SAN JOAQUIN RIVER GROUP AUTHORITY'S WRITTEN COMMENTS TO PROPOSAL BY CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD TO LIST THE SAN JOAQUIN, TUOLUMNE, MERCED AND STANISLAUS RIVERS AS IMPAIRED BODIES OF WATER FOR TEMPERATURE PURSUANT TO SECTION 303(d)

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EXECUTIVE SUMMARY

The information provided to, and relied upon by, the staff of the Central Valley Regional Water Quality Control Board is not sufficient to support the proposed listing of the San Joaquin, Stanislaus, Tuolumne and Merced Rivers as impaired for temperature. If the CVRWQCB were to list these rivers as impaired for temperature, based upon the information received to date, such action would be arbitrary, capricious and contrary to the law.

The proposed listing is legally flawed. The CVRWQCB is relying upon the incorrect narrative standard, and has neither solicited nor received information which would support a listing under the applicable narrative standard which prohibits the increase of natural receiving water temperature by 5 degrees Fahrenheit or more. Further, the CVRWQCB's proposed use of Policy 6.1.5.9 to evaluate the available temperature data and information is improper, as such policy's efforts to utilize information on the health of fishery populations in lieu of actual temperature data expressly contradicts the SWRCB's Basin Plan and Thermal Plan.

The proposed listing is also factually flawed as it relies upon information submitted by the California Department of Fish and Game (CDFG) that is irrelevant, incorrect and incomplete. The EPA Region 10 temperature criteria, submitted by the CDFG as the "threshold" temperatures necessary for the survival of anadromous fish species are not applicable to the San Joaquin River Basin, and have been questioned by reputable biologists and scholars, including the CDFG itself. Further, the lifestage timing and reach location criteria identified by CDFG are not supported by the known data, but rather have been purposely manipulated by CDFG in an effort to support the proposed listing. Had CDFG presented accurate lifestage timing and reach location data, there would be no justification for the proposed listing. For example, CDFG contends that the adult upstream migration period begins on September 1 and ends on October 31. Relying upon this, the CVRWQCB staff is prepared to find that the number of temperature exceedances for this period supports a listing. However, the actual period for upstream migration is October 1 through December 20. If the data for this actual migration time period were to be examined, the SJRGA is confident that there would not be enough temperature exceedances to support a listing.

The CDFG made it clear at the September 25, 2007 staff workshop that it believes that reservoir releases can and must be used to reduce temperatures in the San Joaquin, Stanislaus, Tuolumne and Merced Rivers. Model runs demonstrate, however, that it will be virtually impossible to operate the existing reservoirs in such a way as to achieve the CDFG recommended temperature criteria for all time periods and locations. While improvements in temperatures can be achieved in portions of the rivers, such improvements are bought with tremendous costs to reservoir storage and, consequently, water deliveries for all existing beneficial uses. In 1991, the SWRCB concluded that it would be a waste and unreasonable use of water to use reservoir releases to control water temperatures at Vernalis. Current information and technology demonstrate that this conclusion is correct and circumstances have not changed, and further suggest that the

use of reservoir storage for temperature control anywhere within the San Joaquin Basin will be a waste and unreasonable use of water.

Finally, the proposed listing is procedurally flawed. The SWRCB established February 28, 2007 as the deadline for the receipt and consideration of information and data as part of the 2008 listing cycle. The SWRCB expressly provided that information and data submitted after February 28, 2007 would be accepted, but would not be used in the 2008 listing cycle, but only in the 2010 listing cycle. The CVRWQCB has acknowledged that it did not receive sufficient information and data by the February 28, 2007 deadline concerning the current and historic state of the San Joaquin River Basin fishery necessary to support a listing. Nonetheless, and in contravention of the SWRCB's deadline, the CVRWQCB contacted the CDFG and asked it to provide the necessary information well after the February 28, 2007 deadline had come and gone. Since the CVRWQCB did not receive the information it needed to support a listing by the February 28, 2007 deadline, it cannot list the San Joaquin, Stanislaus, Tuolumne and Merced Rivers as part of the 2008 listing cycle.

I. INTRODUCTION

Having (1) reviewed the materials submitted to the Central Valley Regional Water Quality Control Board ("CVRWQCB") by the California Department of Fish and Game ("CDFG"), and (2) considered the methodology for determining impairment laid out by CVRWQCB staff at the September 25, 2007 workshop, the San Joaquin River Group Authority ("SJRGA") finds that the legal and factual bases asserted by the CDFG and CVRWQCB's staff in support of the proposed listing are faulty. As such, it is the SJRGA's position that the CVRWQCB cannot list the San Joaquin, Tuolumne, Merced or Stanislaus Rivers as impaired bodies of water for temperature during this listing cycle for numerous reasons described herein.

II. LEGAL OBJECTIONS

A. The "Narrative Objective" the CVRWQCB Claims to Be Complying With Is Not An Objective At All, And Cannot Be Used to Justify the Proposed Action.

In the materials and presentation the CVRWQCB staff gave as part of the September 25, 2007 workshop, RWQCB staff indicated that the first step in the Section 303(d) Listing Policy is to identify the relevant water quality objectives. (*See* Power Point Presentation of Danny McClure, Slide # 7). In this particular instance, the CVRWQCB identified the relevant water quality objective as

> "The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses." (Id., Slide # 9; *see also* Preliminary Draft Example Assessment of Merced River, p. 1-2).

While the quoted language is contained in the *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (5A-5B)* ("the Basin Plan")(*see* Chapter III, p. 8.00), it does not constitute a "water quality objective" as defined by the Water Code.

A water quality objective is a standard that limits the levels of water quality constituents or characteristics. Specifically, the Water Code defines a "water quality objective" as "**the limits or levels** of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area."(*See* Wat. Code 13050(h)(emphasis added)). The language cited by the CVRWQCB as a "narrative objective" does not qualify as a water quality objective as defined by the Water Code as it does not contain any level, criteria, characteristic or other description or limitation regarding the temperature of an intrastate water. Rather, the language relied upon by the CVRWQCB merely provides that no alteration of temperature will be allowed unless expressly approved by the RWQCB. So,

while the language relied upon by the CVRWQCB establishes that alterations of temperature are allowed, it provides for no such alterations unless prior approval is obtained from the CVRWQCB. The need to obtain prior RWQCB approval is not a description or identification of a limit or level of water quality constituents as required by Water Code Section 13050(h).

The language relied upon by the CVRWQCB similarly does not comply with federal requirements under the Clean Water Act. Pursuant to federal regulation, a water quality standard is comprised of both the designation of use to be made of the water, and the criteria necessary to protect such use. (*See* 40 C.F.R. § 131.2). In addition to not identifying any criteria, the language relied upon by the CVRWQCB fails to identify any beneficial use or uses which are to be protected. All that the language relied upon by the CVRWQCB says is that temperature cannot be altered, absent the permission of the CVRWQCB, if it will harm "beneficial uses." But, both the Water Code and the Clean Water Act require the CVRWQCB to evaluate, weigh and balance a host of factors before identifying the beneficial use or uses for a particular water (not to mention the criteria necessary to protect such beneficial use). (Wat. Code § 13241; *see* 33 U.S.C. § 1313(c)(2)(A); *see also* 40 C.F.R. §§ 131.10-131.13). In this case, the language relied upon by the CVRWQCB indicates that the type of weighing and balancing that the CVRWQCB is supposed to have engaged in did not occur, as the language does not identify any specific beneficial use or uses which are to be protected.

The inappropriateness of using the language relied upon by the CVRWQCB as a water quality objective becomes clearer when looked at in terms of implementing a total maximum daily load ("TMDL"). TMDLs are required to be established at a "level necessary to implement the applicable water quality standards…" (*See* CWA 303(d)(1)(C)). But, given that the language relied upon by the RWQCB does not set any limit or level of temperature, a TMDL cannot be devised which implements such language. Indeed, the only way that a TMDL can be developed in this case is if, after deciding to list the San Joaquin, Tuolumne, Merced and Stanislaus Rivers as impaired for temperature, the CVRWQCB then identifies the specific limits or levels of temperature that are appropriate as part of the TMDL itself. Such an effort would, however, be illegal, as the CVRWQCB does not have the authority to adopt "water quality objectives" as part of the development of a TMDL. (*See* June 12, 2002 memorandum from the SWRCB Office of Chief Counsel entitled *The Distinction Between A TMDL's Numeric Targets and Water Quality Standards*, attached hereto as Exhibit A).[1] Indeed, "TMDLs are not water quality objectives," but rather "serve as a means to an end. That end is the attainment and maintenance of existing water quality standards." (Id., p. 5, 6). In this instance, since the language relied upon by the CVRWQCB does not contain any limits, levels, characteristics or other description of the temperature objectives for the San Joaquin, Stanislaus, Merced and Tuolumne Rivers, nor does it identify the beneficial use or uses to be protected, a TMDL to attain such limits is impossible. Indeed, it is clear that to properly establish a TMDL in this case, a water quality objective, including both the

[1] The June 12, 2002 memorandum explains that a water quality objective is developed after consideration of a variety of policy considerations (*see* Wat. Code § 13241), whereas such policy considerations do not apply to the development of TMDLs. (Id., p. 3-9).

identification of the beneficial use and the temperature criteria necessary to protect such beneficial use, will need to be developed as part of the TMDL.

B. The Applicable Water Quality Objective is Identified in the Basin Plan for COLD Intrastate Waters.

If the CVRWQCB were interested in evaluating whether or not the San Joaquin, Tuolumne, Merced and Stanislaus Rivers were impaired for temperature, the water quality objective that would apply is the narrative objective identified for COLD intrastate waters, which is

> "At no time or place shall temperatures of COLD or WARM intrastate waters be increased more than 5ºF above natural receiving water temperature." (Basin Plan, Chapter III, p. 8.00).

The San Joaquin, Merced, Tuolumne, and Stanislaus Rivers have all been identified as COLD intrastate waters. (Basin Plan, Chapter II, p. 7.00-8.00).

Unlike the language relied upon by the CVRWQCB to date, narrative objective for COLD intrastate waters complies with State and federal law by including both a beneficial use designation and a temperature criteria designed to protect such designated beneficial use.[2] The designation "COLD" means that the recognized beneficial use of these rivers is "Cold Freshwater Habitat" that supports aquatic vegetation, fish and wildlife. (Basin Plan, Chapter II, p. 2.00). The criteria for protecting such designated beneficial uses is that natural receiving water temperatures cannot be increases by more than 5ºF.

None of the information solicited by nor made available to the CVRWQCB uses this water quality objective. As such, there is simply no information available upon which the CVRWQCB could rely to determine, as part of this listing cycle, if the San Joaquin, Merced, Tuolumne and Stanislaus Rivers are impaired for temperature.

C. The CVRWQCB's Proposed Use of Policy 6.1.5.9 Is Inappropriate.

The CVRWQCB indicated that it intends to rely upon the alternate approach to evaluating temperature data as set forth in Section 6.1.5.9 of the September 2004 *Water Quality Control Policy For Developing California's Clean Water Act Section 303(d)*

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[2] This narrative objective would not be applicable in this case even if the language relied upon by the CVRWQCB is considered a "water quality objective." It is hornbook law that where a general regulation conflicts with a specific regulation, the specific controls. (People v. Weatherill (1989) 215 Cal.App.3d 1569, 1577-1578).Here, the CVRWQCB has adopted a general prohibition on alterations unless it gives prior approval. But, then the CVRWQCB actually approves of specific levels of alteration for COLD and WARM waters; ie, that any alteration that does not result in an increase of 5ºF above natural receiving water temperature is acceptable. Since the rivers at issue are designated COLD, this more specific objective would apply in lieu of the more general "objective" relied upon by the CVRWQCB.

List. ("the Listing Policy") (Power Point Presentation of Danny McClure, Slide # 11; *see* Preliminary Draft Example Assessment of Merced River, p. 1). The use of this alternate approach is inappropriate as it is contrary to the Basin Plan and the *Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California* ("the Thermal Plan") adopted by the SWRCB in 1975.[3] Further, even if alternate policy were to be found to be applicable generally, the factual predicates necessary to using the alternate policy do not exist in this case.

1. **The Alternate Policy is Contrary to the Basin Plan and Thermal Plan**.

The alternate policy expressed in Section 6.1.5.9 of the Listing Policy provides that, in the absence of "historical"[4] or "natural" temperature data, recent temperature data can be compared to the temperature requirements of aquatic life found in the water segment at issue. (Listing Policy, § 6.1.5.9, p. 25). This alternate policy is similarly described in the SWRCB's September 2004 *Final Functional Equivalent Document Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List* ("the Functional Equivalent Document").There, the SWRCB stated that the primary problem in assessing a body of water for temperature impairment is the lack of temperature data necessary to determine the "natural receiving water temperature" specified in the Basin Plan's temperature objectives. (Functional Equivalent Document, p. 132). The SWRCB explained that "Determining 'natural receiving water' temperature is limited by the availability of historic temperature monitoring data that is considered representative of unaltered and/or natural conditions in a water body." (Id., p. 132-133). The SWRCB went on to discuss two possible alternative methods of interpreting temperature data, including the one adopted in Section 6.1.5.9 of the Listing Policy. (Id., p. 133-135).

The SWRCB's discussion of the need for an alternate method of interpreting temperature data due to the lack of "historic" or "natural" temperature data representative of "unaltered" conditions is, however, severely wanting. There is simply nothing in the Basin Plan itself which suggests that the "natural receiving water temperature" refers to "unaltered conditions" justifying the SWRCB's development of an alternate policy. To the contrary, the SWRCB's definition of "natural receiving water temperature" expressly belies the SWRCB's stated need for temperatures indicative of the "unaltered" condition.

Both the language relied (inappropriately) upon by the CVRWQCB and the language establishing the narrative objective for COLD and WARM intrastate waters use the term "natural receiving water temperature." This term is expressly defined by the SWRCB in the Thermal Plan to mean "The temperature of the receiving water at locations, depths, and times which represent conditions unaffected by any elevated

[3] The Thermal Plan is expressly incorporated into and made part of the Basin Plan. (Basin Plan, Chapter III, p. 2.00; Chapter IV, p. 10.00, Appendix Item 11). Further, the Thermal Plan is expressly identified by the SWRCB as one of the policies with which all state agencies, including the CVRWQCB, must comply. (Basin Plan, Chapter IV, p. 8.00 (Policy #12)).
[4] The term "historical" is not defined in the Listing Policy.

temperature waste discharge or irrigation return waters." (Thermal Plan, p. 1).[5] The term "elevated temperature waste," used in the definition of "natural receiving water temperature" is likewise defined. That term refers expressly to "Liquid, solid, or gaseous material including thermal waste discharged at a temperature higher than the natural temperature of receiving water. Irrigation return water is not considered elevated temperature waste for the purposes of this plan." (Thermal Plan, p. 1).[6] Thus, "natural receiving water temperature" has nothing to do with "historic" or "unaltered" conditions, but rather is the temperature of the water before the addition of elevated temperature waste discharges and irrigation return waters.

To the extent that this conclusion was at all left in doubt based upon the definitions provided by the SWRCB itself, such doubt is utterly extinguished by the SWRCB when it provides that:

> "Natural water temperature will be compared with waste discharge temperature by near-simultaneous measurements accurate to within 1ºF. In lieu of near-simultaneous measurements, measurements may be made under calculated conditions of constant waste discharge and receiving water characteristics." (Thermal Plan, p. 6).

Given the SWRCB's insistence that temperature comparisons be made using "near-simultaneous measurements," it is clear that the SWRCB was not contemplating the need or use for data reflective of the "historic" or "unaltered" condition of the water body.

Although the definition of "natural receiving water temperature" is in the Thermal Plan and applies only to interstate waters, not intrastate waters such as are at issue in this case, the use of the same term in similar regulations is presumed to have the same meaning. (Boise Cascade Corp. v. USEPA, 942 F.2d 1427, 1432 (9th Cir. 1991)).[7] This is especially true when, as here, the agency has given a specific definition for a term. (Urban Renewal Agency v. Calif. Coastal Zone Conservation Co. (1975) 15 Cal.3d 577, 584-585). Since the SWRCB used the term "natural receiving water temperature" in regards to the interstate waters, coastal waters and enclosed bays covered expressly by the Thermal Plan, and in regards to the intrastate waters which are not discussed in the Thermal Plan, in the absence of some other manifestation of a differing intent, the two terms are to be treated as if they have the same meaning.

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[5] This definition is misquoted in the Functional Equivalent Document on page 132 in such a way as to change the entire meaning of the definition. A comma is inappropriately added between the words "temperature" and "waste" which breaks up, avoids and negates the SWRCB's given definition for the term "elevated temperature waste" discharge.

[6] The term "thermal waste" as used in the definition of "elevated temperature waste" is also expressly defined as "Cooling water and industrial process water used for the purpose of transported waste heat." (Thermal Plan, p. 1).

[7] This standard of statutory interpretation also works in reverse. Where one statute uses a specific term, and another, similar statute omits the specific term, it is evidence that the promulgating body had a different intent in mind. (People v. Licas (2007) 41 Cal.4th 362, 367).

Further, there is no doubt that the SWRCB could have set up a different scheme for measuring temperatures in intrastate waters generally, or in the San Joaquin, Tuolumne, Merced and Stanislaus Rivers specifically. In the Basin Plan, on the very same page that the narrative objective for COLD and WARM waters is provided, the SWRCB identified specific temperatures for specific water bodies. (Basin Plan, Chapter III, p. 8.00, Table III-4 and Table III-4A). Moreover, these specific limitations on temperature changes are not related to "natural receiving water temperature," which is not mentioned at all, but rather are related to "temperature changes due to controllable factors." (Ibid.).

The Basin Plan and Thermal Plan make it clear that the alternate policy contained in Section 6.1.5.9 is inappropriate and unnecessary. To determine whether or not temperatures of a water body are in excess of the "natural receiving water temperature," the RWQCB must take nearly simultaneous temperature readings upstream and downstream of discharges of thermal waste and irrigation return flows. If the temperature of the water downstream of the discharge is more than 5ºF hotter than the temperature upstream of the discharge, then an exceedance exists. There is no reason or justification for the RWQCB to attempt to equate "natural receiving water temperature" with the "unaltered condition."

2. **Even Assuming Section 6.1.5.9 Applies, There Is No Information Justifying Its Use in this Case**.

Assuming, *arguendo*, that the alternate policy set forth in Section 6.1.5.9 does apply generally, there is not enough information justifying its application as to the San Joaquin, Tuolumne, Merced and Stanislaus Rivers in this instance. By its own terms, Section 6.1.5.9 applies only when "'historic' or 'natural' temperature data are not available…" (Listing Policy, § 6.1.5.9, p. 25). The submittal made to the CVRWQCB by the CDFG on February 28, 2007, and the information submitted by the CDFG at the workshop on September 25, 2007, did not show, and made no effort to show, that the "historic" or 'natural" temperatures are not available. Rather, the submittals by CDFG, as well as the Preliminary Draft Example Assessment of Merced River, assumed the unavailability of such "historic" or "natural" temperature data. The CVRWQCB must do more than rely upon this, as yet, unfounded assumption.

First, there is no indication that either the CDFG or the CVRWQCB looked to determine if "historic" or "natural" temperature data existed. Before applying, or attempting to apply, the alternate policy, it is incumbent on the CVRWQCB to determine if such "historic" or "natural" temperature data exist. (*See* EPA's 2004 Final Upper Main Eel River and Tributaries Total Maximum Daily Loads for Temperature and Sediment, p. 12 ["No information on pre-dam conditions was uncovered, nor general stream temperatures before the 1964 flood."]).

Second, "historic" or "natural" temperature data need not be generated solely from actual measurements taken, but may also come from modeling.[8] For example, in the Eel River TMDL, EPA used a computer model to calculate "natural stream temperatures" and also to evaluate the temperature affects of four additional riparian management scenarios. (Id., p. 20-24, 28-32). In so doing, EPA noted that "Modeling of stream temperature is a well developed area of inquiry and many models are available to assist policymakers in understanding the factors controlling stream temperatures." (Id., p. 20).

In this instance, even if data from actual temperature measurements taken at some point in the past are unavailable, "historic" or "natural" temperature can still be accurately calculated using the HEC-5Q model constructed for evaluating temperature in both the upper and lower San Joaquin River system, including the Stanislaus, Merced and Tuolumne Rivers, as part of the San Joaquin River Basin-Wide Water temperature Modeling Project ("the SJR Basin Model").[9] The SJR Basin Model, which is the model used by both the SJRGA and the CDFG for their respective presentations on September 25, 2007,

> "is designed to simulate the thermal regime of mainstem reservoirs and river reaches. The SJR [Basin] Model project focuses on understanding the relationship between air temperature, reservoir operations, river hydraulics, stream flow, and water temperature, both in-reservoir and in-river…the HEC-5Q model will analyze different water operation scenarios (e.g., reservoir storage and release patterns)…" (CDFG's March 22, 2006 *Lower San Joaquin River Basin-Wide Temperature Modeling Project Data Collection Protocol*, p. 4 (attached to CDFG's February 28, 2007 submittal as Exhibit E)).

Just as the SJR Basin Model is capable of predicting future water temperatures given a range of operation scenarios, it is likewise capable of accurately identifying "natural" or "historic" temperatures using the same principles. As an example, in the Case 1 run done for the SJRGA by AD Consultants, the model identified and compared "actual" temperatures with "historic" temperatures at varying locations in the Stanislaus River for the period 1967-1982. The "historic" temperatures were derived solely from the model by removing New Melones Dam and reservoir, installing the original Melones Dam and reservoir, and using historical flow and operation criteria for Melones Dam and reservoir. Similarly, the "actual" temperatures, which assumed the existence of New Melones Dam and reservoir and the Interim Plan of Operation as the operating criteria for the period 1967-1982, were derived solely from the model. Once the run was completed, the results were compared with temperature data collected at Vernalis and downstream of

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[8] The SWRCB's December 4, 2006 data solicitation and the January 30, 2007 clarification notice expressly provided that there are no limits on the data and information that the public can provide. The SWRCB made it clear that the RWQCBs would accept any and all data.

[9] The SJR Basin Model is still being reviewed by all of the stakeholders and some minor tweaking and improvements are expected.

Goodwin Dam. The comparison indicated that the model under-predicted the observed temperatures slightly, indicating that the model results are conservative from a temperature increment standpoint. (*See* Exhibit B, p. 6, p. 10 [Figure 7]).

Since the SJR Basin Model is capable of accurately depicting "historic" temperatures for the San Joaquin, Tuolumne, Merced and Stanislaus Rivers, there is no need for the CVRWQCB to rely upon the alternate policy set forth in Section 6.1.5.9 of the Listing Policy.

D. Action Taken as Part of the 2008 Cycle Is Arbitrary and Capricious.

1. **CVRWQCB Does Not Have Sufficient Information About the Current and Historic State of the Fishery**.

The SWRCB initiated the solicitation of data and information regarding water quality conditions from interested parties by public notice dated December 4, 2006. That notice provided, in bold type,

> "**To be considered in this review process, data and information must be submitted to the appropriate Regional Water Board no later than February 28, 2007.**" (SWRCB Notice of Public Solicitation of Water Quality data and Information for 2008 Integrated Report – List of Impaired Waters and Surface Water Quality Assessment [303(d)/305(b)], December 4, 2006, p. 2)(bold in original).

The notice also had attached to it a document entitled "Enclosure 3." Paragraph 4 of Enclosure 3 specifically provided that

> "All new information and data must be received by the respective Regional Water Board…by the close of business on February 28, 2007. Please note that any information received after February 28, 2007 will not be used for the 2008 section 303(d) List or for compiling the section 305(b) Report, but will be considered in developing the 2010 section 303(d) List and Section 305(b) Report." (Enclosure 3, p. 1, ¶ 4).

The SWRCB made it clear to everyone, including the RWQCBs tasked with compiling and assessing the water quality data and information submitted, that no extensions of the February 28, 2007 deadline were permitted or would be granted. Rather, the SWRCB specifically provided that data submitted after the close of the solicitation period would be considered only in the context of the development of the 2010 cycle.

As discussed above, the CVRWQCB is ostensibly relying on the alternate policy of Section 6.1.5.9 to support the proposed listing. This Policy, however, specifically provides that information "on current and historic conditions and distribution of sensitive beneficial uses (e.g., fishery resources) in the water segment **is necessary**…" (Listing Policy, § 6.1.5.9, p. 25-26). In this instance, as the September 12, 2007 Preliminary Draft Example Assessment submitted by CVRWQCB staff at the September 25, 2007 workshop demonstrates, information and data about the current and historic distribution of salmon is still needed.

For example, on page 1 under the heading "Decision," the document indicates "List – Pending information about the fishery." (Similar statements are provided elsewhere on page 1 ["Insert information about current and historic salmonid distribution"]). On page 9, the CVRWQB staff expressly acknowledges the lack of fishery information needed as it specifically admits

> "INFORMATION ABOUT THE HISTORICAL AND CURRENT STATE OF THE FISHERY WILL BE NEEDED TO COMPLETE THE ASSESSMENT." (September 12, 2007 Preliminary Draft Example Assessment, p. 9)(capitalization original).

Since it is clear that information and data regarding the historical and current state of the fishery was not submitted to the CVRWQCB by February 28, 2007 as required by the SWRCB, the CVRWQCB does not have enough information to list the San Joaquin, Tuolumne, Merced and Stanislaus Rivers as impaired for temperature using the alternate policy of Section 6.1.5.9.

2. **CVRWQCB's Apparent Effort to Solicit Information from CDFG After the February 28, 2007 Deadline Was Biased and Unfair, and Any Use of that Information in the 2008 Listing Cycle Will Be Arbitrary and Capricious**.

At the September 25, 2007 workshop, staff from CDFG gave a presentation which, among other things, discussed the current and historic status of the fishery. (*See*, *e.g.*, Marston slides entitled "Why List?" SJR Salmon Trend" and "Re-Cap Summary"). The SJRGA thought this presentation odd, as the CDFG had not submitted any such information as part of its February 28, 2007 submittal.

Further, Mr. Marston of CDFG indicated that CDFG was, as part of the workshop, submitting to the CVRWQCB a paper regarding the current and historic status of the fishery. This paper, dated September 2007 and entitled "San Joaquin River Fall-run Chinook Salmon and Steelhead Rainbow Trout Historical Population Trend Summary" was provided to the SJRGA on October 18, 2007 as the result of a Public Records Act

request.[10] In this paper, Mr. Marston discloses that CDFG submitted information about historic fishery trends ***at the request of the CVRWQCB***. Mr. Marston writes

> "The Central Valley Regional Board asked the Department to submit information regarding the historical trends of salmon and steelhead in the San Joaquin River Basin (excluding the Mokelumne and Cosumnes Rivers)." (San Joaquin River Fall-run Chinook Salmon and Steelhead Rainbow Trout Historical Population Trend Summary, September 2007, p. 4).

Assuming that Mr. Marston's statement is accurate, the request by CVRWQCB that the CDFG submit additional evidence and data regarding current and historic fishery trends after the SWRCB's February 28, 2007 deadline is, at best, inappropriate, and at worst, evidence of prejudice and bias that calls into question the CVRWQCB's entire process.

Regardless of the propriety of the request itself, any effort by the CVRWQCB to use the information submitted by CDFG or any other party regarding current and historic fishery trends in the 2008 listing cycle will be arbitrary and capricious. The SWRCB established the February 28, 2007 deadline to insure that the various regional boards would have enough time to evaluate and assimilate the information submitted such that the Integrated Report could be completed and submitted to the USEPA by April 1, 2008. (*See* December 4, 2006 Notice, p. 2). The SWRCB made no provision for the change, relaxation or other extension of the February 28, 2007 deadline. To the contrary, the SWRCB flatly stated that any information submitted after February 28, 2007 "will not be used" as part of the 2008 listing cycle, but would instead be used in the 2010 listing cycle. (Id., Enclosure 3, p. 1, ¶ 4). The SWRCB expressly considered and resolved how information submitted after February 28, 2007 was to be treated and used. The fact that CDFG and/or other parties failed to submit sufficient information to the CVRWQCB by February 28, 2007 which will enable it to evaluate whether or not there is an impairment for temperature under the alternate policy of Section 6.1.5.9 is not sufficient reason for the CVRWQCB to unilaterally contact CDFG and request that it provide the missing information. (*See* Halaco Engineering Co. v. South Central Coast Regional Com. (1986) 42 Cal.3d 52, 79 [defining arbitrary and capricious conduct as that "not supported by a fair or substantial reason…"]).

Since it is clear from both the CVRWQCB's own September 12, 2007 Preliminary Draft Example Assessment and Mr. Marston's September 2007 paper "San Joaquin River Fall-run Chinook Salmon and Steelhead Rainbow Trout Historical Population Trend Summary" that the CVRWQCB did not receive the information it

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[10] In addition to the September 2007 paper *San Joaquin River Fall-run Chinook Salmon and Steelhead Rainbow Trout Historical Population Trend Summary*, CDFG also furnished copies of two additional items that were submitted to the CVRWQCB after the February 28, 2007 deadline: a June 6, 2007 letter from Mr. John M. Bartolow, USGS (retired), and a September 24, 2007 report by Alice A. Rich, Ph.D., entitled *Impacts of Water Temperature on Fall-Run Chinook Salmon (Oncorhynchus tshawytscha) and Steelhead (O. mykiss) in the San Joaquin River System.*

needs regarding the current and historic state of the fishery to utilize the alternate policy of Section 6.1.5.9 by the SWRCB's February 28, 2007 deadline, the CVRWQCB cannot list the San Joaquin, Tuolumne, Merced and Stanislaus Rivers as impaired for temperature in the 2008 listing cycle.

E. The Use of Stored Water to Reduce Temperature At Vernalis is a Waste of Water In Violation of the California Constitution.

In its February 28, 2007 submittal, CDFG recommended that the San Joaquin River at Vernalis be declared impaired for temperature due to alleged exceedances of temperatures in the April 15-June 15 time frame, and again in the September 1-October 31 timeframe. (*See* February 28, 2007 letter, Table 1). During the September 25, 2007 workshop, staff from CDFG made it clear that the method of lowering temperatures at all proposed compliance points, including Vernalis, was by increasing flow through manipulation of reservoir storage. Mr. Marston submitted a slide entitled "Can H2O Be Cooled?" which specifically contemplates use of coldwater storage accounts in reservoirs as a method of cooling temperatures. (*see* Marston slide from the same presentation linking increased flows from reservoir storage and reduced temperatures, entitled "Flow Level & H2O Temp."). CDFG also contracted with AD Consultants to conduct two modeling runs using the SJR Basin Model to look at the impact of increased flow on temperatures at the confluence of the Tuolumne River and the San Joaquin River (Marston slide entitled "Tuolumne River Confluence (2001)") and Vernalis (Marston slide entitled "San Joaquin River at Vernalis (2001)").

CDFG's focus on the use of reservoir releases to cool temperatures, particularly at Vernalis, is of dubious value as the SWRCB has already concluded that the use of reservoir releases to control temperatures measured at Vernalis would be a waste and unreasonable use of water in contravention of the California Constitution. In the SWRCB's May 1991 Water Quality Control Plan for Salinity ("1991 Salinity Plan"), the SWRCB noted temperature objectives measured at Vernalis, but refused to implement them, stating controlling temperatures at Vernalis by "utilizing reservoir releases does not appear reasonable due to the distance of the [Vernalis] downstream of reservoirs and uncontrollable factors such as ambient air temperature, water temperature in the reservoir releases, etc. For these reasons, the State Board considers reservoir releases to control water temperatures [at Vernalis] a waste of water…" (1991 Salinity Plan, Table 1, p. 1-13).

There is no evidence that the CVRWQCB can rely upon to come to a different conclusion than that reached by the SWRCB in 1991. Mr. Marston admitted during the workshop that CDFG did not ask AD Consultants to evaluate the impact on reservoir storage that would result if CDFG's increased releases of reservoir storage were implemented. Further, the SJRGA did ask AD Consultants to evaluate impacts to reservoir storage as part of the model runs they commissioned, and in each case the increased releases not only were unable to achieve the temperature criteria at all times and in all locations, but had profound, detrimental impacts to reservoir storage. (*See*

Results of modeled Cases, attached hereto as Exhibit B, and complete discussion in Section III, *infra*.).

Article X, Section 2 of the California Constitution provides that waters of the state must be put to reasonable and beneficial use. Any use which is unreasonable or non-beneficial can be prohibited. (Gin S. Chow v. City of Santa Barbara (1933) 217 Cal. 673; Antioch v. Williams Irr. Dist. (1922) 188 Cal. 451; Joslin v. Marin Mun. Water Dist. (1967) 67 Cal.2d 132). Moreover, what constitutes a reasonable and beneficial use of water is a question of fact. (People v. Forni (1976) 54 Cal.App.3d 743, 750). As such, any evaluation of the propriety of a use of water must involve the examination of the proposed use and a determination of the proposed use justified the amount of water utilized. (Antioch, *supra*, 188 Cal. 451 (sought flows to prevent saltwater intrusion); Peabody v. City of Vallejo (1935) 2 Cal.2d 351, 375-376 (flows to flood land and to provide incidental recharge); Forni, *supra*, 54 Cal.App.3d 743 (sought water for frost protection); Imperial Irr. Dist. v. State Water Resources Control Bd. (1990) 225 Cal.App.3d 548 (examined irrigation and delivery practices which resulted in tailwater and drainage flowing into the Salton Sea); Erickson v. Queen Valley Ranch Co. (1971) 22 Cal.App.3d 578, 585 (determined method of diversion which resulted in loss of 5/6 of diverted water during transport); Joslin, *supra*, 67 Cal.2d at 141-145 (use of water to transport gravel not reasonable)).

In 1991, the SWRCB concluded that the use of reservoir releases to meet temperatures at Vernalis was a waste and unreasonable use of water "based upon the record in [the] proceedings" before it. (1991 Salinity Plan, p. 1-13). Further, the SWRCB stated that it "will require a test of reasonableness before consideration of reservoir releases" for the purpose of controlling water temperature at Vernalis. (Id.). Here, the information submitted by CDFG has done nothing to demonstrate that the use of reservoir releases to control temperatures at Vernalis is reasonable in contradiction to the findings of the SWRCB in 1991, particularly since the temperatures now cited by CDFG are even lower (*i.e.*, 64.4ºF [18ºC]) than those included in the 1991 Salinity Plan (*i.e.*, 68ºF [20ºC]) at Vernalis in April through June, September and November. Moreover, the information submitted by the SJRGA demonstrates that any attempt to use reservoir releases to achieve the recommended temperatures at Vernalis will (a) be unable to achieve such temperatures during the recommended time periods and (b) have a significant, detrimental impact on reservoir storage. The information submitted to date requires the CVRWQCB to conclude that the use of reservoir releases to meet the recommended temperatures at Vernalis continues to be a waste and unreasonable use of water.[11] Since the current proposed listing is dependent upon the use of reservoir releases, the CVRWQCB cannot list the San Joaquin River as impaired for temperature at this time.

[11] Given the SWRCB's prior findings, the CVRWQCB must also evaluate and determine whether the use of reservoir releases to meet the recommended temperatures in the other locations is a reasonable and beneficial use of water. The modeling data, discussed in Section IV, *infra*, certainly suggests that the use of reservoir releases to control water temperatures at the confluence of the San Joaquin River and its tributaries is not a reasonable and beneficial use of California's water resources.

III. BIOLOGICAL OBJECTIONS

The CDFG material is clearly selective and was presented to CVRWQCB staff with the sole purpose of obtaining an impairment determination. It is in fact astonishing, and of course extremely troubling to the SJRGA, that the staff did not evaluate the accuracy of that CDFG information as there are many obvious problems and biases with it as is revealed in detail in the following sections. The evaluation process consists of a formulaic assessment largely of "if this (CDFG claims), then this (impairment conclusion)" which in this case results in "Garbage in, garbage out".

The CDFG material and the staff's evaluation process makes little recognition of the inherent variability in the natural annual and seasonal hydrology and corresponding water management operations which are based on a purposeful (and often legally required) adaptive management approach that adjusts to changing conditions. Further variability exists within the fishery information and important exogenous factors such as weather and climate. The SJRGA contends that it is important for the staff to understand that such variability exists, that it is a dominant factor in the San Joaquin basin, and that it be reflected in the information and assessment under consideration in this process. The application of absolute temperature criteria to define impairment in the San Joaquin Basin rivers ignores the reality of year-to-year variability in temperature and flow conditions that have always naturally occurred in those rivers. The use of such inflexible, absolute criteria also discounts the adaptive capabilities, within certain limits, of the salmonids and other native biota to variable conditions.

Because there is inevitable natural cycling between warmer, low-flow years and cooler, high-flow years, it would be logical to apply different sets of temperature criteria to define degrees of impairment depending on the environmental/climate conditions prevailing in the San Joaquin Basin in given years. Thus, a river may be considered impaired if its temperature exceeded certain thresholds during normal years, but it would not necessarily be considered impaired if it exceeded the same thresholds during the drier years.

It should also be recognized this is a preliminary review of the information submitted by CDFG as some of it has only recently even been made available to the SJRGA. However this review is intended to bring to the CVRWQCB's attention many of the inconsistencies, inaccuracies, and inappropriate substitutions of data which invalidate CDFG's analysis of impairment and the subsequent staff assessment as well. For example, the CDFG analysis:

- uses temperature criteria that are not applicable to the San Joaquin Basin
- is not congruent with, or completely ignored, readily available fisheries information
- misrepresents conditions by substituting data from a distant (up to 28 miles away) thermograph location for a location where data was missing
- does not consider temperature records that are readily available for some locations in the Stanislaus and Tuolumne Rivers to expand the number of observations

- does not evaluate the biological significance of temperature conditions
- does not address other relevant issues.

Based on these issues, which are described in more detail below, the CDFG analysis cannot be used as the basis for a 303(d) listing.

A. Temperature Criteria Recommended By CDFG Are Not Appropriate.

CDFG chose to use EPA Region 10 criteria but did not provide adequate justification for their recommendation. In fact, the very report by A.A. Rich and Associates that was submitted to support their position clearly states that site-specific data are extremely important in ascertaining the effects of water temperature on Chinook salmon and steelhead populations in the San Joaquin River System and CDFG has admittedly performed no evaluation of the biological significance of temperature for these populations. EPA Region 10 temperature criteria are not consistent with other criteria previously cited by CDFG, are based on laboratory studies conducted in the Pacific Northwest, and do not apply to wild Central Valley fall Chinook salmon and steelhead at the southern extent of their range. . Discussion of some of these issues follows.

1. **The A.A. Rich and Associates Report Does Not Support Using the EPA Region 10 Criteria**.

The report from A.A. Rich and Associates recently submitted by CDFG does not provide adequate support for using the EPA Region 10 criteria to assess impairment. In fact, the report clearly states that site specific data are essential to ascertaining the effects of water temperature on Chinook salmon and steelhead populations in the San Joaquin River System and "knowledge of temperature tolerance and sublethal stress responses of Chinook salmon and steelhead are far from adequate to define safe thermal limits for Chinook salmon and steelhead in the San Joaquin River System". Despite this lack of critical information, Dr. Rich and CDFG assert that there has been a dramatic decrease in populations of these species as a result of temperature impairment. In addition to the paucity of site specific temperature criteria, the statement that decreased abundance is the result of in-stream thermal conditions completely ignores the influence of key factors such as ocean conditions on salmon abundance. Many scientists consider poor ocean conditions to potentially be the primary factor responsible for low returns to the Central Valley and along much of the West Coast during 2007. In addition, since most of the salmon life occurs in the ocean, Rich's statement: "…the Chinook salmon and steelhead are each exposed to higher than optimal water temperatures throughout their life cycle" is a misrepresentation.

The report also falsely asserts that Chinook salmon and steelhead are exposed to higher than optimal water temperatures throughout their freshwater lifecycle as a result of increased water temperatures associated with water impoundments and diversions, and the long-term result has been a dramatic decrease in populations of these species. However, recent analyses show that temperatures in the lower Stanislaus River were

warmer prior to operation of New Melones Reservoir (*see* Section IV, *infra*), yet salmon abundance was higher during this time period. Again, temperature does not appear to be the limiting factor as reduced temperatures have not increased salmon escapement. The sweeping statement by Rich that "declining fish populations provide strong evidence the increased water temperatures have contributed overwhelmingly to cumulative physiological stress" is unsupported conjecture.

Numerous studies are provided in Tables 1-11 of the report and are supposedly organized to identify lethal, stressful, optimal temperatures ranges for the freshwater life stages of Chinook salmon. However, when compared to the ranges presented on pages 5-6, it is not clear, specifically, how the optimal ranges for each lifestage were established. They are not clearly derived from the tables. For example:

- The range presented for Chinook salmon egg and alevin incubation/fry emergence is 42.5°F (5.8°C) to <55°F (13°C) and no reference is cited for this range. However, Table 6 summarizes results of studies to determine the optimal water temperatures for this lifestage. Only one study is listed and the range was 39.8°F (4.3°C) to 59°F (15°C).
- Ranges are presented for various lifestages of steelhead yet no reference is cited and there are no tables that summarize the results of studies that have been conducted.

The criteria and tables presented in the report appear to be a repeat of testimony presented by Dr. Rich during hearings regarding the Delta Wetlands Project during 1997. These discrepancies were also identified during those proceedings and have clearly not been addressed.

With regard to steelhead, the report presents an optimal incubation temperature of <54°F which is warmer than the temperature reported for adult migration and spawning (<52°F). This does not make sense and in the absence of references there is no way of knowing where these numbers came from.

Perhaps many of the optimal temperatures cited in the report were taken from Dr. Rich's 1987 report. If so, the results are questionable as discussed in the following excerpt from Williams 2006.[12]

> "Rich (1987) reported maximum growth at 15.3°C (Figure 4-7a), and no survivors at 24°C, in contrast to Marine (1997), Cech and Myrick (1999), and Brett et al. (1982). Possible reasons for the difference are tank effects and disease. Marine (1997) used 400 L circular tanks with filtered surface water from Putah Creek and initial density of 550 fish per tank (0.73 L per fish). Cech and Myrick (1999) used 110 L circular tanks and pathogen-free well water and 30 fish per tank (3.67 L per fish). Both used

[12] The references cited in this Section III are attached hereto as Exhibit C.

directed sprays to maintain a current in the tanks. Brett et al. (1982) did not describe their experimental tanks, each of which held 25 fish. Rich (1987) used 57 L rectangular tanks with unfiltered surface water from the American River, and a high density of fish (initially 160 per tank, or 0.36 L per fish). The densities in both the Myrick and Rich experiments decreased over time as fish were sacrificed for various assays. Dr. Rich noted disease as an indicator of stress for the 19°C and higher treatments, and this, together with confinement in tanks with little current, may explain the difference between her results and those from other studies (there is evidence that confinement in aquaria without current causes stress (Milligan et al. 2000), and the unfiltered surface water probably introduced pathogens). Rich's results underscore the need to consider the extent to which higher temperatures increase the virulence of pathogens (Myrick and Cech 2001), but whether her experimental conditions reasonably reflect natural conditions is questionable."

2. **Biological Significance of Temperature and Previous Criteria Cited by CDFG**.

CDFG's analysis of impairment is also lacking in that it provides no evaluation of the biological significance of their chosen temperature criteria in the San Joaquin Basin – a point that they confirmed during the September 25, 2007 workshop. The approach used by CDFG presumes that there is no impact to the population if temperatures are below the EPA Region 10 criteria, but the population is reduced if temperatures exceed the criteria. The impairment analysis has no function to weight impact based on the proportion of the population affected which is a function of the proportion of the population experiencing a given condition, the severity of the condition (relationship of temperature to mortality rate), and the duration of exposure.

As cited from Moyle 2005 "the most productive spring-run Chinook salmon stream left in California, Butte Creek, can experience daily maxima up to 24ºC (75.2ºF) with minima of 18-20ºC (64.4-68.0ºF) for short periods of time in pools where juveniles are rearing and adults are holding. It is thus possible for Chinook salmon to maintain populations even when they experience periods of suboptimal or even near-lethal conditions. They are also capable of finding, through behavioral means, temperature refuges (where cooler water is present due to ground water seeps, shady areas, and other factors). The bottom line is that Chinook salmon do not have to experience (and usually do not) temperatures that are continuously in the temperature ranges specified by criteria. In fact, it is this flexibility that has made Chinook salmon so successful in the Central Valley and to thrive where less temperature tolerant salmonids (e.g., coho salmon) cannot."

If temperatures were a problem for adult migrants in the San Joaquin Basin, one might also expect to observe problems with pre-spawning mortality. However, studies conducted by CDFG (Guignard 2005, Guignard 2006) demonstrated that the incidence of pre-spawn mortality is quite low (i.e., 2%-4.5%) and appears to be density, not temperature, dependent.

a. *CDFG Has Cited to Temperature Criteria In Other Reports*.

Although CDFG has based its entire recommendation on the notion that the EPA Region 10 criteria are the temperature thresholds against which temperature impairment for anadromous fish beneficial uses, CDFG itself has not and does not rely on such criteria itself. To the contrary, CDFG has and does cite to a variety of temperature criteria. For example:

- CDFG uses <13ºC (<55.4ºF) maximum temperature in the impairment analysis for spawning/ incubation
  - <14.2ºC (<57.6ºF) is acceptable for egg incubation (CDFG 1987)
  - 13.3ºC (56ºF) average daily temperature, not maximum (CDFG 1987 to 2004; CDFG 1992).

- CDFG uses <15ºC for smolt outmigration in the tributaries and <18C (<64.4ºF) for oversummering and smolt outmigration in the San Joaquin River
  - In a previous document the criteria is defined as <20ºC (<68ºF) for fry, smolts, and yearlings (encompasses smolt outmigration and oversummering; CDFG 1987)

It is clear that, despite the impression left by CDFG, CDFG itself does not rely solely on the EPA Region 10 temperature criteria.

b. *Other Sources Also Support the Conclusion that the EPA Region 10 Temperature Criteria Are Inapplicable Here*.

In addition to CDFG, many scholars and scientists are also critical of the EPA Region 10 criteria. A preliminary review of some available sources identified indicates:

- considerable variation in thermal tolerance between stocks, with higher temperatures recommended for some populations;
- the need to consider other factors, such as acclimation conditions in thermal tolerance among populations;
- some evidence suggesting that San Joaquin Basin populations may be adapted to higher temperatures; and
- that local observations support other criteria that those for the Northwest by EPA are better suited to the San Joaquin Basin (SJB).

Specific information from some of the available sources regarding these issues is provided in the following bullets.

- In contrast with the EPA recommended threshold of 15°C (59.0ºF) for smoltification, Chinook salmon juveniles transform into smolts in the wild at temperatures in excess of 19°C (66.2ºF), and in a laboratory study highest growth and survival of smolts was found if they underwent transformation at temperatures of 13-17°C (55.4-62.6ºF; Marine and Cech 2004). Studies evaluating the relationship between growth and temperature of Central Valley Chinook found no difference in growth rates between 13-16°C (55.4-60.8ºF) and 17-20°C (62.6-68.0ºF) temperature treatments (Marine 1997); and found that growth rate increased up to 19°C (66.2ºF; Cech and Myrick 1999).

- (McMahon 2006). The applicability of thermal criteria derived from the laboratory has long been debated, and unfortunately, there has been no confirmatory lab or field data for the growth vs. temperature relationship for any of the listed species in the Central Valley to assess if laboratory results are transferable to these southern stocks (Myrick and Cech 2004). Wurtsbaugh and Davis (1977, as cited in Myrick and Cech 2004) found 61.5ºF (16.4ºC) to be the optimum growth temperature for steelhead, whereas Myrick and Cech (2005) found that American River steelhead grew fastest at 66.2ºF (19.0ºC) over the range of 51.8-66.2ºF (11.0-19.0ºC). If optimal growth in the laboratory represents an upper temperature limit in the field, then the Wurtsbaugh and Davis laboratory results suggest that temperatures above 61.5ºF for prolonged periods may cause reduced growth and survival. As Myrick and Cech (2004) point out, however, these southerly steelhead stocks may have greater thermal tolerance, as perhaps evidenced by their results.

- (Moyle 2005). Optimal temperatures are typically defined under laboratory conditions as those in which physiological processes operate at the least energetic cost, so growth and survival are both high and predictable. The reality of wild Chinook salmon in the Central Valley is that they often experience temperatures higher than "optimal" yet still have high growth and survival. For example, Dr. Hanson indicates that for juvenile Chinook rearing "the seven day average of daily maximum temperatures should not exceed 16ºC (60.8ºF)" while I put optimal conditions for rearing in the range of 13-20ºC (55.4-68.0ºF), temperatures which are based on an exhaustive USEPA report (McCullough 1999). It would not at all be unusual to find juvenile Chinook salmon growing rapidly at daytime maxima of 20ºC (68.0ºF) with temperatures at night dropping to 15-16ºC (59.0-60.8ºF). I also point out that juvenile Chinook can survive exposure to temperatures of 24ºC (75.2ºF), depending on their thermal history, availability of refuges in cooler water, and night-time temperatures. While seven-day single temperature averages such as Dr. Hanson recommends as standards not-to-be-exceeded are often used because of the simplicity of doing so, they do not reflect the temperatures that juvenile Chinook salmon regularly experience in Central

Valley streams at some times of the year. For example, the most productive spring-run Chinook salmon stream left in California, Butte Creek, can experience daily maxima up to 24ºC (75.2ºF) with minima of 18-20ºC (64.4-68.0ºF) for short periods of time in pools where juveniles are rearing and adults are holding (Ward et al. 2003). It is thus possible for Chinook salmon to maintain populations even when they experience periods of suboptimal or even near-lethal conditions. They are also capable of finding, through behavioral means, temperature refuges (where cooler water is present due to ground water seeps, shady areas, and other factors). The bottom line is that Chinook salmon do not have to experience (and usually do not) temperatures that are continuously in the temperature ranges that the Hanson statement says are necessary. In fact, it is this flexibility that has made Chinook salmon so successful in the Central Valley and to thrive where less temperature tolerant salmonids (e.g., coho salmon) cannot.

- (Williams et al. 2007). While much information is available on lifestage-specific temperature ranges of Chinook salmon and steelhead little is known about the specific responses of Central Valley species to temperature. Anecdotal evidence suggests that some species of CV salmonids are heat tolerant: "the high temperature tolerance of San Joaquin River fall run salmon, which survived temperatures of 80°F (26.7ºC), inspired interest in introducing those salmon into the warm rivers of the eastern and southern US (Yoshiyama 1996)."

- (CALFED 1999). It is possible that populations southern range of the Central Valley including the Eastside rivers and San Joaquin tributaries have evolved to tolerate higher water temperatures. Laboratory studies indicate that mortality rates of juvenile Chinook salmon begin to increase at water temperatures above 65°F (18.3ºC). However, historically the San Joaquin basin has had higher water temperatures than all the other rivers that support Chinook salmon and so it is possible that the San Joaquin race has evolved to withstand higher temperatures than 65°F (18.3ºC).

- (Spina 2007). Oversummering Southern California steelhead accept an elevated body temperature in excess of the preference and heat tolerance information reported for the species and remain active and forage throughout the day, apparently as a means for coping with warm water at the southern extent of their range. The relatively high body temperatures that steelhead accept appear to represent a compromise in exchange for maintaining an expanded geographic (latitudinal) range.

- (Myrick and Cech 2001). Cherry et al. acclimated rainbow trout to temperatures of 6-24°C (42.8-75.2ºF; Cherry et al. 1975) and 12-24°C (53.6-75.2ºF; Cherry et al. 1977) in 3°C (37.4ºF) increments. They reported that the preferred or selected temperature changed with acclimation temperature in both studies. As acclimation temperatures increased from 6-18°C (42.8-64.4ºF), selected temperatures were higher than the acclimation temperature, but fish acclimated to temperatures higher than 18°C (64.4ºF) selected cooler temperatures. The overall mean

preferred temperatures for the fish in the 6–24°C (42.8-75.2ºF) and 12–24°C (53.6-75.2ºF) experiments were 16.5(61.7ºF) and 18.4°C (65.1ºF), respectively. Myrick (1998) measured American River (Nimbus strain) steelhead thermal preference over the 11–19°C (51.8-66.2ºF) range. He reported a similar increase in thermal preference with acclimation temperature, but did not reach an acclimation temperature where juvenile steelhead began to select cooler temperatures. Myrick's (1998) results are interesting because (1) the steelhead selected higher temperatures than one might expect for a cold-water fish (Moyle 1976), and (2) because the selected temperatures closely match the temperature at which Myrick observed the highest growth rates. Myrick and Cech (2000) measured the thermal preference of hatchery Feather River steelhead acclimated to constant (16°C; 60.8ºF) and diel cycling temperature regimes (16 ± 2°C) (60.8 ± 3.6ºF) and that of wild-caught Feather R. steelhead that were fasted 24 h before testing and fed 24 h before testing. Hatchery fish acclimated to constant and cyclical thermal regimes had similar thermal preferences, selecting temperatures in the 18–19°C (64.4-66.2ºF) range. Wild fish, which probably were exposed to cooler temperatures in the Feather R. (Myrick and Cech 2000), selected slightly cooler temperatures (17°C; 62.6ºF) under both fed and food deprived conditions. Interestingly, the wild fish were collected from much cooler temperatures (< 15°C; <59.0ºF), yet selected warmer temperatures, as one might expect from the trends seen in Cherry et al.'s (1975; 1977) studies (Figure 1).

- Rob Titus of CDFG reported at the 2007 American River Conference on successful steelhead rearing in the lower American River at up to 18°C (64.4ºF) daily **average** [presumably daily maximum temperatures were higher] based on growth rates, condition factor, and absence of disease (Titus 2007).

B. Concerns With Lifestage Timing and Reach Location Criteria.

The critical importance of appropriately applying the temperature criteria with regard to the timing and location of different salmonid lifestages is well recognized by fisheries researchers. In a recent review of the temperature requirements of Pacific salmonid species, Richter and Kolmes (2005: p.38) stated:

> "For all these criteria, the significant challenge of defining the spatio-temporal range over which they should be applied remains. Those spaces occupied by threatened and endangered salmonids need to be regulated at the times of year that sensitive life stages are present, and defining the bodies of water involved and the times to apply the standards requires additional consideration and research. The complex life histories of salmonids, the variety of habitats used by their different life stages, and the spatially and temporally dynamic nature of the habitats involved, make this an enormous scientific undertaking. . . . Laboratory studies cannot fully substitute for field data, because of difficulties in replicating acclimation conditions, food availability, social interactions including territoriality, diurnal physiochemical periodicity, and the complexities of microhabitats accessible to fish in nature . . ."

Richter and Kolmes (2005:p.40) emphasized that the proper application of thermal tolerance information to effectively protect salmonids will require an adaptive and realistic management approach:

> "Definitive criteria for salmonid recovery should eventually define ways to incorporate spatio-temporal variability into them in a realistically complex fashion and have as their eventual goal a process that realigns the distribution of current environmental variables so that they overlay historic conditions rather than simply act as a floor or ceiling. . . . The challenge of this task is exacerbated by the multiple salmonid life stages whose distributions over space and time will need identification and monitoring."

In contrast to the ecologically-based approach recommended by Richter and Kolmes (2005), the information submitted by CDFG provides no justification for the seasons or reaches defined for the presence of each lifestage and used in their analysis of impairment. Information to assess the validity of the seasons and reaches defined by CDFG is readily available from several sources and according to listing policy RWQCBs and SWRCB shall actively solicit, assemble, and consider all readily available data and information. However, historical and current fisheries information was not solicited or considered prior to the September 25, 2007 workshop and a placeholder for current and historic salmonid distribution exists in the draft CVRWQCB assessment for the Merced River. It is impossible to assess potential impairment to a population without describing when a given lifestage is present, where they are located, and the relative proportion of the population that may be affected in a given location at a given time. Given serious flaws in the information submitted by CDFG and reviewed by the CVRWQCB re-analysis using lifestage timing and stream reach criteria supported by readily available scientific data is warranted. Concerns with CDFG's timing and stream reach criteria for each lifestage are provided in the following sections.

1. **Adult Upstream Migration**.

In their analysis submitted to the CVRWCB, CDFG defined the adult upstream migration period as occurring from September 1 through October 31. However, their submittal provided no justification for this assertion and such timing is not consistent with historical conditions, management actions taken by CDFG, and available data. Based on the evidence provided below, the primary adult upstream migration period occurs from October 1 through late December.

a. *Historical conditions and adult upstream migration timing*.

The lowest unimpaired (computed natural) flows of the year typically occur during the month of September. During 1922-1992, the average unimpaired flows during September were 117 cfs in the Stanislaus River, 185 cfs in the Tuolumne River, 84 cfs in

the Merced River, and 808 cfs in the San Joaquin River (DWR 1994). Although not widely recognized, September unimpaired flows can be extremely low or nonexistent in dry years – for example, of the ten lowest September flows of the 1922-1992 period for the Tuolumne River (the largest of the three tributaries), five had zero average flow for the month and the other five averaged only 15 cfs. Average unimpaired flows in the San Joaquin River increase to just 933 cfs during October and then to 2,374 during November as average seasonal rainfall increases. The fall-run moved upstream in the fall or early winter after water temperatures had dropped and flows increased (CDFG 1987). Specifically, the Comprehensive Monitoring, Assessment, and Research Program report states that "adult San Joaquin fall-run Chinook salmon begin to enter the western Delta near Jersey Point in September and they migrate upstream slowly, typically entering the San Joaquin tributaries in late October or early November and continuing to migrate through December (Hallock et al. 1970; Department of Fish and Game annual reports; Carl Mesick Consultants 1998)".

b. *Management actions and adult upstream migration timing*.

The timing of management actions that directly involve CDFG for purposes of adult salmon migration in the San Joaquin Basin (i.e., Head of Old River Barrier operation and attraction flows) contradict the migration timing asserted by CDFG in their impairment analysis. This discrepancy has continued even since their analysis was submitted to the CVRWQCB in February 2007. Each year in the fall since 1968, CDFG determines whether and when to request that the temporary Head of Old River Barrier (HORB) be installed to improve conditions for migrating adult Chinook salmon in the San Joaquin River, in particular to address low dissolved oxygen conditions in the Deep Water Ship Channel at Stockton. As directed by CDFG, during 1968-2005 the average date that the HORB was completed is September 30 (Figure 2)[13]. During 2007 it was not until September 27 that CDFG even requested that DWR install the HORB and barrier installation was completed on October 18 (CDWR 2007).

CDFG's fall salmon attraction flow schedules also contradict the migration period used in their impairment analysis. Since the early 1990s, adult attraction flows that have been released from the Stanislaus, Tuolumne, and Merced rivers were scheduled during mid to late October, not September. During 2007, the attraction pulse flow on the Stanislaus River was scheduled for October 16-31 which corresponds to the last two weeks of the migration time period used by CDFG in the impairment analysis. Much of the 2007 attraction pulse flow on the Merced River, scheduled for October 24-November 9, occurred after the end of the migration period designated by CDFG and used in the impairment analysis (i.e., October 31).

In addition, long-standing base flow requirements for the tributaries were established to correspond with the typical timing of the run starting in October and have not included September. For example, the designated summer flow period for the Tuolumne River over the last 36 years has extended through September, with the higher base flow for salmon migration and spawning not starting until October 1 or as late as October 16.

[13] The Tables and Figures referenced in this Section III are attached hereto as Exhibit D.

c. *Available data on timing of adult upstream migration*.

CDFG provided no information to support using the September 1 through October 31 time period in their impairment analysis, and the available data from the Merced River Hatchery (MRH), the Stanislaus River Weir, tributary spawning surveys, and historical weir, trapping, and fish rescue operations provide the following evidence that most migration is much later than September and continues well after October.

i. *Merced River Hatchery*

CDFG annual reports state that "a standard measure of the timing of spawning runs in the San Joaquin Basin is the date on which the first salmon enter the MRH spawning trap each year" (CDFG 1987 to 2004). The average date that the first salmon arrived at the Merced River Hatchery from 1974 to 2003 is October 17 (CDFG 2004). CDFG reports do not present the average date that the last salmon arrived at MRH, however the date that trapping was terminated is reported in annual hatchery operations reports for the period 1996-2004 (CDFG 1997 to 2005). Based on this information the average date that trapping activities are terminated annually is December 20.

ii. *Stanislaus River Weir*

Operations at the Stanislaus River Weir have recorded that more than 97% of adult FRCS migrate after October 1 in recent years (Figure 3). Although temperatures were exceptionally cool during September 2006 (Figure 4), salmon did not migrate earlier than during 2003-2005 (Figure 5). During September 2006 temperatures on average were as much as 5 degrees cooler in the San Joaquin River at Rough and Ready Island (RM 37.9), Mossdale (RM 56.3), and Vernalis (RM 72.3), and as much as 9 degrees cooler in the Stanislaus River at Ripon (RM 15.7) as compared to monthly average temperatures at the same locations during 2003-2005 (Figure 6). September flows in the Stanislaus and San Joaquin Rivers exceeded average unimpaired flow conditions during all of these years (Figure 6, Figure 7).

iv. *Tributary Spawning Surveys*

During annual spawning surveys in the Stanislaus, Tuolumne and Merced rivers CDFG counts live fish observed in river reaches on a weekly schedule. This data provides a long-term measure of run timing and is available from annual CDFG escapement reports and in spreadsheet queries that they have provided from their database. CDFG has typically begun their spawning surveys in early to mid October. The following run timing has been observed based on live counts in the tributaries.

a. *Stanislaus River* live counts (CDFG 2007b) show that the earliest fall-run adult salmon observed in the Stanislaus River during 2000-2006 was September 25, and most of the run is from early October through mid-December (Figure 8).

b. *Tuolumne River* live counts demonstrate that relative numbers of adult salmon are generally very low in early October and after mid-December (Figure 9). Data provided by CDFG (CDFG 2007b) show that the earliest fall-run adult salmon observed in their surveys during 1992-2005 was September 27.

c. *Merced River* live counts (CDFG 2007b) show that the earliest fall-run adult salmon observed in their surveys during 1992-2006 was September 15, but again with most of the run being from early October to mid-December (Figure 10), much later than asserted by CDFG. Timing of first salmon arrival at Merced River Hatchery from 1974-2003 had a median date of October 17 with several years not occurring until November; the earliest date was September 24.

v. *Fish Barrier and Historical Weir Operations in the Tributaries*

a. *Weir counts during 1940s*

During 1940 and 1941 CDFG counted adult Chinook migrants entering each of the tributaries, and counts were also made on the Tuolumne River during 1942, 1944, and 1946 (Figure 11). Counts on the Stanislaus and Merced rivers were described as incomplete since sampling ended in November during both years. Sampling on the Tuolumne River was considered to be complete during 1940 and 98.6% of the run occurred during October through early December in that year. Counts continued through November 30th in 1942 and 1944. (Cloyd 1962; Hatton and Clark 1942).

b. ***Stanislaus River Egg Collection Station***

CDFG operated an egg collection station (trap) on the Stanislaus River at Orange Blossom Bridge (RM 46.9) during 1990 and 1991. In both years trap operation began on October 12 and continued until December 7 and December 10, respectively.

c. *Merced River Fish Guidance Project, Gallo Ranch Barriers*

In 1996, two fish barriers were built and installed by CDFG to prevent adult salmon from entering irrigation return channels on the Gallo Ranch. Dates of operation are provided in CDFG's annual job performance reports for the San Joaquin Drainage Chinook Salmon and Steelhead Habitat Restoration Program. During 1996-1998 the barriers were installed in October and during 2000-2001 the barriers were installed on September 20. The barriers continued to operate until December during all years.

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vi. *San Joaquin River Fish Barrier and Trapping Operations*

a. *Trapping at Banta Carbona*

During 1977 a decision was made by CDFG to attempt to trap the entire run of migrating adult salmon bound for the Stanislaus, Tuolumne, and Merced rivers (CDFG 1978). Trapping was conducted from November 1 through December 15 and peak catches occurred on November 8 and November 26 (Figure 12). Clearly one may deduce from the stated objectives and timing of this effort that CDFG believed that the majority of salmon migration occurred during November 1 through December 15. However, this period does not even overlap with the September 1 through October 31 period recently designated by CDFG for use in their impairment analysis.

b. Trapping near Los Banos

Trapping near Los Banos was conducted during 1988-1991 to determine the number of adult salmon migrating in the San Joaquin River upstream of the confluence with the Merced River. Based on information from CDFG reports, trapping was initiated in November and terminated in mid-December each year.

c. Hills Ferry Barrier

Since 1992, CDFG personnel have constructed and operated a temporary fish barrier (Hills Ferry Fish Barrier) each fall on the San Joaquin River immediately upstream of its confluence with the Merced River. It is operated from September/October through December each year (CDFG 2003). Dates of operation are provided in CDFG's annual job performance reports for the San Joaquin Drainage Chinook Salmon and Steelhead Habitat Restoration Program. Based on information available from the reports, the barrier has been operated as early as September 17 and as late as December 23 during 1993-2002.

The available data show that the major portion of adult upstream migration occurs well after September 1, generally becoming substantial after the first week of October, and the adult migration period extends well into December. Hence, a much more representative period for most migration based on these many types of concurring and consistent evidence would be from about October 1 to December 20 (or about Julian weeks 40-51). Consequently, any impairment assessment should examine that period instead. We suspect the result would find only a small fraction of the initial flawed approach would be considered to be impaired, even under the biased temperature impairment criteria defined by CDFG.

d. <u>*Adult upstream migration location*</u>

During development of the CALFED temperature model for the Stanislaus River, CDFG proposed that compliance points for some adult migration dynamically change

depending on hydrologic year type as follows: Adult migration= Confluence (Above Normal/Wet); Ripon (Below Normal); McHenry Bridge (Dry/Critical). In contrast to this proposal, CDFG now asserts that conditions are impaired if criteria are not met all the way down to Vernalis under all hydrologic conditions. In Dry/Critical years this is a shift of 32 miles from CDFG's previously proposed criteria.

2. **Spawning and Egg Incubation**

a. *Timing of spawning and egg incubation*

In the analysis of potential impairment submitted by CDFG the spawning (egg deposition) and egg incubation season is defined as October 1 through December 15 which is not supported by existing data. US EPA Region 10 recommends that the season be defined as the average date that spawning begins to the average date that incubation ends. The end of incubation is when fry emerge from the gravel. Based on available data from the Merced River Hatchery, tributary spawning surveys, and rotary screw trap monitoring provided below, the average date that spawning begins is October 10 on the Stanislaus River, October 9 on the Tuolumne River, and October 17 on the Merced River. Incubation extends into March on all three streams.

i. *Merced River Hatchery*

The average date that the first salmon arrived at the Merced River Hatchery from 1974 to 2003 is October 17 (CDFG 1987 to 2004). The average date that the spawning is terminated at MRH is December 20 (CDFG 1997 to 2005).

ii. *Tributary spawning surveys*

Average date of first redds observed during carcass surveys is October 10, October 9, and October 17 on the Stanislaus, Tuolumne and Merced, respectively (CDFG 2007b).

iii. *Rotary screw trap monitoring*

The capture of emergent fry in rotary screw traps provides an indication of emergence timing. Most emergent fry are typically captured by early to mid-March indicating that incubation extends into March. The truncated time period selected by CDFG skews the assessment of impairment by focusing on just a fraction of the time over which spawning and egg incubation actually occurs.

In addition to specific data, several agency documents describe spawn timing in the San Joaquin tributaries as beginning during October or later. For example:

- IFIM studies conducted by the USFWS (Aceituno 1993; USFWS 1995) describe the spawning period as beginning in mid-October and continuing through January.

- A 1987 Agreement between the US Bureau of Reclamation and CDFG states that spawning begins in mid-to-late October, reaches a peak in mid-November, and ends in January (CDFG and USBR 1987).
- A 1967 Davis-Grunsky Contract (Amendment #D-GGr17-A2) between the State of California Department of Water Resources and the Merced Irrigation District specifies that spawning/incubation flows shall be provided November 1 to April 1 on the Merced River (CDFG 1987).
- Emergence of fry increases mid-January to mid-March (CALFED 1999).

In summary, the available data show that the primary spawning and egg incubation season essentially begins about mid-October and extends into March —a substantially longer period than defined by CDFG. Hence, the putative impaired conditions as defined by the CDFG criteria would occur only for a fraction of the actual spawning and egg incubation period.

b. *Location of spawning and egg incubation*

Historically the spawning reaches of the Stanislaus and Tuolumne Rivers were described by G.H. Clark in the 1920s as extending from Knights Ferry to Oakdale and La Grange to Waterford (Clark 1929). These continue to be the reaches where most spawning activity occurs, although a small proportion of late-season spawning occurs on the Stanislaus down to Riverbank and on the Tuolumne down to Fox Grove. For example, less than 5% of spawning occurs below Oakdale and 95% of this activity occurs after November 30.

CDFG has advanced the hypothesis that a higher proportion of spawning would occur in the lower reaches if temperatures were made cooler earlier in the season. However, the spawning distribution on the Stanislaus River did not change during 2006 when temperatures were exceptionally cooler than average (Figure 13).

During development of the CALFED temperature model for the Stanislaus River, CDFG proposed that compliance points for incubation dynamically change depending on hydrologic year type as follows: Incubation= Riverbank (Above Normal/Wet); Oakdale (Below Normal); Valley Oak (Dry/Critical). In contrast to this proposal, CDFG now asserts that conditions are impaired if criteria are not met all the way down to Riverbank under all hydrologic conditions. In Dry/Critical years this is a shift of approximately 12 miles downstream from CDFG's previously proposed criteria.

Based on the temporal and geographic distribution of spawning and egg incubation, the downstream reach boundaries should be Oakdale on the Stanislaus River, Waterford on the Tuolumne River, and Shaffer Bridge on the Merced River from the beginning of the spawning period through November 30 (Table 1). After November 30 the boundaries should be Riverbank on the Stanislaus River, Fox Grove on the Tuolumne River, and Shaffer Bridge on the Merced River.

3. **Juvenile Outmigration and Smoltification**

In the analysis of potential impairment submitted by CDFG the smoltification and emigration season is defined as March 15 through June 15 which is not supported by existing information. Rotary screw trap data collected annually since 1995 indicate that emigration typically begins in January and about 97% of salmon juveniles migrate out of the Stanislaus River by May 15; therefore, temperatures at the confluence to protect smoltification after May 15 are not necessary for such a small portion (i.e., 3%) of the population. Less extensive rotary screw trap data from the Merced and Tuolumne suggest similar outmigration timing.

In particular, there is no evidence to support the June 15 ending being applicable for all years. Most management activities (flow operations and evaluations) have targeted about the April 15-May 15 period for primary smolt outmigration; monitoring data indicate almost all smolt outmigration from the tributaries has concluded by May 31 or earlier.

The period of years selected by CDFG was truncated for the Stanislaus (starting in 2000) and should be extended at least to 1998 to be consistent with the other tributaries. The same period should also be selected for Vernalis as there is no purpose in evaluating years back to 1973 which are not representative of current basin operational conditions.

4. **Oversummering**

CDFG asserts that steelhead are present and rearing in all three tributaries, yet it has not been conclusively established that steelhead exist in the Tuolumne and Merced Rivers. We do agree that rainbow trout are present in all three tributaries and the following discussion pertains to that population.

a. *Timing of oversummering*

CDFG defined the oversummering period as June 15 to September 15; however, National Marine Fisheries Service defines the oversummering period as June 1 to November 30 (NMFS 2004). Logical start and end-dates for the oversummering period would be June 1-September 30 as done by existing flow requirements, or some later date based on the onset of the fall rains. As described for the other lifestages the use of inappropriate time periods invalidates CDFG's assessment of impairment.

b. *Location of oversummering*

CDFG has here defined a 10-mile oversummering reach in the Tuolumne River with a lower boundary at Turlock Lake State Recreation Area (RM 42), yet provides no basis for that requirement. It is interesting to note that in the same month (February 2007) that CDFG filed their temperature impairment package with the Regional Board, CDFG also prepared a joint document with FWS and NMFS dated February 27 and filed

with the Federal Energy Regulatory Commission on March 6, stating they wanted to "provide a minimum of 8 miles of habitat" for summer rearing in all but "wet" years (when 13 miles were recommended). Thus inconsistent criteria were identified by CDFG within the same month.

CDFG also agreed to increased flow schedules, including summer flows from June through September, until 2016 in a 1995 FERC Settlement. Those flows are reduced in the summer during the drier 50% of years, but the results have been the expected improvement in providing suitable oversummering conditions for several river miles in those dry years. In fact, it has been well documented that the summer flow regime since 1995 has routinely extended the trout distribution to include the upper 10 river miles. CDFG also is on record of not supporting any allocation of an optional portion of the existing required annual river flow volume to the June through September period. It is egregious for CDFG to even claim temperature impairment under the improved conditions they agreed to, to recommend differing target reaches in different venues, all while at the same time not supporting that existing flows be allocated to the period they have identified as impaired.

CDFG's impairment analysis designates the first 10 miles below Crocker-Huffman Dam as the oversummer rearing reach. However, there is no evidence to support this designation and oversummer rearing in the lower Merced River is generally known to occur within the first few miles downstream of Crocker-Huffman Dam.

c. *Years of assessment*

CDFG selected a biased set of years (2001-2006) for their Tuolumne River assessment that is dominated by dry years, even though CDFG began both the Stanislaus and Merced assessment periods in 1999; the Merced period was truncated at 2005 and should be extended. The first entire summer period under the present Tuolumne flow schedule criteria was in 1997 and it would be appropriate to begin the assessment period then.

C. Concerns With How The Criteria Are Applied

I. CDFG's use of criteria for smoltification is inconsistent between locations. Specifically, the CDFG assessment uses 15ºC as the criteria for the tributaries and 18ºC in the San Joaquin River.
II. CDFG substituted data from distant locations when data was missing for a particular station. For example in the assessment of Tuolumne River adult upstream migration, data are not available from Shiloh (RM 4) during 2002. Instead, data from Waterford (RM 32) is substituted to represent conditions near the confluence. This issue was found by chance while perusing the formulas and hyperlinks used in CDFG's Excel spreadsheets. Obviously the data was not presented properly which casts doubt on the accuracy of the rest of the analysis, especially in light of the other factors identified during this preliminary review.
III. The sub-set of available data used in CDFG's assessment focuses on a string of several dry years and the periods do not generally represent the distribution of

water year types. CDFG's decision to only use some of the available data is clearly another bias that was purposefully introduced. Additional data has been provided to CDFG previously and is available from monitoring efforts conducted by TID/MID on the Tuolumne River since 1986 and by Tri-Dam on the Stanislaus River since 1998.

IV. The ability of individual salmon to survive, tolerate, or thrive at a particular temperature is the result of a combination of recent thermal history (i.e., acclimation), availability of thermal refuges, length of exposure time, daily temperature fluctuations, genetic background, life stage, interactions with other individuals and species, food availability, and stress from other factors (e.g., pollution). CDFG's analysis ignores 8 out of the 9 factors.

V. Abundance of a given lifestage is not evenly distributed through time or space and CDFG's analysis does not account for the proportion of the population that may be exposed to the conditions that they have defined as impaired. For example, if 5 out of 20 weeks are impaired, CDFG's approach would calculate that the lifestage is 25% impaired. However, if only 5% of the population was present during that 5 week period, CDFG's approach would have overestimated the impairment five-fold.

VI. The EPA criteria are based on constant laboratory conditions which are not directly comparable to diurnally fluctuating field conditions. Fish in the wild are acclimated to the mean of the average and maximum temperatures, and are not constantly exposed to the 7DADM temperatures. As such, the criteria assume a constant exposure to a given temperature rather than potentially brief exposure under diurnally fluctuating conditions.

VII. Adverse biological impacts associated with attempting to meet temperature criteria through increased flow have not been addressed. For example, increasing flows down the Stan during fall to meet temp criteria will result in negative consequences for spawning Chinook. Flood control releases on the Stanislaus during fall 2006 delayed spawning and very little spawning activity occurs during annual attraction pulses. Other biological issues may include de-watering and strandingand the relationships of these factors to instream flow will differ by stream.

VIII. The approach used by CDFG does not consider whether fish utilize potential areas of thermal refugia such as pools and areas of groundwater upwelling. During June 1989 a groundwater source in the Tuolumne River was identified where temperatures were about 5ºF (~3ºC) cooler than the surrounding water (EA Engineering 1992).

D. Sample Revised Assessment

Based on the corrected location and timing information described previously in the document and supported by actual fisheries information an example of a revised assessment was calculated using the EPA Region 10 criteria and the same basic impairment analysis structure used by CDFG (Table 2). Even with the use of the EPA temperatures which are overly conservative with regard to more heat tolerant stocks of

the San Joaquin Basin, the number of exceedances was not adequate for listing adult upstream migration on the Tuolumne River.

E. Other Relevant Issues

Other relevant issues such as the relative benefits to the population that may be achieved through other types of restoration actions and global warming have not been addressed by CDFG. Although CDFG has stated that substantial restoration actions (in this case temperature reductions) must be taken because present average population trends are well short of targeted population levels (Marston 2007), they have failed to take several obvious and prudent actions to protect salmon and steelhead. For example:

- The California Fish and Game Commission establishes angling regulations in Title 14 of the California Code of Regulations. These are published annually in a booklet by CDFG as the California Freshwater Sport Fishing Regulations. Legal sport harvest of San Joaquin salmon has continued, with more liberalized regulations starting in 2004. The season was generally extended by two weeks to the end of October, thus exposing a much greater part of the runs to inland recreational harvest, and the daily limit was increased from zero to one salmon in part of the San Joaquin and Stanislaus Rivers (California Fish and Game Commission 2007). The extent of legal and illegal harvest is unknown and there is limited enforcement of existing regulations.

- CDFG has stymied implementation of collaboratively developed key spawning gravel additions, long recognized as an important habitat restoration need, and extensive monitoring efforts on the Tuolumne River, by withholding all funds from two grants approved by the CALFED Program.

- CDFG continues to support protection and restoration of striped bass, a non-native fish which preys on native salmon and steelhead.

Global warming is a serious concern that should not be ignored. Dettinger (2005) determined that the most likely projection of annual average warming over Northern California is about 5°C by 2100, together with a decrease in precipitation. Recent experience suggests that most climate models have been too conservative and the actual effects occurring are more accelerated than forecasted. Williams (2006) asserts that warming is already affecting Central Valley Chinook. The predicted increase in temperature begs the question whether Central Valley salmon are a lost cause, so that efforts to protect salmon are a waste of resources that should be applied elsewhere (Williams 2006).

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IV. PRACTICAL OBJECTIONS

The SJRGA retained AD Consultants and Resource Management Associates, Inc. (hereinafter referred to as "AD Consultants") to run the SJR Basin Model in an effort to assess a variety of items, including whether or not (1) the model could accurately predict historic temperatures, (2) the construction and operation of New Melones dam and reservoir have made increased temperatures during the spring and fall time periods identified by CDFG, (3) the release of reservoir storage from new Melones could achieve the temperatures recommended by CDFG at Riverbank, the confluence of the Stanislaus and San Joaquin Rivers and Vernalis, and what the affect on reservoir storage would be as a result of such effort, (4) attainment of temperatures at the confluences of all three tributaries and the San Joaquin River would, in combination with additional reservoir releases in the tributaries, would result in achieving the recommended temperature criteria at Vernalis, (5) flows anticipated under the Friant Settlement will adversely affect water temperatures during the spring and fall time periods identified by CDFG, and (6) CDFG recommended temperatures can be met even if all water in the San Joaquin River Basin is allocated for temperature. The actual results of these cases run for the SJRGA by AD Consultants are attached hereto as Exhibit E. The results show that while the additional release of reservoir storage can reduce temperatures, the temperatures recommended by CDFG cannot be met at all times and in all locations and the impacts to reservoir storage are severe.

A. Case 1 Run Shows that the Construction and Operation of New Melones Have Improved Temperatures in the Stanislaus River and at Vernalis.

For Case 1, the SJRGA asked AD Consultants to analyze the time period from 1967-1982, which is the time period that provides the basis for the idea of doubling the natural production of salmon in the San Joaquin River Basin. During the 1967-1982 time period, the SJRGA asked AD Consultants to model temperatures at five times and locations identified by CDFG as critical in terms of evaluating impairment for temperature: the confluence of the Stanislaus River and San Joaquin River between September 1 and October 31, Vernalis between September 1 and October 31, Riverbank between October 1 and December 15, the confluence of the Stanislaus River and San Joaquin River between March 15 and June 15, and Vernalis between March 15 and June 15. As for the operational scenarios, the SJRGA asked AD Consultants to use actual hydrology, but model one scenario as if New Melones reservoir and dam were in place and operated under the terms of the Interim Plan of Operation ("IPO") currently used by the United States Bureau of Reclamation (referred to as the "Actual Temperature" or "IPO Scenario"), and model another scenario as if Old Melones dam and reservoir existed (referred to as the "Historic Temperature" or "Historic Scenario"). (A complete description of the Case 1 assumptions and instructions is found in Exhibit B, p. 2-3).

While we invite the CVRWQCB to review the entire set of results from this run, a few items need to be highlighted. First, the CDFG recommended temperatures were never met at all times and locations in the Historic Scenario. Typically, for each of the three locations – Riverbank, the confluence and Vernalis – the CDFG temperature criteria

were achieved only on the shoulders of the recommended time periods. Second, in some instances, the recommended temperatures were barely achieved under the Historic Scenario. For example, in 1976, temperatures at Vernalis and the confluence were met only once in March and during the last 9 days of October. In 1977, the recommended temperatures at the confluence were met approximately the 1st six days of March and the last 10 days of October.[14] Under the Historic Scenario, even assuming that the CDFG recommended temperatures are appropriate, temperatures were hardly ideal for salmon and steelhead.

Things change slightly when the IPO Scenario is examined. In almost all instances, temperatures are improved compared to those identified in the Historic Scenario.[15] Sometimes, the improvement is dramatic. For example, at the confluence, in 1972 the IPO Scenario meets the recommended temperatures approximately 25 days in March and April, and approximately the last 27 days of October. In 1976, the IPO Scenario meets the recommended temperatures approximately 25 days in March and April and approximately the last 28 days of October. In 1977, the IPO Scenario meets the recommended temperatures approximately the 1st 18 days of the March-April time period, and approximately the last 20 days of October. Similar improvement can be found when comparing the results of the IPO Scenario and the Historic Scenario at Riverbank. Under the IPO Scenario, the recommended temperature criteria are met at all times in 1967, 1970 and 1982, as compared with such criteria not once being achieved at all times under the Historic Scenario.

Overall, the results of Case 1 refute the conventional wisdom that the construction and operation of dams and reservoirs generally, and in this case New Melones particularly, have made water temperatures during key times worse than they were before such construction and operation. Case 1 shows that the temperatures in the Stanislaus River and at Vernalis, in the absence of New Melones and the IPO were not met at all locations and time periods identified by CDFG as critical. This means that the construction and operation of New Melones is not the cause of any temperature problem that allegedly exists. Moreover, and to the contrary, the results of Case 1 show that temperatures are generally better, and sometimes significantly so, with the construction and operation of New Melones.

The results of Case 1 are not surprising, as actual data collected at the reservoirs on the Merced River show that the reservoirs dramatically cool the river water as compared to natural conditions during late spring, summer and early fall. During these time periods, water released from Lake McClure is almost always 55º F or less, whereas the temperature of the Merced River as it flows into Lake McClure during the same time period can be as hot as 80º F. (*See* Graphs attached hereto as Exhibit F).[16] Again, the

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[14] Temperatures at Riverbank followed a consistent pattern throughout the 1967-1982 timeframe. In almost every year, CDFG recommended temperatures were achieved in mid-November through December 15. This pattern did not deviate, even in 1976 and 1977.

[15] Temperatures at Vernalis under the IPO Scenario are virtually unchanged from those of the Historic Scenario.

[16] This data also shows that the reservoirs improve winter-time temperatures for optimal salmon egg incubation and fry growth compared to inflow water temperatures. Inflow temperatures are cold enough to

existence and operation of the tributary reservoirs are not the cause of any perceived temperature impairment, but rather already dramatically improve temperature conditions as compared to the temperature of the natural condition.

B. Case 2 Runs Show That New Melones Operations Cannot Be Manipulated to Meet CDFG's Recommended Temperatures at All Times and At All Locations, and that Any Effort to Do So Will Have Dramatic, Negative Affects on Reservoir Storage and Future Operations.

For Case 2, the SJRGA asked AD Consultants to look at the time period of 1980-2003, and assume that the IPO controlled the operation of New Melones throughout that period. Then, AD Consultants was asked to increase releases from Goodwin Dam over and above what would have been released under the IPO such that the releases were equal to the following rates during the identified periods:

- 500 cfs between March 15 and April 15
- 1000 cfs between April 16 and May 15
- 1500 cfs between May 16 and June 15
- 1500 cfs between September 1 and September 31
- 1000 cfs between October 1 and October 15
- 500 cfs between October 16 and October 31 (*see* Ex B, p. 4).

AD Consultants was asked to determine (a) whether or not the identified flow releases would achieve CDFG's recommended temperatures at Riverbank, the confluence and Vernalis during the specified periods, and (b) what impacts, if any, accrued to New Melones storage as a result of making the increased releases. The results of Case 2 demonstrate that the increased releases from New Melones suggested by the SJRGA were not sufficient to meet CDFG's criteria at all specified times and locations. Moreover, making the suggested releases had a significant, detrimental impact on storage at New Melones, and hence on its ability to meet current and future water requirements.

1. **Increased Releases Insufficient to Meet CDFG's Recommended Temperatures**.

The results of Case 2 show that increasing the releases from New Melones as suggested by the SJRGA will not result in the achievement of the CDFG recommended temperature criteria at all times and locations during the modeled period of 1980-2003. Indeed, the percentage of time that the CDFG recommended temperature would be exceeded is virtually unchanged with the additional flow as compared to flow under the IPO.[17] Improvement can be seen in terms of meeting the recommended temperatures at the confluence, particularly in the Fall of some years during the modeled period.

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retard fish growth during the Winter and delay salmon outmigration in the Spring which would not be beneficial to San Joaquin salmon.

[17] During the March 15 through June 15 time period, compliance with the IPO would meet the recommended temperatures at Vernalis approximately 6% of the time, which is almost exactly the same amount of time that the temperatures would be met with the additional releases. During the September 1

2. **Minor Benefits Purchased at Great Cost**

As part of Case 2, AD Consultants evaluated the affect that the additional releases specified by the SJRGA would have on storage at New Melones. The results are striking. Between 1980 and 1987, storage is generally less as a result of the additional releases than it would have been had the IPO been complied with. However, for a 9 ½ year period, from September 1986 through April 1997, the reduction in storage is significant.

Under both the IPO and additional release scenarios, storage in September 1986 is approximately 2 MAF. When the 1987-1992 drought hits, storage under the IPO drops to a low of approximately 200,000 AF in December 1992. Storage returns to approximately 2 MAF at the end of March 1996. However, with the additional releases, storage hits 200,000 AF in May of 1990 (as opposed to December 1992) and remains at or below 200,000 from May of 1990 until February of 1993. In fact, the reservoir is essentially at dead storage from July of 1990 through January of 1993 with the additional releases. Moreover, with the additional releases, storage drops below 200,000 AF again between August 1994 and January 1995 (it never drops below 200,000 AF with the IPO only after December 1992). Storage does not return to 2 MAF until April of 1997. Finally, the modeling shows a precipitous drop in storage begins anew in March of 2000. In that year with the IPO only, storage is at about 2 MAF and drops to approximately 1.2 MAF by November 2003. With the additional releases, storage in March of 2000 is approximately 1.9 MAF and drops to approximately 400,000 AF by November 2003.

The IPO is, of course, a set of operations criteria for New Melones designed to meet the majority of the demands on New Melones over time. (*See* Exhibit G). As a result, allocations and deliveries from New Melones in any given year are made based upon a combination of storage at the end of February plus forecasted inflow between March and September. Under the IPO, if storage plus inflow is between 0 and 1.4 MAF, no water is allocated or released to CVP contractors or for the Bay-Delta. Allocations for fishery are between 0 and 98,000 AF, and allocations for water quality at Vernalis are between 0 and 70,000 AF. These allocations rise as the combination of storage and inflow rises, although it is not until storage plus inflow is between 2.5 MAF and 3 MAF that all of these needs receive an allocation.

While the modeling runs do not show inflow in any given year, it is clear that the reductions in storage which result from the additional releases will mean that all of the needs dependent upon New Melones will get less water than if the increased releases did not occur. For example, storage on February 28, 1995 was 921,000 AF under the IPO, but only 354,000 AF with the additional releases. Assuming that anticipated inflow for that year was 750,000 AF (mean annual inflow is approximately 1.1 MAF). Under the "normal" IPO circumstances, the storage plus inflow would be in excess of 1.6 MAF (921,000 + 750,000). As such, the allocation for fisheries would be between 98,000 and

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through October 31, compliance with the IPO would meet the recommended temperatures at Vernalis approximately 28% of the time, while the additional releases would meet such criteria approximately 33% of the time.

125,000 AF and for water quality at Vernalis would be between 70,000 and 80,000 AF. The Bay-Delta and CVP Contractors would not receive an allocation.

However, under the additional releases scenario, the storage plus inflow number would only be about 785,000 AF (35,000+ 750,000). As such, the allocation for fisheries would be between 0 and 98,000 AF and for water quality at Vernalis between 0 and 70,000 AF. Again, the Bay Delta and CVP Contractors would not receive an allocation.

C. Case No. 3 Shows That CDFG's Recommended Temperatures at Vernalis Cannot Be Met By Increasing Flows From the Tributaries.

The SJRGA asked AD Consultants to evaluate whether or not increasing flows from the tributaries would be an effective method for achieving CDFG's recommended temperatures at Vernalis. (Ex. B, p. 4). Recognizing that CDFG is recommending that certain temperatures be met at the confluence of the San Joaquin River and each of the three tributaries, Case No. 3 assumes that the CDFG recommended temperatures at each confluence is met for the time periods 9/1 – 10/15 and 3/15 – 6/15. (Id.). Flows are then increased from each of the tributaries to determine if CDFG's recommended temperature at Vernalis for these time periods can be met. (*See* Ex. B., p. 4 and p. 19, Table 3, for description of the flow increases).

What these Case No. 3 runs showed is that while it is theoretically possible to reduce temperatures at Vernalis by increasing releases from the tributaries if it is assumed that the CDFG recommended temperature at each confluence is met, the reduction is not sufficient to achieve the CDFG recommended temperature at Vernalis. (*See* Ex. B, p. 17, Figure 15). Moreover, as in Case No. 2, this runs shows that the benefit obtained by increasing releases from the tributaries is extremely slight and not worth the water cost. In the Spring absent the additional releases, the maximum average temperature is 62.8º F. The additional releases reduce the maximum average temperature by .7º F or less. (*See* Ex. B, p. 18, Table 3). The same phenomenon occurs in the Fall, when the additional releases reduce the maximum average temperature by 1.6º F or less. (Id.).

D. Anticipated Friant Restoration Flows Will Make It Harder to Achieve CDFG's Recommended Temperature Criteria.

The first three cases discussed above were each presented to the CVRWQCB staff at the September 25, 2007 workshop. At the workshop itself, CDFG staff indicated that temperatures could be improved by increased flows from the San Joaquin River's tributaries. However, CDFG staff admitted during the question and answer period that it had not looked at what impact, if any, the anticipated flows in the main stem of the San Joaquin River itself resulting from the Friant settlement would have on the ability to use additional tributary releases to meet CDFG's recommended temperature criteria. As a result, after the conclusion of the workshop, the SJRGA asked AD Consultants to evaluate the impact of the anticipated Friant settlement flows on temperatures in the San Joaquin River. The results, which were not presented at the workshop, are contained in full as part of Exhibit E.

The assumptions that went into this Case No. 4 are described on page 5 of Exhibit B. Essentially, the flows restoration flows that are anticipated once the settlement is approved, as well as operation of the Madera and Friant-Kern Canals were added to the 1980-2005 hydrology, and the Stanislaus River was added using both historical and IPO conditions. The relationship between releases from New Exchequer Dam and the new flow and temperature at the confluence of the San Joaquin and Merced Rivers was then developed.

The results of the run show two things. First, the additional water from Friant will not reduce temperatures by themselves. Temperatures at the confluence of the San Joaquin and Merced Rivers will remain essentially unchanged. Although the Friant settlement flows will add more water, the travel time is such that when the new water reaches the confluence, it approaches equilibrium with ambient temperature. (Ex. B., p. 18).

Second, the additional water actually makes it harder to achieve the CDFG recommended temperature at the confluence of the Merced and San Joaquin Rivers. Even though it is anticipated that the water temperature at the confluence of the Merced and San Joaquin Rivers will be the same with and without the anticipated Friant flows, the Friant flows themselves are of such a large volume that it will take a greater volume of water from the Merced River to reduce temperatures at the confluence. (*See* Ex. B, p. 18-19). Given the storage capacity of Lake McClure, the releases necessary to reduce temperatures at the confluence can only be made for limited duration before exhausting the available water supply. (Ex. B, p. 19, Figure 2).

E. <u>The CDFG Recommended Criteria Cannot Be Met At All Times And Locations Even If All of the Water In The Basin Is Dedicated to That Purpose</u>.

Again responding to CDFG staff's indication that its recommended temperature criteria could be met using reservoir releases, the SJRGA asked AD Consultants to evaluate whether or not such criteria could be met at all times and at all locations if all of the water within the basis was dedicated for that purpose. To make this determination, the SJRGA asked AD Consultants to (1) assume that all diversions in the three tributaries were eliminated and allowed to remain in the river, (2) re-shape all such rerouted diversions to maximize temperature reduction in the Spring and Fall time periods identified by CDFG, and (3) evaluate whether or not the additional water would achieve the CDFG recommended criteria. (*See* Ex. B, p. 5-6).

Consistent with all of the other runs performed by AD Consultants, this scenario again demonstrated that temperatures could be improved. However, as with all of the other runs, such temperature improvement was not enough to meet the CDFG recommended criteria at all times and at all locations. (*See* Ex. B, p. 20). Indeed, under the definition for impairment used by the CVRWQCB, dedication of all of the basin's water to meeting CDFG's recommended temperature criteria would still result in all

locations during the Spring time frames being impaired, and all of the Fall locations impaired except for the Tuolumne and Stanislaus River confluences. (*See* Ex. B., p. 20, Table 4).

The inability of the system as a whole to meet the CDFG recommended temperature criteria at all times and locations, even assuming that all of the water was dedicated for that purpose, is a stunning indictment of the appropriateness of the CDFG recommendation. The CVRWQCB cannot justify a finding that the San Joaquin, Stanislaus, Tuolumne and Merced Rivers are impaired for temperature based upon the CDFG recommended criteria given that it is almost impossible for such criteria to ever be met.

Thank you for the opportunity to submit these written comments. Please let us know if there are any questions.

Very truly yours,

O'LAUGHLIN & PARIS LLP

By_____

TIM O'LAUGHLIN
Attorneys for the San Joaquin River Group Authority

EXHIBIT A

June 12, 2002 memorandum from Michael J. Levy, Office of the Chief Counsel, State Water Resources Control Board, to Ken Harris and Paul Lillebo, Department of Water Quality, regarding the distinction between a TMDL's numeric targets and water quality standards

Winston H. Hickox
Secretary for Environmental Protection

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Gray Davis
Governor

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our website at www.swrcb.ca.gov.

TO: Ken Harris, DWQ
Paul Lillebo, DWQ

FROM: Michael J. Levy
Staff Counsel
OFFICE OF CHIEF COUNSEL

DATE: June 12, 2002

SUBJECT: THE DISTINCTION BETWEEN A TMDL'S NUMERIC TARGETS AND WATER QUALITY STANDARDS

This memorandum is intended to explain the distinction between numeric targets in a total maximum daily load (TMDL) and water quality standards. In general, section 303(d) of the Federal Clean Water Act (CWA)[1] requires each state to establish a TMDL for waters within its boundaries for which effluent limitations are not stringent enough to implement applicable water quality standards.[2] TMDLs, in turn, must be established at a level necessary to implement the applicable water quality standards.[3] In short:

1. TMDLs require a quantitative numeric target necessary to implement existing water quality standards;
2. While a TMDL's numeric target is an interpretation of existing water quality standards, it is not a water quality standard itself, and therefore, the processes required when adopting such standards do not apply;
3. Strategies to attain water quality standards, such as TMDLs, do not change the fact that enforcement of the Clean Water Act against point source dischargers is primarily through their NPDES permits; A TMDL's numeric target is not directly enforceable against dischargers absent a corresponding permit provision.

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[1] The CWA is more accurately identified as the "Federal Water Pollution Control Act." (See 33 U.S.C. § 1251 et seq.) As used above, "section 303(d)" refers to the section number of the CWA as enacted by Congress. The same section is codified in title 33 of the United States Code in section 1313(d). Text in the body of this memorandum refers to the sections of the CWA as enacted by Congress. Corresponding citations to title 33 appear in footnotes.

[2] See generally 33 U.S.C. § 1313(d)(1)(A)-(D); see also 40 C.F.R. § 130.7.

[3] 33 U.S.C. § 1313(d)(1)(C); 40 C.F.R. § 130.7(c)(1).

I. TMDLs Require the Calculation of a Quantitative Numeric Target Necessary to Implement Water Quality Standards in Impaired Water Bodies

Section 303(d) contains two sentences regarding what a TMDL actually is. The first sentence requires establishment of the "total maximum daily load" for those pollutants suitable "for such calculation." The second sentence states that "[s]uch load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality."[4] Based on these statements, a TMDL should be based on a quantitative value, or target,[5] designed to attain water quality standards in a particular water body.

The federal regulations corroborate that TMDLs require a quantitative numeric target. First, they repeat essentially the same statements from the statute.[6] Next, they define a TMDL as the "sum" of the individual waste load "allocations" for point sources and load "allocations" for nonpoint sources and natural background.[7] Both types of allocations are based on the concept of "loading capacity," which the regulations define as the greatest "amount" of loading (i.e., the introduction of matter or thermal energy) that a water body can receive without violating water quality standards.[8] Finally, the regulations provide that TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate "measures."[9] Federal regulations, therefore, envision TMDLs (including the respective load and waste load allocations) as establishing a quantitative target for a particular water body that will assure attainment of water quality standards.

The developing body of federal case law also views TMDLs in the same way. As was recently noted by the United States District Court for the Northern District of California, "[a] TMDL defines the specified maximum amount of a pollutant which can be discharged or 'loaded' into

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[4] 33 U.S.C. § 1313(d)(1)(C).

[5] Although the term "numeric target" does not appear in the CWA, use of the phrase is a matter of convenience due to a peculiarity in the CWA vernacular. The term "TMDL" has come to have two meanings, the first of which is the numeric target, or the literal "load" referenced in section 303(d). The term "TMDL" is also used to reference not merely the load, but the allocations of the load and the implementation plan as well. For clarity, in this document the term "target" or "numeric target" refers to the "load", and the term "TMDL" is reserved to describe the culmination of the state's responsibilities under section 303(d), i.e., the load, allocations, and implementation plan.

[6] 40 C.F.R. § 130.7(c)(1).

[7] *Id.*, § 130.2(i).

[8] *Id.*, §§ 130.2(e) and (f).

[9] *Id.*, § 130.2(i).

the waters at issue from all combined sources."[10] Federal courts outside of California and the Ninth Circuit share the same view.[11]

The U.S. Environmental Protection Agency, Region IX (EPA) also views TMDLs as containing water body-specific targets necessary to attain water quality standards. According to a recent publication from EPA:

> "[a] TMDL is a written, quantitative assessment of water quality problems and contributing pollutant sources. It identifies one or more numeric targets based on applicable water quality standards, specifies the maximum amount of a pollutant that can be discharged (or the amount of a pollutant that needs to be reduced) to meet water quality standards, allocates pollutant loads among sources in the watershed, and provides a basis for taking actions needed to meet numeric target(s) and implement water quality standards."[12]

Numerous pages of that publication are devoted to explaining how TMDL targets are used to interpret narrative or numeric water quality standards and to explaining the requirement to quantify the loading capacity and allocations.[13]

In short, the Clean Water Act, federal regulations, case law, and interpretive guidance from EPA all describe TMDLs as requiring numeric pollutant targets that are established at levels necessary to achieve water quality standards in impaired waters.

II. A TMDL Implements Existing Water Quality Standards; It Does Not Create New Standards

The federal regulations specify essentially four components of water quality standards. These are use designations, water quality criteria based upon those uses, an antidegradation policy, and certain policies generally affecting the application and implementation of water quality standards.[14] Water quality criteria are defined as "elements of State water quality standards,

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[10] *Pronsolino v. Nastri* (9th Cir., 2002) --- F.3d ----, 2002 WL 1082428, p. 3, quoting *Dioxin/Organochlorine Center v. Clarke* (9th Cir. 1995) 57 F.3d 1517, 1520.

[11] See, e.g., *American Iron and Steel Institute v. EPA* (D.C.Cir. 1997) 115 F.3d 979, 1002, citing 40 C.F.R. § 132.2; *Manasota-88, Inc. v. Tidwell* (11th Cir. 1990) 896 F.2d 1318, 1321; *Scott v. City of Hammond* (7th Cir. 1984) 741 F.2d 1318, 1321.

[12] U.S. Environmental Protection Agency, Region IX, Guidance for Developing TMDLs in California (January 7, 2000), p. 1, which is available at: www.epa.gov/region09/water/tmdl.

[13] *Id.*, pp. 2-6.

[14] 40 C.F.R. §§ 131.6(a), (c), and (d); 40 C.F.R. § 131.13. Unlike TMDLs, which are specific plans to attain standards in a specific water body, section 131.13 policies are generally applicable policies, e.g., mixing zones, low flows, and variances. See Memorandum to Paul Lillebo, Basin Planning Unit Chief, Division of Water Quality,

expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports a particular use."[15] Federal law contemplates, "[w]hen criteria are met, water quality will generally protect the designated use."[16]

Similar to federal requirements, under state law, each Regional Board must establish water quality objectives that will ensure the reasonable protection of beneficial uses and the prevention of nuisance.[17] Water quality objectives are "the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area."[18] The Water Code provides that such beneficial uses include, but are not limited to: domestic, municipal, agricultural, and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves.[19]

Under state and federal law, therefore, water quality standards designate the uses to be made of the water and set criteria necessary to protect the uses. These standards have two functions: (1) they establish the water quality goals for a specific water body; and (2) they serve as the regulatory basis for establishing water quality-based treatment controls and strategies (such as TMDLs) beyond the required technology-based levels of treatment.[20]

Water quality objectives or criteria can be expressed in numeric terms (i.e., concentration or mass per time), or narrative terms (e.g., "no toxics in toxic amounts").[21] When adopting a TMDL for an impaired water body, sometimes the numeric criteria can be used as the TMDL target (e.g., mass-per-time criteria). More typically, however, to comply with TMDL requirements, the objective will need to be translated into another measure amenable to allocating the total load (e.g., concentration-based numeric criteria, or narrative criteria). While this translation involves articulating a new number to express the existing criteria for the purposes of section 303(d), selection of this new number does not establish a new water quality standard.

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from Michael J. Levy, Staff Counsel, Office of Chief Counsel, re: *The Extent to Which TMDLs are Subject to the Alaska Rule* (January 28, 2002) (hereinafter "*TMDLs and the Alaska Rule*").

[15] 40 C.F.R. § 131.3(b).

[16] *Ibid.;* 33 U.S.C. § 1313(c)(2)(A).

[17] Wat. Code, § 13241.

[18] *Id.*, § 13050, subd. (h).

[19] *Id.*, § 13050, subd. (f).

[20] 40 C.F.R. § 131.2.

[21] 40 C.F.R. § 131.11.

Although the assignment of a numeric value that ultimately must be implemented in NPDES permits may at first glace appear similar to establishment of a water quality standard, a comparison of the statutory requirements for TMDLs and water quality standards demonstrates they are quite distinct: section 303(c) of the Clean Water Act requires creation of the water quality standards; section 303(d) requires TMDLs to implement those standards when technology-based limits are insufficient.[22] "[T]he basic purpose for which the § 303(d) list and TMDLs are compiled [is] the eventual attainment of state-defined water quality standards."[23] TMDLs are therefore not themselves standards, but mechanisms to implement them. Unlike water quality standards, TMDLs do not designate existing or potential uses. They do not establish new criteria necessary to protect uses, but rather, interpret existing criteria. They do not establish policy guiding the circumstances under which water quality must be protected against degradation. TMDLs merely create an enforceable strategy to attain those standards (with seasonal variations and a margin of safety) that were already established but which are not yet attained in a specific water body.[24] TMDLs thus serve as a means to an end. That end is the attainment and maintenance of existing water quality standards.[25]

III. Water Code Section 13241 Does Not Apply When Establishing the Numeric Targets in a TMDL

Water Code Section 13241 establishes the requirements attendant to the Regional Boards' adoption of water quality objectives. Because "it may be possible for the quality of water to be changed to some degree without unreasonably affecting beneficial uses," the section requires the Regional Boards to consider a number of factors when establishing objectives. These include:

a. Past, present, and probable future beneficial uses of water;

b. Environmental characteristics of the hydrographic unit, including the quality of water available to it;

c. Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area;

d. Economic considerations;

e. The need to develop housing within the region; and

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[22] 33 U.S.C. § 1313(d).

[23] *Pronsolino v. Nastri* (9th Cir., 2002) --- F.3d ----, 2002 WL 1082428, p. 13.

[24] 33 U.S.C. § 1313(d)(1); 40 C.F.R. §§ 130.7(b)(1) and (c)(1).

[25] For a detailed analysis of how the process of creating a TMDL is distinct from and incompatible with the process of adopting a water quality standard, see *TMDLs and the Alaska Rule*, *supra* note 14.

f. The need to develop and use recycled water.[26]

The Clean Water Act similarly provides that water quality standards "shall be established taking into consideration their use and value for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other purposes, and also taking into consideration their use and value for navigation."[27] Considering these factors is appropriate because assignment of the appropriate level of water quality properly involves a balance between appropriate "designated" or "beneficial" uses of water, numeric or narrative water quality "objectives" or "criteria," and a host of sometimes-competing policy considerations, including economic and environmental interests.

Since TMDLs are not water quality objectives, the requirements for adopting such objectives do not apply to TMDLs. Nor should they. Numeric targets used by TMDLs to implement standards are not designed to re-balance the policy interests underlying those standards. Although the state must consider a variety of factors in establishing the different elements of a TMDL, considering the economic impact of the required level of water quality, for example, is not among them; that impact was already determined when the standard was adopted. This conclusion is not altered when a TMDL is established to implement a narrative water quality objective. The economic impact associated with maintaining ambient water quality at the level described by the narrative statement was considered when the narrative objective was adopted.[28]

While policy considerations are important in developing water quality standards, they play a smaller role in the formulation of the TMDLs that implement them. The statutory directive to adopt TMDLs to "implement the applicable water quality standards with seasonal variations and a margin of safety,"[29] is not qualified by the predicate "so long as it is economically desirable to do so." Therefore, not only would an in-depth economic analysis be redundant, it would be inconsistent with federal law.

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[26] Wat. Code, § 13241, subds. (a)-(f). Notably, section 13241 contains no dictate as to the weight the Regional Board must afford to any particular factor, only that these factors be considered.

[27] 33 U.S.C. § 1313(c)(2)(A). See also 40 C.F.R. §§ 131.10-13.

[28] That is not to say that no economic analysis is required when adopting a TMDL. Indeed, depending on the specific activity under consideration, different parts of a TMDL may require differing levels of economic considerations. Section 13241 analysis, however, is not among them. For a detailed discussion of economic analysis requirements, see Memorandum to Stefan Lorenzato, TMDL Coordinator, Division of Water Quality, from Sheila K. Vassey, Senior Staff Counsel, Office of Chief Counsel, re: *Economic Considerations in TMDL Development and Basin Planning* (October 27, 1999).

[29] 33 U.S.C. § 1313(d)(1)(C).

In short, a water quality standard defines the water quality goals of a water body by designating the use or uses to be made of the water and by setting criteria necessary to protect the uses.[30] TMDLs, in contrast, establish numeric targets for pollutants—targets that are designed to achieve water quality standards in impaired waterbodies. TMDLs implement the existing objectives that are designed to protect designated beneficial uses and, therefore, serve as a water quality-based treatment control or strategy that necessarily rests on the established goals and balanced policy considerations embodied by water quality standards. As stated in a recent Ninth Circuit decision:

> "TMDLs serve as a link in an implementation chain that includes federally-regulated point source controls, state or local plans for point and nonpoint source pollution reduction, and assessment of the impact of such measures on water quality, all to the end of attaining water quality goals for the nation's waters."[31]

IV. Numeric Targets in a TMDL are not Directly Enforceable Against Dischargers

The difference between water quality standards and TMDLs is highlighted in the context of the "citizen suits", which are authorized by section 505 to enforce the CWA.[32] In pertinent part, section 505 authorizes "any person" to commence a "civil action" against any person who has allegedly violated "*an effluent standard or limitation*" or "an order" issued by the EPA or a "State with respect to such a standard or limitation[.]"[33] The Clean Water Act language does not support the notion that third parties can invoke the effluent provision in section 505 to directly enforce TMDL numeric targets against dischargers.

In contrast to the broad definition of "effluent limits" in section 502 of the Clean Water Act, section 505 limits citizen suits specifically to a narrower subset of effluent standards and limitations. Section 505 states, in particular, that "[f]or purposes of this section," the term "effluent standard or limitation" is limited to seven instances. Citizen suits are permitted to enforce:

a. An unlawful act, under section 301(a);

b. An effluent limitation or other limitation, under section 301 or 302;

c. A "standard of performance" under section 306;

d. A prohibition, effluent standard or pretreatment standards, under section 307;

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[30] 40 C.F.R. § 131.2.

[31] *Pronsolino v. Nastri* (9th Cir., 2002) --- F.3d ----, 2002 WL 1082428, p. 4.

[32] 33 U.S.C. § 1365.

[33] 33 U.S.C. § 1365(a)(1) (Italics added).

e. A certification, under section 401;

f. A permit or condition thereof, issued under section 402; or

g. A regulation under section 405(d).[34]

A TMDL's numeric targets do not fall within any of these provisions. Although the regulations refer to a waste load allocation as a "type of water quality-based effluent limitation,"[35] TMDLs are required by section 303(d), not sections 301, 302, or 307. Nor, for that matter, does a TMDL that establishes a total load or waste load allocation of "zero" establish a directly enforceable prohibition, unlawful act, regulation, or performance standard under sections 301, 306, 307, or 405. Again, the target is established under section 303(d). No section 303(d) limit is enumerated in section 505. Accordingly, a plain reading of the effluent limits that may be directly enforced by way of a citizen suit under the Clean Water Act does not include waste load allocations required by section 303(d).

The federal regulations reveal at least one obvious explanation for the exclusion of TMDLs from matters that can be directly enforced against dischargers. Those regulations contemplate flexibility in translating waste load allocations into permit conditions. The NPDES permitting provisions require that water quality-based effluent limits must be "consistent with the assumptions and requirements of any available wasteload allocation."[36] The provisions do not require the limit to be "identical to the wasteload allocation." This language leaves open the possibility that the Regional Board could determine that fact-specific circumstances render something other than literal incorporation of the waste load allocation to be consistent with its assumptions and requirements.[37] The regulations thus contemplate the additional step of revising applicable NPDES permits to make them "consistent with the assumptions" of the TMDL.[38]

Thereafter, it is the effluent limit set forth in the permit, and not the TMDL, that provides the potential vehicle for citizen suit enforcement under the Clean Water Act.[39] These requirements

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[34] 33 U.S.C. § 1365(f).

[35] 40 C.F.R. § 130.2(h).

[36] 40 C.F.R. § 122.44(d)(1)(vii).

[37] The rationale for such a finding could include a trade amongst dischargers of portions of their load or waste load allocations, performance of an offset program that is approved by the Regional Board, or any number of other considerations bearing on facts applicable to the circumstances of the specific discharger.

[38] Of course, if a permit is already consistent with a newly adopted TMDL, the permit need not be amended to render its terms enforceable. The permit conditions are already enforceable, including by a citizens suit. (33 U.S.C. §§ 1365(a)(1)(B), 1365(f)(6).)

[39] *Id.*

are consistent with section 402(k)'s requirement that compliance with an NPDES permit is deemed compliance that bars most enforcement actions and citizen suits.[40]

CONCLUSION

Section 303(c) of the Clean Water Act obligates the State and Regional Boards to establish water quality standards to protect appropriate designated uses of waters. Section 303(d) requires the states to establish TMDLs at levels necessary to implement those water quality standards in waters that are not attaining them. While extensive policy considerations are evaluated when adopting standards, those considerations are generally not relevant when adopting TMDLs, whose purpose is to cause the compromised waters to attain those policy-based standards.

The distinction between water quality standards and TMDLs is significant both for the manner in which they are adopted, and the manner in which they are enforced. First, because TMDLs are not water quality standards, neither federal nor state law obligates the State and Regional Boards to establish and adopt TMDLs as water quality standards. Second, the provisions of a TMDL, including its numeric targets, are not directly enforceable against dischargers by way of a citizen suit under the Clean Water Act. In general, section 505 permits such suits to directly enforce an effluent limit or standard. Because TMDLs are neither water quality standards nor a type of effluent limit addressed in section 505, TMDLs, including the respective waste load allocations, are not directly enforceable under the citizen suit provision of the Clean Water Act. The NPDES permits implementing the TMDL provide the vehicles for enforcement. The TMDL does not.

Should you have any questions about this memorandum, feel free to contact me at (916) 341-5193 or mlevy@swrcb.ca.gov.

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[40] 33 U.S.C. § 1342(k).

EXHIBIT B

Temperature Modeling and Analysis for the San Joaquin River

Requested by the San Joaquin River Group Authority
in Connection with the 303(d) Proceedings

Prepared by

AD Consultants
RMA, Inc.

November 19, 2007

Temperature Modeling and Analysis for the San Joaquin River

Requested by the SJRGA in Connection with the 303(d) Proceedings

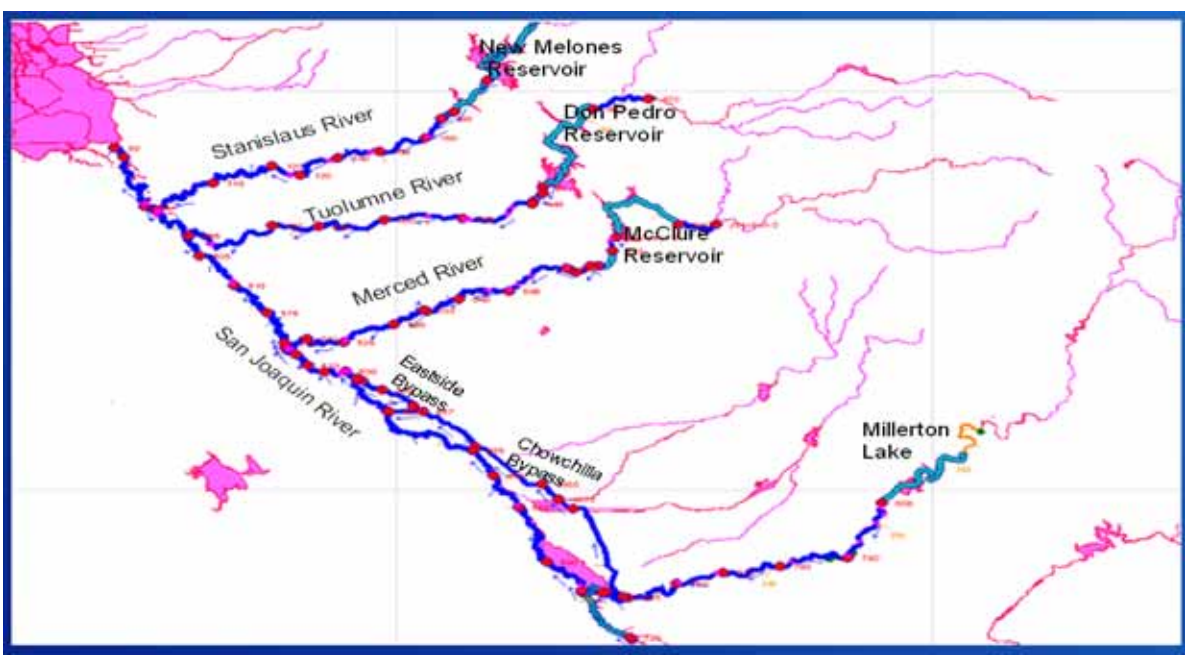
I. General

This report presents the results of water temperature modeling and analysis for the San Joaquin River (SJR) performed by AD Consultants and Resources Management Associates, Inc (RMA) as requested by the San Joaquin River Group Authority (SJRGA). The work was done to address issues in connection with the 303(d) Proceedings.

Most of the modeling results were presented to the Regional Water Quality Control Board (RWQCB) in the September 25 Temperature Workshop in Sacramento, California. Nevertheless, the report provides a more in-depth review of the results, as well as follow up analyses, specifically for the potential impact of the Friant Restoration on temperatures in the SJR in relation to the temperature objectives recommended by the CDFG and a broad view about the possibility to achieve these objectives given all the water physically available in the basin.

The modeling was performed using the CALFED sponsored San Joaquin River Basin-Wide Water Temperature Model. This HEC-5Q model encompasses the Stanislaus, Tuolumne, Merced and the main-stem and upper San Joaquin rivers, including Friant (Millerton Lake), as shown in Figure 1.

Figure 1 - HEC-5Q Model Representation of the San Joaquin Basin



The model has the capabilities to simulate various scenarios of system operation and then compute temperature response at any location throughout the system on a sub-daily basis (6-hour time increments). Using the model, it is possible to assess whether or not certain temperature objectives can be achieved given a prescribed operation scenario and what is the ramification of such operation on system storage.

II. Objective:

The objective of this analysis was to perform simulations with the HEC-5Q model and evaluate thermal conditions in the Stanislaus, main-stem SJR and lower SJR at Vernalis for different operation scenarios in connection with the Impaired Waters and Surface Water Quality Assessment 303(d) initiated by CDFG.

In the letter to the RWQCB on February 28, 2007, the CDFG proposed certain objectives (criteria) for temperatures at discrete locations on the Stanislaus, Tuolumne, Merced and the main-stem SJR at Vernalis. These objectives are summarized in Figure 2 below:

Figure 2 – Table 1 from CDFG letter to Regional Water Quality Control Board, February 28, 2007.

CDFG Proposed Temperature Criteria

River	Location	River Mile	Season	Life Phase	Threshold (ºF)	Affected River Miles	Threshold (ºC)
San Joaquin	Vernalis	72	9/1 - 10/31	Adult/Egg	64.4	118	18
	Vernalis	72	3/15 - 6/15	Smolt	59.0	118	15
Stanislaus	Mouth	0	9/1 - 10/31	Adult/Egg	64.4	58	18
	Riverbank	33	10/1 - 12/15	Egg	55.4	33	13
	Mouth	0	3/15 - 6/15	Smolt	59.0	58	15
Tuolumne	Mouth	0	9/1 - 10/31	Adult/Egg	64.4	52	18
	Waterford	28	10/1 - 12/15	Egg	55.4	24	13
	Mouth	0	3/15 - 6/15	Smolt	59.0	52	15
Merced	Mouth	0	9/1 - 10/31	Adult/Egg	64.4	52	18
	River Mile 28	28	10/1 - 12/15	Egg	55.4	24	13
	Mouth	0	3/15 - 6/15	Smolt	59.0	52	15

As such, all the results for the modeling runs (labeled "tasks" in this report) were evaluated with respect to the above objectives.

III. Tasks:

The following tasks were prepared for the September 25 staff workshop on temperature:

1. How "Actual" Temperatures Compare with "Historic" Conditions?

Model the "Historic" and "Actual" (1967-1982) temperatures for the following locations and times:

- Confluence of the Stanislaus River 9/1 – 10/31
- Vernalis 9/1 – 10/31
- Riverbank 10/1 – 12/15
- Confluence of the Stanislaus River 3/15 – 6/15
- Vernalis 3/15 – 6/15

For the purpose of this analysis, "Historic" temperatures were defined as pre-new storage development and "Actual" as post-new storage development on the Stanislaus River.

Concepts and assumptions:

The existing Stanislaus component of the Temperature Model was modified as follows:

- Removed New Melones and replaced with Old Melones.
- Extended stream section between Old Melones and Tulloch.
- Assumed same river cross sections above Old Melones to Stanislaus PH

- Removed Collierville PH
- Meteorology – extended based on Modesto max/min temperatures
- Hydrology – assumed historical flow and operation for Old Melones and Tulloch

Assess the following:

1) What were the "Historic" temperatures at the above mentioned locations and periods?
2) What were the "Actual" temperatures at the above mentioned locations and periods?
3) How do the "Historic" and "Actual" temperatures compare?
4) Did "Historic" temperatures meet the temperature objectives proposed by CDFG?

2. Can the IPO and Augmented IPO Meet CDFG Criteria?

Model temperatures in the Stanislaus and Lower SJR at Vernalis for the period 1980-2003 under the current IPO. Then, increase New Melones releases (Augmented IPO) and check if CDFG recommended criteria can be met.

Concepts and Assumptions:

Convert the IPO flows to daily time steps. Then run the IPO with the 5Q and track temperatures on a sub-daily basis at three locations: Riverbank, Confluence and Vernalis. Assume historical flows and temperature inflows for the main-stem SJR at the confluence. Increase releases from Goodwin for two periods: Spring and Fall as follows:

$Q_{Goodwin} = \max(Q_{IPO}, Q_{Schedule})$

Where:

Q_{IPO} = minimum flow per the IPO for fish, water quality, etc. (not including spills), and

$Q_{Schedule}$ varies (linearly) as follows:

Period	From	To	Flow Rate (cfs)
Spring	3/15	4/15	500
Spring	4/16	5/15	1000
Spring	5/16	6/15	1500
Fall	9/1	9/31	1500
Fall	10/1	10/15	1000
Fall	10/16	10/31	500

Assess the following:

1) Can the CDFG recommended criteria be met at all times and under all conditions?
2) If not, when and how often does New Melones Reservoir run out of water?

3. Can CDFG Criteria at Vernalis Be Met by Increasing Flows from the Tributaries?

Assume that the CDFG recommended temperatures at the confluences of all three tributaries are met for the time periods 9/1 – 10/31 and 3/15 – 6/15. Then, increase releases from the tributaries and check if CDFG criteria are met at Vernalis.

Concepts and Assumptions:

Use 1995-2006 for an example. First, assume historical flows from the Stanislaus, Tuolumne and Merced for the above periods. Assume temperatures are met (per CDFG criteria) at the confluence of each river with the SJR. Then:

- Route historical flows from the three rivers and check temperatures at Vernalis.
- Set Tuolumne and Merced flows (to equal historical) and increase Stanislaus. Compute temperatures at Vernalis.

- Set Stanislaus flows (to equal historical) and increase Tuolumne and Merced flows (50/50 split between the two rivers). Compute temperatures at Vernalis.

Assess the following:

1) Will the attainment of temperatures at the confluences have any improvement to temperatures at Vernalis?
2) If so, will it be enough to meet the Vernalis temperature criteria recommended by CDFG for those two time periods?

The following tasks were prepared as a follow up to the September 25 staff workshop on temperature:

4. What is the Impact of Friant Restoration on Temperature in the SJR?

Analyze the potential impact of Friant Restoration on temperatures in the SJR with respect to CDFG objectives per the 303(d) proceedings.

Concepts and Assumptions:

- 1980 - 2005 hydrology as defined in the USBR report.
- Restoration flows (minimum flow requirement below Friant Dam) defined by year type (Settlement Decision Tables 1A - 1F of 9/13/2006).
- Historical Friant diversions (Madera and Friant-Kern Canals) with physical operation constraints (maximum diversion rate computed as a function of reservoir elevation).
- Bypass operation and diversion to historical river channel at Sand Slough defined as a function of flow.
- Simulate the 26-year period to compute the flow and temperature in the San Joaquin River at Stevinson to provide upstream boundary of the CalFed Model.
- All subsequent simulations will use the CalFed model with the computed or historical data based Stevinson boundary flow and temperature.
- Simulate historical conditions with Stanislaus operating under IPO and historical boundary conditions.
- Simulate IPO-historical conditions with computed Friant restoration boundary conditions.
- Develop minimum flow relationships at Exchequer to examine feasibility of countering effects of Friant restoration. The minimum flow requirements will also need to be based on hydrologic year type). Simulate various Merced River minimum flow assumptions.

Assess the following:

1) What would be the temperature conditions at the confluence with the Merced River as a result of Friant Restoration?
2) To what extent can the Merced River reduce temperatures at the confluence given the new flow regime?

5. Is the SJR Temperature Impaired Even if All the Water the Basin is allocated for Fish?

Assume that all the water in the basin is allocated for fish release (no diversions). Compute the temperature response at the confluence of each river and at Vernalis. Check if the new computed temperature frequencies will still pass the temperature impairment test defined by RWQCB.

Concepts and Assumptions:

- Use the historical 1995 - 2005 hydrology as a case study.
- Maintain the same storage levels as historically occurred.
- Reroute all the historical diversions back the rivers.
- Reshape the rerouted diversions around the spring and fall to maximize temperature reductions in these seasons.

Assess the following:

1) Would the temperatures in confluences of the Stanislaus, Tuolumne and Merced and at Vernalis pass the temperature impairment test, as defined by the RWQCB?

IV. Modeling Results

All modeling results are saved in HEC-DSS (Data Storage System) files and are provided in the CD attached as Exhibit E to the SJRGA's November 19, 2007 comments. The HEC-DSS is a database developed the U.S. Army Corps of Engineers' Hydrologic Engineering Center designed to efficiently store and retrieve scientific data that is typically sequential. The database was designed to make it easy for users and application programs to retrieve and store data. HEC-DSS is incorporated into most of HEC's major application programs, including the HEC-5Q.

To view the content of the model results in the HEC-DSS files requires a special software called DSS-Vue. This is public domain software and is available for download from the following link:

http://www.hec.usace.army.mil/software/hec-dss/hecdssvue-download.htm

Also included in the CD are Excel and other supporting files used for post processing and analyzing of the results.

The following are summaries of the results for the above-mentioned Tasks.

1. How "Actual" Temperatures Compare with "Historic" Conditions?

Assessment of results:

1) "Historic" water temperatures in the Stanislaus River and the Lower San Joaquin River at Vernalis are higher than "Actual" water temperatures majority of the time.

2) "Historic" water temperatures do not meet the temperature objective set forth by CDFG for the proposed locations in the Stanislaus River and the Lower San Joaquin River at Vernalis majority of the time.

The first assessment is supported by Figure 3 to Figure 7:

Average daily temperatures at Riverbank, Confluence (of the Stanislaus with SJR) and Vernalis – the three reference points identified by CDFG for temperature objective, are presented in Figure 3. The line labeled "IPO_67" represents "Actual" and the line labeled "Hist1" represents "Historic". The Y-axis on the left shows the absolute values of these lines. The line labeled "Hist-IPO_67 difference" represents the difference between "Actual" and "Historic" (i.e., "Historic" minus "Actual"). The Y-axis on the right shows the values for this line. Whenever this line is above zero, it means that "Historic" temperatures are higher than "Actual".

Figure 4 shows similar results except for maximum daily temperatures (assumed to be at hour 18:00 in the model). Since CDFG proposed to use the average of 7-days maximum temperatures for defining temperature criteria at their proposed reference points, this graph might be more relevant than average temperatures, as far as the 303(d) is concerned.

Table 1 is a summary of Figure 4 and Figure 4 showing the numbers of days, on average, that "Historic" temperatures were higher than "Actual". The table also shows day-count for other locations on the Stanislaus River. This information can be obtained from the attached HEC-DSS file.

Table 1 – Number of days and % of time "Historic" temperatures are higher than "Actual"

Location	Average Temperatures # of days Historic > Actual	Average Temperatures % of Time Historic > Actual	Maximum Temperatures # of days Historic > Actual	Maximum Temperatures % of Time Historic > Actual
GOODWIN	248	68%	340	93%
KNIGHTS FERRY	241	66%	287	79%
ORANGE BLOSSOM	243	67%	278	76%
RIVERBANK	247	68%	318	87%
RIPON	251	69%	328	90%
CONFLUENCE	221	61%	303	83%
VERNALIS	205	56%	279	76%

The primary reason for the cooling effect under the "Actual" conditions is the increased storage in New Melones. Old Melones Reservoir had a storage capacity of approximately 110 thousand acre-ft while New Melones Reservoir storage capacity is approximately 2.4 million acre-ft. Old Melones Reservoir would cycle from full to empty on a yearly basis thus either spilling large quantities of water during the flood control season or passing through low flows when the reservoir is empty. New Melones Reservoir, on the other hand, has significantly larger capacity for carry-over storage that allows regulating releases as well providing cool water supply. This observation is demonstrated in Figure 5 which shows reservoirs storages for Old and New Melones, Goodwin release and water temperatures downstream to Goodwin Dam.

Another observation is the blending effect of Stanislaus River water with the water in the main-stem SJR the at confluence which is often already at ambient temperature (due to the long travel time from the upstream reservoirs, as will be discussed later in the report). As such, the differences between "Historic" and "Actual" temperatures diminish by the time the water reaches Vernalis.

It should be noted that for quality control purposes, model results for the "Historic" temperatures at Vernalis were compared with observed data. As shown in Figure 6, the comparison indicates that the model under-predicts the observed temperatures slightly, indicating that the model results are conservative from a temperature increment standpoint. Nevertheless, model results have a high degree of reliability with a coefficient of determination R^2=0.945, as shown in Figure 7.

The second assessment is supported by Figure 8 to Figure 10. These figures show the temperature objectives proposed by CDFG at Riverbank, the confluence (of the Stanislaus with SJR) and Vernalis and the computed "Historic" temperatures at these locations. The results show that systematically, the temperatures "shave" the beginning and ending periods specified for the objectives. Examples for an above-normal year (1970) and for dry year (1968) are provided in Figure 9 and Figure 10, respectively.

Figure 3 - Average Daily Temperatures at Riverbank, Confluence and Vernalis (1967-1982)

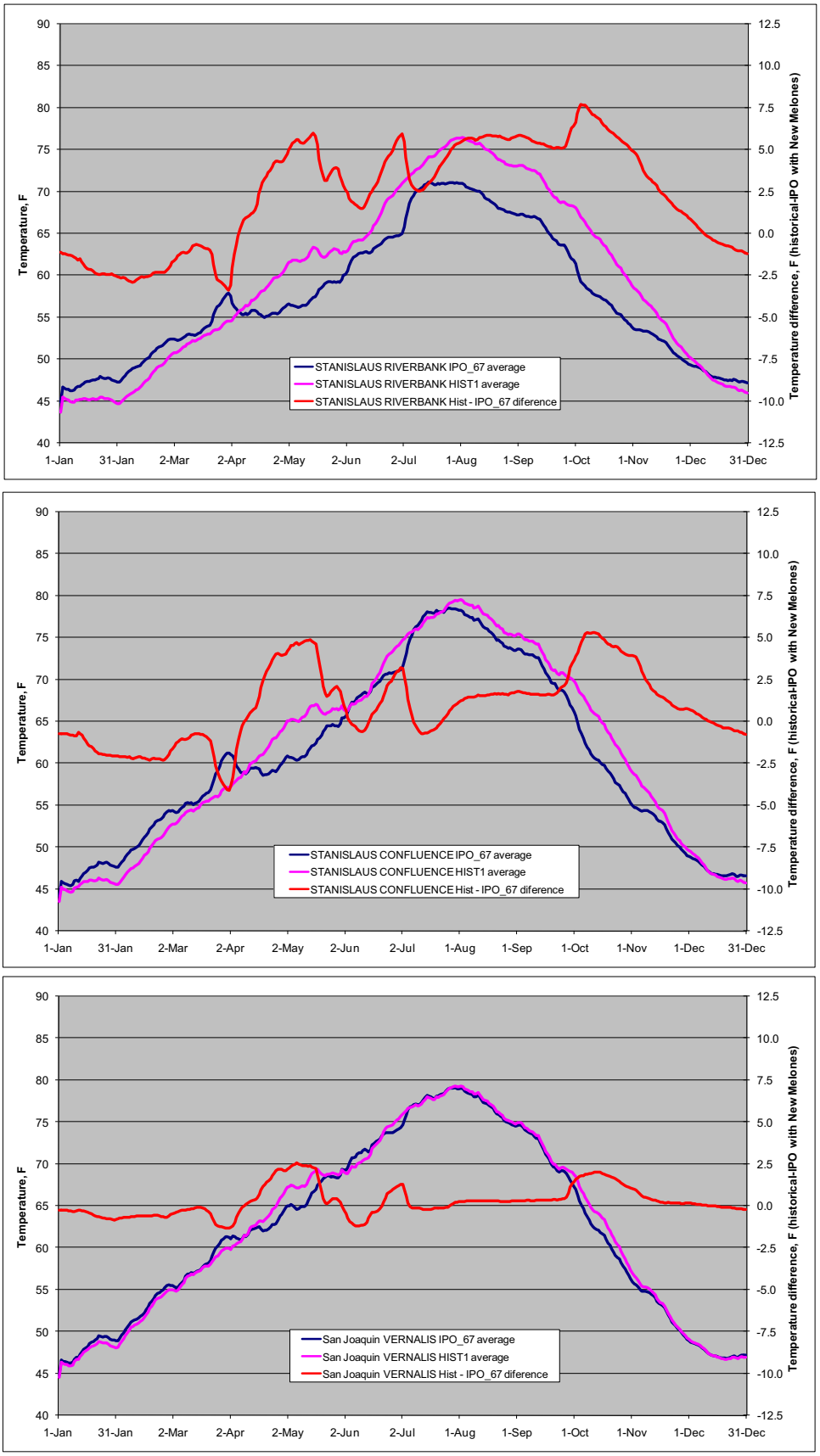


Figure 4 - Maximum Daily Temperatures at Riverbank, Confluence and Vernalis (1967-1982)

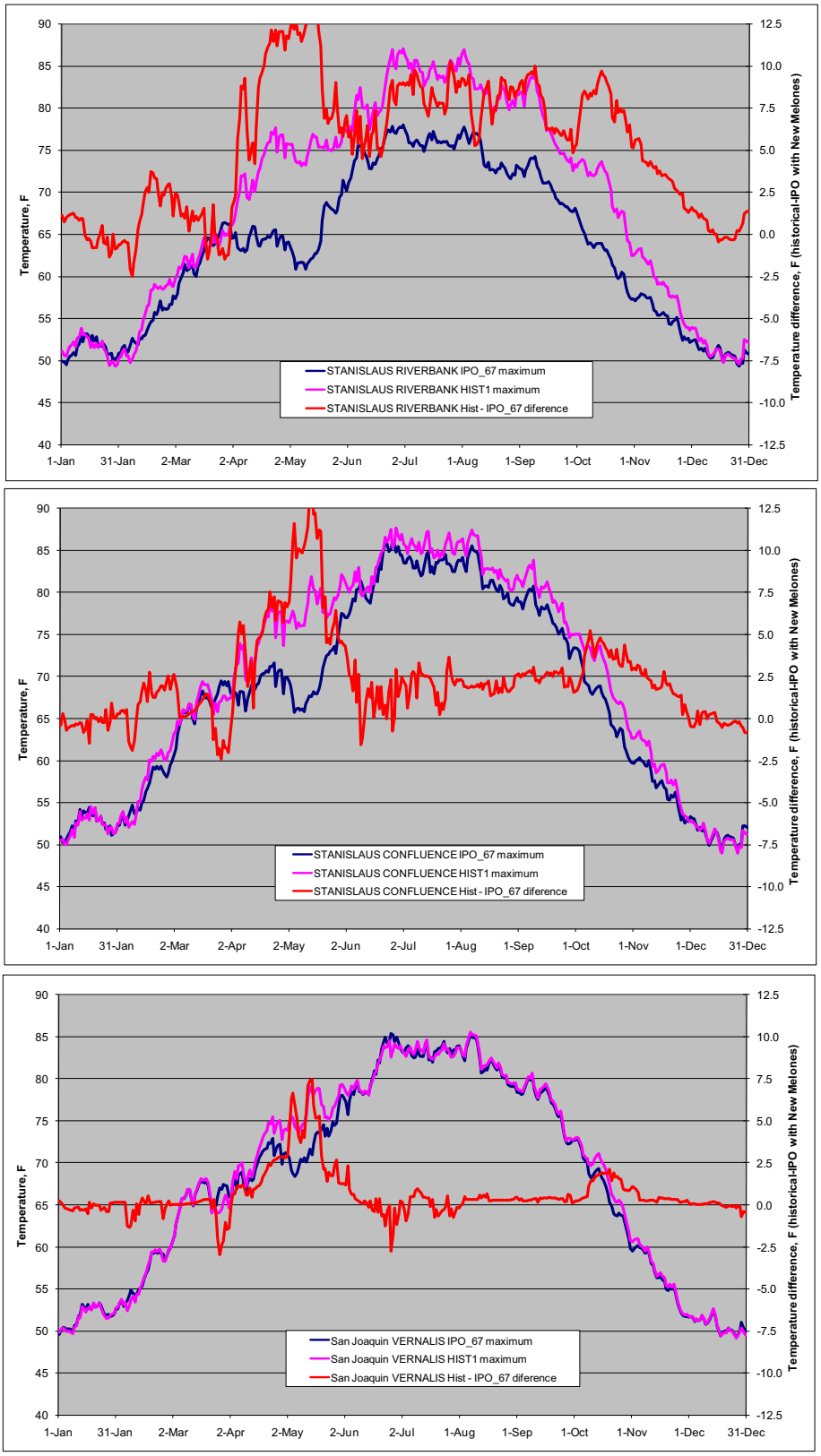


Figure 5 – New and Old Melones Storage, Goodwin Releases and Goodwin Temperatures under "Historic" (HIST1) and "Actual" (IPO_67) Operations.

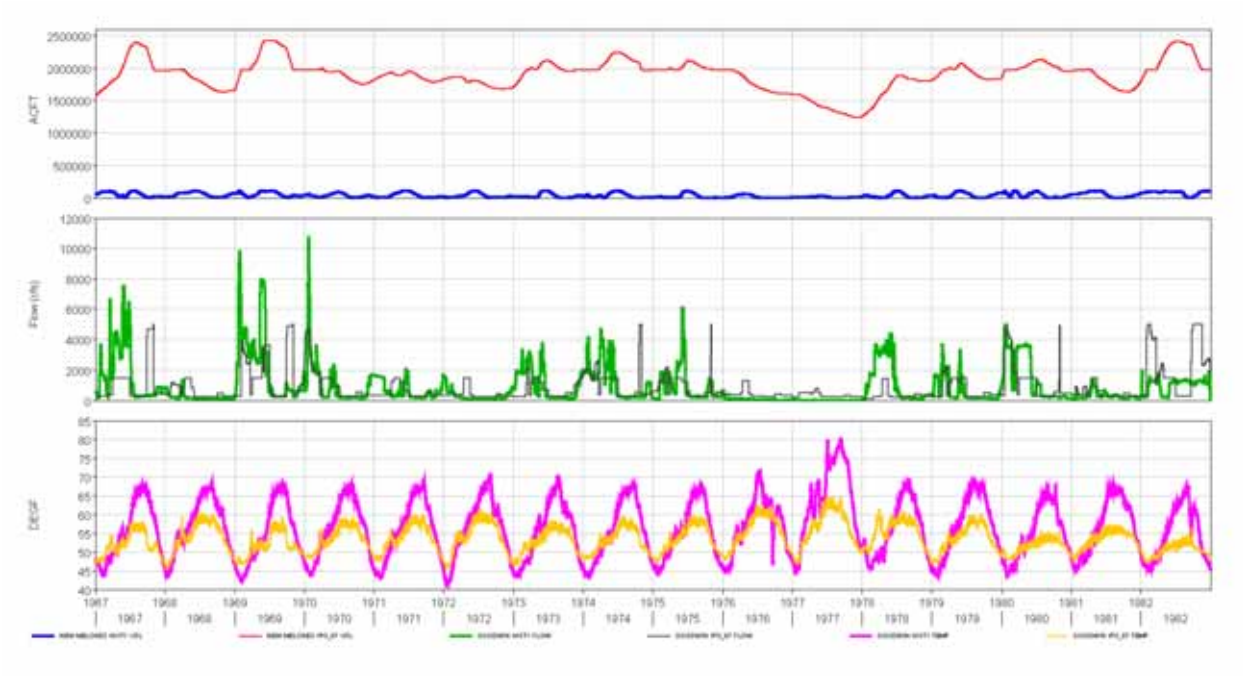


Figure 6 – Computed vs. Observed Temperatures at Vernalis for the "Historic" Conditions

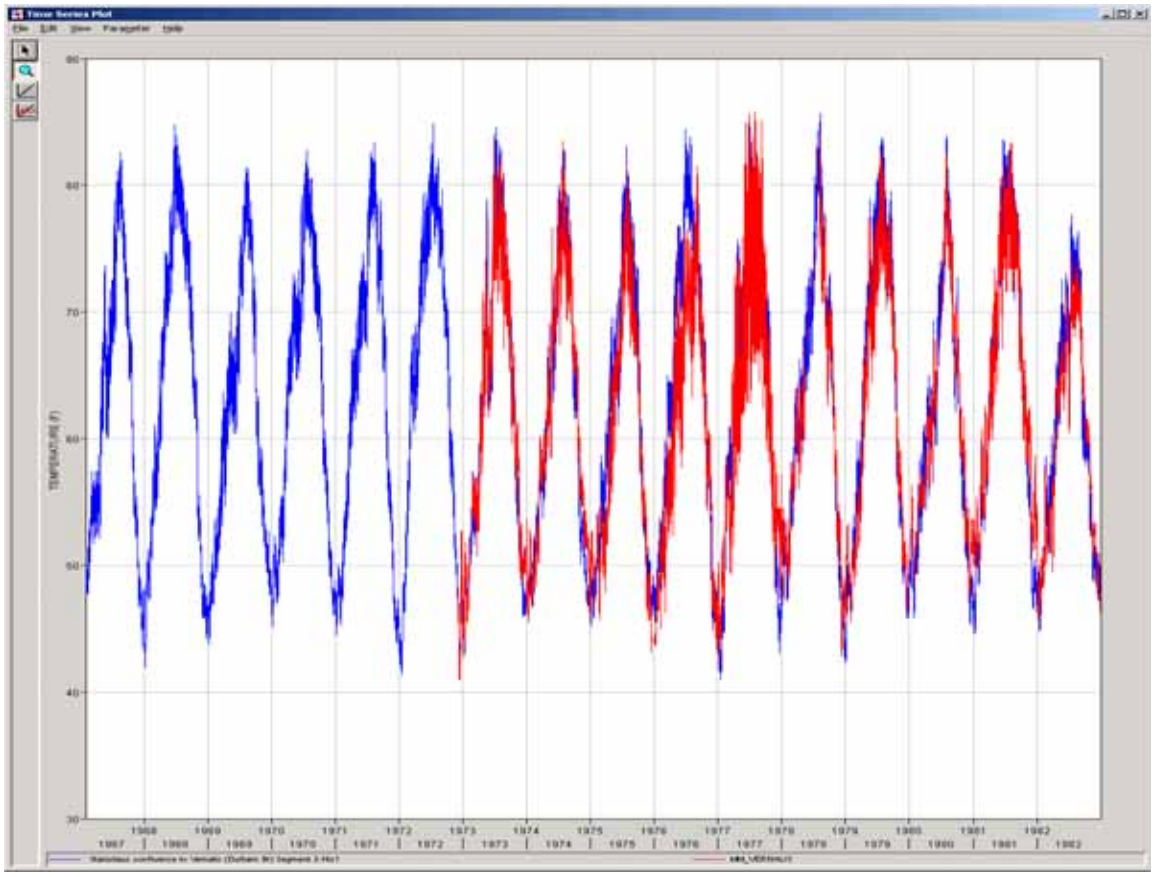


Figure 7 – Correlation between Computed vs. Observed Temperatures at Vernalis for the "Historic" Conditions

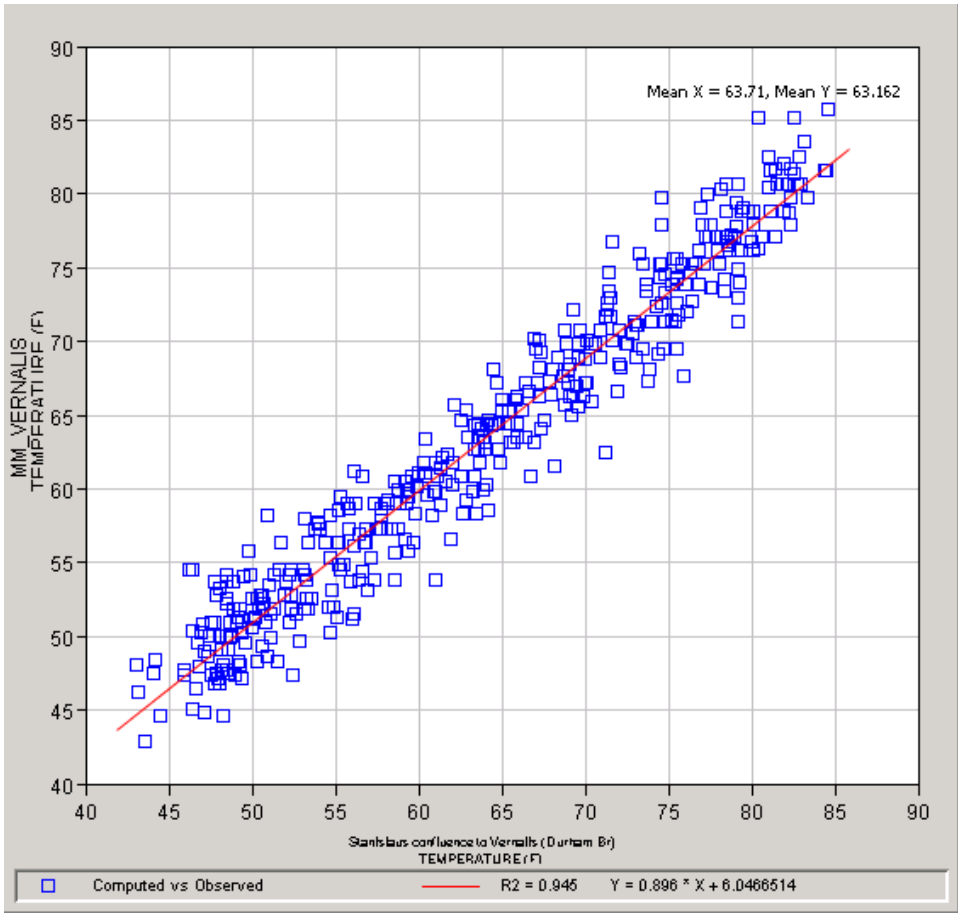


Figure 8 – "Historic" Temperature with respect to CDFG Proposed Temperature Objectives at Riverbank, Confluence (Stanislaus with SJR) and Vernalis.

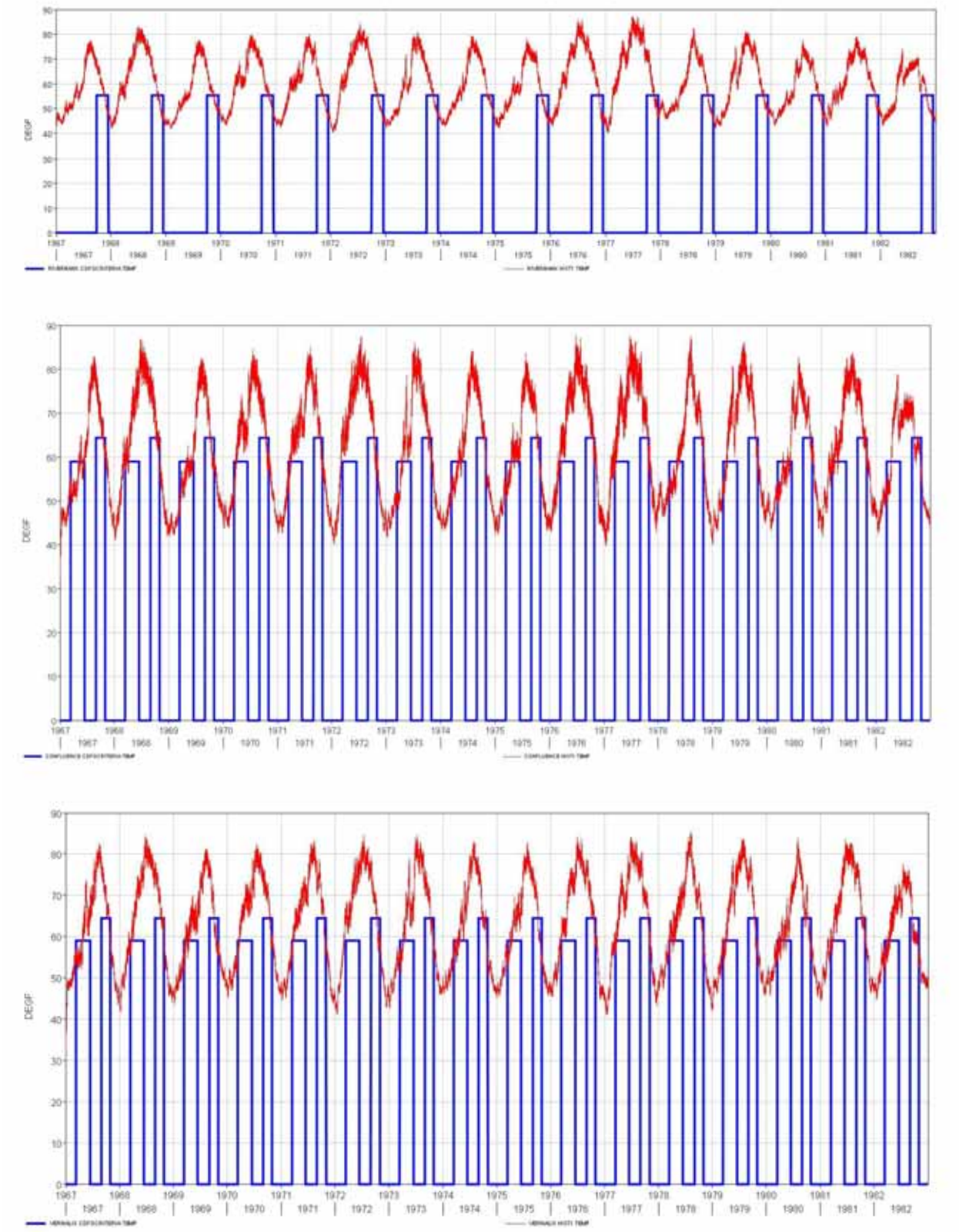


Figure 9 – "Historic" Temperatures vs. CDFG Objectives at the Confluence in Above-Normal Year (1970)

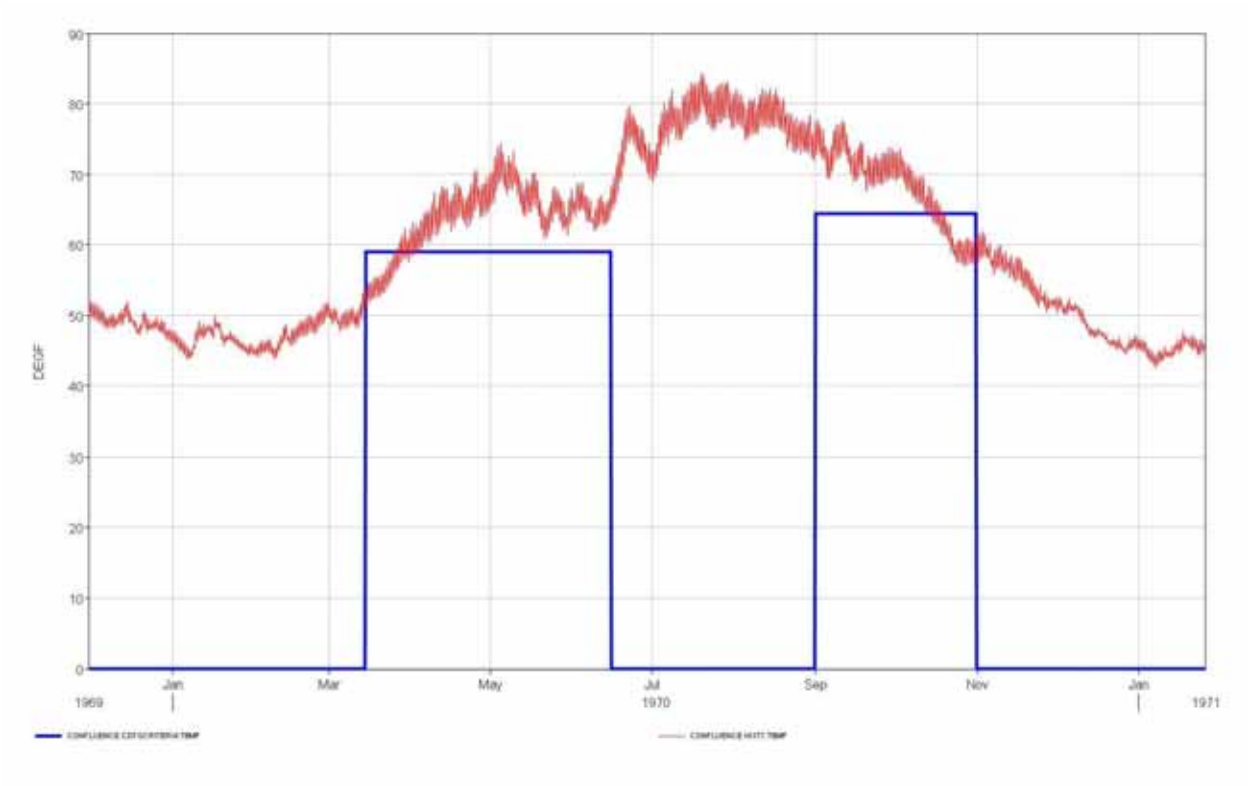
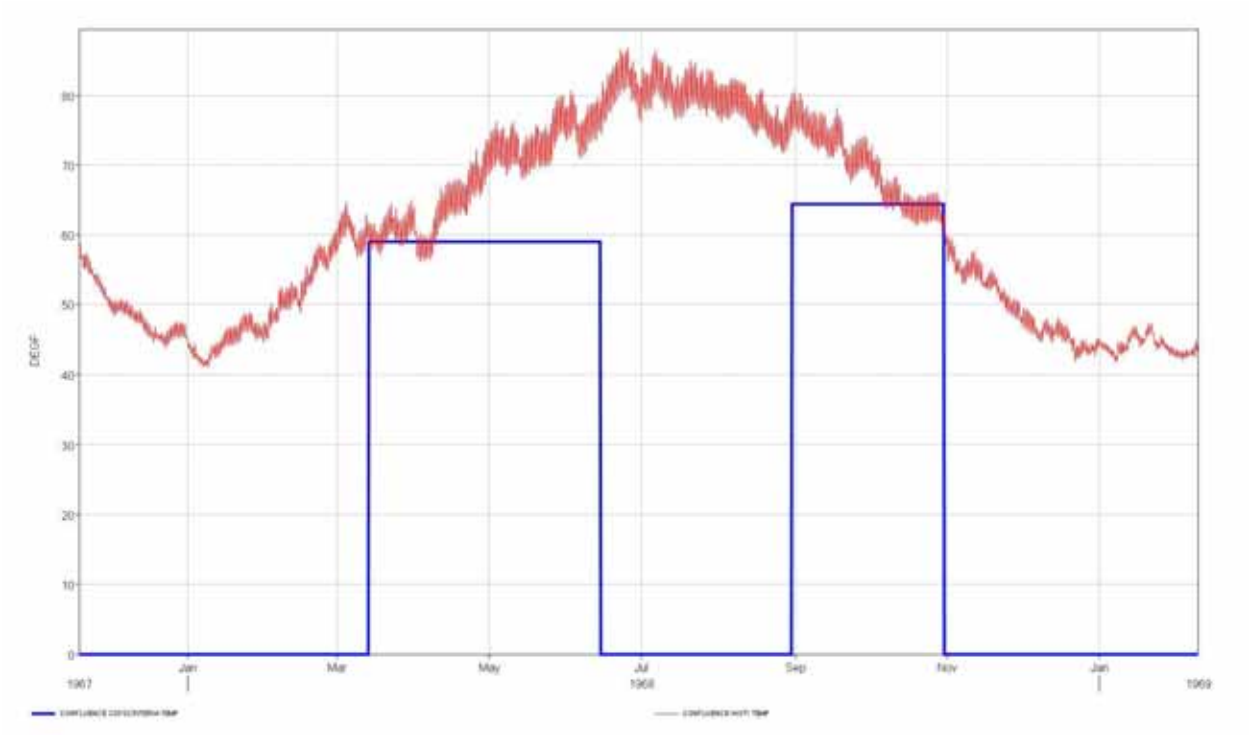


Figure 10- "Historic" Temperatures vs. CDFG Objectives at the Confluence in Dry Year (1968)



2. Can the IPO[1] or Augmented IPO Meet CDFG Criteria?

Assessment of results:

1) *The CDFG recommended criteria cannot be met most of the time under the current IPO or Augmented IPO.*

2) *Using New Melones as a surrogate to reduce water temperatures at Vernalis, through an Augmented IPO, could result in prolonged periods of an empty New Melones Reservoir, yet with minimal ability to meet CDFG recommended criteria.*

The above assessments are supported by the following figures:

Figure 11 and Figure 12 show the percent of the time, during the period 1980-2003, that maximum water temperature conditions at Vernalis equaled to or exceeded CDFG objectives (criteria), for the following cases:

- Historic flows[2].
- IPO flows.
- Augmented IPO flows.

Also shown in the figures are CDFG temperature objectives for the fall (in Figure 11) and spring (in Figure 12). A summary of these figures is presented in Table 2. It shows that although temperatures at Vernalis can be reduced somewhat by augmenting IPO releases from New Melones, the CDFG objectives still cannot be met the majority of the time.

Like in Task 1 above, the results show that systematically, the temperatures "shave" the beginning and ending periods specified for the objectives.

An example for the extent of the thermal improvement at Vernalis due to the Augmented IPO in relation to CDFG objectives is presented in Figure 13. The figure shows computed temperatures at Vernalis for a sequence of 4 years: 2000 to 2003. During this time frame, IPO releases were increased by a total of approximately 600, 000 AF or 155,000 AF annually. At the same time, the number of days during the fall and spring when the increased releases lowered water temperatures to the compliance level, as defined by CDFG objectives, is 17 or approximately 4 days per year.

The ramification of the increased releases (under the Augmented IPO) from New Melones storage is depicted in Figure 14. The figure shows that for the analysis period 1980-2003, New Melones Reservoir would have been dry for solid two and a half years during 1990 to 1993 and again in late 1994 with limited ability to recover in between. New Melones storage would also drop below 500,000 AF in 2003.

[1] The flow regime downstream of New Melones Reservoir is primarily characterized by the current Interim Plan of Operation (IPO) between the USBR and the California Department of Fish and Game that was signed in 1987. The IPO defines allocation of water from New Melones for fishery, Vernalis water quality, Bay-Delta and Central Valley Project contractors as function of New Melones storage and projected inflow. A more complete description of the IPO is attached as Exhibit G to the SJRGA's November 19, 2007 comments.

[2] Historic flows in this context are daily releases based on actual operation.

Table 2 – Percent of the Time Maximum Temperatures at Vernalis are Equal to or Greater Than CDFG Objectives.

	Fall	Spring
	(9/1 to 10/31)	(3/15 to 6/15)
	% of Time	% of Time
Case	Max Temp >= 59 F	Max Temp >= 64.4 F
Historic Flows	73.4%	93.3%
IPO Flows	71.7%	94.1%
Augmented IPO Flows	67.0%	94.2%

Figure 11 – Duration Curves for Maximum Water Temperatures at Vernalis in the fall (9/10 to 10/31)

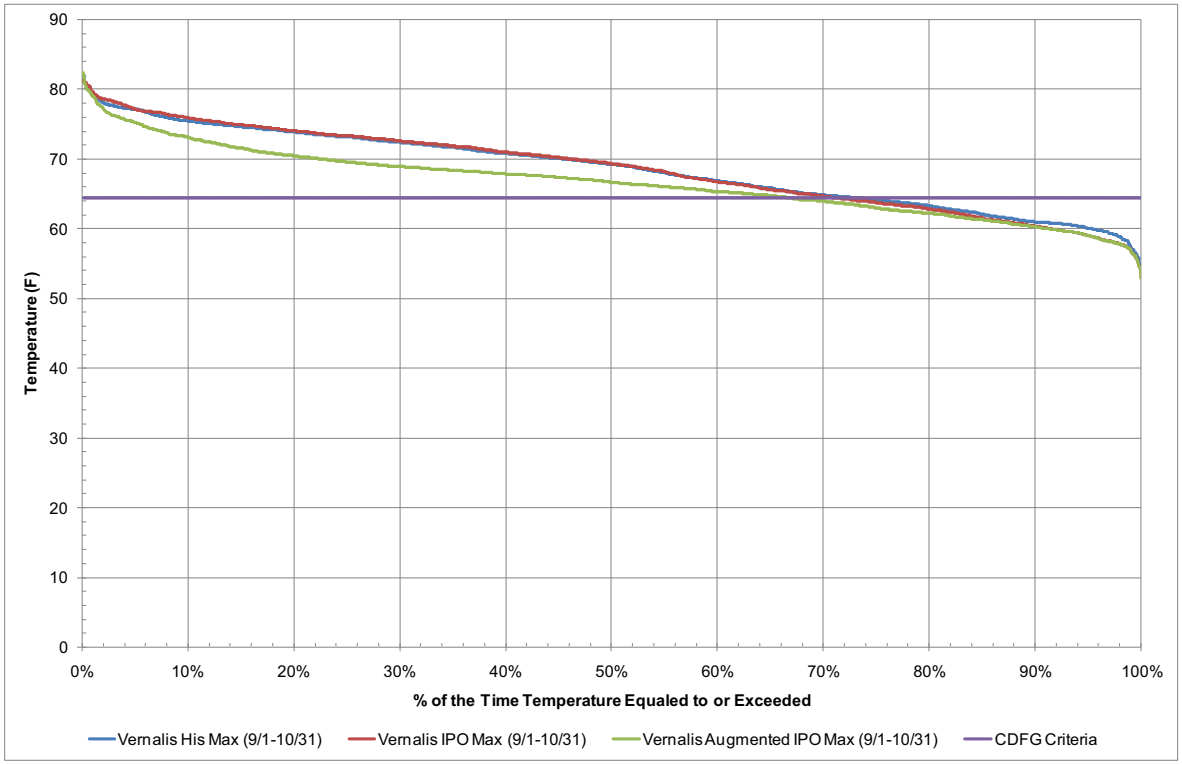


Figure 12 - Duration Curves for Maximum Water Temperatures at Vernalis in the Spring (3/15 to 6/15)

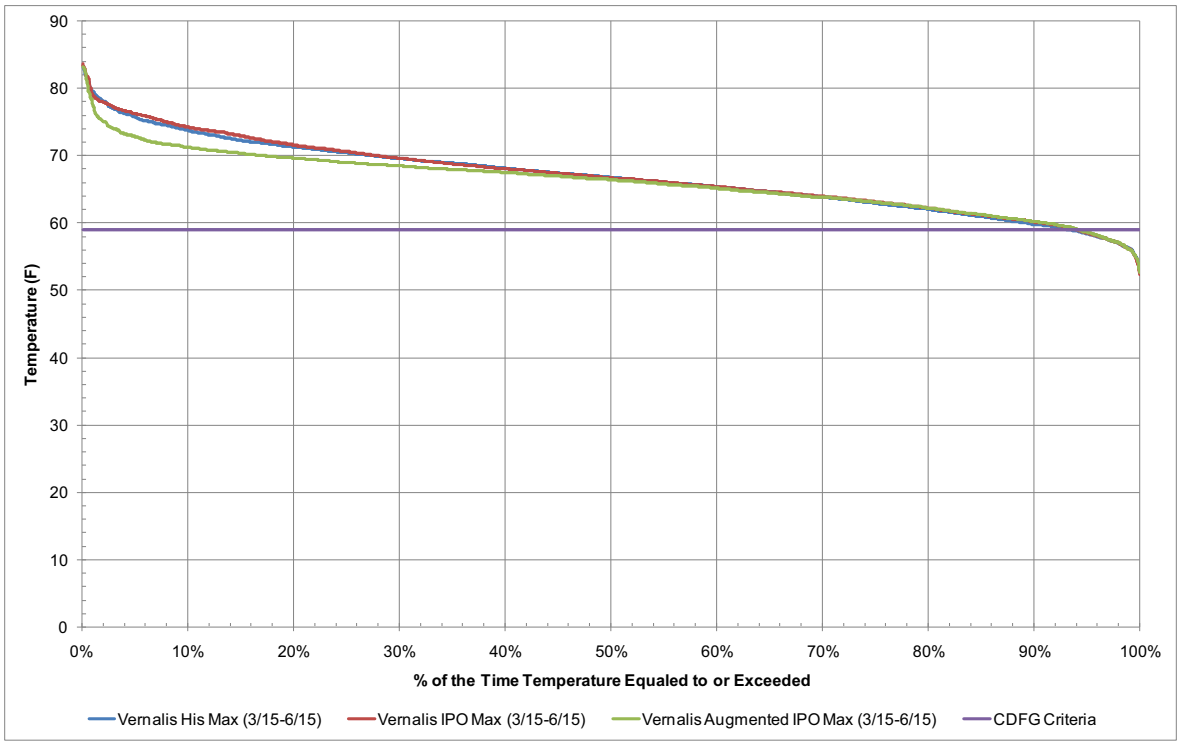


Figure 13 – Potential Thermal Improvements at Vernalis by Augmenting IPO releases and the Effect on New Melones Storage.

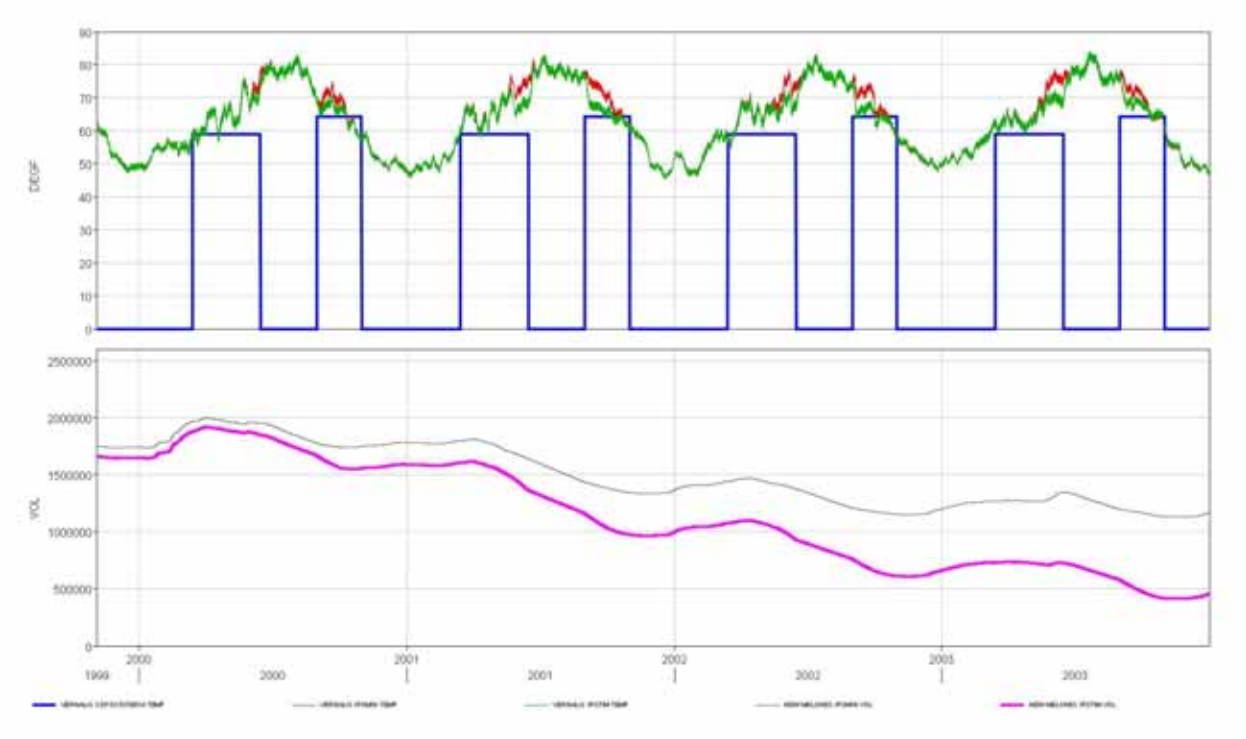


Figure 14 – New Melones Storage under the IPO and Augmented IPO

3. **Can CDFG Criteria at Vernalis Be Met by Increasing Flows from the Tributaries?**

Assessment of results:

1) *Attainment of temperatures at the confluences may have improvement to temperatures at Vernalis depending on the portion of the flow from each tributary and the time of the year.*

2) *However, attainment of temperatures at the confluences will not be enough to meet the Vernalis temperature criteria recommended by CDFG.*

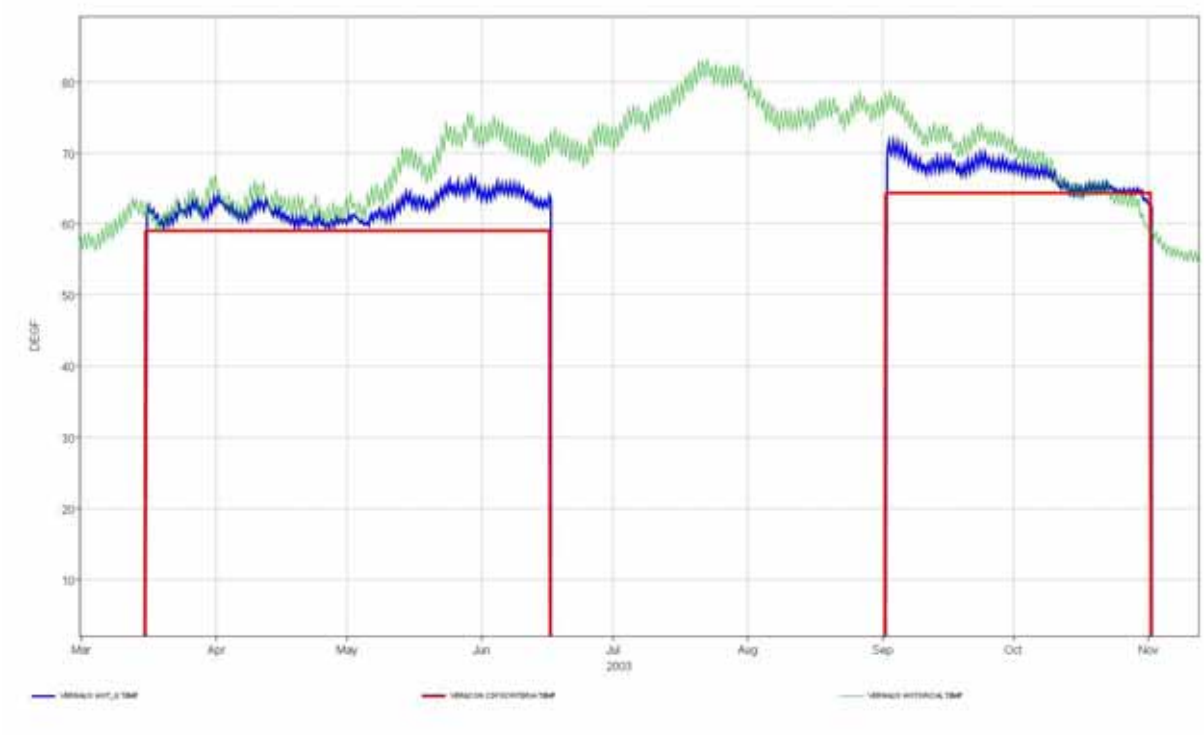
The first assessment is supported by a typical example in Figure 15. This figure shows two lines that represent computed temperatures at Vernalis for historical flows:

1) HISTORICAL – This is the computed temperatures at Vernalis for the historical conditions.

2) HIST_Q – This is a hypothetical case in which water temperatures at the confluence of each tributary were artificially set to equal CDFG's proposed temperature criteria (59 F for the spring and 64.4 F for the fall).

The graph shows that if, theoretically, water would leave the three tributaries at temperatures equal to CDFG criteria, it could reduce temperatures at Vernalis in late spring and early fall. The graph also shows less temperature improvements in early spring and late fall since in both cases the water approaches ambient temperatures.

Figure 15 – Vernalis Historical Vs. Modified Historical Temperatures Assuming Attainment of CDFG Temperature Criteria at the Three Confluences (Stanislaus, Tuolumne and Merced).



The second assessment is supported by series of runs that were built on top of the Hist_Q case above.

Summary of these runs are given in Table 3. The table shows that, on average, maximum temperatures at Vernalis cannot be met regardless of the amount released from each tributary, even if the initial temperature conditions are artificially set to equal CDFG criteria.

Table 3 – Vernalis average maximum temperatures given different release cases from the tributaries with initial water temperatures set to equal CDFG criteria.

	Minimum Flow (cfs)	Minimum Flow (cfs)	Minimum Flow (cfs)	Vernalis Average Max Temperatures (F)	
				Period	Period
Case	Stanislaus	Tuolumne	Merced	Spring	fall
CDFG CRITERIA	na	na	na	59.0	64.4
HIST_Q	Historic	Historic	Historic	62.8	66.7
SR_M2000	2000	Historic	Historic	62.1	65.3
TR_M1000	Historic	1000	Historic	62.5	65.8
MR_M1000	Historic	Historic	1000	62.8	66.1
TRMR_M1000	Historic	1000	1000	62.5	65.7
S2000_MT1000	2000	1000	1000	62.1	65.1

4. **What is the Impact of Friant Restoration on Temperature in the SJR?**

Assessment of results:

1) *Friant Restoration will have a minimal effect on temperatures in the SJR at the confluence with the Merced River.*

2) *However, since the Friant Restoration will introduce more water at the confluence, it will require larger releases from the Merced to reduce temperatures. This type of operation can be sustained for only a short period of time because of storage limitation on the Merced River and will not achieve the CDFG recommended criteria at the confluence.*

The above assessments are supported by the following figures:

Figure 16 shows the computed Historical and Settlement (Restoration) flows and temperatures in the SJR upstream to the confluence with the Merced for the period 1998-2001. The figure shows that although the Settlement flows are higher than the Historical, the temperatures are about the same. This phenomenon can be explained by the fact that due to the long travel time, the Friant water approaches equilibrium with ambient temperature by the time it arrives at the Merced confluence.

Figure 17 shows the extent of temperature reduction in the SJR at the confluence and the ramification of on Lake McClure storage when historical releases are augmented. The figure shows that in the first two years (1999 and 2000) that follow a wet year (1998) increased releases from Lake McClure could reduce temperatures at the confluence. However, due to the limited storage capacity of the reservoir, this type of operation will result in depletion of all the water by the third year (2001) and as such will not yield any temperature benefits thereafter.

Figure 16 – Flow and Temperature in the SJR Upstream to the Confluence with the Merced River

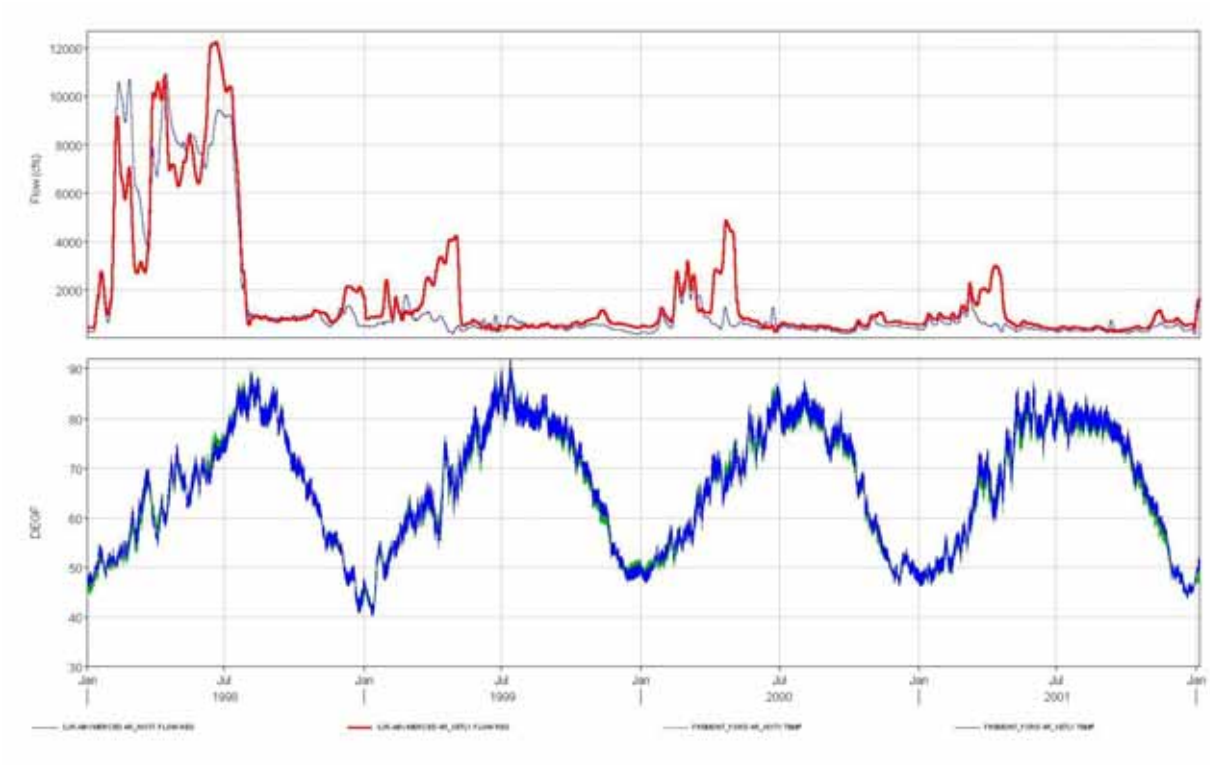
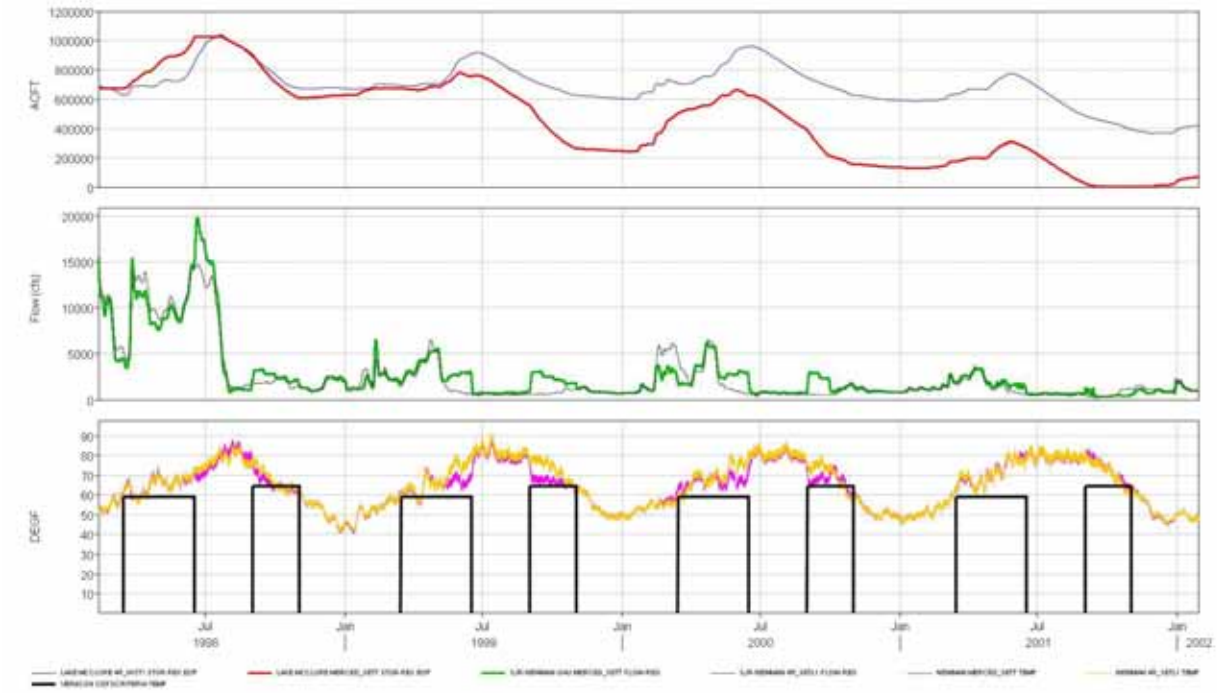


Figure 17 – Lake McClure Storage and Temperature Response at the Merced Confluence for Augmented Releases from the Merced River



5. **Is the SJR Temperature Impaired Even if All the Water in the Basin is Allocated for Fish Release ("All for Fish" case)?**

Assessment of results:

1) *If all the water in the SJR Basin would be allocated for fish release, most the SJR will still be considered temperature impaired, given CDFG temperature criteria and RWQCB impairment threshold.*

The above assessment is supported by the following:

Figure 18 is an example for the Stanislaus River that illustrates the concepts employed for "All for Fish" case: all the diversions are rerouted back to the river and reshaped in accordance with the spring and fall objectives periods, while maintaining the historical storage volumes in New Melones. This concepts was implemented as to all three the tributaries.

Table 4 shows summary results for Case 5. The table shows the RWQCP threshold of exceedances that defines temperature impairment, a number that varies depending on the number of samples. The count of exceedances is then tested against this threshold. If the number of exccedances is greater than the threshold, then by definition, there is temperature impairment.

As shown in the table, except for the Tuolumne and Stanislaus in the fall, in all other locations and periods there is temperature impairment, even if all the water in the SJR basin is allocated for fish release.

Figure 18 – Example of Concepts Employed in the "All for Fish" Case.

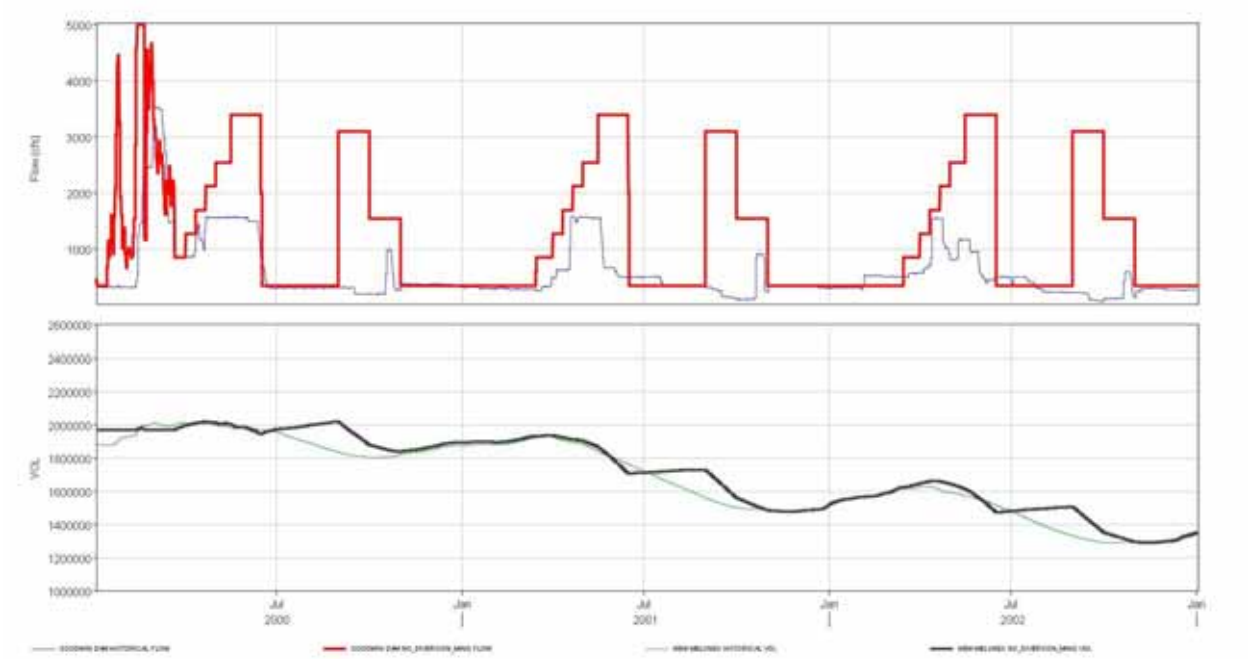


Table 4 – Summary of "All for Fish" case.

Number of samples >>	837	549
Threshold of exceedances for impairment >>	139	92
Counts of Exceedances		
Location	59 F Spring Criteria	64.4 F Fall Criteria
Merced River confluence	729	280
Tuolumne River confluence	410	7
Stanislaus River confluence	523	37
San Joaquin River at Vernalis	743	125

Note:

	Exceeds the threshold that defines impairment

EXHIBIT C

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EXHIBIT D

TABLES

Table 1. Geographic and temporal distribution of spawning in the Stanislaus, Tuolumne and Merced Rivers.

STANISLAUS RIVER					
		Distribution of Redds[2]			
Date	%Redds Observed[1]	Goodwin	Knights Ferry to Horseshoe	Horseshoe to Oakdale	Oakdale to Riverbank
Before Oct 1	0.1%	100.0%	0.0%	0.0%	0.0%
Oct 1-15	1.5%	32.1%	61.3%	4.8%	1.8%
Oct 16-31	10.5%	17.5%	55.0%	24.5%	3.0%
Nov 1-15	29.4%	15.1%	51.4%	31.1%	2.5%
Nov 16-30	29.4%	13.6%	49.5%	33.6%	3.3%
Dec 1-15	19.0%	19.7%	38.9%	33.2%	8.2%
Dec 16-31	9.0%	14.5%	44.6%	34.3%	6.6%
Jan 1-15	1.1%	0.0%	46.5%	43.9%	9.7%

TUOLUMNE RIVER					
		Distribution of Redds[2]			
Date	%Redds Observed[1]	La Grange Dam to Basso Bridge	Basso Bridge to Turlock Lake	Turlock Lake to ~Waterford	~Waterford to Fox Grove
Before Oct 1	<0.1%	0.0%	0.0%	0.0%	0.0%
Oct 1-15	0.4%	69.6%	17.4%	10.1%	2.9%
Oct 16-31	9.6%	77.5%	18.4%	3.7%	0.3%
Nov 1-15	23.0%	70.5%	18.4%	9.4%	1.7%
Nov 16-30	28.6%	60.2%	21.0%	15.6%	3.2%
Dec 1-15	21.9%	61.4%	18.2%	14.3%	6.1%
Dec 16-31	13.7%	61.2%	19.6%	13.7%	5.5%
Jan 1-15	2.8%	67.2%	17.9%	11.6%	3.2%

MERCED RIVER					
		Distribution of Redds[2]			
Date	%Redds Observed[1]	Merced River Hatchery to Snelling Road	Snelling Road to Hwy 59	Hwy 59 to Shaffer Bridge	Shaffer Bridge to Santa Fe Road
Before Oct 1	0.0%	0.0%	0.0%	0.0%	0.0%
Oct 1-15	<0.1%	100.0%	0.0%	0.0%	0.0%
Oct 16-31	3.1%	71.1%	21.4%	7.1%	0.4%
Nov 1-15	26.1%	65.8%	25.8%	7.7%	0.8%
Nov 16-30	33.6%	60.4%	24.9%	12.5%	2.2%
Dec 1-15	23.8%	31.1%	29.7%	28.7%	10.6%
Dec 16-31	11.1%	17.5%	28.5%	33.5%	20.5%
Jan 1-15	2.4%	5.5%	26.4%	39.2%	28.9%

[1] Based on 1998-2005 CDFG spawning survey data.
[2] Based on 2000-2005 CDFG spawning survey data. CDFG indicated there are problems with earlier data.

Table 2. Revised assessment of temperature impairment summary for adult salmon migration in the Tuolumne River based on the corrected time period.

Tuolumne Salmon Migration Impairment Summary												
Max 7DADM Temperature												
Year	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**
1998	16.5	15.8	15.4	15.1	14.9	13.6	13.5	13.4	13.1	10.8	10.7	10.1
1999	19.3	18.9	16.8	16.7	16.0	15.3	14.8	12.6	12.1	11.0	10.3	10.4
2000	20.7	17.8	17.9	16.0	15.0	14.6	12.3	11.7	11.4	12.7	11.8	11.0
2001	No data available						16.1	15.3	12.5	12.1	11.1	10.8
2002	20.6	21.3	19.0	17.1	15.1	14.7	15.4	14.3	13.0	12.3	12.0	11.7
2003	21.8	19.9	18.7	18.4	15.6	14.9	14.6	12.4	11.3	13.0	12.0	11.5
2004	No data available								9.9	10.2	13.4	10.9
2005	19.9	19.0	17.3	16.7	15.9	15.0	14.3	12.1	10.8	10.0	9.9	11.0
2006	17.1	17.1	15.0	14.3	13.6	13.9	12.6	12.2	9.5	9.2	10.7	8.3
Average	**19.4**	**18.5**	**17.1**	**16.3**	**15.1**	**14.6**	**14.2**	**13.0**	**11.5**	**11.3**	**11.3**	**10.6**
											Total number of observations	**92**
											Number of observations >18C	**12**
											Number of observations required to list	**16**

FIGURES

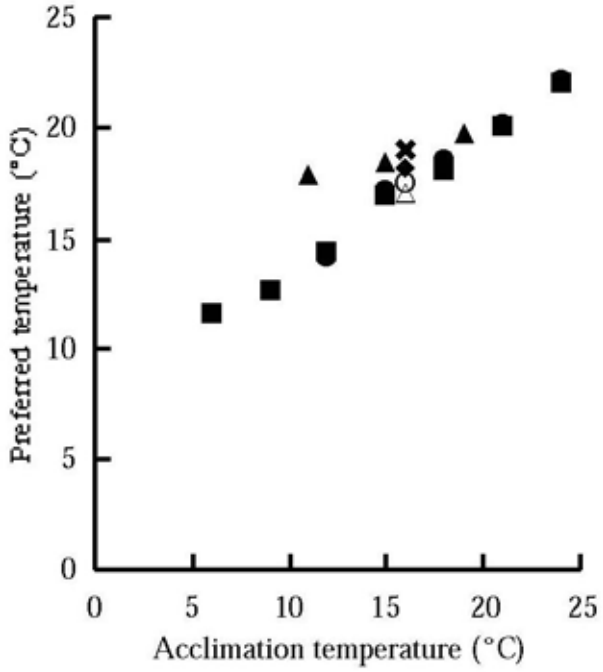


Figure 1. Relationship between preferred temperatures and acclimation temperatures for steelhead. From Myrick and Cech 2004.

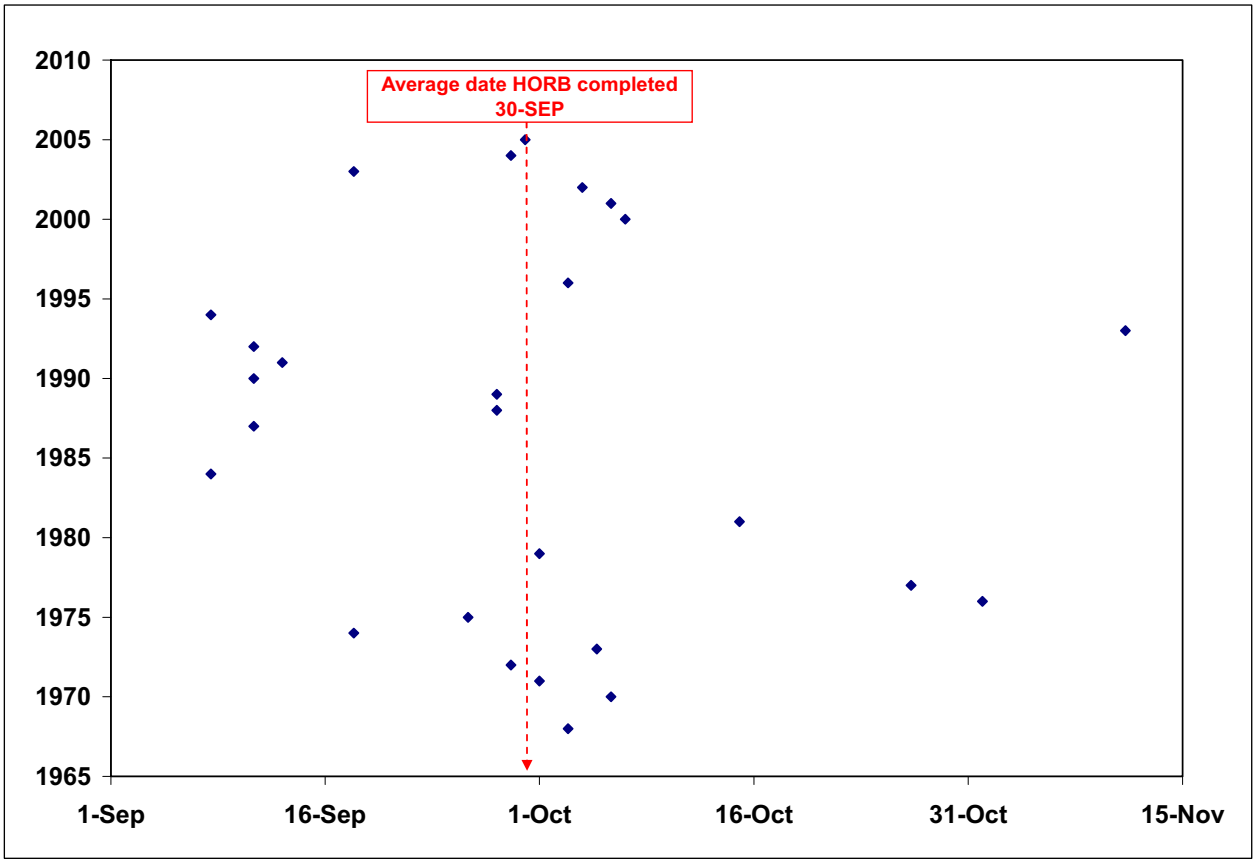


Figure 2. Timing of Head of Old River Barrier completion during fall 1968-2005.

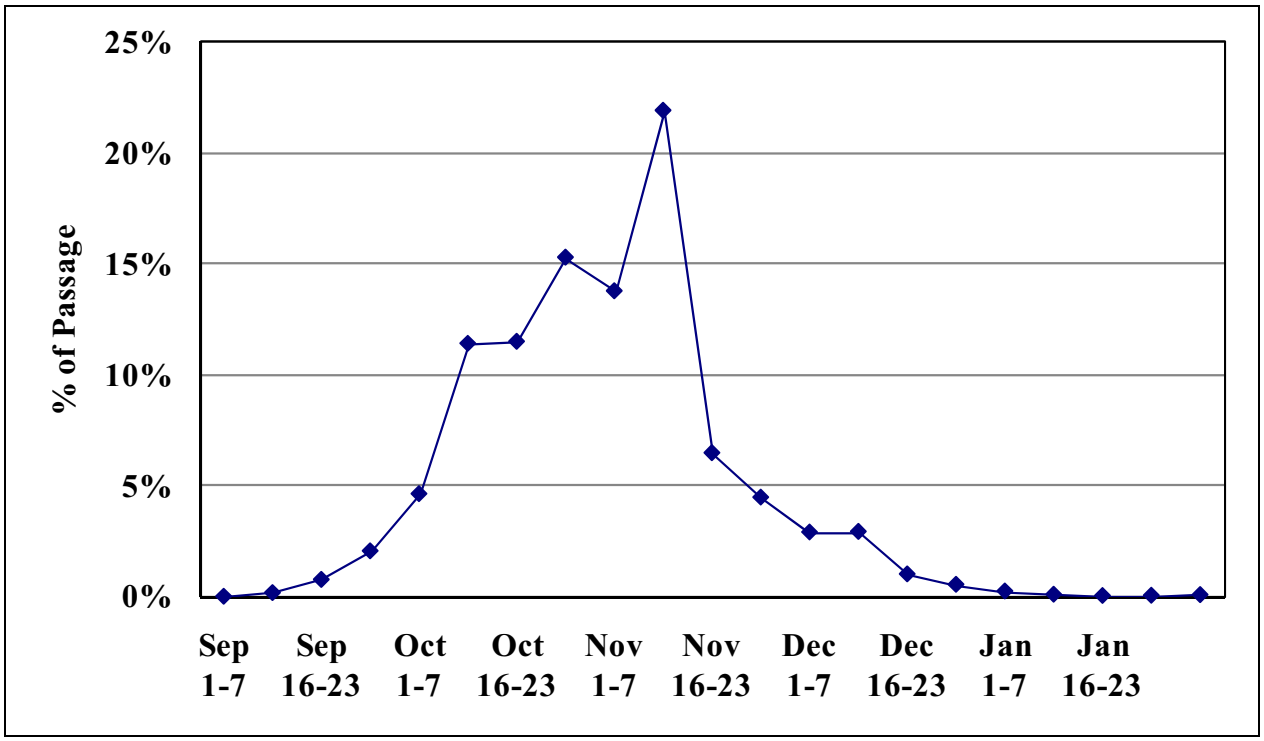


Figure 3. Generalized upstream migration timing pattern observed at the Stanislaus River Weir near Riverbank (River Mile 31.4) during 2003-2006.

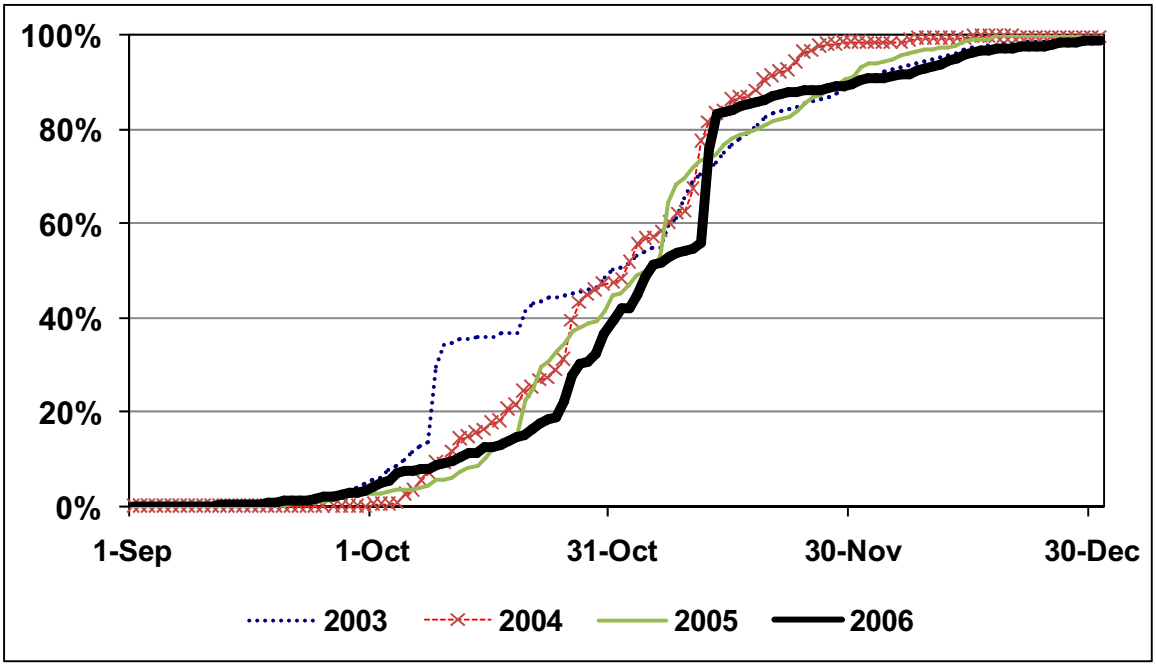


Figure 4. Cumulative passage at the Stanislaus River Weir during 2003-2006.

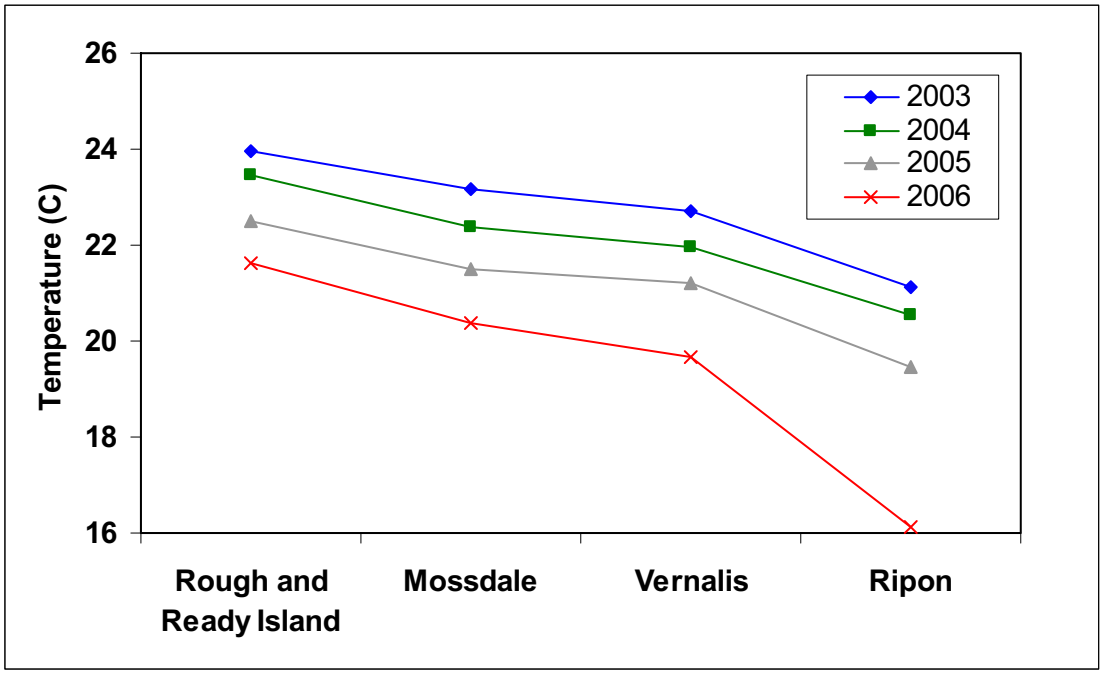


Figure 5. Average monthly temperatures in the San Joaquin and Stanislaus rivers during September 2003-2006.

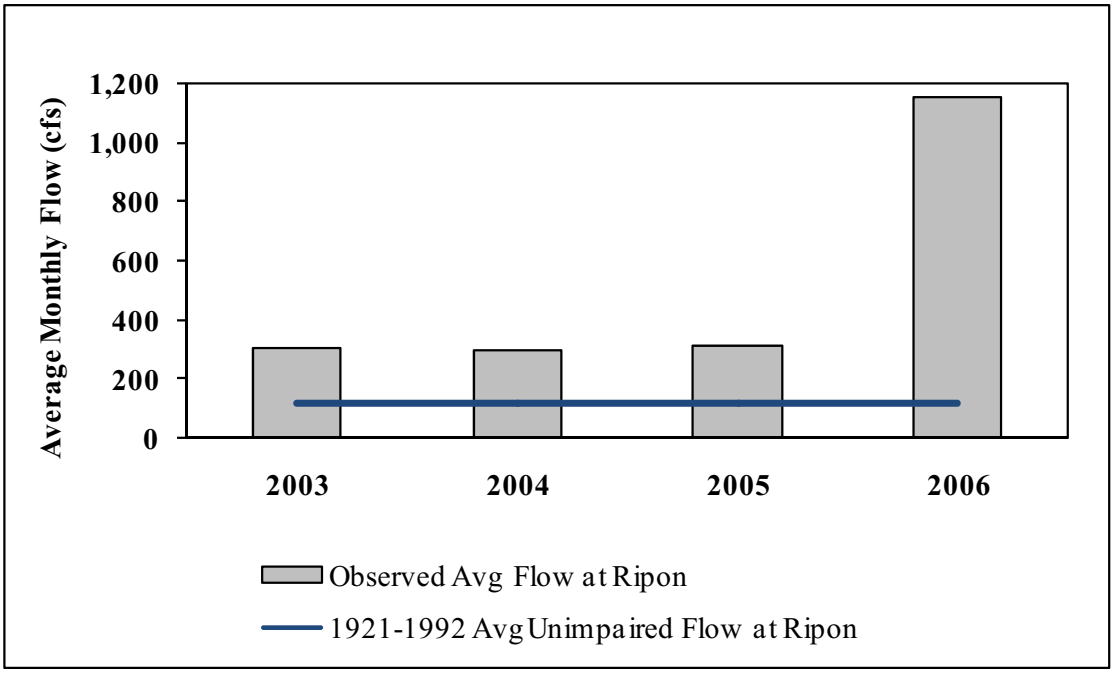


Figure 6. Average unimpaired monthly flow and observed average flow in the Stanislaus River at Ripon during September.

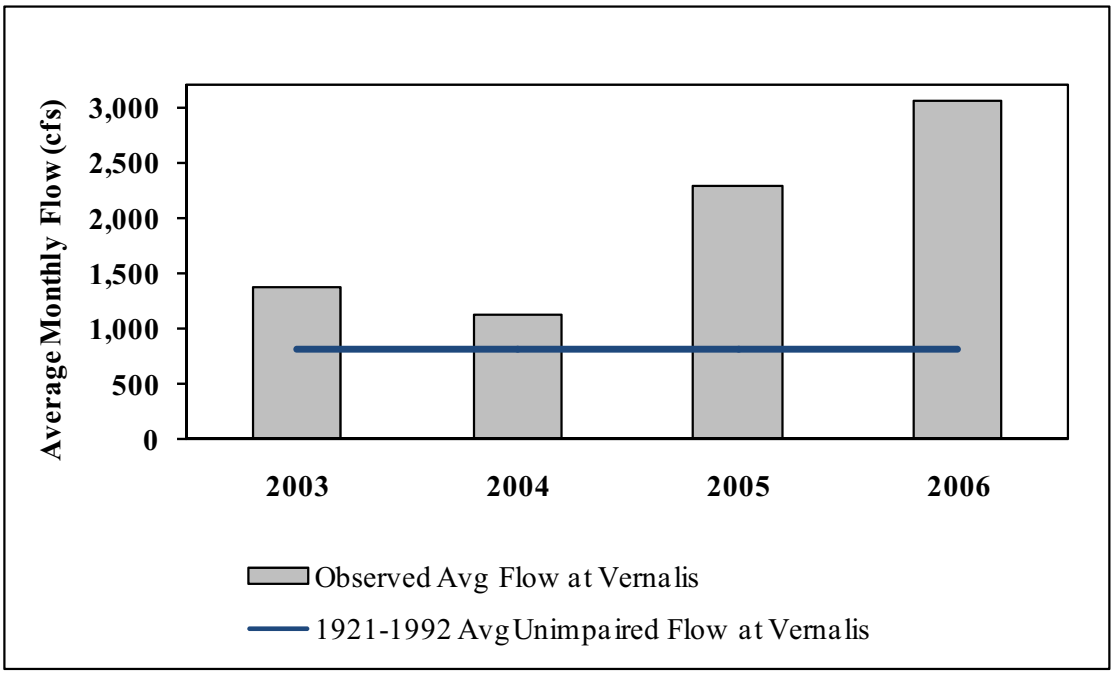


Figure 7. Average unimpaired monthly flow and observed average flow in the San Joaquin River at Vernalis during September.

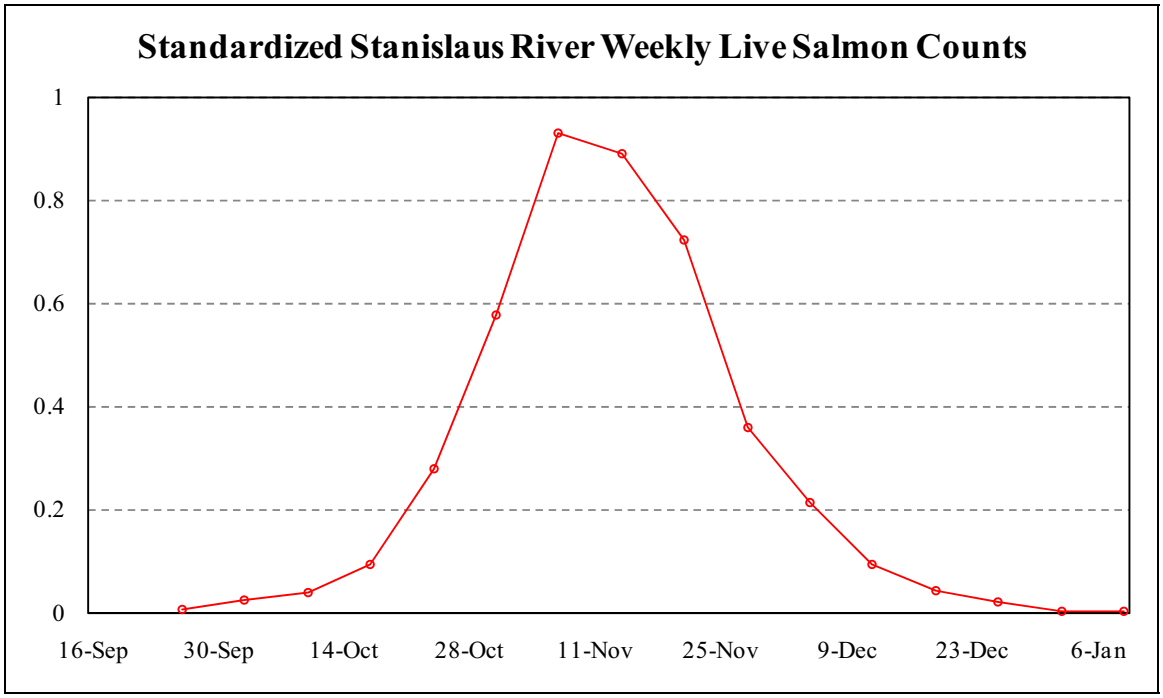


Figure 8. Standardized weekly live salmon counts from spawning surveys conducted on the Stanislaus River during 2000-2006.

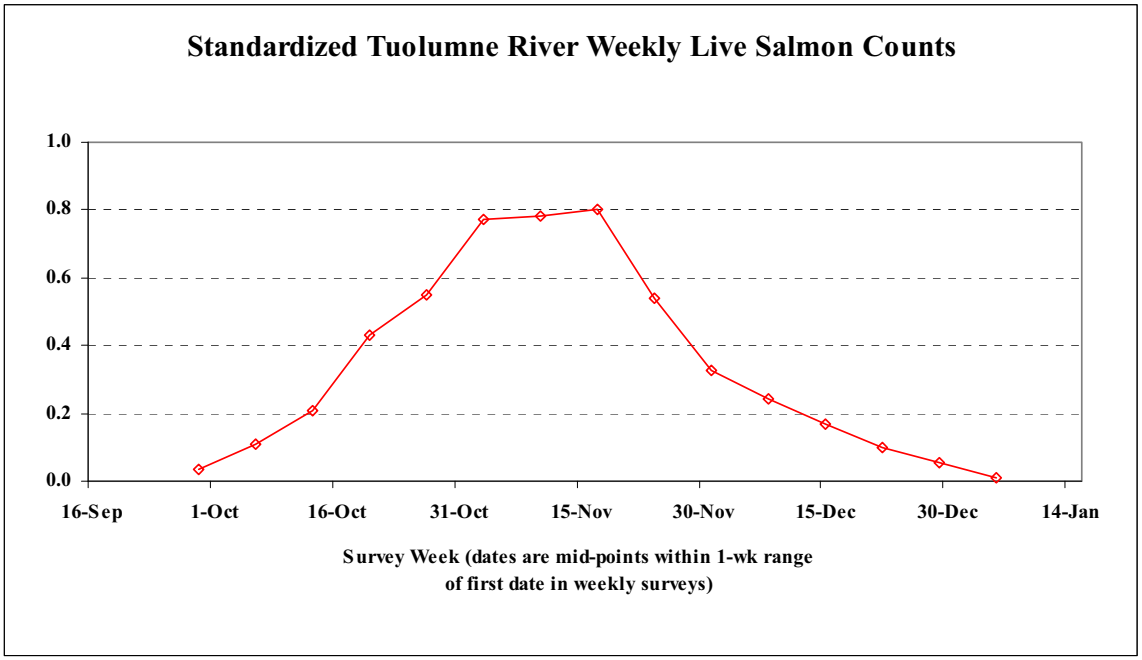


Figure 3. Standardized weekly live salmon counts from spawning surveys conducted on the Tuolumne River during 1982-2005.

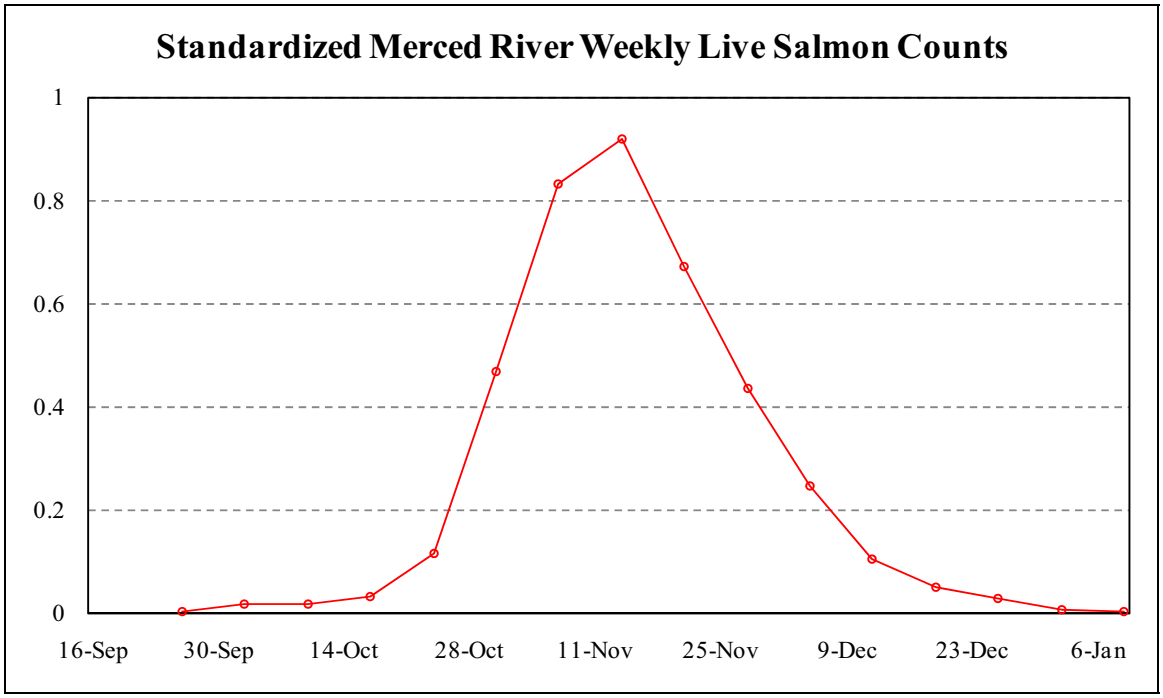


Figure 10. Standardized weekly live salmon counts from spawning surveys conducted on the Merced River during 1992-2005.

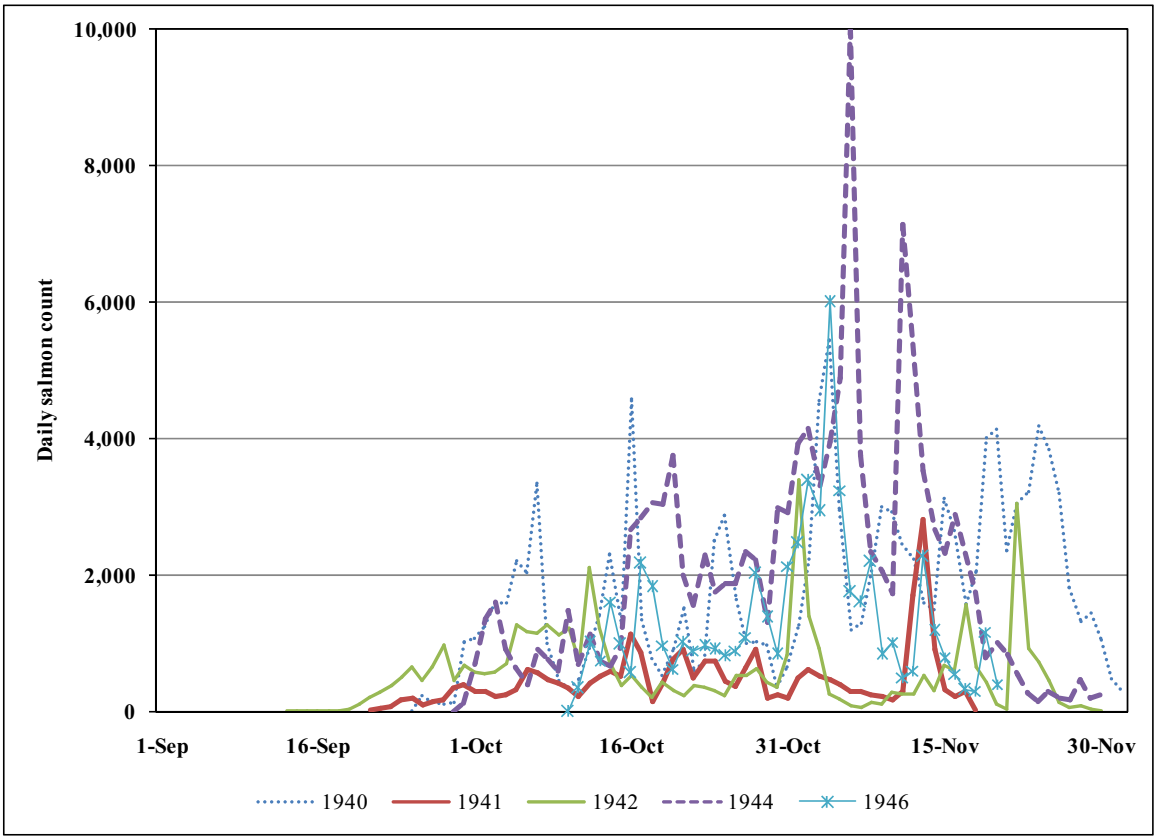


Figure 11. Daily adult salmon counts on the Tuolumne River during weir operations in 1940-1942, 1944, and 1946.

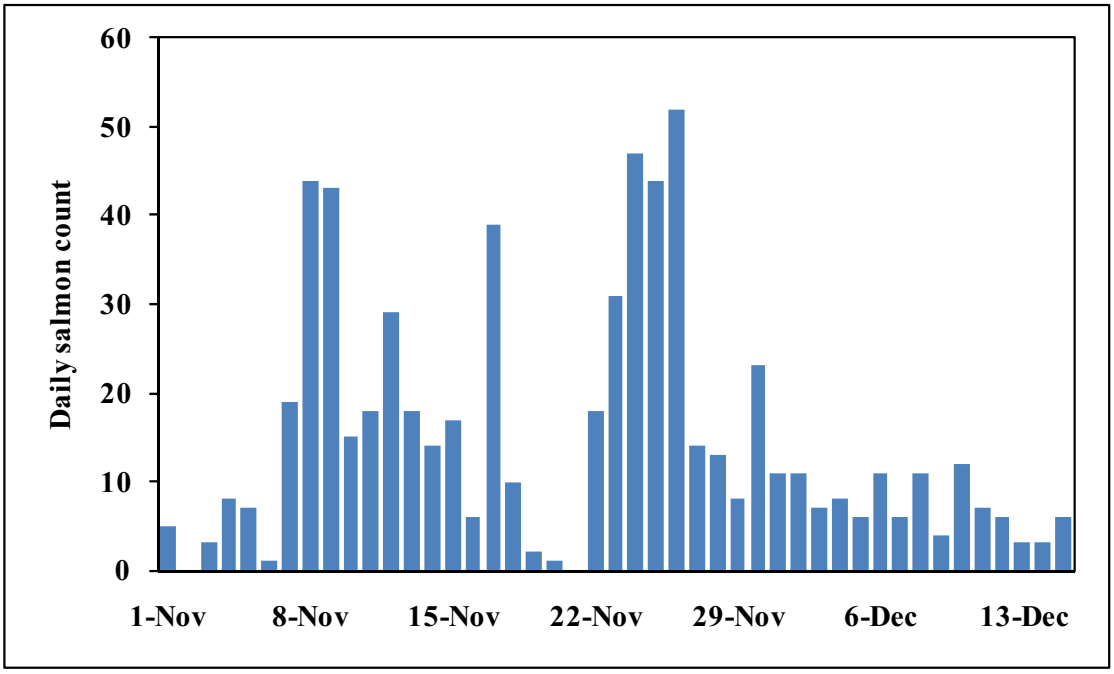


Figure 12. Daily salmon counts during operation of an adult upstream migrant trap in the San Joaquin River near Banta Carbona during 1977.

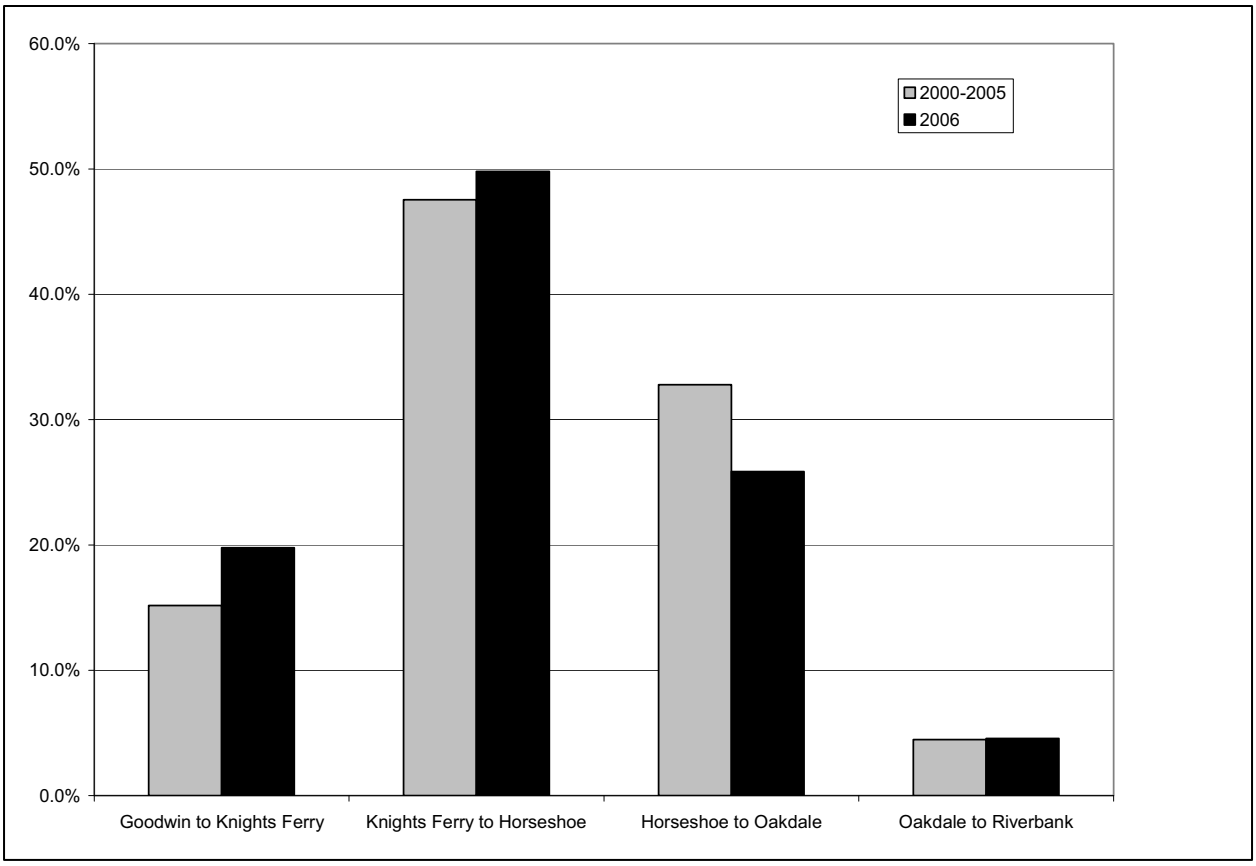
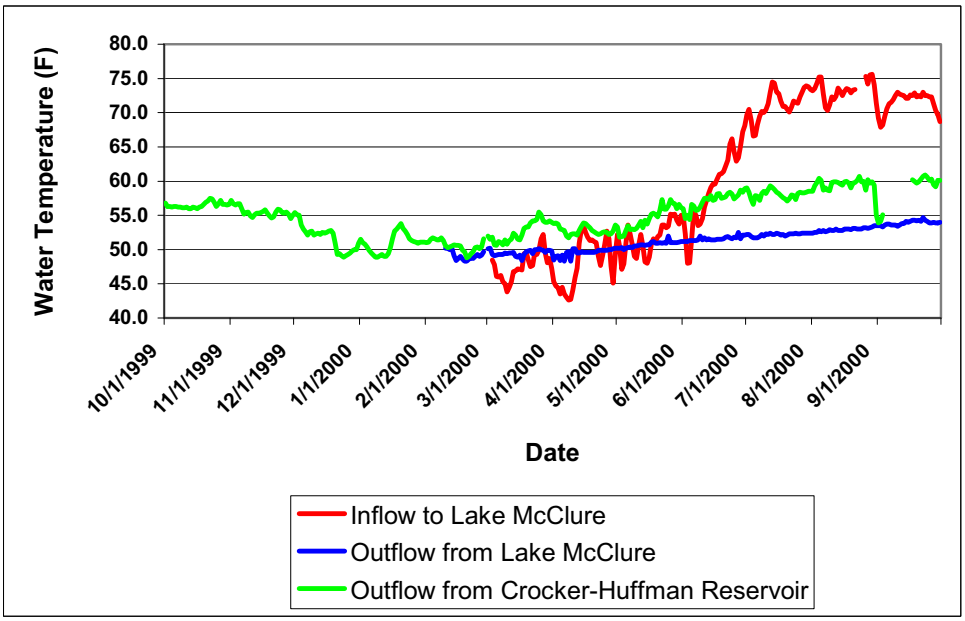


Figure 13. Distribution of redds in the Stanislaus River during 2000-2005 and 2006.

EXHIBIT E

AD Consultants (November 19, 2007) “SJR Temperature Modeling and Analysis”
(enclosed compact disc)

EXHIBIT F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45.0
40.0
10/1/1999
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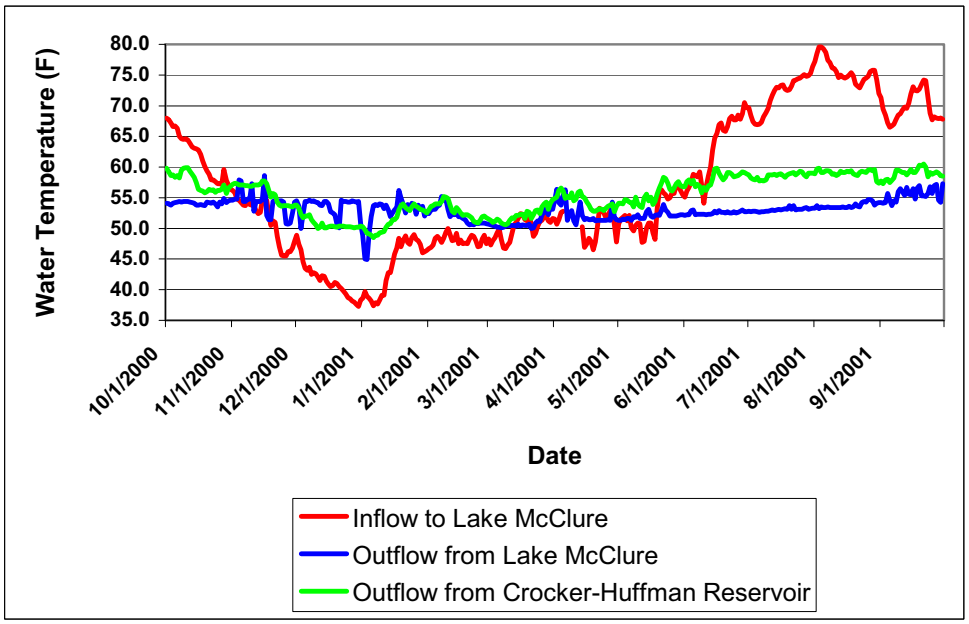
12/1/1999
1/1/2000
2/1/2000
3/1/2000
4/1/2000
5/1/2000
6/1/2000
7/1/2000
8/1/2000
9/1/2000
Date
Inflow to Lake McClure
Outflow from Lake McClure
Outflow from Crocker-Huffman Reservoir


Water Temperature (F)
80.0
75.0
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3/1/2001
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5/1/2001
6/1/2001
7/1/2001
8/1/2001
9/1/2001
Date
Inflow to Lake McClure
Outflow from Lake McClure
Outflow from Crocker-Huffman Reservoir