation, as noted in our overarching comments about consultation and collaboration, and modeling, above.

We recommend that a peer review process be added to this study plan.

K. W&AR 11: Chinook Salmon Otolith Study

Conservation Groups support this study, and believe that the information it will collect will be very useful in this proceeding.

⁶³ *See* SWRCB, *Revised Notice of Preparation and Notice of Additional Scoping Meeting* for the Update to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary: Water Quality Objectives for the Protection of Southern Delta Agricultural Beneficial Uses; San Joaquin River Flow Objectives for the Protection of Fish and Wildlife Beneficial Uses; and the Program of Implementation for Those Objectives. (In these comments, "San Joaquin Flow and Salinity Proceeding,"). The Notice of Preparation was submitted by NMFS as an appendix to its comments on the Don Pedro PAD and SD1 comments, *see* eLibrary no. 20110610-5160, p. 215 (pdf pagination) and following pages.

L. W&AR 12: *O. mykiss* Habitat Survey Study

Conservation Groups believe that this study is incomplete and so recommend several additions. The study as proposed by the Districts is designed to 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 will be used to inform the evaluation of in-river factors that may affect the quantity and quality of habitat available for juvenile *O. mykiss*.

The proposed methodology does not adequately address two central questions about LWD in the lower Tuolumne:

- What is the optimal distribution, abundance, and quality of LWD for juvenile *O. mykiss* in the highly altered system of the lower Tuolumne River?
- What is the transport rate of LWD out of the lower Tuolumne River?

The proposed study will identify and provide a count of LWD, but it will not provide sufficient data to answer the questions above.

We recommend several approaches to understand the distribution, abundance, quality and transport rate of LWD. First, the Districts could review existing information regarding LWD utilization and abundance taken from other river systems. For example, the Cosumnes River is another Central Valley river that is generally undammed and thus, to a certain degree, representative of what might be found in unregulated Central Valley streams with Sierra Nevada headwaters. We also recommend reviewing information from other streams outside the Central Valley. Second, historical records from the Tuolumne or other Central Valley streams may provide insight into optimal quantities and transport rates of LWD in Central Valley rivers, so we recommend a review of existing information, historical records, and data from the Tuolumne and other Central Valley rivers to assist in establishing the desired condition for LWD. Third, we believe that the elements described in Study NMFS-5, *Effects of Project and Related Facilities and Operations on Fluvial Processes and Channel Morphology for Anadromous Fishes*, will be very useful in answering the questions.

The Districts reject quantification of the LWD trapped in Don Pedro Reservoir because it “would not inform the development of license requirements (ILP Criteria #5) and there is no methodology that can provide reliable estimates of LWD quantities (ILP Criteria # 6).”⁶⁴ However, the Districts do not provide the basis for these conclusions. The Districts do not appear to dispute that the project affects LWD transport from above the dam to below it, or that LWD is an essential element of *O. mykiss* habitat. Given the project nexus, their application of ILP criterion 5 is not clear. We defer to the expertise resource agencies that there are reliable methods to estimate LWD quantities. Quantification, even if imprecise, provides a basis for the level of mitigation effort that is appropriate. If the Districts believe that an alternative basis for evaluation of their responsibility for LWD could be developed, they should describe it.

⁶⁴ PSP, p. 4-10.

We recommend several elements from Study NMFS-05 be merged with the Districts' proposed study. Specifically, NMFS's proposed Elements 2 and 6⁶⁵ provide the best methods for quantifying the amount of LWD trapped by project facilities, loading in the lower Tuolumne, and transport downstream and out of the system. In Element 6, NMFS specifically instructs that, where possible, the existing LWD loading data should be compared with any available historical data to assess how the resource amount is trending through time. LWD sampling reaches should in part be selected to facilitate comparison with any historical data identified (although none is described in the PAD). Also, Element 6 requires collection of a more complete dataset to describe the LWD than the Districts' proposal. The Districts' proposal prescribes a count of LWD at a given location; NMFS's proposal includes requires additional description of many LWD characteristics, including length, diameter, orientation, rootwad presence/absence, etc. These additional elements will be much more useful for understanding utilization of LWD by anadromous fish.

Using the information gathered per Elements 2 and 6, the Districts can develop a LWD budget for the lower Tuolumne per Element 7 in Study NMFS-05. As stated above, we believe this information would be useful to informing a license condition to address the project's impact on LWD for the benefit of *O. mykiss*.

Finally, we believe the Districts' proposal unduly limits the geographic scope of study. The Districts' study as proposed would evaluate only a 15-mile reach of the lower Tuolumne; presumably, this would roughly overlap the area studied in Stillwater (2008), which extended from approximately RM 39 to RM 51. However, LWD should be provided for emigrating juvenile *O. mykiss*, which means that the study should examine the lower reaches of the lower river as well. We therefore recommend that the geographic scope of study be expanded to include the reach of the lower Tuolumne from La Grange to RM 11.

M. W&AR 13: Fish Assemblage and Population between Don Pedro and La Grange Dam Study

Conservation Groups support this study, and believe the proposed survey methods are appropriate.

N. W&AR 14: Temperature Criteria Assessment Study

We disagree with the proposed study's objective to change a water temperature criterion in the absence of site-specific evidence. The study proposes to allow participants to select literature that will support a less protective water temperature criterion than was re-affirmed by the jurisdictional U.S. Environmental Protection Agency (EPA) within the last month. We recommend the objective of the study be recast to be quantification of the exceedences at

⁶⁵ Element 2: Amount of LWD Trapped in Don Pedro Reservoir; Element 6: Frequency and Volume of LWD in Lower Tuolumne River Stream Channel. See eLibrary no. 20110610-5160, pp. 135 ff., (pdf pagination).

different points in the river under existing and potential future flow conditions, not as an effort to revise accepted guidelines.

In the Commission's "Revisions to Study Plan" for the nearby Merced River Project, Commission Staff states:

We note that *EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards* (2003) states that a constant temperature of over 13°C (55°F) can result in reduced viability of gametes in holding adults. We acknowledge that [Merced Irrigation District] selected temperature criteria based upon the results of a collaborative development an adjacent river system; however, we agree with CDFG that no empirical evidence suggests that Merced Basin salmon have a higher temperature tolerance. For these reasons, we find that [Merced Irrigation District] should follow EPA's (2003) guidelines for temperature requirements for salmonids.⁶⁶

In the Merced relicensing as quoted above, the Commission set the standard for changing temperature requirements for salmonids in the Merced River as "empirical evidence" of a higher temperature tolerance. The Districts have not provided any site-specific physiological evidence that Tuolumne River salmonids have a higher temperature tolerance than salmonids on the Merced.

We agree it may be useful to evaluate physiological evidence of a higher temperature tolerance of Tuolumne River salmonids as compared to the EPA criteria; however, the temperature study as proposed by the Districts does not do that. Instead, it seeks to revise temperature criteria based on yet another literature review, and to *re-define criteria*, rather than making them specific to the Tuolumne River.

Section 5.2 of the Temperature Criteria Assessment Study Plan describes how a literature survey will be used:

The results of information developed under Step 1 will identify:

- The relevant life history timing of Chinook salmon and steelhead in the Tuolumne River.
- The types of life stage-specific effects on Tuolumne River Chinook salmon and steelhead that could occur over a range of water temperatures.
- Life stage-specific effects of temperatures in the Lower Tuolumne River on Chinook salmon and *O. Mykiss*.

⁶⁶ See "Revisions to Study Plan" for the Merced River Relicensing, eLibrary no. 20110811-3030, p. 6. "MID" in this quote refers to the Merced Irrigation District.

- The most robust approach to developing parameters applicable to characterizing effects of temperature conditions in the Lower Tuolumne River on its Chinook salmon and *O. mykiss* populations.⁶⁷

The proposed study can achieve the first and second bullets. A literature review can determine the life history timing of salmon and steelhead in the Tuolumne, though we also recommend consultation with resource agency biologists who have direct experience of such timing on the river. A literature review can also evaluate the *types* of effects. However, a literature review cannot identify “[l]ife stage-specific effects of temperatures in the Lower Tuolumne River on Chinook salmon and *O. Mykiss*.” For that, empirical evidence, including physiological study, is needed. Absent such evidence, “[t]he most robust approach to developing parameters applicable to characterizing effects of temperature conditions in the Lower Tuolumne River on its Chinook salmon and *O. mykiss* populations” also cannot be developed.

As stated above, we agree it may be useful to evaluate the effects of project operations on water temperatures in the lower Tuolumne River, and to extend the evaluation to the effects of those temperatures on salmon and *O. mykiss*. The study can and should also quantify the likely effects of different exceedences and degrees of exceedence. Assuming that the physiological effects of temperature on Tuolumne River salmonids are no different than the physiological effects of the same temperatures on salmonids in other geographic locations, then a literature review can help quantify the likely effects.

Such analysis would be made more robust by gathering relevant site-specific information, such as that requested in the FWS’s proposed Age and Growth Study of *O. mykiss* in the Tuolumne River (FWS-2), and CDFG’s proposed studies of Fish Health and Bioenergetics (CDFG-2c and CDFG-2b). The discussion of growth, disease and bioenergetics in the Districts’ proposed Temperature Criteria Study under Section 5.2, Step 2, Chronic and Sublethal Criteria, totally lacks specificity and definition.

If the Districts believe that thermal refugia are available in the Tuolumne River to support a site-specific relaxation of EPA temperature standards for salmonids, then the Districts should design a separate study to map and document the absence or presence of such refugia, and, if present, the location and extent of such refugia, and their actual use if any by salmon or *O. mykiss*.

A potential template for consideration of temperature in the Tuolumne River was already provided by FWS as an exhibit in the 2009 Proceeding on Interim Flow Measures for the Tuolumne River.⁶⁸ The report was created by the East Bay Municipal Utilities District, and was entitled “*Lower Mokelumne River: Reach Specific Thermal Tolerance Criteria by Life Stage for Fall-Run Chinook Salmon and Winter-Run Steelhead.*” This report contains a thorough literature review of thermal criteria for salmon and steelhead. At present, relicensing participants in the Merced River relicensing are using this study as the basis to construct modeling scenarios for

⁶⁷ Study W&AR-14, p. 4.

⁶⁸ Exhibit FWS-59 in the 2009 Proceeding on Interim Measures.

potential PM&E measures, using lifestage histories and geographic locations specific to the Merced River. The bi-weekly meetings proposed in this study (Section 5.0) could provide an opportunity for a similar discussion and development of alternative operations modeling scenarios that would evaluate the biological benefits and the water costs of maintaining various water temperatures at different times and different geographic locations.

As proposed in Study W&AR 14, the Districts plan to analyze temperature exceedences in the Tuolumne River in comparison to baseline conditions (*see* Section 5.2, Step 3). This is a good first step, but such analysis should also be made, in conjunction with the operations model and the water temperature models, of a reasonable range of alternative flow conditions.

O. W&AR 15: Socioeconomics

As stated above, we support the principle that the Districts should study the socioeconomic impacts of the proposed license and alternatives on non-project uses. However, we do not support the Socioeconomic Study in its current form. We recommend that it be revised to treat non-project uses consistently and consider measures to mitigate potential impacts on such uses, per the specific recommendations below.

Section 4(e) of the FPA⁶⁹ and federal guidance on regulatory analysis from the Office of Management and Budget,⁷⁰ require that the Commission consider all the costs and benefits of a policy, not only the target benefits. The fundamental flaw in the socioeconomic study proposed by the Districts is that it does not consider any categories of effects other than the benefits of status quo operations at the Don Pedro Project. This narrow focus will bias the study results by neglecting all costs imposed on others by project operations. The proposed study is more than willing to consider all manner of secondary and tertiary market and non-market benefits of the Project, but even the most direct costs not borne by the Districts are considered outside the scope of study.

The Districts dismiss any proposals to consider project costs borne by third parties. For example, they respond to requests for more complete assessments of the economic consequences of fishery effects by claiming the connections between the Project and fishery effects cannot be ascertained from data because the relationship is not adequately understood. By contrast, the Districts are quick to dismiss considerable data that farmers have enjoyed record earnings despite drought and recession in favor of relying on assumptions about groundwater responses, which

⁶⁹ Section 4(e) states:

In deciding whether to issue any license under this subchapter for any project, the Commission, in addition to the power and development purposes for which licenses are issued, shall give *equal consideration* to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality.

16 U.S.C. §797(e) (emphasis added).

⁷⁰ Office of Management and Budget, Circular A-4 (2003, updated Sept. 17, 2011), *available at* http://www.whitehouse.gov/omb/circulars_a004_a-4/ (last checked Oct. 22, 2011).

are much more difficult to track than the direct effects of water and habitat scarcity on fisheries.⁷¹

The Districts' proposed study is further compromised by its reliance on IMPLAN. IMPLAN and other regional economic models are notorious for providing false precision and inflated multiplier effects by translating small, short-term, and widespread effects as enduring and locally concentrated, with greater local concentration of labor and material sourcing than evidence suggests ever plays out.⁷² IMPLAN is a useful tool when applied appropriately and interpreted at the fair level of confidence. But even when done right, IMPLAN's analysis is still coarser than most biological models of ecological and biological impacts imposed by dams on rivers. Models such as IMPLAN that do not reflect any adaptation or substitution of inputs, crop choice, timing, or irrigation practices overstate effects because people are adaptive. Economies and communities are complex adaptive systems, and the knowledge, skills, adaptability, and capacity for learning that people have make such non-adaptive models much more suitable to explain outcomes for fish than for farmers. Basically, natural systems respond much more consistently to perturbation than economic ones due to complexities of differences among individuals, broader forces at work, and the adaptability of people. The Districts ask us to assume fish are too difficult to predict, and that they are resilient, while people are the opposite. There is no basis for this assumption.

The Districts apply this unbalanced approach throughout the PSP, as shown in its proposed socioeconomics study and its rejection of the Conservation Groups socioeconomic study requests. Recreation is seen as predictable and quantifiable on the reservoir, but not below or above the reservoir. Property values for farmland where water would be applied are within the scope, but potential residential or recreational areas below the reservoir are not, even though residential land values are capable of increasing much more dramatically than agricultural. The Districts scenarios are incomplete, and their modeling is narrow to the point of very little utility, considering the specific gross effects they are addressing are unlikely to have much correlation to the final net effects.

Geographically, the Districts argue that only the immediate region should be considered, and that downstream effects of flows for ecosystems, wildlife populations, recreation, industry, and property should not be included. But the Districts propose to consider the economic benefits of other counties and San Francisco Bay to the extent that their out-of-stream uses provide transfers that are beneficial outside of the region. Manmade conveyance to other regions is considered within the scope, but natural conveyance is not.

Overall, the Districts are surgical in their focus on only the areas and topics sure to receive benefits from unchanged project operations, and their modeling approaches are likely to grossly overstate these benefits. As described above, NEPA, CEQA, and federal economic

⁷¹ See, e.g., Study Plan W & AR-15, p. 3.

⁷² See, e.g., David W. Hughes, *Policy Uses of Economic Multiplier and Impact Analysis*, CHOICES, p. 25 (2003) (Attachment 3); Edwin S. Mills, *The Misuses of Regional Economic Models*, CATO JOURNAL, Vol. 13, No. 1, p. 29 (1993) (Attachment 4).

guidance require a more complete analysis that considers impacts on those not likely to benefit by continuation of the status quo.

In order to comply with the applicable laws and guidance, we recommend the following elements be incorporated into the model.

1. In Section 4.1, the Districts describe the relationship between groundwater use for agriculture vs. municipal and industrial uses in general terms.⁷³ We agree that groundwater use and recharge should be analyzed. To the extent that it is not clear in the proposed study plan, we request that the Districts' evaluate alternative conjunctive management strategies that could optimize surface and groundwater supplies. Our understanding is that the Districts already conjunctively manage their supplies under various scenarios and conditions from year to year, depending on water conditions and demands.⁷⁴ However, to our knowledge the Districts have not offered any specific information regarding their ability to conjunctively manage surface and groundwater supplies over a range of scenarios and water year types.⁷⁵ We also request that the Districts' proposed analysis be expanded to include a comparative analysis of opportunities to recharge groundwater under proposed and alternative operations (including the no action alternative).

2. In Section 4.2.2, the Districts state that they will incorporate information about M&I water purveyors that may be served by project water in the future.⁷⁶ We agree the Districts should include this in the study, and that this should include both the Infiltration Galley/Turlock Area Drinking Water Project at Geer Road and the proposed water sales from the Modesto Irrigation District ("MID") to CCSF. Conservation Groups strongly believe that, despite the repeated assertions of the Districts that they are using water as efficiently as possible, these projects clearly demonstrate that additional efficiency upgrades are possible. We believe reduced withdrawal for water supply would allow for more water to be released to the lower Tuolumne without significant economic hardship. In considering the proposed water sale between MID and CCSF, the Districts need to explain how the proposed sale would avoid secondary economic impacts that they claim would occur if more water was put in the river for the benefit of the environment.

3. The Districts should add a sub-section for Ecosystem Services to Section 4.0. A number of public and private demands for ecosystem services exist downstream and potentially upstream of Don Pedro Reservoir. Increases in ecosystem services such as improved water quality, air quality, general habitat function, and likely others have the potential to generate economic benefits, while decreases in these services might impose economic costs on families and businesses.

⁷³ See Study Plan W&AR-15, p. 3 ("...heavy reliance on groundwater by agriculture may adversely impact the quality and quantity of M&I water supplies, which could generate economic impacts on urban water users.")

⁷⁴ See ALJ's Report on Interim Measures, ¶ 130 ("At the hearing, Mr. Pinhey stated that his testimony did not discuss Modesto's ability to conjunctively manage its groundwater and surface water supplies to meet projected demand under any alternatives than a recurrence of the 1987-1992 drought over the next six years.")

⁷⁵ See, e.g., *id.*

⁷⁶ See *id.*, p. 6.

4. Under Section 4.3, the Districts should incorporate a broader set of background information about recreational use of water below the reservoir, including a description of existing information and the need for additional information. These recreational uses include boating, angling, bird-watching, camping, swimming, and other water sports, not simply boating and angling as indicated in the proposed study plan. These recreational benefits extend down the entire Tuolumne River, into the San Joaquin River, and into the Delta and as such, the scope of the study should capture this.

5. The Districts should expand Section 5.2 – the Study Area to include the San Joaquin River and Sacramento-San Joaquin Delta, and the San Francisco Bay, consistent with Scoping Document 2. In particular, the study should address recreational and environmental services costs and benefits in and along the San Joaquin River, the Sacramento-San Joaquin Delta, and the San Francisco Bay.

6. The methodology for the socioeconomic analysis of recreational use appears to be strictly focused on recreational use at Don Pedro Reservoir and it does not appear to cover adequately, or at all, recreational uses below Don Pedro Reservoir, including the San Joaquin River, the Sacramento-San Joaquin Delta, or the San Francisco Bay.⁷⁷ The Districts should add the following steps to the methodology identified at Section 5.3.3 to better capture the associated benefits and values of recreation below the reservoir:

- a. Identify the likely changes in recreation opportunities under a reasonable range of alternatives and PM&E measures. The analysis will rely upon existing studies and data and other recreation studies conducted in support of the relicensing process to identify for each alternative: review and identify the likely affected recreation opportunities, the change in the quality and quantity of each recreation type relative to the no-action alternative baseline, the geographical distribution, and description of effects for recreation type stability and resiliency.
- b. Identify the socioeconomic demands for affected recreation opportunities. Identify the types of uses of the recreation opportunities affected by each alternative, describe the location and composition of identified users/consumers, and quantify the current and potential level of use and consumption by group and area. Compile data on existing expenditures by demand type at the per unit, per use type, and per region levels. Review and transfer relevant literature on willingness-to-pay to identify potential additional consumer surplus values not captured by revealed expenditures. Identify demand source quantities and identify potential recreation opportunity supply levels whereby demand for additional recreation types might decline to identify diminishing returns and extent/calibration of existing expenditure and total economic value data.

⁷⁷ See Study Plan W&AR-15, p. 12.

- c. Estimate the value of changes in recreation opportunities associated with each alternative. Combine change in supply data (Task a above) with demand characterization (Task b above) to identify marginal and total economic values associated with changes in recreation opportunities for each alternative relative to the no-action alternative baseline. Align values by group, recreation type, and area with quantities expected to change and generate estimates of benefits disaggregated by user group and area. Describe environmental and social justice implications of identified changes in amount and distribution of economic value associated with recreation types influenced by alternatives.
- d. Measure economic activity changes by alternative. Based on the areas of demand affected and level of effect developed in Task c, identify the businesses and labor force that will see changes in demand. Estimate the level of change in demand and associated implications for amount of labor and level of income impacted by changes in economic activity for recreation opportunity-based effects by alternative. Describe the regional distribution of workforce and businesses impacted. Measure the relative importance and connectivity of each business sector impacted.
- e. Characterize risk and uncertainty implications by alternative. Characterize/quantify changes in risk and uncertainty associated with the availability and quality of recreation-based benefits over time by alternative. Compile published data suggesting likely perturbations to recreation opportunities and responses in the future. Describe and quantify to the extent possible, the value of differences in risk (probabilities of undesirable outcomes), uncertainty (undesirable outcomes with unknown likelihoods) and ignorance (potential for unidentified outcomes) associated with each alternative.
- f. Develop a description of the differing levels of resiliency of affected recreation opportunities to perturbations stemming from climate change, other socioeconomic demands and activities, other changes in biophysical conditions, and cumulative effects of other natural and anthropogenic effects.

The products of these analyses will provide estimates of the change in economic value associated with each alternative specific to recreational opportunities. These descriptions of economic value will be relative to the no-action baseline, provide estimates for the underlying recreational opportunities effects, provide monetized values for benefits and costs specific to each recreational opportunity, estimate associated economic activity, and describe the distribution of the economic benefits, economic costs, and economic activity (jobs and income).

7. Section 5.3.4 should be revised to clarify that the evaluation of value of hydropower generation will include information regarding dependable capacity and associated revenues, as well as indirect economic benefits that accrue to the Districts, under proposed and alternative flow releases.

8. A new section on Ecosystem Services should be added to the methodology section. The Project likely provides a range of ecosystem services, and the value and benefit of ecosystem services will likely vary with the different project alternatives that will be considered. To adequately analyze ecosystem services, we recommend the following tasks to be added to the methodology:

- a. Identify the likely changes in ecosystem services due to the full range of alternatives and PM&E measures under consideration. The analysis will rely upon existing and other ecosystem services studies conducted in support of the relicensing process to identify each alternative: review and identify the likely affected ecosystem services, the change in the quality and quantity of each service relative to the no-action alternative baseline, the geographical distribution, and description of effects for service stability and resiliency.
- b. Identify the socioeconomic demands for affected ecosystem services. Identify the types of uses of the ecosystem services affected by each alternative, describe the location and composition of identified users/consumers, and quantify the current and potential level of use and consumption by group and area. Compile data on existing expenditures by demand type at the per unit, per use type, and per region levels. Review and transfer relevant literature on willingness-to-pay to identify potential additional consumer surplus values not captured by revealed expenditures. Identify demand source sizes and identify potential ecosystem service supply levels whereby demand for additional services might decline to identify diminishing returns and extent/calibration of existing expenditure and total economic value data.
- c. Estimate the value of changes in ecosystem services associated with each alternative. Combine change in supply data (Task a above) with demand characterization (Task b above) to identify marginal and total economic values associated with changes in ecosystem services for each alternative relative to the no-action alternative baseline. Align values by group, service, and area with quantities expected to change and generate estimates of benefits disaggregated by user group and area. Describe environmental and social justice implications of identified changes in amount and distribution of economic value associated with services influenced by alternatives.
- d. Measure economic activity changes by alternative. Based on the areas of demand affected and level of effect developed in Task c, identify the businesses and labor force that will see changes in demand. Estimate the level of change in demand and associated implications for amount of labor and level of income impacted by changes in economic activity for ecosystem service-based effects by alternative. Describe the regional distribution of workforce and businesses impacted. Measure the relative importance and connectivity of each business sector impacted.

- e. Characterize risk and uncertainty implications by alternative. Characterize/quantify changes in risk and uncertainty associated with the availability and quality of ecosystem service-based benefits over time by alternative. Compile published data suggesting likely perturbations to ecosystem services and responses in the future. Describe and quantify to the extent possible, the value of differences in risk (probabilities of undesirable outcomes), uncertainty (undesirable outcomes with unknown likelihoods) and ignorance (potential for unidentified outcomes) associated with each alternative. Develop a description of the differing levels of resiliency of affected ecosystem services to perturbations stemming from climate change, other socioeconomic demands and activities, other changes in biophysical conditions, and cumulative effects of other natural and anthropogenic effects.

The products of these analyses will provide estimates of the change in economic value and activity associated with each alternative specific to ecosystem services. These descriptions of economic value and activity will be relative to the no-action baseline, provide estimates for the underlying ecosystem services effects, provide monetized values for benefits and costs specific to each ecosystem service, estimate associated economic activity, and describe the distribution of the economic benefits, economic costs, and economic activity (jobs and income).

P. W&AR 16: River Temperature Model

Conservation Groups support this study. We appreciate the Districts' decision to define the recalibration of the water temperature model in a formal study plan. It is not clear in the study plan that the Districts intend to include the reach between Don Pedro Dam and the La Grange Complex as a reach to be modeled by the river temperature model. The study plan should be revised to explicitly state that this area will be included in the river temperature model.

Q. W&AR 17: Reservoir Fish Population Survey

Conservation Groups support the existing study with the addition of the elements proposed by the CDFG in its alternative study proposal (proposed Study 2d). These elements are found in Section 5.3 Study Methods: Step 2c, Creel Survey; Step 2d, Reservoir Tributary Assessment; and Step 2f, Spawning Habitat. In particular, these steps will gather information about cold water species (trout, Kokanee salmon, and Chinook salmon) that are important target species for many anglers. Information about these important sport species will not be gathered, or will be gathered on a much more limited basis, by the study as proposed by the Districts.

R. RR-2: Whitewater Boating Take Out Improvement Feasibility

Conservation Groups support this study.

S. RR-3: Lower Tuolumne River Boatable Flow

Conservation Groups support this study with modifications. The flows proposed by the Districts are generally too low for adequate boating. Flows as low as 50, 75, and even 100 cfs also will cause harm to the fishery in the river. We recommend that the Districts begin the flow studies at 200 cfs.

Additionally, it appears that the study proposal presently focuses on canoeing and kayaking. 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. Conservation Groups recommend that drift rafters be explicitly included in the boatable flow experiments.

Finally, the Tuolumne River Trust should be noted as a source of existing information for boating on the lower Tuolumne River (study proposal Section 4). The Tuolumne River Trust regularly runs canoe trips on all sections of the Tuolumne River, and has many years of experience and records about the various runs on the river.

IV.

Recommendations for Adoption of Resource Agency Study Requests, or Incorporation of Study Elements into Districts' Studies

A. California Department of Fish and Game Studies

1. Water Resources
 - a. Water Balance/Operations Model
 - b. Water Temperature Model (adapted from Districts' ongoing study)
 - c. Reservoir Water Temperature Management Feasibility Study
2. Aquatic Resources
 - a. Instream Flow Study (adapted from Districts' ongoing study)
 - b. Bioenergetics Study
 - c. Chinook Health Study
 - d. Reservoir Fish Population Study
1. **Incorporate Elements of CDFG Studies CDFG-1a, CDFG 1b, CDFG-2a, and CDFG-2b into Studies Proposed by the Districts**

Conservation Groups believe that the Districts' proposed studies can be modified to incorporate the elements of the following CDFG studies that differ from the studies proposed by the Districts: (1a) Water Balance/Operations Model (use HEC ResSim rather than Excel platform; further define collaborative process for development of hydrology and model

verification and calibration); (1b) Water Temperature Model (use CE-QUAL-W2 platform); further define collaborative process for development of hydrology and model verification and calibration; 2(d) Reservoir Fish Population Study (include steps 2c, 2d and 2f from CDFG's study proposal). Please see also our comments above on the corresponding studies proposed by the Districts.

It is the understanding of Conservation Groups that the Districts will propose incorporating their Instream Flow study, as required by the Commission in the 2009 Proceeding on Interim Measures, as a study in the Revised Study Plan for relicensing. We support the CDFG-proposed study (2a), Instream Flow, which describes this ongoing study and provides steps for consultation with relicensing participants.

2. Adopt Reservoir Water Temperature Management Feasibility Study (CDFG-1c)

On October 11, 2011, the EPA affirmed its decision to list the lower Tuolumne River as impaired for temperature under Section 303(d) of the Clean Water Act.⁷⁸ The Final Water Temperature Report released by the Districts in March, 2011, confirms that the water temperatures in the lower Tuolumne River exceed EPA guidelines.⁷⁹ CDFG's proposed Reservoir Water Temperature Management Feasibility Study would help define opportunities to modify project facilities to allow better management of water temperatures in the lower Tuolumne River. The goals of such management range from possible increases in water temperatures during the winter in order to improve juvenile salmonid growth rates, and possible maintenance of colder water conditions in the spring in order to improve conditions for *O. mykiss* spawning and incubation, and to encourage smoltification of juvenile salmon for emigration. Further, facilities modifications could improve cold water availability in the fall.

3. Adopt Bioenergetics Study (CDFG-2b) and Chinook Health Study (CDFG-2c)

As noted in our overarching comments on model inputs, *see* Section II.A.3, *supra*, the Districts have proposed study of only limited model inputs for their life-cycle models (Studies W&AR 5, 6 and 10). Although the Districts have modified these study plans in the Updated Study Plan to make reference to growth rates and disease, they have not provided any detail or definition regarding how these factors will be incorporated into these models. Similarly they have not provided any reference materials that they intend to use in these models. Conservation Groups are not aware of site-specific studies or reports that provide this information for the lower Tuolumne River.

CDFG's proposed Bioenergetics Study and Fish Health/Disease Risk Study provide the definition that is lacking in the Districts' proposal. The proposed Bioenergetics Study has been

⁷⁸ Letter from Alexis Strauss, U.S. Environmental Protection Agency, to Mr. Tom Howard, Executive Director, California State Water Resources Control Board, October 11, 2011.

⁷⁹ *See* eLibrary no. 20110311-5090.

made substantially more clear and specific since it was first proposed in CDFG's comments on SD1 and the PAD. It builds off a bioenergetics study that was performed in the relicensing of Placer County Water Agency's Middle Fork Project. It is a robust study that points to answers of a critical question in this watershed: what management actions can be taken to improve growth rates of salmonids in the lower Tuolumne? Conservation Groups, in informal study resolution, had sought to have this issue addressed as a modification to Districts' proposed Chinook Fry Study (W&AR 9). The proposal of CDFG to address it in its Bioenergetics Study is better.

Disease pathogens are generally present in river systems. Flow and temperature have a profound effect on stress levels of juvenile salmonids. In dry years in particular, water temperatures in the lower Tuolumne often become stressful for juvenile salmonids. Increased stress can lead pathogens that are present in the system to become harmful or lethal to juvenile salmonids. This establishes nexus between the Project and fish disease. It is known that in dry years, few salmon juveniles successfully reach as far downstream as the lower rotary screw trap operated by the Districts at River Mile 5.⁸⁰ However the causation is not known. CDFG's proposed Chinook Health Study will allow differentiation of this factor from other potential factors such as poor growth rates and predation. This study is needed to inform the life-cycle models proposed by the Districts in Studies W&AR 5, 6 and 10.

B. U.S. Fish and Wildlife Service Studies

1. Age and Growth Study of *O. mykiss* in the Tuolumne River (FWS-2)
2. Chinook Salmon Egg Viability Study (FWS-3)
3. Juvenile Chinook Salmon Survival Study (FWS-4)
4. Genetics of Chinook Salmon in the Upper Tuolumne River (FWS-5)

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

Please see comments in Section II.A.3 (Life-Cycle Modeling Inputs), *supra*. The differentiation of age classes is needed as an input to the *O. mykiss* life-cycle model proposed in Study W&AR 10. The Districts' study plan does not define how this issue will be addressed in developing the model. Study FWS-2 provides a clear and straightforward approach to obtaining the needed information.

2. Adopt Chinook Salmon Egg Viability Study (FWS-3)

Current temperature modeling shows that water temperature for migrating and spawning fall-run Chinook salmon adults are often at levels above EPA-recommended values for these life stages.⁸¹ Temperatures greater than the standard are particularly common in October of each year. It is important to understand potential benefits and problems of earlier or longer fall pulse flows to benefit fall-run Chinook migration and spawning, when compared to past practice. It is important because earlier spawning would, if successful, allow for earlier development of

⁸⁰ Mesick, 2008, 2009, 2010, *Ibid*.

⁸¹ See comments on Water Temperature Criteria Study, Section III.N, *supra*.

juvenile salmon and increase the likelihood of successful outmigration. Therefore, the evaluation of Chinook salmon egg viability is part of the same effort to understand juvenile emigration success that we have discussed in the context of other potential inputs to the salmon life-cycle models in Studies W&AR 5 and W&AR 6.

A similar study was required by the Commission in the Merced relicensing.⁸² It should be one of the suite of studies that the Commission should order to provide site-specific and current data to inform the salmon life-cycle models.

3. Adopt the Juvenile Chinook Salmon Survival Study (FWS-4)

As described in our comments on the Districts' Study W&AR 7 (Predation) and W&AR 9 (Chinook Salmon Fry; revised by Conservation Groups as *Chinook Salmon Flow Manipulation and Emigration Study Plan*), the sample size needs to be increased in studies that require tracking and mark/recapture data collection. Increased sample size is needed to provide defensible inputs to the life-cycle models. The protocols provided in the FWS's Juvenile Chinook Salmon Survival Study provide a starting point for each study. These studies need to be further integrated.

4. Adopt the Genetics of Chinook Salmon in the Upper Tuolumne River Study (FWS-5)

Please see our comments on studies Study NMFS-7 below. It is our understanding the FWS is submitting a modified study plan that will add protocols for evaluating *O. mykiss* genetics upstream of Don Pedro to the study proposal.

C. National Marine Fisheries Service Study Requests

1. La Grange and Project Effects on Anadromous Fishes (NMFS-1)
2. Operations Model (NMFS-2)
3. Fish Passage for Anadromous Fishes (NMFS-3)
4. Hydrology (NMFS-4)
5. Fluvial Processes and Channel Morphology (NMFS-5)
6. Water Temperature (NMFS-6)
7. Upper Tuolumne River Habitats for Anadromous Fishes (NMFS-7)
8. Salmon and Steelhead Full Life-Cycle Population Models (NMFS-8)

1. Incorporate NMFS's requested studies NMFS-2 (Operations Model), NMFS-4 (Hydrology), and NMFS-8 (Life-Cycle Models) into Districts' Studies

NMFS should be requested to define any significant areas of difference between these three studies and those proposed by the Districts (W&AR 2 and W&AR 5, 6 and 10). Please see our comments in Section II.A.3, *supra*.

⁸² See "Revisions to Study Plan" for the Merced River Relicensing, eLibrary no. 20110811-3030, p. 6.

2. Adopt Section 4.0, Subsection 1, 2 and 5 of the La Grange and Project Effects on Anadromous Fishes Study (NMFS-1), or Require that Information be Provided as a Supplement to the PAD

Please *see* Section II.B, *supra*, and Section IV.C.3, *infra*, for Conservation Groups' comments on La Grange. Pursuant to our comments that La Grange is used and useful to the operation of the Don Pedro Project, Conservation Groups believe that the information requested in Section 4.0, subsections 1, 2 and 5 of Study NMFS-1 should be disclosed as a supplement to the PAD. Absent such disclosure, these subsections should be adopted as a formal study plan. Section 4.0, sub-sections 3, 4 and 6 of Study NMFS-1 address environmental impacts of La Grange that have not been disaggregated from the impacts of the Don Pedro Project. To the degree that the information requested in sub-sections 3, 4 and 6 is not already provided in the PAD, or will not otherwise be provided pursuant to studies in this relicensing, it should also be included as part of our requested supplement to the PAD or as part of a separate study of La Grange as proposed by NMFS.

3. Adopt the Fish Passage for Anadromous Fishes Study (NMFS-3)

Information relevant to fish passage past La Grange Dam, the La Grange diversion pool, Don Pedro Dam, Don Pedro Reservoir, the Tuolumne River upstream of Don Pedro, and facilities associated with all of these phenomena does not exist. The Districts should be required to collect it as described in Study NMFS-3, *Effects of Project and Related Activities on Fish Passage for Anadromous Fishes*.

The Districts did not adopt Study NMFS-3 on the basis that La Grange Dam blocks fish from reaching the Don Pedro Dam:

The Districts have not adopted this study request because NMFS has not provided any evidence that anadromous fish occur upstream of La Grange Dam and below Don Pedro Dam.... This study also would not inform license requirements because lack of fish passage at Don Pedro is not affecting the anadromous fish resource.⁸³

We request that the Director of OEP direct the Districts to implement this study plan. Contrary to the Districts' assertions, there is evidence that lack of fish passage at Don Pedro affects the anadromous fish resource. The Don Pedro Project directly blocks downstream passage of *O. mykiss* which would otherwise contribute to anadromous *O. mykiss* recruitment in the lower Tuolumne River. It has cumulative effects on upstream fish passage.

NMFS has stated that lack of fish passage throughout Central Valley rivers has cumulatively impaired anadromous fish:

The lack of fish passage has altered the genotype of CV spring-run Chinook salmon due to hybridization with CV fall-run Chinook salmon, and has likely

⁸³ PSP, p. 4-3.

caused alterations in CV steelhead. Anadromous fishes in the CV of California are now limited to relatively few miles of valley main stem rivers, though they were historically dispersed over many miles of upper main stems and tributaries (Yoshiyama, *et al.* 2001). Temperatures on the valley floor are significantly warmer in the late fall and winter, so that fishes likely hatch and rear earlier than in their natural habitats (CDWR 2005). Valley floor habitats contain fewer features that anadromous fish require, *e.g.*, overhanging vegetation, woody debris, and hydraulic complexity. Juvenile rearing habitat is more open and interconnected, so that available forage is competed for by many conspecifics, as well as the greater numbers of CV fall-run Chinook salmon juveniles. Due to competition for forage, juveniles may migrate downstream at a smaller size, potentially increasing the risk of predation (CDWR 2005).⁸⁴

More specifically, NMFS has stated that lack of passage at the La Grange Complex and Don Pedro Project impact anadromous fish:

Today, the La Grange Complex (Dam + Powerhouse + other facilities) and the Don Pedro Project, acting together, appear to block upstream passage of anadromous fishes, and prevent or seriously impede safe and effective downstream fish passage. These facilities also appear to jointly act to exert direct effects on lower Tuolumne flows, temperatures, sediments, large wood, and other conditions that could affect anadromous fishes (including ESA-listed species).⁸⁵

Given Don Pedro's effects on anadromous fisheries in the lower Tuolumne, it is reasonable to require studies to quantify the impacts more precisely and evaluate how the license could be conditioned to address the blockage of upstream and downstream fish passage.

Further, as discussed in Section II.B, *supra*, the Commission's jurisdiction over the La Grange Complex is unresolved. Commission Staff are reviewing whether the La Grange Complex is subject to the Commission's mandatory licensing authority, either as part of the new license for the Don Pedro Project or as a separate license. Depending on the outcome of this review, the Commission may issue license conditions requiring the Districts to provide fish passage at the La Grange Complex and the Don Pedro Project. NMFS has stated that the La Grange Complex is jurisdictional because: "1) the La Grange Project occupies Federal lands or reservations; 2) the La Grange Project is located on a navigable waterway, and 3) if evidence of navigability is insufficient, evidence warrants a finding that the La Grange Project affects interstate commerce and has undergone project construction or modifications other than routine maintenance on or after August 26, 1935."⁸⁶ With regard to jurisdiction based on occupation on

⁸⁴ NMFS, "Comments on the Applicant's Preliminary Application Document, Comments on the Commission's Public Scoping Meeting and Scoping Document 1, and Requests for Information or Study, Don Pedro Hydroelectric Project, P-2299-075," eLibrary no. 20110610-5160 (June 10, 2011), Enclosure A, p. 7.

⁸⁵ *Id.*, Enclosure F, NMFS Request #1, p. 4.

⁸⁶ Letter from Steve Edmondson, NMFS to Kimberly D. Bose, eLibrary no. 20111018-5030, p. 2.

federal lands, we request that the Commission direct TID to arrange for a cadastral survey by BLM of its lands adjacent to/occupied by La Grange to resolve the federal boundary.⁸⁷

We believe that the La Grange Complex is also jurisdictional and should be included in the new license for Don Pedro Project because it is used and useful to the Project, *see* Section II.B, *supra*. The Districts use the facilities at La Grange to make flow releases required by the terms of their license for the Don Pedro Project. The La Grange Complex is also used by the Districts to regulate peaking flows resulting from power operations at the Don Pedro Project. Given that the Districts use the La Grange Complex to comply with the requirements of the Don Pedro license, La Grange is used and useful and a part of the complete unit of development for the Don Pedro Project.

4. Adopt Elements of the Fluvial Processes and Channel Morphology Study (Study NMFS-5)

In our comments on study plans proposed by the Districts, we have made a case for adoption of Study NMFS-5, elements 3 – 8. Please see comments in Section III.D (W&AR 4), III.H (W&AR 8), III.J (W&AR 10), and III.L (W&AR 12), *supra*.

The Districts object to Elements 1 and 2 of the NMFS study, which propose to quantify the amount of sediment and the amount of large woody debris that are captured by Don Pedro Reservoir. The Districts have argued that such quantification may not provide insight into feasible actions in the river downstream of La Grange. The Districts have also argued that non-project impacts in the lower river may make the quantifications of capture in Don Pedro Reservoir of limited value. NMFS's counterargument, as we understand it, is that the Project's contribution to, and the Districts' relative obligation to mitigate, the cumulative impacts, needs to be quantified. Regardless of the cumulative factors, Don Pedro Reservoir is the upstream-most and largest repository of sediment and LWD in the system, excepting in part for the CCSF facilities far upstream.

The non-flow channel improvements and other mitigations that have taken place subsequent to the 1996 Settlement Agreement, while significant, have been extremely modest in proportion to the condition of the lower Tuolumne River channel. In terms of the size of the problem, these improvements have been inadequate by several orders of magnitude. If the Districts do not wish to quantify the amount of sediment and LWD captured by Don Pedro Reservoir in order to establish at least some parameters for their obligation to mitigate impacts to habitat in the lower Tuolumne, then they should suggest an alternative basis on which the Commission can determine their obligation to mitigate.

⁸⁷ See <http://www.blm.gov/wo/st/en/prog/more/cadastralsurvey.html> (last checked Oct. 22, 2011).

5. Adopt a Modified Version of Element 1 and Adopt Element 2 of the Water Temperature Study (NMFS-6), and Incorporate the Remaining Elements into Districts' studies

Element 1 of NMFS's Water Temperature study request asks that the Districts implement the proposed interim flow schedule that was recommended by the fisheries agencies in the 2009 Proceeding on Interim Measures.⁸⁸

The Final Water Temperature Modeling Report issued by the Districts in March 2011, pursuant to the 2009 Order on Rehearing, demonstrates that the temperature requirements in the agencies' recommended interim flow schedule cannot be fully met in most years.⁸⁹ This report suffers from the gross defect that it does not demonstrate the degree of exceedence over the period of record. Therefore, it does not allow stakeholders to understand how close to the agencies' temperature recommendations the Districts can come, and at what water cost. Because of the all-or-nothing approach taken in the water temperature modeling report, and because the temperature requirements of the interim flows recommended by the agencies cannot be fully achieved in most years, Conservation Groups recommend that NMFS's Element 1 be modified so that the numeric flow values given in cubic feet per second in the agencies' interim flow recommendations can be implemented immediately by the Districts.

We further recommend that the Districts monitor the water temperatures under this revised flow schedule for a period of at least two years, with the protocols described by NMFS in Element 2 of proposed Study NMFS-6.⁹⁰

Recalibration of the water temperature model for the lower Tuolumne River has been proposed by the Districts in the Updated Study Plan, in Study W&AR 16. The Districts are constructing a water temperature model for Don Pedro Reservoir. Conservation Groups believe that Elements 3 and 4 of Study NMFS-6 are therefore covered in studies proposed by the Districts.

6. Adopt the Upper Tuolumne River Habitats for Anadromous Fishes Study (NMFS-7)

Please see our comments on La Grange in Section II.B, *supra*, and our comments on Study NMFS-3, Section IV.3.C, *supra*. The Districts have declined this study on grounds of nexus. Conservation Groups believe that nexus exists. The information requested by NMFS in Study NMFS-7 is technically necessary for evaluation of reintroduction of anadromous fish to the Tuolumne River upstream of Don Pedro Reservoir. Conservation Groups recommend adoption of Study NMFS-7.

⁸⁸ See Exhibit NMFS-FWS-DFG #1.

⁸⁹ See Final Water Temperature Modeling Report, eLibrary no. 20110311-5090.

⁹⁰ NMFS requests that monitoring occur "throughout the relicensing process." Since it is unclear exactly what is meant or how long this will be, we recommend two years.

V.
Proposal for Additional Study

A. AR-15: Effects of Project and Related Activities on Recruitment of Cottonwoods and Other Native Riparian Vegetation

The Districts do not adopt AR-15, *Effects of Project and Related Activities on Recruitment of Cottonwoods and Other Native Riparian Vegetation*, which Conservation Groups previously requested.

The Districts reject our study proposal on the basis that:

AR-15 offers no reason why existing information is not adequate for addressing this question. This topic has been thoroughly studied. Cottonwood improvements would need manipulation of the recession rate of the runoff hydrograph. Management of high flow levels at the Project is in accordance with the ACOE Flood Control Manual and ACOE approval. A previous request by the Districts that the ACOE consider modifications to the Flood Control Manual did not meet with success and is unlikely to do so now. Therefore, this study would also not inform the development of license requirements.⁹¹

Contrary to the Districts' assertions, the existing information, as presented 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 (e.g. Fremont cottonwood seed release coincides with peak runoff, whereas willow seed dispersion coincides with spring runoff). 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. They do not provide information to answer the following questions:

- What peak releases are necessary to benefit natural recruitment of cottonwoods?
- What is the optimal timing of these peak releases?
- How frequently should these recruitment flows occur?
- What are optimum ramping rates for willow dispersion?
- What is the optimal timing for targeting willow seed dispersion?
- How frequently should these targeted ramping rates occur?

Our study request is designed to identify specific magnitude and timing of peak flood flows and shaping hydrograph recession rates to maximize recruitment of native woody vegetation. Conservation Groups believe that this objective can be accomplished within the management criteria set by the ACOE Flood Control Manual. There are many potential opportunities to manage the necessary quantities of water needed for release within the limits of the ACOE Flood Control Manual. "Flood flows," particularly over a long period, can be shaped. Because the Districts have not in the past considered the effects of flood flows on seed dispersal

⁹¹ PSP, p. 4-13.

and germination, does not mean that this cannot or should not be considered in the future. Shaping the recession in three or four years out of twenty could have a significant beneficial effect on cottonwood recruitment.

CONCLUSION

We request that Commission Staff adopt the Conservation Groups' recommended proposals and revisions to the Proposed Study Plan in its study plan determination. The study plan is critical to any relicensing process because it brings pre-filing finality to the issue of what information gathering and studies will be required by the Commission to provide a sound evidentiary basis on which the Commission and other participants in the process can make recommendations and provide terms and conditions. We believe our recommendations will provide a sound evidentiary basis for the Commission's ultimate decision on the new license.

A robust study plan with broad stakeholder support is especially important in this proceeding because many of the studies proposed are intended to address issues, notably fishery-related issues, that have been pending in one form or another since before the original license issued in 1964. We cannot afford to drag out studies and defer the design of license conditions into the next licensing term; every effort should be made to resolve these issues through relicensing.

Thank you for your consideration of these comments.

Dated: October 24, 2011

Respectfully submitted,



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*Conservation Groups' Comments re Proposed Study Plan
MID and TID's Don Pedro Project (P-2299-075)*

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*Conservation Groups' Comments re Proposed Study Plan
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CERTIFICATION OF SERVICE

Modesto and Turlock Irrigation Districts, New Don Pedro Project (P-2299-075)

I, Julie Gantenbein, hereby certify that I have this day served by electronic mail the foregoing document, "Comments of Conservation Groups Regarding Licensee Proposed Study Plan, and Study Requests for the Don Pedro Project," upon each person with an email address designated on the official service list compiled by the Secretary in the P-2299 docket.

Dated: October 24, 2011

By:



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Conservation Groups provide the following tables to indicate our support, or lack thereof, for studies proposed by the Districts and other study requests.¹ In the table for studies proposed by the Districts, we adopt the numeration used by the Districts in its Updated PSP, and group these studies into the following categories: Support, Support with Modifications, Have Serious Concerns, Oppose. In the table for study requests, we include only study requests that we support, in full or in part. For studies proposed by the California Department of Fish and Game (“CDFG”), we use the numeration CDFG employs in its comments on the PSP. For studies proposed by the U.S. Fish and Wildlife Service (“FWS”), by the National Marine Fisheries Service (“NMFS”), and by Conservation Groups, we use the numeration employed by these entities in their respective comments on Scoping Document I (“SD1”) and the Pre-Application Document (“PAD”). Where applicable, we delineate under each such study proposed by entities other than the Districts particular elements that we support.

Conservation Groups’ Support/Opposition to Districts’ Proposed Studies

Study Number and Title	Support	Support with modifications	Have serious concerns	Oppose
W&AR 1: Water Quality	Pending SWRCB Approval			
W& AR 2: Operations Model	Support			
W&AR 3: Reservoir Temperature Model		Change platform		
W&AR 4: Spawning Gravel		Add elements		
W&AR 5: Salmon Population Information and Integration			See narrative	
W&AR 6: Chinook Salmon Population Model			See narrative	
W&AR 7: Predation		Add high flows. See narrative		
W&AR 8: Salmonid Redd Mapping		Recommend a few additional elements		
W&AR 9: Chinook Salmon Fry		Support with major modification. See narrative and redline alternative study plan		

¹ This format is similar to the table recently provided in the Study Determination for the relicensing of the Yuba River Development Project (FERC No. 2246). See eLibrary no. 20110930-3051, Appendix B, p. 63 of appendices. *Attachment 1*
Conservation Groups’ Comments re Proposed Study Plan
MID and TID’s Don Pedro Project (P-2299-075)

Chart of Districts' Proposed Studies, Continued

Study Number and Title	Support	Support with modifications	Have serious concerns	Oppose
W&AR 10: <i>O. mykiss</i> Population			See narrative	
W&AR 11: Chinook Salmon Otolith	Support			
W&AR 12: <i>O. mykiss</i> Habitat Survey		Add element per NMFS		
W&AR 13: Fish Assemblage and Population between Don Pedro and La Grange Dam	Support			
W&AR 14: Temperature Criteria Assessment			See narrative	
W&AR 15: Socioeconomics				Study must be sub-substantially altered. Oppose in current form
W&AR 16: River Temperature Model		Add elements per NMFS		
W&AR 17: Reservoir Fish Population Survey		Add elements per CDFG		
RR-2: Whitewater Boating Take Out Improvement Feasibility	Support			
RR-3: Lower Tuolumne River Boatable Flow		Add elements		

Conservation Groups' Support and Recommendations for CDFG Study Requests

Study number and name	Adopt	Incorporate into Districts' Studies
CDFG-1a: Water Balance/Operations Model		X
CDFG-1b: Water Temperature Model		X
CDFG-1c: Reservoir Water Temperature Management Feasibility Study	X	

*Attachment 1
Conservation Groups' Comments re Proposed Study Plan
MID and TID's Don Pedro Project (P-2299-075)*

**Conservation Groups' Support and Recommendations for CDFG Study Requests,
Continued**

Study number and name	Adopt	Incorporate into Districts' Studies
CDFG-2a: Instream Flow Study		X
CDFG-2b: Bioenergetics Study	X	
CDFG-2c: Chinook Health Study	X	
CDFG-2d: Reservoir Fish Population Study		X

Conservation Groups' Support and Recommendations for FWS Study Requests

Study number and name	Adopt	Incorporate into Districts' Studies
FWS-2: Age and Growth Study of <i>O. mykiss</i> in the Tuolumne River	X	
FWS-3: Chinook Salmon Egg Viability Study	X	
FWS-4: Juvenile Chinook Salmon Survival Study	X	
FWS-5: Genetics of Chinook Salmon in the Upper Tuolumne River	X	

Conservation Groups' Support and Recommendations for NMFS Study Requests

Study number and name	Study Element	Adopt	Incorporate into Districts' Studies
NMFS-1: La Grange and Project Effects on Anadromous Fish		X	
NMFS-2: Operations Model			See narrative
NMFS-3: Fish Passage for Anadromous Fishes		X	
NMFS-4: Hydrology			See narrative
NMFS-5: Fluvial Processes and Channel Morphology			

Conservation Groups' Recommendations for Studies Proposed by NMFS, Continued

Study number and name	Study Element	Adopt	Incorporate into Districts' Studies
NMFS-5: Request Element 1	Quantify the volumetric flux of coarse and total sediment trapped in Don Pedro Reservoir on an average annual basis	Adopt unless Districts provide alternative. See narrative	
NMFS-5: Request Element 2	Quantify the frequency and volume of LWD trapped and removed from the riverine ecosystem on annual basis in Don Pedro Reservoir	Adopt unless Districts provide alternative. See narrative	
NMFS-5: Request Element 3	Quantify coarse sediment storage in the lower Tuolumne River	X	
NMFS-5: Request Element 4	Quantify available spawning habitat for anadromous fish in the lower Tuolumne River	X	
NMFS-5: Request Element 5	Quantify fine sediment storage in the lower Tuolumne River	X	
NMFS-5: Request Element 6	Quantify the frequency and volume of LWD stored in the Tuolumne River channel downstream of Don Pedro Dam to the confluence of SJR	X	
NMFS-5: Request Element 7	Develop coarse and fine sediment budgets and LWD budgets for the lower Tuolumne River	X	

Conservation Groups' Recommendations for Studies Proposed by NMFS, Continued

Study number and name	Study Element	Adopt	Incorporate into Districts' Studies
NMFS-5: Request Element 8	Synthesize data from this study with other study requests to assess potential Project effects on anadromous fish and their habitats	X	
NMFS-6: Water Temperature			
NMFS-6: Request Element 1	Interim Flows	With modification	
NMFS-6: Request Element 2	Water Temperature Monitoring	With modification	
NMFS-6: Request Element 3	Water Temperature Modeling		X
NMFS-6: Request Element 4	Reservoir Temperature Modeling		X
NMFS-7: Upper Tuolumne Habitats for Anadromous Fishes		X	
NMFS-8	Life-cycle model for anadromous fish		See narrative

Conservation Groups' Recommendation for Additional Studies

Study number and name	Adopt
AR-15: Effects of Project and Related Activities on Recruitment of Cottonwoods and Other Native Riparian Vegetation	X

STUDY PLAN W&AR-9

**TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT**

**DON PEDRO PROJECT
FERC NO. 2299**

Chinook Salmon Flow Manipulation and Emigration Study Plan

October 2011

~~Related Study Requests: NMFS-08~~

1.0 Project Nexus

The continued operation and maintenance of the Don Pedro Project (Project) influences the magnitude and timing of flows in the Lower Tuolumne River which may, in turn, contribute to ~~direct and~~ cumulative effects on the temporal and spatial distribution of Chinook salmon ~~juveniles~~. Changes in the temporal and spatial distribution of ~~these juveniles~~ could affect their overall survival potential and ultimately the abundance of Chinook salmon spawned in the lower Tuolumne River.

2.0 Resource Agency Management Goals

The Districts believe that four agencies have resource management goals related to salmonid species and/or their habitat: (1) U.S. Department of Interior, Fish and Wildlife Service (USFWS); (2) U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS); (3) California Department of Fish and Game (CDFG); and (4) State Water Resources Control Board, Division of Water Rights (SWRCB). Each of these agencies and their management direction, as understood by the Districts at this time, is described below.

A goal of the USFWS (2001) Anadromous Fish Restoration Program, as stated in Section 3406(b)(1) of the Central Valley Project Improvement Act, is to double the long-term production of anadromous fish in California's Central Valley rivers and streams. Objectives in meeting this long-term goal include: (1) improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat; (2) improve survival rates by reducing or eliminating entrainment of juveniles at diversions; (3) improve the opportunity for adult fish to reach spawning habitats in a timely manner; (4) collect fish population, health, and habitat data to facilitate evaluation of restoration actions; (5) integrate habitat restoration efforts with harvest and hatchery management; and (6) involve partners in the implementation and evaluation of restoration actions.

NMFS has developed Resource Management Goals and Objectives for species listed under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 et seq.) and the Endangered Species Act (ESA) (16 U.S.C. §1531 et seq.), as well as anadromous species that are

not currently listed but may require listing in the future. NMFS' (2009) Public Draft Recovery Plan for Sacramento River Winter-run Chinook salmon, Central Valley Spring-run Chinook salmon, and Central Valley steelhead outlines NMFS' framework for the recovery of ESA-listed species and populations in California's Central Valley. For Central Valley steelhead, the recovery actions identified for the Tuolumne River are to: (1) conduct habitat evaluations; and (2) manage cold water pools behind La Grange and Don Pedro dams to provide suitable water temperatures for all downstream life stages. For Central Valley fall/late fall-run Chinook, the relevant goals are to enhance the Essential Fish Habitat downstream of the Project and achieve a viable population of Central Valley fall/late fall-run Chinook salmon in the Tuolumne River.

CDFG's mission is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. CDFG's resource management goals, as summarized in restoration planning documents such as "Restoring Central Valley Streams: A Plan for Action" (Reynolds et al. 1993), are to restore and protect California's aquatic ecosystems that support fish and wildlife, and to protect threatened and endangered species under California Fish and Game Code (Sections 6920-6924).

SWRCB has responsibility under the federal Clean Water Act (33 U.S.C. §11251-1357) to preserve and maintain the chemical, physical and biological integrity of the State's waters and to protect water quality and the beneficial uses of stream reaches consistent with Section 401 of the federal Clean Water Act, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, the California Environmental Quality Act, and any other applicable state law.

3.0 Study Goals

The Chinook salmon flow manipulation and emigration study will examine the influence of flow manipulation on movements of Chinook salmon juveniles from the Lower Tuolumne River during the early stages of fry rearing and during later juvenile development. Studies of fry emigration and distribution indicate that fry survival to emigration in the Tuolumne River may be reduced during below normal water years. Studies of emigration of larger juveniles including smolts, and studies of otoliths taken from Tuolumne River adult Chinook, indicate that changes in flow influence the timing of emigration in the Tuolumne River, and that only 8% of successful spawners in 2001-2004 emigrated from the Tuolumne River as fry. (Mesick, 2008, 2009, 2010). In the Tuolumne River, the abundance of fry estimated to leave the river and the proportion of fry to larger juvenile emigrants are substantially different than those conditions observed in other Central Valley streams where Chinook salmon adult escapement estimates are substantially higher. Specific data obtained by this study will update information from prior studies in order to:

- Evaluate the ability of the Project to induce fry emigration by manipulating flow;
- Evaluate the ability of the Project to induce emigration of larger juveniles including smolts by manipulating flow during the March 20 to April 20 time period.
- Evaluate the potential benefits and costs of inducing fry to emigrate early in the rearing period in "below normal" water years.

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4.0 Existing Information and Need For Additional Information

Upon emergence from spawning beds, juvenile salmonid fry begin foraging for food and seek cover in areas of reduced flow or move downstream (Healy 1991). A large downstream movement of Chinook salmon fry shortly after emergence is typical of most fall-run Chinook salmon populations in the Central Valley (Moyle 2000). Emigrating salmon in the Central Valley begin their downstream movement when less than 50 mm fork length (TID/MID 2011, Report 2010-3), as found for other rivers in the Central Valley (Erkkila et al. 1950, Hatton 1940, Hatton and Clark 1942, Willis 1920, Rutter 1902). Seaward migrating fry appear to disperse once they encounter the upper reaches of the Delta with some moving into the estuary.

Kjelson et al. (1981) observed that peak catches of Chinook fry in the Sacramento-San Joaquin Delta often followed flow increases and speculated that flow surges influence the numbers of fry that migrate from the upper river spawning grounds to the Delta (CDFG 2010). Healey (2001) also observed that downstream juvenile movement correlates to river flow. Juvenile fall-run Chinook salmon out-migration monitoring in the San Joaquin River tributaries also indicates that fry movement is stimulated by changes in flows in the February and March time frame.

Considering the historical extent of floodplain inundation in the San Joaquin system, and the expanse of Tule marsh along the San Joaquin River prior to land development, it is likely that juvenile Chinook salmon reared on inundated floodplains in the San Joaquin River and its tributaries in the lower reaches where larger numbers and higher growth rates increased survival potential (CDFG 2011). Sommer et al. (2001) found higher growth and survival rates of Chinook salmon juveniles reared on the Yolo Bypass compared with those in the mainstem Sacramento River. Moyle (2007) observed similar results on the Cosumnes River floodplain. Drifting invertebrates, the primary prey of juvenile salmonids, were more abundant on the inundated Yolo Bypass floodplain than in the adjacent Sacramento River (Sommer et al. 2001).

It is also reported that salmon fry historically reared in high numbers in the lower river reaches and Delta where they would grow to become smolts then leave for the ocean. Accordingly, a smaller proportion of juvenile salmon remained in the natal stream reaches before emigrating, some of which were smolt-sized fish that left as late as June and July. The contribution of these different life history strategies to production of adult salmon likely varied with a number of factors, including dry water year conditions when flow and temperature in the lower river and Delta in the late spring were poorly suited for salmon survival to the ocean. It is likely that during dry water years, opportunity to successfully emigrate to and rear in the Delta is limited to fry emigration in the early season. Flow manipulations that encourage fry to emigrate from their natal reaches during such dry years may increase their survival potential.

Current conditions in the Delta are generally not favorable to successful rearing of Chinook salmon juveniles. In the 2009 FERC proceeding on Interim Measures for the Tuolumne River ordered by the Commission, Noah Hume (2009), outside consultant to the Districts, testified: “[a]bsent major reductions in export levels, however, it is unlikely that predator habitat suitability and predation levels in the Delta will markedly improve.”¹

¹ Exhibit DIS-15, p. 17. Dr. Hume’s testimony describes numerous factors that create conditions in the Delta that contribute to low likelihood of survival for fish rearing in there or migrating through the Delta.

Dr. Peter Moyle (2009), outside consultant to the City and County of San Francisco, testified in the same proceeding that moving juvenile salmon quickly through the Delta might improve their survival:

However, once the juvenile salmon leave the river, transported by winter flows, they mostly die. In the past, prior to extensive habitat loss and alteration in the Delta and San Francisco Estuary, salmon fry and juveniles probably were able to survive and rear in areas downstream of the Tuolumne River, in extensive marshes and shallows (Moyle et al. 2008). Today few of these small juveniles survive to come back as adults. The best survival appears to be of fish that have become smolts in the river and move rapidly out to sea, spending little time in the Delta. Highest survival occurs during wet years, when there are high flood flows simultaneously coming from the Merced, Tuolumne, and Stanislaus rivers (Mesick and Marston 2007; Moyle et al. 2008).

In *Comments on the Draft Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives* a paper submitted to the State Water Board in as the proceeding to update the Water Quality Control Plan for the South Delta, biologist Carl Mesick (2010), outside consultant to the California Sportfishing Protection Alliance recommended: “Instead, it would be more beneficial, particularly during Critical and Dry years, to focus the flow requirements on temperature management in March and April, when flow releases can best control water temperatures.”

Flow modifications, or ramping flows, have been associated with increased emigration of juvenile Chinook salmon (Demko and Cramer 1995, 2000). The mechanism that encourages migration may vary depending upon the local conditions. Snider and Titus (2001) observed increased emigration in the lower American River to be related to decreasing flow and that increased flow encouraged lateral movement, to floodplains, rather than longitudinal movement out of the river. Similar relationships have been noted in the Tuolumne River (Vasques and Kundargi 2001; TID/MID 2010, Report 2010-4), Stanislaus River (M. Palmer, FISHBIO, pers. comm. 2011). Erikkla et al. (1950) observed emigration from the San Joaquin River to correspond with reduced flows. Temperature, turbidity, season, fish size, density – all have been considered cues to seaward emigration (Williams 2008).

5.0 Study Methods

5.1 Study Area

The study area includes the Tuolumne River from the upper rotary screw trap (RST) location at River Mile [RM] 29.8) to the existing downstream RST location at RM 5.2.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner and study methodology will be modified appropriately to ensure safety.

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- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

This study will involve marking and recapturing Chinook salmon fry to characterize potential migratory responses to flow modifications.

Step 1 – Compile Data from Previously Conducted Studies. Information from previously conducted Chinook salmon spawning and emigration studies (e.g., TID/MID 2010, 2011), will be evaluated to identify potential relationships between flow changes and fry-movements of juvenile salmon. An attempt will be made to identify any relationship among spawning timing, determined from Chinook salmon adult migration surveys, redd surveys, escapement surveys, emergence data, and temporal distribution and abundance of juvenile salmon fry. This information will be used to identify the appropriate timing and magnitude of the flow manipulations relative to peak of fry abundance.

Step 2 – Collect New Data. The magnitude, timing, and duration of the flow manipulation will be designed and implemented based on the results of Step 1. Flow manipulation to induce fry emigration is anticipated to involve increasing then decreasing flows within a short period (e.g., three to five days) following peak emergence, to stimulate movement of fry when fry density is greatest. Flow manipulation to induce emigration of larger juveniles in the March 20 to April 20 time period is anticipated to involve two types of approaches, one applicable to wet years and one applicable to dry years. These two types of manipulation will take place in separate years, one in 2012 and one in 2013. The flows in either year may be selected by the Districts to correspond to annual water availability, but the March-April flow manipulations will be completed in the two years regardless of water year type, unless flood release requirements are too great to allow completion of the dry year manipulation. The wet year-type manipulation will begin on April 1, and involve increasing flows from baseflow to 3000 cfs over a four day period, then ramping these flows down at a rate of 10% per day for 5 to 10 days (to approximately 1770 cfs or 1040 cfs), then increasing flows to 4000 cfs, ramped over a period of 3 days and holding for 5 days (flow C), then dropping the flow to 2000 cfs over a period of 2 days. The dry year-type manipulation will begin at any time between March 20 and April 1, and will consist of a two day up-ramp from baseflow to 2000 cfs, holding the flow for 10 days, and reducing flow to baseflow with a two day down-ramp. [This may correspond to the flows called for in the predation study, W&AR 9]. The rationale for the wet year manipulations is to understand the response to juvenile salmon to both rapid and gradual, large and small up-ramps and down-ramps. The rationale for the dry year evaluation is to evaluate the emigration response to a pulse flow that does not inundate the floodplain and that occurs earlier in the year than the previous VAMP flows, as well as to evaluate response to a rapid drop in flow following this pulse flow.

Potential Chinook juvenile fry response to the flow manipulations will be evaluated by acquiring data on the size, timing, composition, and condition of the migrating populations. These data will be collected at the upstream and downstream trapping locations before, during, and after the flow manipulation. Ongoing emigration monitoring on the Tuolumne River will be used to assist in collecting data on response to flow modifications. Routine sampling protocols currently being used at the two trapping locations (Sonke et al. 2010) will provide the required information.

Additional information will be acquired to determine the travel time and overall temporal distribution of potential juvenile emigration, and relative survival during and outside the flow modification, using a mark and recapture approach.

This study element will utilize fish marking to measure transport timing and survival from the upper to the lower river before, during, and after flow modification. A minimum of 800 juveniles per flow manipulation period (one period in February-March and one period in March-April in each year) collected at the upper trapping site (RM 29.8) will be marked then released. When recaptured at downstream trapping location (RM 5.2), information on each observed marked fish will be recorded. All salmon collected at the upper location will be marked using Bismarck brown, an external mass marking technique that will allow trap technicians to readily identify marked fish when collected at the downstream trapping location. Additionally, subsamples of each release group will be sorted with a narrow size range (e.g., ± 3 mm) with each group marked with unique colors using pan jet marking on specific fins to provide information on transport timing between release locations and recapture locations as well as estimates of growth rates. The uniquely marked fish will allow for improved estimates of numbers of recaptured fish.

The ongoing seine surveys will be expanded to include up to two additional sample sites between the two RSTs. Seining will be conducted using the current protocols. The purpose of seining is to determine distribution at time between the two traps.

Step 3 – Analysis. Using data collected in Steps 1 and 2, the response of Chinook salmon juveniles to the flow manipulation will be summarized by time frame (i.e., prior, during and after flow modification). Individual fish transport times in relation to environmental variables will be determined as well as estimates of growth rates. Summary of magnitude, composition, and condition will be compared among the three time frames to identify changes in those attributes relative to the flow manipulation.

A literature search will also be conducted to address the pros and cons of differing timing scenarios that are advantageous to encouraging juvenile Chinook salmon emigration predominantly as fry. The research would compile and analyze data on emigration trends in Central Valley streams, delta salmonid monitoring results, predation risk, and available information on delta rearing conditions under varying water year types. Such information would help reduce uncertainties regarding the utility of inducing juvenile emigration at differing times and salmon lifestages.

Step 4 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods and Analysis, (3) Results, (4) Discussion, and (5) Conclusions.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011, and the study is not disputed by a mandatory conditioning agency:

- Existing Data CompilationJanuary 2012 – February 2012

- Consultation Workshop with Relicensing Participants.....February 2012
- New Data Collection February 2012 – March April in 2012 and in 2013
- Data Entry, QA/QC, and Analysis April 2013 – June 2013
- Report Preparation June 2013 – September 2013
- Report Issuance..... January 2014

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7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The methods used to monitor response to the flow fluctuations are consistent with the protocols developed by the US FWS (1997, 2008) and methods being used in other similar investigations within the Central Valley.

8.0 Deliverables

The Districts will prepare a report, which will document the methodology and results of the study.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

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Policy Uses of Economic Multiplier and Impact Analysis

By David W. Hughes

A proposal being floated by a local economic development organization predicts that a new food processing plant will add 800 jobs and \$100 million to the local economy. Jobs and income will be generated at the plant and in real estate, health care, and agriculture. The plant is also touted as having a local economic multiplier of \$6. As an industry policy analyst, you are asked to evaluate the proposal. To do so, you will need to understand what these values really mean, the assumptions underlying their estimation, and whether they are realistic. Your reply is important, because public and private sector leaders, the general public, and even professionals can misinterpret economic impact and multiplier analysis. Worse yet, impact studies can be used to exaggerate the benefits of policies or proposals in some cases and their costs in others.

Outlined here are issues that should be considered in conducting and interpreting impact and multiplier analysis (see Checklist). These issues should influence choice of models and interpretation of results by policy analysts. The emphasis is on the regional (multistate, state, substate, or local) level, where such studies are normally conducted.

Multiplier and Impact Analysis

Although a variety of methods can be used to generate economic multipliers, the focus here is on input-output (I-O) models as the most popular tool for such analysis. This popularity has been engendered by the growth of ready-made I-O modeling systems such as IMPLAN, where a basic knowledge of personal computers is sufficient for generating models, multipliers, and impacts.

Export base theory underlies the use of economic multiplier and impact analysis. It springs from the idea that a region must earn income to survive by producing a good or service that the out-

side world will purchase. The use of I-O models has caused this idea to be extended to the sales generated by any industry—whether export oriented or not. The income injected into an economy by exports has a multiplier effect, as it is respent locally. The level of respending is based on how much local businesses and consumers buy from local businesses.

Impact analysis looks at the effects of a positive or negative change in economic activity. Impact analysis is based on economic multipliers, which account for the total effect across the entire economy of the event under study. For example, impact analysis is often used to estimate the effects of a new local industry on jobs and incomes in all parts of the economy. It is also used to estimate policy or investment impacts and the total contribution of an industry to an economy.

I-O Model Construction and Assumptions

I-O models examine the market flow of products between industries, sales by industries to households and other final users, and industry use of factors of production (labor and capital). Such models can be very detailed, containing several hundred industries.

Backward Linkages and I-O Multipliers

Several different types of multipliers are generated using regional I-O models. For a given local industry, the output multiplier measures the combined effect of a \$1 change in its sales on the output of all local industries. All I-O multipliers measure the strength of backward linkages or the degree to which an increase in activity by a given local industry causes additional purchases from other local industries and local resource providers. The same relationships are used in impact analysis, but the initial change in output is much larger than \$1 and is usually spread across several local industries.

Multipliers are generated in I-O models based on the key assumption of fixed-proportion production functions, where input use moves in lockstep fashion with production. For example, if a poultry processor doubles production, its use of each input also doubles. This production function is based on a completely elastic supply. That is, shifts in demand only result in changes in output, with no changes in real (inflation removed) prices. Such supply curves are based on the assumption that all units of a given input are equal in quality, and there are no barriers to firms entering or exiting markets.

Similar assumptions are also made in I-O models of regional economies. For example, if a local poultry processor doubles production, its current use of regional inputs will also double. Household spending (and implicitly population) is also assumed to move in a lockstep fashion with economic activity.

Limitations of Multiplier and Impact Analysis Including Possible Solutions

Several issues can influence the interpretation of results in multiplier-based studies. These issues may lead policy analysts to do additional analysis or use alternative models. Such issues include investment or project feasibility, employment impacts, effects on current residents, considerations about capital, impacts on local government, and accounting stance. Concerns about feasibility and profitability can be particularly important in interpreting model results.

Profitability and Other Feasibility Issues

Impact analysis does not by itself address several issues related to feasibility in project (investment) analysis—the most important being profitability. A local industry with a sizeable multiplier is not nec-

essarily profitable, and multipliers do not account for this lack of profitability. If profitability is negative, then further development of the industry is not feasible. For a particular study, it is preferable to include profitability analysis as a separate component. For multipliers in general, policy analysts should be aware that by themselves multipliers do not speak to profitability.

Second, resource constraints are often ignored in multiplier impact analysis. For example, a local community may be considering a new paper mill, but the regional timber supply does not meet mill needs. In this case, the investment may be infeasible. A solution is to expand the study explicitly to include resource impacts. Basic I-O model textbooks contain examples of approaches to environmental and energy issues, which can be used in looking at resource pressures.

Another issue related to feasibility is possible impacts on prices. In a growing economy, supply pressures may lead to big price increases often ignored in multiplier-based studies. Rapid growth could lead to upward pressure on local wages, forcing businesses to cut back on employment. Such cutbacks would mute the expansion estimated with multipliers based on the no change in prices assumption. When price pressures are significant, policy analysts should be aware that more complex models are available (such as a computable general equilibrium model, which allows for changes in prices). Alternatively, they can interpret the quantity change (such as a change in output) as an upper bound on the expected actual change. Sound judgment is required in deciding if an I-O model yields appropriate answers in such situations.

Employment Impacts

The major concern in most impact studies is the effect on local employment. Under a growth scenario, job impacts are generally based on the assumption that new jobs go to new residents, which leads to population growth. This in turn leads to increased consumer spending on local products. However, any number of factors could break this chain of events. For example, the new jobs could go to current residents (the unemployed, job upgraders, or current out-commuters). New jobs could also go to new in-commuters. In either

What are SAMs and CGEs?

A Social Accounting Matrix (SAM) provides a detailed picture of the economy but in a more complete fashion than an I-O by explicitly accounting for all market and nonmarket (such as government welfare payments to households) income and resource flows. A CGE also provides a complete and detailed picture of an economy. However, prices are free to change and thus impact product, consumption, and trade relationships. Hence, more data is used in a complex set of nonlinear equations. Consequently, eliminating the fixed-price assumption may lead to less precise model estimates.

case, the increase in local population and spending would be less than expected.

For a decline impact scenario, job losses could be less than predicted. For example, those losing their jobs could commute to work elsewhere, with no loss in population and little decline in local spending.

An integrated I-O labor market model is one possible solution to this limitation. These models use other sources of information to help determine the distribution of job changes between new and current residents. If this approach is viewed as too resource intensive, policy analysts should be aware that the projected change in employment is an upper bound on the actual change with the caveat that model predictions could be wide of the mark.

Other considerations should also be raised in evaluating employment impacts. For example: Under a growth scenario, will new jobs be permanent and full-time? Another consideration is the type of occupations that will be generated (a key determinant of desirability in many rural areas). In addition, local workers may be unqualified for the new positions, and in-migrants or in-commuters will be employed instead.

Some of these issues can be examined with an I-O model. For example, wage estimates—an important part of desirability—are imbedded in such models. An industry occupation table (matrix), showing the distribution of occupations by industries, can be used to predict the types of generated occupations. The table translates employment estimates for each industry into a group of occupations. For example, ten new jobs in a given agricultural industry directly lead to one new farm management and nine new farm laborer jobs. Coupled with information about the local labor force, the matrix can show if local individuals can fill the new occupations. Other questions such as the permanence of employment impacts can be evaluated based on knowledge of the economy and the issue at hand.

Financial and Physical Capital Considerations

Another set of issues involves financial and physical capital. In evaluating a growth scenario, the level of the new capital investment and the residency of investors (local or otherwise) may be important. A regional SAM, which extends I-O by tracing all

market income flows, could be used to shed light on these issues.

In evaluating a decline in economic activity, one should consider if the facilities involved (physical capital) could have an alternative use. For example, the impacts of the closure of military bases are important concerns for local economies. Economic impact analysis could indicate a major loss in local jobs and income when the base closes. However, the base is now available for other uses that may benefit the local economy. The proper response is to also evaluate the likelihood of success and economic impact of such alternative uses.

Impact on Current Residents and Activity

The effect on current residents and economic activity is another set of issues often ignored in multiplier-based studies looking at local economic growth. The value of the current housing stock may increase, especially if the economy is already growing and the anticipated impact is large. If population growth cannot be easily absorbed, surges in economic activity may create a tax burden for current residents by increasing property values.

Population growth can also place additional pressures on other industries that should be considered. In particular, local farms may close because of subdivision growth and other population-related impacts. Environmental degradation from a new industry could also have negative consequences for existing industries.

Local Government Impacts

The effect on government services and revenues is another important consideration, especially at the local level. A new industry may place pressures on locally provided public services. An impact study of a proposed casino touted the projected increase in local tax yield, but ignored possible increases in the cost of public services (such as additional police protection). If population growth occurs, local government may have to finance new roads, schools, and other infrastructure. Likewise, residents may have to endure crowding costs (such as increased traffic) if infrastructure development does not keep up with population growth.

An integrated public service I-O model can help shed light on these issues. Such models predict changes in employment and population and then

Table 1. What are some reasonable values for local economy multipliers?

County employment size class	Average multiplier	Probable range
1,000-2,999	1.7	1.5-1.9
3,000-4,999	1.8	1.5-2.0
5,000-9,999	1.9	1.6-2.1
10,000-19,999	2.0	1.8-2.2
20,000-49,999	2.2	2.0-2.4
50,000 and over	2.2	2.0-2.5

All things else equal, multipliers will tend to be higher where: (a) the community is larger with a more diverse economy; (b) the community is a substantial distance from competitive retail/service centers; and (c) the per capita income is low. Any output multiplier larger than 2.5 should be especially examined!
Source: Mulkey, 1978.

indicate how changes in both lead to increases in the cost of publicly provided services and government revenue. If using such a model is not possible, then the tax analysis should be eliminated from the study or at least tempered by indicating that changes in the cost of government services are not estimated.

Accounting Stance

Improper accounting stance (comparison of apples and oranges) also occurs in impact studies. For example, a statement sometimes made concerning the statewide impact of an institution of higher learning is the following: “\$3 of output are generated in the state economy for every \$1 that we receive in state funding”. The comparison is one of apples and oranges because output measures gross sales while state government revenue has some type of income as its source.

Part of the solution to such accounting stance issues is not to compare apples and oranges. Education and proper interpretation concerning the different measures of economic activity estimated with I-O models should also help eliminate this problem.

Summary

Multiplier and impact analysis indicate the level of economic activity that may be generated by a given industry or event. Although useful, limitations of such work should always be discussed. Policy analysts should consider additional efforts to shed further light on critical issues when appropriate.

Table 2. Multiplier and impact analysis checklist (concerns and solutions).

Concerns	Solutions
Feasibility:	
Profitability	Include profitability in analysis; warn that profitability is not addressed
Resource constraint	Include resource impacts in analysis; warn that resource availability is assumed
Price impacts	Use price change model; interpret quantity changes as upper bounds
Employment impacts:	
Who gets job	Use integrated I-O labor market model; interpret local resident job changes as upper bound
Type of job	Include industry-occupation analysis; use knowledge of the situation to interpret results
Capital considerations:	
Financial capital	Use model that traces capital flows; use knowledge of the situation to interpret results
Physical capital	Determine likelihood of success of alternative uses
Current versus new residents:	
Housing stock	Use knowledge of situation to interpret results
Pressure on other industries	Include resource impacts; include declines in other industries in analysis
Local government impacts	Use integrated public service model; omit tax analysis; indicate public service impacts not considered
Accounting stance	Do not compare apples and oranges; properly interpret different variables

For Further Information:

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THE MISUSE OF REGIONAL ECONOMIC MODELS

Edwin S. Mills

Introduction

That economic analysis is sometimes used selectively and prejudicially to support positions motivated by self-interest or ideology is hardly news to most scholars. The purpose of this paper is to describe an important example of the misuse of economic models to support ideology and self-interest of state and local government officials. Billions of dollars of taxpayers' money are at stake.

The subject of the paper is the use by state and local governments and their consultants of regional economic models in order to justify proposed government projects in physical capital facilities. The models are used in ways that systematically exaggerate the public benefits of proposed government projects, thus biasing government decision-making in the direction of excessive government spending and expansion into areas that should be left to the private sector.

Most state and local governments require that economic impact studies be undertaken before important proposed investment projects can be approved. The purpose of economic impact studies is similar to that of environmental impact studies: to measure the positive and negative economic impacts of a proposed project on people and businesses in the surrounding areas. That is certainly a desirable goal; most scholars would agree that no important government project should be undertaken without a prior economic impact study. It is also important that such studies be carried out objectively and with models that are appropriate for the purpose.

This paper analyzes the use of a model called REMI in economic impact studies. REMI is an acronym for Regional Economic Models

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Incorporated, a firm in Amherst, Massachusetts of which George Treyz is president. Two facts justify concentration on REMI in this paper. First, it is widely used, perhaps more widely used than any similar model. Second, it is available in explicit detail in publicly accessible papers. Several consulting firms have regional models of one kind or another, but most consultants keep their models proprietary and there is no easy way to evaluate them. The same is true of most macro models owned by profit-making consulting firms. To REMI's credit, the REMI model is completely public.

Two excellent surveys of economic impact studies and related regional models are Nijkamp (1986) and the *Journal of Regional Science*, vol. 25 (1985). Roger Bolton's (1985) contribution is especially valuable. Based on these surveys, reading of dozens of published model documents, and reading of many impact analyses undertaken with proprietary models, REMI appears to be among the very best regional impact models extant. Much research and hard work have gone into REMI's formulation and estimation; much of its content is based on publications in scholarly journals. Thus, my at times severe criticism is of the ways REMI is misused, not of REMI itself. Any model can be misused. How responsibility for misuse of REMI should be divided between REMI staff and the government officials who use it, I have no way to ascertain.

The Model

A Brief Description

The description of REMI in this section is based on careful reading of all REMI reports available in early 1992. Relevant published and unpublished papers are listed in the references. Like any such model, REMI evolves and becomes more detailed and complex as time passes. REMI has been estimated for states, counties, and groups of counties such as metropolitan areas. Inevitably, more detail is available for some places than for others.

The most detailed version of REMI contains 49 private production sectors. Production functions are Cobb-Douglas, relating sectoral output in the region to sectoral labor, capital, and fuel inputs, assuming constant returns to scale. Regional share coefficients indicate shares of inputs purchased locally, and are determined in the same way that regional export shares are determined. Shares of sectoral production exported from the region are similarly set by share coefficients, which depend on endogenous regional prices relative to national prices for each sector. Regional consumption of each locally produced consumer good and service is proportional to local dispos-

able income, allowing for regional variation in consumer demands. Local prices are set by local production costs, but do not affect the composition of local demand. Disposable income is correctly defined as earnings plus property income plus government transfers minus taxes paid. Sectoral investment equations bring sectoral capital stocks to their desired levels, determined by marginal productivity conditions. Local wage rates are determined by demands for workers in various occupations, by overall demand and supply for local labor, and by national wages and local consumer prices. Labor demand adjusts gradually to the level indicated by equilibrium labor market conditions. The local labor force depends on the local population, adjusted for labor force participation rates by cohorts. Cohorts are adjusted by births, deaths and aging. Economic migration between the region and elsewhere is modeled as a function of income and amenities in the region relative to national averages.

The model's representation of government sectors is crucial for this paper. Personal taxes per dollar of personal income (less transfers) equal national average taxes per dollar of personal income (similarly adjusted) multiplied by a local tax factor. Personal taxes per dollar of adjusted personal income do not vary with government policy simulations carried out with the model. Government spending is represented by six equations, one each for: federal civilian; federal military; state and local education; state and local health and welfare; state and local safety; and state and local miscellaneous. The first two categories are exogenous. State and local spending in each of its four categories is proportional to the region's share of national population, adjusted for national average state and local spending and a local factor. Analyses of government expenditure on proposed projects and policy simulations are carried out by adding terms to relevant equations to represent the government actions. For example, spending on a proposed state or local government project would be represented by terms added to the demand equations for inputs needed to produce the project.

Evaluation of the Model

The key point about REMI's representation of government sectors is that the model contains no budget constraint for any set of governments. There is no requirement that state and/or local government tax receipts plus user fees plus transfers from other governments plus increase in indebtedness equal expenditures. In fact, there is no exhaustive list of government receipts and expenditures. For example, there is no government debt or debt service in the model.

REMI is calibrated one region at a time, based on estimates using data from all states. REMI has been estimated for all 48 contiguous states to ensure that state estimates add up to 48-state totals that are consistent with a national 48-state model. Particular state or local projects are small relative to 48-state totals, and there is of course no way to analyze an exhaustive set of state and local proposals in all 48 states. The implication is that the national government's budget constraint is of relatively minor importance in the model. For example, a national decision to build a military base in a particular county would have only negligible effects on national taxes paid by residents of the county. However, a county government decision to build a domed stadium to be financed by county government funds logically implies some combination of reduction in other spending by the county government, increased taxes in the county or increased indebtedness by the county government. State government projects are somewhere between the above extremes. A convention center to be built in a particular municipality and to be financed partly by the municipal government's funds and partly by state government funds requires some tax increases, or other changes among those listed above, in the municipality. Using state government funds requires state tax increases, or other changes among those listed above. But state tax increases (if that is the method of financing) paid by local residents are a large or small part of the total costs paid by the state depending on how large the municipality is relative to the state and on the pattern of state tax increases. The remainder of the required state tax increase is paid by state residents outside the municipality, but they are not represented in the model analysis.

The implication of the above is that REMI makes it appear that all increments to government spending, federal, state and local, for projects REMI analyzes are free. To finance new government projects, the model introduces no extra taxes, no cuts in other government services or transfers, and no increase in government indebtedness. Many projects whose impacts are analyzed by REMI are infrastructure investments. Frequently, capital costs are to be paid by governments and the facility is expected to generate revenues from user fees that will cover operating costs. Since most infrastructure projects are capital intensive, REMI evaluates the projects as though the capital were free. There is no opportunity cost of government project spending in REMI.

The contention here is not that there are no federal, state or local taxes in REMI. It has been shown above that there are. Indeed, it is possible that state and/or local taxes might be so high that REMI would predict that they would drive workers and/or businesses from

the jurisdiction. State and local government spending is basically driven by population in REMI. Thus, if a proposed government project would increase population and employment, REMI calculates increases in government tax receipts and spending that would result from the changes in population and employment. But REMI is used to analyze government projects, not overall state and/or local government spending or receipts. Nothing in the REMI model requires that government project spending be matched by tax receipts that would cover parts of project costs not covered by money from other sources.

A state or local government project may nevertheless have some adverse effects on the local economy, according to REMI. If there is little local unemployment and immigration is not very responsive to increases in local wages, then a proposed government project may reduce private output and employment. Some output and employment are transferred to the government sector. But it is impossible for REMI to indicate a reduction in total real private income from a proposed government project. This is an implication of the structure of the model, not of particular parameter sets. Since a project requires no increased taxes or other measures that might deter private spending, total employment and private income are predicted by REMI to rise as a result of any government project spending. If there is any labor response because of immigration or reduced unemployment, REMI inevitably shows an increase in total employment and private income from any proposed government project analyzed. The model result occurs regardless of the project's merits.

The conclusion is that REMI inevitably exaggerates the benefits of government projects. The opportunity cost of state and local government funds for projects is represented to be zero. In fact, REMI is certain to show that the transfer of any project or economic activity from the private to the government sector is socially beneficial. REMI contains nothing that could permit the model to indicate that the private sector has a comparative advantage in producing any good or service. Hence, a transfer of an activity from the private to the government sector avoids the private sector's capital costs, while at the same time failing to register governments' expenditures in capital and labor as costs. Thus increases in consumer welfare result (since the private sector had to charge prices that covered costs whereas the government can give the good or service to consumers). Total earnings are unaffected, since the same employment and wage rates are required in the government as in the private sector.

None of the above relies on choices of particular parameter values for REMI. The conclusions are inherent in REMI's structure.

How REMI Is Used

I do not have an exhaustive list of applications of REMI. REMI has kindly furnished a list of REMI projects and REMI clients, but I have come across several economic impact studies done for proposed state and/or local government projects that indicate that REMI was employed, but are not on the lists furnished by REMI. Nevertheless, between the lists furnished by REMI and applications that have come to my attention in other ways (mostly reports sent to me in connection with other work), it is my estimate that I have seen nearly 100 applications of the model. (Some analyses may appear in more than one source.) That is probably a quite representative list of REMI applications.

I have no way to calculate accurately how much money is involved in government projects that REMI has been used to analyze. However, projects that I know about plus descriptions of analyses furnished by REMI make clear that, in the last five to ten years, REMI has been used to analyze projects whose costs are many billions of dollars. Likewise, it is impossible to know how much influence REMI has had in the process of project approval. REMI calculations are advisory to the political process. However, government agency statements in support of proposed projects frequently quote REMI calculations as to how many jobs and how much taxes the project will generate. A few examples of REMI uses are: analysis of the economic impact of proposed expansion of the McCormick Convention Center in Chicago; analysis of proposed expansion of MASSPORT/Logan Airport in Boston; economic impact of expansion of Fort Drum in New York; several economic impact analyses of proposed highway expansion projects. Many uses are reported of REMI for general modeling of state or sub-state areas by state and sub-state government agencies to analyze an unidentified variety of state and sub-state programs. Finally, it should be stated that REMI will do analysis for clients, rent REMI programs to clients, or sell the model to clients. REMI has no control over modifications to the model made by clients in some of the above arrangements.

Many REMI applications appear to be entirely appropriate and may provide better analyses than any alternative model available. However, the description of REMI in the previous section implies that use of REMI to analyze economic impacts of proposed government investments leads to exaggerated estimates of projects' net public benefits. A typical economic impact analysis concludes that (x) jobs, (y) dollars of private income, and (z) dollars of state and local government tax revenues will be generated by the proposed

project. These conclusions are generated by simulations with REMI that were described in the previous section. In project analysis, one simulation is done in the absence of the project and another in the presence of the project. REMI enables users to calculate multipliers, which are employment- or income-generated per dollar of government spending on the project. Typical income multipliers I have seen in economic impact analyses are between two and five. That means that each dollar of spending on the proposed project is projected to generate 2 to 5 dollars of additional income in the area included in the study. Income generated includes both income paid to workers and contractors on the project and also income generated by subsequent income recipients of subsequent rounds of spending. The multiplier process is precisely analogous to Keynesian multiplier analysis that appeared in macro texts some years ago. But REMI takes account of limitations on labor supply and of leakages outside the jurisdictions studied, which some Keynesian macro multiplier analyses did not do.

The exaggeration of public benefits of government projects in such REMI simulations stems precisely from the incomplete modeling of government sectors. If state and local government budget constraints were included in the model, REMI would recognize that increased government spending would entail increased taxes or other government fiscal alterations as indicated above. Then, increased spending by recipients of the increased government spending would have to be weighted against reduced spending by those whose taxes were increased or by reduced spending by recipients of government purchases that were cut in order to finance the project.

Obviously, all costs of a government project not financed by charges for use of the facility should be regarded as being financed by taxes with negative multiplier effects. It is often proposed to finance a government facility by taxes ostensibly levied on facility users—for example, a tax on hotel and restaurant bills in the vicinity of a proposed convention center. To the extent that such taxes are paid by convention center users, they are simply indirect charges for use of the facility and should be, but typically are not, added to user charges with the same assumed deterrent effect on use as direct user charges. In fact, such taxes are paid by all those who consume the taxed services, whether they use the proposed facility or not. To that extent, they are just one kind of tax levied on the population and have the same negative multiplier effect as any other tax to pay for the facility. More important, I have indicated in Mills (1991) that taxes ostensibly levied on facility users seldom cover more than a small fraction of facility costs. The remainder must be paid by usual

taxes levied on local residents and businesses. It really does not matter whether other taxes are to be increased or other government expenditures are to be reduced to pay for the tax-financed part of a facility's cost. If other spending is to be reduced, it could have been reduced in the absence of the facility, so the facility requires taxes in excess of what they would need to be in the absence of the facility.

Finally, the analysis does not depend on whether the facility is bond financed or not. The present value of taxes needed to finance bond debt service, discounted at the government's borrowing rate, equals the sale price of the bond. If taxpayers' discount rates exceed the government borrowing rate then of course the present value of the debt service costs is less than the sale price of the bond, but the difference is not likely to be large.

An additional benefit is typically claimed in economic impact analyses of proposed government projects: the so-called outside money multiplier. A proposed convention center or domed stadium, for example, is assumed to draw patrons from outside the jurisdiction in which effects are being analyzed. It is undoubtedly true that many patrons of a large convention center or sports stadium come from outside the county or metropolitan area in which the center is located. Such patrons spend money in the jurisdiction but outside the facility on hotels, meals, etc. REMI is then used to trace the effects of such outside spending through the local economy, and multipliers are calculated that are precisely analogous to those calculated for spending on the project itself.

An unusually well documented example of distortions from regional impact analyses has been provided by the plans for a billion dollar expansion of McCormick place, Chicago's convention and exposition center. The consultant's economic impact study, KPMG Peat Marwick (1990), concluded that the outside money multiplier would result in a permanent net creation of 6,000 jobs. (Outside money multiplier jobs are permanent in that the outside money comes in each year. Construction multiplier jobs result from a one-time injection of construction money and disappear after the construction multiplier has worked itself out.) Virginia Carlson (1991) redid the calculations using all the consultant's assumptions except that she took account of jobs that would be displaced by the McCormick expansion and of the impact of local taxes that are to be levied to help finance the project. Her estimate is that the expansion of McCormick Place will result in a net loss of 348 jobs. She estimates that 3,335 jobs will be created by direct and indirect effects of outside money spent on the expanded convention center. The offsets are 2,799 jobs lost because of business displacement and 884 jobs lost

because of negative multiplier effects of tax increases. No estimates are made by Carlson of revenues that will be raised by the increased taxes, but they are unlikely to raise more than enough to offset the center's operating losses. Capital costs must be financed in other ways. Interestingly, the Peat Marwick analysis was undertaken with a U.S. government model and Carlson's analysis was undertaken with REMI. Carlson predicts net job loss despite the absence of a government-balanced-budget equation in REMI.

The outside money multiplier has really nothing to do with the fact that the project is government-sponsored. Any local business activity that sells goods or services outside the local area—a pension management company or auto assembly plant, for example—brings precisely the same kinds of outside money benefits to the local area. In most kinds of private investments, state and local governments recognize this benefit and provide temporary and declining tax forgiveness, low interest loans, or other subsidies that are intended to stimulate investments in the private businesses. Convention centers and domed stadiums are no different and there is nothing in the modeling that indicates that government policies toward them should be different or that governments should own them. Visiting patrons to conventions or sporting events consume services that are exported from the local area just as is true of any other locally produced commodity or service that is sold to businesses or residents outside the local area. The fact that government produces the export good or service has nothing to do with the magnitude of the local benefit. The absence from the models of a cost side to government financing of the projects makes it appear that there are public benefits that are peculiar to government projects.

Of course, any increased outside money spending in a jurisdiction resulting from a government or private investment in the jurisdiction is precisely offset by decreased spending in other jurisdictions, other things equal. It is a zero-sum game. However, our federal political system produces state and local governments that, at best, represent narrow local interests. The zero-sum character of outside money multipliers should be taken into account in federal spending programs, but state and local government programs cannot be expected to do so.

Conclusion

The conclusion of this paper is that REMI and other regional models are frequently misused by state and local governments and their consultants in ways that patently exaggerate the benefits of

proposed state and local government projects. By ignoring the need of state and local governments to raise money to finance capital costs of proposed projects, and by counting construction wages as benefits instead of costs, the models permit users to make it appear to the public that there are benefits to government projects that would not flow from similar private projects.

Such biased analysis cries out for explanation. Why do governments produce such patently exaggerated estimates of benefits of government projects? After all, the notion that state and local governments have budget constraints is not exactly an alien concept either to the public, to government officials or to scholars.

I simply throw out the following conjectures to stimulate thought. First, government officials like to promote big government. They benefit from large government roles in the economy. Adequate evidence is the observation that state and local governments resist cutting spending and, indeed, frequently raise taxes, in recessions when taxpayers' ability to pay has decreased. Second, to justify increased spending, government officials must identify some publicly desired goal to be accomplished by government spending. Creation of new jobs is among the best such goals that can be found. Third, they must make it plausible that government can accomplish the goal in a way that the private sector cannot. This is where REMI is so valuable. It is a complex computer model that lay people cannot understand or evaluate, and it has important scientific merits. Thus, the frequent government claim that the best scientific model available shows that x thousand jobs will be created by the project helps to carry the day. Finally, the inherent characteristics of the project help. A convention center can be claimed to improve the image of the city, and a domed stadium can be claimed to help keep the team in town.

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