UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
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DEC 22 2016

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Clerk to the Board
State Water Resources Control Board
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Re: Response to the State Water Resources Control Board's Draft Revised Substitute Environmental Document Phase 1, 2016 Bay-Delta Plan

NOAA's National Marine Fisheries Service (NMFS) has reviewed the State Water Resources Control Board's (Board) revised draft Substitute Environmental Document (SED), on the proposed updates to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality (Bay-Delta Plan). We commend the Board on their efforts to improve conditions in the lower San Joaquin River Basin as a result of the proposed changes to the Bay-Delta Plan. We understand the difficult task that the Board must undertake to balance, not only the San Joaquin River Basin, but the Central Valley system as a whole. NMFS appreciates the opportunity to engage in pre-consultation technical assistance by submitting these comments on the revised draft SED.

NMFS is responsible for the administration of the Endangered Species Act of 1973 (ESA), as amended [16 U.S.C. 1531 et seq.] with regards to ESA listed anadromous fish species. Listed species and critical habitat that are directly affected by this activity include federally threatened California Central Valley (CCV) steelhead (*Oncorhynchus mykiss*) and their designated critical habitat and federally threatened Central Valley (CV) spring-run Chinook salmon (*O. tshawytscha*). Additionally, NMFS has the responsibility of administering the Magnuson-Stevens Fishery Conservation and Management Act (MSA) for essential fish habitat (EFH) for Pacific Coast Salmon. The San Joaquin River Basin is designated EFH for Pacific Coast Salmon, which includes the CV spring-run Chinook salmon Evolutionarily Significant Unit (ESU) and fall/late-run Chinook salmon ESU (*O. tshawytscha*). The CV spring-run Chinook salmon were previously extirpated from the San Joaquin River Basin. However, the San Joaquin River Restoration Program (SJRRP), was established as a result of the Stipulation of Settlement in *NRDC, et al., v. Kirk Rogers, et al.,* to reintroduce CV spring-run to this historic range of the species. NMFS has designated CV spring-run Chinook salmon as a Non-essential Experimental Population in the SJRRP Area, which extends from the confluence of the Merced River to Friant Dam. Outside of the SJRRP Area, (*i.e.* downstream of the confluence of the Merced River, including the eastside tributaries), the reintroduced fish and their progeny become part of the CV spring-run Chinook ESU.

Below, we have summarized NMFS' main concerns regarding the draft revised SED. Enclosed with this letter are more detailed comments and supplemental attachments to support our concerns:

1) **40% Default and 30-50% Unimpaired Flow Range**. NMFS believes an unimpaired flow of 60% would be most protective of fish and wildlife beneficial uses, however, we recognize the Board's determination to adaptively manage a 30-50% range and a 40% starting point based on other beneficial uses. According to our assessment, a 40% of unimpaired flow on the Stanislaus River would be slightly higher than the minimum February to June flow on the Stanislaus River required by the 2009 Biological Opinion on the *Long-Term Operations of the Central Valley Project and State Water Project* (2009 NMFS BiOp). In addition, the 40% scenario would appear to improve flows on the Tuolumne and Merced rivers compared to existing flow requirements.

2) **Year-Round Flow Schedule**. Flows are needed year-round, not just the February to June period, to support all CCV steelhead and Chinook salmon life stages and their habitat needs. Fall-run Chinook salmon have instream flow needs from October through June, while spring-run Chinook salmon and CCV steelhead have instream flow needs year-round. We recommend assigning a default year-round flow schedule for each tributary consistent with the default 40% unimpaired flow in February through June, and also include default flow criteria at Vernalis to further support salmonid outmigration. Assigning a default year round schedule is essential to ensure there are not unintended consequences to species in other times of year, as a result of increasing flows in the late winter and spring.

3) **Reservoir Constraints**. Reservoir constraints similar to those assumed in the modeling must be included as standards in the Water Quality Control Plan in order for the program to work. The Water Supply Effects spreadsheet modeling set some constraints for carryover storage, minimum water deliveries, and refill-after-drought provisions in order to limit the frequency of severe reservoir drawdown and associated impacts to water temperatures, deliveries, and ability to meet instream flow requirements. However, those constraints are not currently proposed as a requirement in the Water Quality Control Plan, either in Table 3 or in the Program of Implementation. Without some certainty that the assumed or comparable constraints will be in effect, the modeled flows, temperatures, and water deliveries cannot be reasonably assumed to occur.

4) **Environmental Baseline of Chinook salmon and CCV steelhead in the San Joaquin River Basin.** NMFS continues to be concerned about the poor instream conditions in the San Joaquin River Basin that contribute to the low abundance of anadromous fish species. The Environmental Protection Agency will be requesting consultation from NMFS at a later time for the approval of the implementation program for Phase 1. NMFS will be required to ensure Phase I will not jeopardize the continued existence of listed species under NMFS jurisdiction. In order to analyze the effects of this project, the current "baseline" condition is determined, and the current project effects as well as expected future effects, are analyzed.

5) **Adaptive Management**. NMFS supports the use of adaptive management, however, the Board should provide more clear direction in the adaptive management process. The decision making process should be well defined with clear guidance, for example, that any adjustment of protective measures should be linked to observed population trends and conditions needed to meet the narrative fish and wildlife protection objectives.

6) **Protecting flow through the San Joaquin River and Delta.** It is important for there to be adequate flows at Vernalis for outmigrating salmonids and the scientific basis for the minimum base flow in the revised SED appears unclear. We suggest a higher range of minimum flows at Vernalis, particularly during the April-May period. Current survivals in this corridor are very low, and significant improvements are needed. The San Joaquin River and Delta are major migratory corridors for upstream and downstream migrating salmonids. We recommend that the Board protect the unimpaired flow released from each of the tributaries and provide that protection not only to Vernalis but also through the entire Delta for the success and survival of anadromous fish species.

7) **Agricultural Economic Effects.** The analysis of agricultural production forecasts that dedicating 40% of unimpaired flows to environmental purposes would lead to a less than three percent change in regional economic output and employment. We believe the forecasted economic impacts likely overstate the true impacts, as these estimates are the upper bound of job and output losses, and in addition, the context for the forecasted change within the regional economy is absent from the analysis.

We thank you for the opportunity to provide these comments to the Board. We look forward to continue working with the Board and other stakeholders in the Bay-Delta Plan process. If you have any questions regarding this correspondence or if NMFS can provide further assistance, please contact Monica Gutierrez in our California Central Valley Office at (916) 930-3657 or via email at Monica.Gutierrez@noaa.gov.

Sincerely,

Maria Rea
Assistant Regional Administrator
California Central Valley Office

Enclosures
1. NMFS California Central Valley Office Comments
2. Southwest Fisheries Science Center's Comments
3. Excerpt from 2009 NMFS BiOp: Appendix 2-E – Stanislaus River Minimum Flows for Fish Needs

Literature cited:

National Marine Fisheries Service (NMFS). 2009. Biological Opinion and Conference Opinion on the Long-term Operations of the Central Valley Project and State Water Project. Southwest Region.

cc: To the File: 151405-WCR2016-SA00002

National Marine Fisheries Service, West Coast Region
California Central Valley Office

Comments on the State Water Resources Control Board's
Draft Revised Substitute Environmental Document Phase 1 - 2016 Bay-Delta Plan

Environmental Baseline of Chinook salmon and CCV steelhead in the San Joaquin River Basin

The Environmental Protection Agency will be requesting ESA section 7 consultation from NMFS at a later time. In order to analyze the effects of this project, the Section 7 consultation will take into account the current "baseline" conditions, and the expected effects of the proposed action, both at the time of implementation and in the future. Through this consultation, NMFS will be required to ensure that Phase I will not jeopardize the continued existence of listed species under NMFS jurisdiction. The NMFS Central Valley Recovery Domain 5-Year Review of California Central Valley steelhead Distinct Population Segment (DPS) concluded that CCV steelhead remain listed as threatened, and that the DPS is likely to become endangered within the foreseeable future throughout all or a significant portion of its range (NMFS 2016). The CCV steelhead in the San Joaquin River Basin are currently not considered a viable population. Poor baseline conditions in the San Joaquin River Basin contribute to the low abundance of anadromous fish species, including CCV steelhead. Thus, significant improvements are needed to reverse these conditions within the foreseeable future.

Flow Related Salmonid Stressors

The NMFS (2014) Recovery Plan identified many threats (stressors) to listed salmonids in the Central Valley and the San Joaquin River and eastside tributaries (Stanislaus, Tuolumne, and Merced rivers) that are related to salmonid flow requirements. Several of the threats of **High** importance identified for the Southern Sierra Diversity group (San Joaquin River Basin) involve ***direct*** impacts to salmonids and their habitats from flow alterations during every life stage. Several threats that are ***indirectly*** related to flow were also identified in the Recovery Plan, such as: high water temperature, loss of natural river morphology and function, loss of riparian habitat and instream cover, predation, and poor water quality. Inadequate flow in the San Joaquin River Basin is a primary threat to CCV steelhead and Chinook salmon (NMFS 2014). The NMFS has identified flow-related recovery actions needed to ameliorate these stressors, including: releases to support all CCV steelhead life history stages, dedicated instream flows for fish, assessment of the benefits of pulse attraction flows for adult steelhead, and negotiation of water right purchases and/or increased flow releases. Inadequate flow in the San Joaquin River Basin results in multiple stressors for CCV steelhead and Chinook salmon (NMFS 2014), and the adverse effects of these stressors could be alleviated with higher flows.

Climate Change

Climatological model predictions indicate that it is likely that climate change will result in some direct and indirect adverse effects to salmonids. Multiple predictions indicate that water supply in the Central Valley is likely to decrease throughout the 21st century as warming trends continue. The combination of low precipitation and high ambient air temperatures favor elevated stream temperatures, further impacting salmonids in the future. Drought cycles in the San

Joaquin River Basin, including the severe drought during 2012 through 2015, have reduced the already limited habitat quality and range for CCV steelhead. The frequency of these drought events is predicted to increase (NMFS 2016). The NMFS remains concerned that because of the current low levels of abundance and productivity, some populations may not be able to recover during long dry spells, and re-establishment of these populations may be difficult due to the already degraded habitat conditions. Given these predictions, NMFS expects that substantial efforts will be required in order to reverse declining abundance trends.

Year-round Flow Schedule

NMFS appreciates the Board's improvements on their proposed flows in the revised SED. The Board has proposed a flow objective of 30 to 50% of unimpaired flow, with a starting flow of 40% of unimpaired flow, from February to June for the Stanislaus, Tuolumne, and Merced rivers. However, a year-round flow schedule is necessary to protect all the life stages for ESA listed CCV steelhead and for Chinook salmon. While CV Fall-run Chinook salmon have instream flow needs from October through June, listed CV spring-run Chinook and CCV steelhead have instream flow needs year-round. Year-round flows could be protective for each salmonid life-stage: adult migration, spawning, egg incubation, juvenile rearing, and smoltification.

We understand there is a paucity of data for CCV steelhead in the Central Valley, especially in the San Joaquin River Basin. However, it is known that CCV steelhead may remain in freshwater for a year or more before migrating to the ocean, and thus year-round flows are needed to maintain suitable habitat and temperature conditions in order to mitigate for the loss of access to cold-water habitat blocked by dams. In addition, observations at the fish counting weirs on the Stanislaus River indicate that CCV steelhead enter the river as early as October. This timing coincides with the release of fall attraction flows that provide cooler water and flow cues for CCV steelhead and fall-run Chinook salmon. Thus it is recommended to provide an unimpaired flow schedule beyond the February through June period. An example of a year-round flow schedule on the Stanislaus River is provided in Enclosure 3 (*Appendix 2-E Stanislaus River Minimum Flows for Fish Needs)*. This flow schedule is one of a suite of actions deemed necessary to avoid jeopardy for CCV steelhead as part of the 2009 Biological Opinion on the *Long-Term Operations of the Central Valley Project and State Water Project* (NMFS 2009). Many of the features in the schedule (fall and spring pulse flows, winter storm pulses, see Figure 1) could be achieved using the percent of unimpaired flow approach proposed for the February to June period. We urge the Board to consider setting a percent of unimpaired flow approach based year-round flow standard for each of the tributaries.

Lastly, there have been some discussions at recent hearings about whether or not June could be omitted from the current February to June period for implementing the unimpaired flow approach. While NMFS agrees that in some years Delta conditions by mid- to late June may not be suitable for salmonids, and that should be considered in the adaptive shaping of flows, protecting the "tails" of the outmigration distribution can be important for population resilience. In addition, June represents a significant contribution to unimpaired inflow in the snowmelt-driven southern Sierra. Therefore, June inflow should not be excluded from the annual water budget.

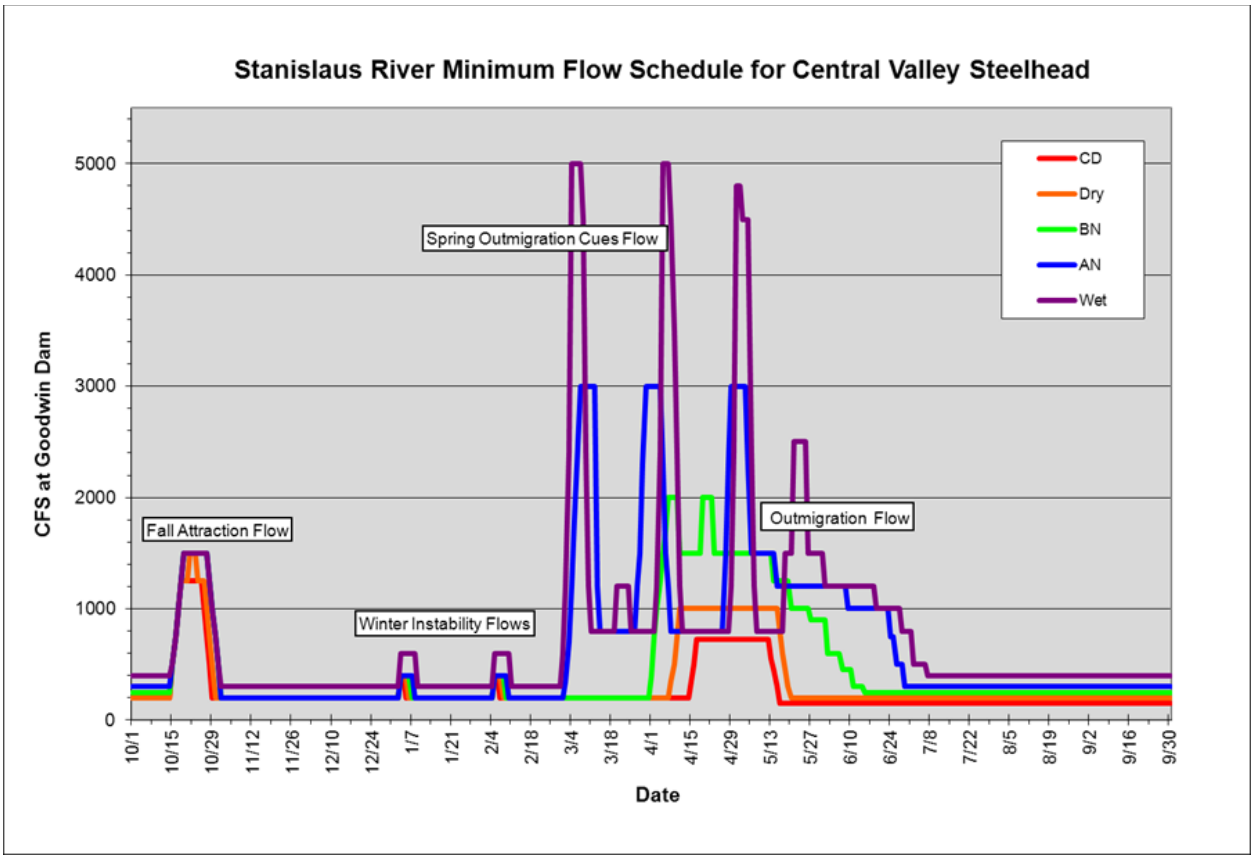

Figure 1. Graphic depiction of Stanislaus River Minimum Flows for Fish Needs (2-E).

40% Default and 30-50% Unimpaired Flow Range

The Board has incorporated some important updates into the revised draft SED from their 2012 draft. Again, those updates include a numeric flow objective with a required percent of unimpaired flow range from 30% to 50%, with a starting flow at 40% of unimpaired flow. In addition, adaptive implementation of the flow schedule will allow flow shifting in time and shape to provide the greatest benefits to fish and wildlife.

The NMFS believes an unimpaired flow of 60% would be more protective of fish and wildlife. However, we recognize the Board's determination to adaptively manage a 30-50% range and a 40% starting point based on other beneficial uses. According to our assessment, 40% of unimpaired flow on the Stanislaus River would be slightly higher than the minimum February to June flow on the Stanislaus River required by the 2009 Biological Opinion on the *Long-Term Operations of the Central Valley Project and State Water Project* (NMFS 2009). In addition, the 40% scenario would appear to improve flows on the Tuolumne and Merced rivers compared to existing flow requirements. We support the Board's efforts to improve conditions in the San Joaquin River Basin and their proposed range of unimpaired flows.

The scientific basis for the proposed range of 30% to 50%, with a starting point at 40% of unimpaired flow is not clear and NMFS remains concerned that the proposed levels of flow continue to be too low and not protective enough for anadromous fish species. The proposed percent of unimpaired flow (40%) is likely insufficient to support recovery in the eastside tributaries. The Stanislaus River is the only one of the three tributaries that currently outputs flows close to 40%, and while it has the highest fall-run Chinook salmon escapement of the three tributaries, the majority of spawners are strays of hatchery origin, indicating that the current flow regime is still inadequate for natural reproduction.

Lastly, we recommend to the Board to consider the "shaping" and variability of the hydrograph when incorporating the unimpaired flow. Shaping the unimpaired flow (magnitude, timing, and frequency) plays an important role in the survival and resilience of salmonid populations. In addition, the variability of flows is also beneficial for salmonids. The San Joaquin salmonid populations occupy an important spatial diversity component of the Central Valley populations. There are data that support the importance of interpopulation diversity for the stability of salmonid populations (Carlson and Satterthwaite 2011). Variable flows stimulate outmigration of salmonids at different sizes to promote diversity and increase the resilience of returning adults.

Reservoir Constraints

The Water Supply Effects spreadsheet modeling effort set some reservoir constraints for carryover storage, minimum water deliveries, and refill-after-drought provisions in order to limit the frequency of severe reservoir drawdown and associated impacts to water temperatures, deliveries, and ability to meet instream flow requirements. However, those constraints (Table F.1.2-23c excerpted below) are not currently proposed as a requirement in the Water Quality Control Plan (WQCP), either in Table 3 or in the Program of Implementation. Without some certainty that the assumed or comparable constraints will be in effect, the modeled flows, temperatures, and water deliveries cannot be reasonably assumed to occur. NMFS recommends that the Board include similar constraints in Table 3 of the WQCP.

Table F.1.2-23c. Minimum Diversion, Minimum September Carryover Guideline, Maximum Draw from Storage, and Flow Shifting for the Merced River

	Baseline	20% Unimpaired Flow	30% Unimpaired Flow	40% Unimpaired Flow	50% Unimpaired Flow	60% Unimpaired Flow
Minimum District Diversion (TAF, % of District Max)	0 TAF	78 TAF (15%)	78 TAF (15%)	78 TAF (15%)	78 TAF (15%)	78 TAF (15%)
Minimum September Carryover Guideline (TAF)	115 TAF	300	300	300	300	300
Maximum Storage Draw (% of Mar 1 minus Sep guideline)	80%	70%	60%	50%	45%	35%
Shifting to Fall[a]	NA	None	None	Yes	Yes	Yes
Drought End Storage Refill	NA	100%	100%	100%	50%	50%
Vernalis Minimum[b] Feb–Jun (cfs)	D-1641/ VAMP	1000	1000	1000	1000	1000

TAF = thousand acre feet

cfs = cubic feet per second

[a] In the alternatives, the shifting of a portion of unimpaired flow requirement was completed during wet years, designed to allow only a percentage of diversions in the qualifying years (if storage was within 10% of the guideline September storage and inflow was projected to be higher than average).

[b]For unimpaired flow alternatives, the Merced River is assumed to provide 24 percent of additional releases necessary to meet the Vernalis minimum flow requirement based on its long-term fraction of unimpaired flow among the three eastside tributaries.

Adaptive Management

There is a need for additional description and development of the adaptive management process. The Board proposes to task the management of the Vernalis base flow and percent of unimpaired flow, to the Stanislaus, Tuolumne, and Merced Working Group (STM Working Group). The assumption is that the STM Working Group will use adaptive management to implement the Board's plan to achieve biological goals that benefit fish and wildlife while incorporating the expertise and opinions of all of the stakeholders involved. While NMFS recognizes the value of collaboration, we have several concerns. The STM Working Group's purpose, requirements, structure, assets, and authority is vague. The NMFS does not recommend deferring the protocols and details of the process entirely to the STM Working Group. Rather, said details should be described by the Board. The NMFS also is concerned that the STM Working Group may not be able to come to consensus on anything but the default 40% = of unimpaired flow. The Board needs to provide clear biological goals and objectives that can guide the working group as it manages within the adaptive range, and implement flexibilities such as flow shifting. Importantly, the STM Working Group will need a way to measure those biological goals and objectives.

Protecting flow through the San Joaquin River and Delta

Protecting flow
The revised Water Quality Control Plan (Appendix K, p. 28) states that the "State Water Board will exercise its water rights and water quality authority to help ensure that the flows required to meet the lower San Joaquin River flow objectives are used for their intended purpose and are not diverted for other purposes." This is critical because downstream diversion of flows for other purposes will lessen the benefit to the intended fish and wildlife beneficial uses. The Board should clarify how it will ensure that flows are used for their intended purposes.

Vernalis Minimum Base Flow
The Board has proposed a Vernalis flow requirement with an adaptive range of 800 to 1200 cubic-feet-per-seconds (cfs), which establishes a minimum flow in the event that the percent of unimpaired flow would have resulted in decreased flow released, such as in critically dry years. The scientific basis or rationale for the minimum base flow range of 800 to 1200 cfs is unclear. NMFS believes that the minimum base flows are biologically insufficient, and it is important for there to be adequate flows at Vernalis to be protective of outmigrating salmonids. Therefore, we suggest a higher range of minimum flows at Vernalis, particularly during the April-May period.

While there are not instances of consistent large-scale flow releases intended to benefit fish since the installment of the Central Valley rim dams, there is some evidence that anadromous fish populations in the Central Valley do respond positively to timely increased flows. Small, variable flow experiments have been conducted, such as the Vernalis Adaptive Management Plan (VAMP), and have demonstrated a high positive correlation between managed spring-time pulse flows and adult escapement returns 2.5 years afterwards. This demonstrates that increased flow at the right times can yield results, which is the purpose of the Board formally allocating some of the unimpaired flow for fishes during the spring-time melt. However, that study, and other modeling efforts, as detailed in Appendix C of SWRCB's 2016 review, suggest that a Vernalis base flow of about 5,000 cfs would be necessary to elicit positive, consistent population growth. And to reach such a base flow, about 60% of unimpaired flow would be required (as estimated by SWRCB). The proposed 800 to 1,200 cfs base flow at Vernalis and 40% unimpaired flow (with a cap at 50% for Alternative Plan 3) is therefore insufficient. While the data may be sparse, multiple estimates of base flow at Vernalis are fairly consistent and suggest that these values (5,000 cfs and 60% unimpaired flow) are a good starting point to maintain viable salmonid populations in these tributaries.

Other General Comments

Water Quality Objectives for Fish and Wildlife Beneficial Uses (Narrative Objective)
In our 2013 comment letter to the Board, we provided recommendations on the language in the narrative objective. However, our recommendations were not incorporated into the revised narrative objective. The narrative objective remains vague and lacks the incorporation of the default requirement for 40 % of unimpaired flow. Additionally, we would like to see language regarding a year-round flow schedule and quantitative measures incorporated into the narrative objective.

7-day Running Average

We appreciate that the Board changed the "implementation window" from a 14-day running average in the first draft SED to a 7-day running average in this revised SED. This is closer to the recommendation we made in our 2013 comment letter for an even shorter period of three to five days, with no limit on maximum flows. Our recommendation of a shorter period of three to five days would achieve a more natural hydrograph.

Literature cited:

Carlson. S.M. and W.H. Satterthwaite. 2011. Weakened Portfolio Effect in a Collapsed Salmon Population Complex. Can. J. Fish. Aquat. Sci. Vol. 68, 2011.

National Marine Fisheries Service (NMFS). 2009. Biological Opinion and Conference Opinion on the Long-term Operations of the Central Valley Project and State Water Project. Southwest Region.

National Marine Fisheries Service (NMFS). 2014. Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of California Central Valley Steelhead. California Central Valley Area Office. July 2014.

National Marine Fisheries Service (NMFS). 2016. 5-Year Review: Summary and Evaluation of California Central Valley Steelhead Distinct Population Segment. NOAA.

Review of Economic Analysis Contained in State Water Resource Control Board's Phase 1 Substitute Environmental Document (SED)

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December 14, 2016

This review covers portions of the Economic Analysis presented in Chapter 20 "Economic Analysis" and Appendix G "Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives: Methodology and Modeling Results" of the draft revised SED. This review covers the analysis of the forecasted effects of proposed Lower San Joaquin tributary flows on regional agricultural production and the resultant local economic impacts. This review does not cover the analysis of potential effects on municipal and industrial water supplies nor does it cover the analysis of potential effects on hydropower generation.

Summary of SED Economic Analysis

The analysis of agricultural production forecasts that:

- Dedicating 20 percent of unimpaired flows to environmental purposes would lead to a less than one percent change in regional economic output and employment
- Dedicating 40 percent of unimpaired flows to environmental purposes would lead to a less than three percent change in regional economic output and employment
- Dedicating 60 percent of unimpaired flows to environmental purposes would lead to an approximately 8 percent change in regional economic output an employment

The analysis occurs in three steps.

(1) Generate estimates of applied water available for diversions using estimates of allowable surface water diversions for each policy alternative and a baseline state (2009 is used as the base year). This is done using the State Water Board's Water Supply Effects model (WSE).

(2) Estimate agricultural acreage and revenue by crop for each alternative. This is done using the UC-Davis group's Statewide Agricultural Production model (SWAP).

(3) Estimate regional economic impact (employment, output, and government fiscal impacts) for each alternative. This is done using IMPLAN software and its input-output model.

Comments

1. The methods used in the economic analysis are consistent with standard economic practice.

Overall, the methods used to generate the economic impacts seem to be consistent with standard practice. The SWAP model used to estimate acreage and revenue is the same model used to generate the popular series of annual drought impact estimates produced by UC Davis.

2. The forecasted economic impacts likely overstate the true impacts of the proposed alternatives

When interpreting the results of the economic analysis it is important to note that the results likely represent an upper bound on job and output losses. It is unlikely that any observed impacts of the proposed policies will be larger than the forecasted values. That is, the forecasted impacts contained in the SED are likely greater in magnitude than what the effects will be in practice.

Two points support this assertion:

1. Input-output analysis (the IMPLAN component of the SED economic analysis) generally overestimates the impact of changes in production. The SED economic analysis acknowledges this (see Appendix G, page G-63). Input-output analysis imposes fairly rigid assumptions that businesses cannot find alternative ways to employ resources and that the relative prices of goods do not change in response to changes in economic conditions (see, for example, Midmore 1993 or Berck and Hoffman 2002).

2. Retrospective analyses show that the SWAP-IMPLAN method of estimating the economic impacts of changes in water supply overstated those impacts during the 2009 drought. Initial estimates of the projected impacts of policy actions, including changes in water supply, are rarely checked for accuracy after the fact. However, in the case of the 2009 drought and Delta export restrictions some retrospective analysis exists.

Table 1 summarizes successively updated estimates of revenue and job losses due to the export restrictions produced by the SWAP and IMPLAN models.

Table 1. Impact estimates for 2009 San Joaquin water supply reductions generated by SWAP-IMPLAN method (reproduced from Table 1 in Howitt et al 2011)

Date	Revenue (Million $)	Acres Fallowed	Jobs Lost
May 2009	710	450,000	21,000
September 2009	710	450,000	21,000
September 2010	370	270,000	7,500

Economist Jeffrey Michael provided alternative *ex ante* and *ex post* estimates that are summarized in Table 2. These results were also produced with IMPLAN, but did not use SWAP to estimate changes in acreage.

Table 2. Impact estimates for 2009 San Joaquin water supply reductions generated by county crop report data and IMPLAN

Date	Farm Revenue Lost (Million $)	Total Jobs Lost
August 2009	732	10,878 - 12,319
August 2009	627 - 710	11,324 - 12,823
August 2009	--	9,840 - 12,835
December 2009	--	7,000 - 10,000
September 2010	343	5,600

An additional retrospective check on changes in employment due to changes in water supply from the Delta was provided by economist David Sunding and others. Sunding et al (2011) estimate a very simple regression model with employment as function of CVP and SWP deliveries by county. Their results estimate 4,965 lost agricultural jobs due to Delta export restrictions in 2009.

Three conclusions can be drawn from the preceding sequence of results. First, both *ex ante* and *ex post* results vary considerably. This is due to different assumptions, methods, and in some cases different data sources. Second, the SWAP-IMPLAN estimates are always higher than alternatives estimates by Michael. Third, as more information becomes available on observed employment outcomes estimated impacts decrease. The most updated *ex ante* projection by SWAP-IMPLAN of total job losses from May 2009 is 2.8 times greater than the retrospective analysis in 2010.

None of this implies that the estimates of economic impacts from the SWAP and IMPLAN models are not useful. IMPLAN is widely used as a planning tool in many applications and is a standard method. The SWAP model has been used previously in water resources planning exercises in general. The positive math programming approach upon which is based is also frequently used and is grounded in accepted economic theory. It is important, however, to keep in mind that these tools predict outcomes of uncertain processes, but are not able to provide estimates of the degree of uncertainty surrounding those predictions.

3. Context for the forecasted changed within the regional economy is absent from the analysis

Though the SED economic analysis appears to be performed correctly and consistently with standard practice, it fails to put the magnitude of the forecasted employment and output changes into the context of the larger regional economy. For some of this context, we can look at historical water diversions and employment data to see if large job losses occurred in years where the volume of diversions was reduced from the previous year. Historical diversions data can be constructed using flows at specific USGS gauges on the Stanislaus, Tuolumne, and Merced Rivers[1]. These flow records do not represent all diversions in the study area (diversions

[1] OID/SSJID North (USGS Gage #11300500), OID South (USGS Gage #11301000), SEWD/CSJWCD, Modesto ID (USGS Gage # 11289000),Turlock ID (USGS Gage #11289500). Merced ID diversions from October 1969 – September 2006 are from the Merced ID operations model.

by riparian rights holders and smaller districts are not included), but we can construct a time series of OID, SSJID, MID, and TID diversions from 1990-2013 and diversions from Merced ID, SEWD, and SJWCD from 1998-2006. The California Employment Development Department provides historical employment data by industry for all counties in California.

Between 1991 and 2013, we observe 11 years when diversions on the Stanislaus and Tuolumne Rivers (by OID, SSJID, MID, and TID) declined from the previous year. These declines averaged about 6.5 percent relative to the previous years. In those 11 years, total employment across the three county study area declined in only two years – 2008 and 2009, the years most affected by the national recession and the national and local housing price collapse. In those 11 years, the average change in total employment was an increase of just under one percent. Further, observed diversions from the Stanislaus and Tuolumne Rivers declined by magnitudes similar to the differences between LSJR Alternative 3 (40 percent of unimpaired flows left in the river) in two years: by 14 percent in 1991 (a critically dry year) and by 16 percent in 1998 (a wet year). Total regional employment increased in both years (by 2 and 3 percent respectively).

Between 1999 and 2006, we observe 4 years when reported diversions on all three rivers declined. The decline in diversion volume averaged just under 4 percent. Total employment across the three county study area did not decline in any of these nine years. The average change in total employment was just under 2 percent. Further, observable diversions in all three rivers declined by 13 percent in 1998. Total regional employment increased by 3 percent.

This analysis does not imply that there will be no adverse employment impacts to reductions in allowable diversions. In fact, lower agricultural employment is observed in some years where diversions are reduced[2]. The economic analysis presented in the SED indicates that total regional employment will be lower than it would otherwise be as a result of improved instream flow conditions for fish. This is a plausible result given that inexpensive irrigation water is a key input to local agricultural production. However, past changes in local water diversions and coincident employment changes have not been associated with disruptions in the local labor market.

[2] Note that farm/nonfarm employment is defined differently in the EDD data than in the SED economic analysis. EDD county employment is reported as farm employment and nonfarm employment. EDD farm employment data includes both direct employment by farms and employment by farm contractors. The SED model classifies changes in farm contractors as an indirect impact. Therefore it is difficult to directly compare the direct and indirect/induced impacts in the SED analysis to the farm/nonfarm data in the EDD data.

Literature Cited:

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Appendix 2-E

Stanislaus River Minimum Flows for Fish Needs

Stanislaus River Minimum Fish Flow Schedule
Water Year Type: Critically Dry

OCT	CFS	NOV	CFS	DEC	CFS	JAN	CFS	FEB	CFS	MAR	CFS
1	200	1	200	1	200	1	200	1	200	1	200
2	200	2	200	2	200	2	200	2	200	2	200
3	200	3	200	3	200	3	400	3	200	3	200
4	200	4	200	4	200	4	400	4	200	4	200
5	200	5	200	5	200	5	200	5	400	5	200
6	200	6	200	6	200	6	200	6	400	6	200
7	200	7	200	7	200	7	200	7	200	7	200
8	200	8	200	8	200	8	200	8	200	8	200
9	200	9	200	9	200	9	200	9	200	9	200
10	200	10	200	10	200	10	200	10	200	10	200
11	200	11	200	11	200	11	200	11	200	11	200
12	200	12	200	12	200	12	200	12	200	12	200
13	200	13	200	13	200	13	200	13	200	13	200
14	200	14	200	14	200	14	200	14	200	14	200
15	500	15	200	15	200	15	200	15	200	15	200
16	750	16	200	16	200	16	200	16	200	16	200
17	1000	17	200	17	200	17	200	17	200	17	200
18	1250	18	200	18	200	18	200	18	200	18	200
19	1250	19	200	19	200	19	200	19	200	19	200
20	1250	20	200	20	200	20	200	20	200	20	200
21	1250	21	200	21	200	21	200	21	200	21	200
22	1250	22	200	22	200	22	200	22	200	22	200
23	1250	23	200	23	200	23	200	23	200	23	200
24	1250	24	200	24	200	24	200	24	200	24	200
25	1250	25	200	25	200	25	200	25	200	25	200
26	1000	26	200	26	200	26	200	26	200	26	200
27	750	27	200	27	200	27	200	27	200	27	200
28	500	28	200	28	200	28	200	28	200	28	200
29	200	29	200	29	200	29	200			29	200
30	200	30	200	30	200	30	200			30	200
31	200			31	200	31	200			31	200

APR	CFS	MAY	CFS	JUN	CFS	JUL	CFS	AUG	CFS	SEP	CFS
1	200	1	725	1	150	1	150	1	150	1	150
2	200	2	725	2	150	2	150	2	150	2	150
3	200	3	725	3	150	3	150	3	150	3	150
4	200	4	725	4	150	4	150	4	150	4	150
5	200	5	725	5	150	5	150	5	150	5	150
6	200	6	725	6	150	6	150	6	150	6	150
7	200	7	725	7	150	7	150	7	150	7	150
8	200	8	725	8	150	8	150	8	150	8	150
9	200	9	725	9	150	9	150	9	150	9	150
10	200	10	725	10	150	10	150	10	150	10	150
11	200	11	725	11	150	11	150	11	150	11	150
12	200	12	725	12	150	12	150	12	150	12	150
13	200	13	550	13	150	13	150	13	150	13	150
14	200	14	450	14	150	14	150	14	150	14	150
15	350	15	300	15	150	15	150	15	150	15	150
16	500	16	150	16	150	16	150	16	150	16	150
17	725	17	150	17	150	17	150	17	150	17	150
18	725	18	150	18	150	18	150	18	150	18	150
19	725	19	150	19	150	19	150	19	150	19	150
20	725	20	150	20	150	20	150	20	150	20	150
21	725	21	150	21	150	21	150	21	150	21	150
22	725	22	150	22	150	22	150	22	150	22	150
23	725	23	150	23	150	23	150	23	150	23	150
24	725	24	150	24	150	24	150	24	150	24	150
25	725	25	150	25	150	25	150	25	150	25	150
26	725	26	150	26	150	26	150	26	150	26	150
27	725	27	150	27	150	27	150	27	150	27	150
28	725	28	150	28	150	28	150	28	150	28	150
29	725	29	150	29	150	29	150	29	150	29	150
30	725	30	150	30	150	30	150	30	150	30	150
		31	150			31	150	31	150		

Stanislaus River Minimum Fish Flow Schedule
Water Year Type: Dry

OCT	CFS	NOV	CFS	DEC	CFS	JAN	CFS	FEB	CFS	MAR	CFS
1	200	1	200	1	200	1	200	1	200	1	200
2	200	2	200	2	200	2	200	2	200	2	200
3	200	3	200	3	200	3	400	3	200	3	200
4	200	4	200	4	200	4	400	4	200	4	200
5	200	5	200	5	200	5	400	5	400	5	200
6	200	6	200	6	200	6	200	6	400	6	200
7	200	7	200	7	200	7	200	7	400	7	200
8	200	8	200	8	200	8	200	8	200	8	200
9	200	9	200	9	200	9	200	9	200	9	200
10	200	10	200	10	200	10	200	10	200	10	200
11	200	11	200	11	200	11	200	11	200	11	200
12	200	12	200	12	200	12	200	12	200	12	200
13	200	13	200	13	200	13	200	13	200	13	200
14	200	14	200	14	200	14	200	14	200	14	200
15	500	15	200	15	200	15	200	15	200	15	200
16	750	16	200	16	200	16	200	16	200	16	200
17	1000	17	200	17	200	17	200	17	200	17	200
18	1250	18	200	18	200	18	200	18	200	18	200
19	1250	19	200	19	200	19	200	19	200	19	200
20	1250	20	200	20	200	20	200	20	200	20	200
21	1500	21	200	21	200	21	200	21	200	21	200
22	1500	22	200	22	200	22	200	22	200	22	200
23	1500	23	200	23	200	23	200	23	200	23	200
24	1250	24	200	24	200	24	200	24	200	24	200
25	1250	25	200	25	200	25	200	25	200	25	200
26	1250	26	200	26	200	26	200	26	200	26	200
27	1000	27	200	27	200	27	200	27	200	27	200
28	750	28	200	28	200	28	200	28	200	28	200
29	500	29	200	29	200	29	200			29	200
30	200	30	200	30	200	30	200			30	200
31	200			31	200	31	200			31	200

APR	CFS	MAY	CFS	JUN	CFS	JUL	CFS	AUG	CFS	SEP	CFS
1	200	1	1000	1	200	1	200	1	200	1	200
2	200	2	1000	2	200	2	200	2	200	2	200
3	200	3	1000	3	200	3	200	3	200	3	200
4	200	4	1000	4	200	4	200	4	200	4	200
5	200	5	1000	5	200	5	200	5	200	5	200
6	200	6	1000	6	200	6	200	6	200	6	200
7	200	7	1000	7	200	7	200	7	200	7	200
8	350	8	1000	8	200	8	200	8	200	8	200
9	500	9	1000	9	200	9	200	9	200	9	200
10	750	10	1000	10	200	10	200	10	200	10	200
11	1000	11	1000	11	200	11	200	11	200	11	200
12	1000	12	1000	12	200	12	200	12	200	12	200
13	1000	13	1000	13	200	13	200	13	200	13	200
14	1000	14	1000	14	200	14	200	14	200	14	200
15	1000	15	1000	15	200	15	200	15	200	15	200
16	1000	16	800	16	200	16	200	16	200	16	200
17	1000	17	600	17	200	17	200	17	200	17	200
18	1000	18	450	18	200	18	200	18	200	18	200
19	1000	19	300	19	200	19	200	19	200	19	200
20	1000	20	200	20	200	20	200	20	200	20	200
21	1000	21	200	21	200	21	200	21	200	21	200
22	1000	22	200	22	200	22	200	22	200	22	200
23	1000	23	200	23	200	23	200	23	200	23	200
24	1000	24	200	24	200	24	200	24	200	24	200
25	1000	25	200	25	200	25	200	25	200	25	200
26	1000	26	200	26	200	26	200	26	200	26	200
27	1000	27	200	27	200	27	200	27	200	27	200
28	1000	28	200	28	200	28	200	28	200	28	200
29	1000	29	200	29	200	29	200	29	200	29	200
30	1000	30	200	30	200	30	200	30	200	30	200
		31	200			31	200	31	200		

Stanislaus River Minimum Fish Flow Schedule
Water Year Type: Below Normal

OCT	CFS	NOV	CFS	DEC	CFS	JAN	CFS	FEB	CFS	MAR	CFS
1	250	1	200	1	200	1	200	1	200	1	200
2	250	2	200	2	200	2	200	2	200	2	200
3	250	3	200	3	200	3	400	3	200	3	200
4	250	4	200	4	200	4	400	4	200	4	200
5	250	5	200	5	200	5	400	5	400	5	200
6	250	6	200	6	200	6	400	6	400	6	200
7	250	7	200	7	200	7	200	7	400	7	200
8	250	8	200	8	200	8	200	8	400	8	200
9	250	9	200	9	200	9	200	9	200	9	200
10	250	10	200	10	200	10	200	10	200	10	200
11	250	11	200	11	200	11	200	11	200	11	200
12	250	12	200	12	200	12	200	12	200	12	200
13	250	13	200	13	200	13	200	13	200	13	200
14	250	14	200	14	200	14	200	14	200	14	200
15	500	15	200	15	200	15	200	15	200	15	200
16	750	16	200	16	200	16	200	16	200	16	200
17	1000	17	200	17	200	17	200	17	200	17	200
18	1250	18	200	18	200	18	200	18	200	18	200
19	1500	19	200	19	200	19	200	19	200	19	200
20	1500	20	200	20	200	20	200	20	200	20	200
21	1500	21	200	21	200	21	200	21	200	21	200
22	1500	22	200	22	200	22	200	22	200	22	200
23	1500	23	200	23	200	23	200	23	200	23	200
24	1500	24	200	24	200	24	200	24	200	24	200
25	1500	25	200	25	200	25	200	25	200	25	200
26	1500	26	200	26	200	26	200	26	200	26	200
27	1500	27	200	27	200	27	200	27	200	27	200
28	1250	28	200	28	200	28	200	28	200	28	200
29	1000	29	200	29	200	29	200			29	200
30	750	30	200	30	200	30	200			30	200
31	500			31	200	31	200			31	200

APR	CFS	MAY	CFS	JUN	CFS	JUL	CFS	AUG	CFS	SEP	CFS
1	400	1	1500	1	900	1	250	1	250	1	250
2	750	2	1500	2	600	2	250	2	250	2	250
3	1000	3	1500	3	600	3	250	3	250	3	250
4	1250	4	1500	4	600	4	250	4	250	4	250
5	1500	5	1500	5	600	5	250	5	250	5	250
6	1700	6	1500	6	600	6	250	6	250	6	250
7	2000	7	1500	7	450	7	250	7	250	7	250
8	2000	8	1500	8	450	8	250	8	250	8	250
9	2000	9	1500	9	450	9	250	9	250	9	250
10	2000	10	1500	10	450	10	250	10	250	10	250
11	1500	11	1500	11	300	11	250	11	250	11	250
12	1500	12	1500	12	300	12	250	12	250	12	250
13	1500	13	1500	13	300	13	250	13	250	13	250
14	1500	14	1250	14	300	14	250	14	250	14	250
15	1500	15	1250	15	250	15	250	15	250	15	250
16	1500	16	1250	16	250	16	250	16	250	16	250
17	1500	17	1250	17	250	17	250	17	250	17	250
18	1500	18	1250	18	250	18	250	18	250	18	250
19	2000	19	1250	19	250	19	250	19	250	19	250
20	2000	20	1000	20	250	20	250	20	250	20	250
21	2000	21	1000	21	250	21	250	21	250	21	250
22	2000	22	1000	22	250	22	250	22	250	22	250
23	1500	23	1000	23	250	23	250	23	250	23	250
24	1500	24	1000	24	250	24	250	24	250	24	250
25	1500	25	1000	25	250	25	250	25	250	25	250
26	1500	26	1000	26	250	26	250	26	250	26	250
27	1500	27	900	27	250	27	250	27	250	27	250
28	1500	28	900	28	250	28	250	28	250	28	250
29	1500	29	900	29	250	29	250	29	250	29	250
30	1500	30	900	30	250	30	250	30	250	30	250
		31	900			31	250	31	250		

Stanislaus River Minimum Fish Flow Schedule
Water Year Type: Above Normal

OCT	CFS	NOV	CFS	DEC	CFS	JAN	CFS	FEB	CFS	MAR	CFS
1	300	1	200	1	200	1	200	1	200	1	200
2	300	2	200	2	200	2	200	2	200	2	350
3	300	3	200	3	200	3	400	3	200	3	700
4	300	4	200	4	200	4	400	4	200	4	1200
5	300	5	200	5	200	5	400	5	400	5	1800
6	300	6	200	6	200	6	400	6	400	6	2300
7	300	7	200	7	200	7	400	7	400	7	3000
8	300	8	200	8	200	8	200	8	400	8	3000
9	300	9	200	9	200	9	200	9	400	9	3000
10	300	10	200	10	200	10	200	10	200	10	3000
11	300	11	200	11	200	11	200	11	200	11	3000
12	300	12	200	12	200	12	200	12	200	12	3000
13	300	13	200	13	200	13	200	13	200	13	1200
14	300	14	200	14	200	14	200	14	200	14	800
15	500	15	200	15	200	15	200	15	200	15	800
16	750	16	200	16	200	16	200	16	200	16	800
17	1000	17	200	17	200	17	200	17	200	17	800
18	1250	18	200	18	200	18	200	18	200	18	800
19	1500	19	200	19	200	19	200	19	200	19	800
20	1500	20	200	20	200	20	200	20	200	20	800
21	1500	21	200	21	200	21	200	21	200	21	800
22	1500	22	200	22	200	22	200	22	200	22	800
23	1500	23	200	23	200	23	200	23	200	23	800
24	1500	24	200	24	200	24	200	24	200	24	800
25	1500	25	200	25	200	25	200	25	200	25	800
26	1500	26	200	26	200	26	200	26	200	26	800
27	1500	27	200	27	200	27	200	27	200	27	1200
28	1250	28	200	28	200	28	200	28	200	28	1500
29	1000	29	200	29	200	29	200			29	2300
30	750	30	200	30	200	30	200			30	3000
31	500			31	200	31	200			31	3000

APR	CFS	MAY	CFS	JUN	CFS	JUL	CFS	AUG	CFS	SEP	CFS
1	3000	1	3000	1	1200	1	300	1	300	1	300
2	3000	2	3000	2	1200	2	300	2	300	2	300
3	3000	3	3000	3	1200	3	300	3	300	3	300
4	3000	4	3000	4	1200	4	300	4	300	4	300
5	2300	5	2300	5	1200	5	300	5	300	5	300
6	1500	6	1500	6	1200	6	300	6	300	6	300
7	1200	7	1500	7	1200	7	300	7	300	7	300
8	800	8	1500	8	1200	8	300	8	300	8	300
9	800	9	1500	9	1000	9	300	9	300	9	300
10	800	10	1500	10	1000	10	300	10	300	10	300
11	800	11	1500	11	1000	11	300	11	300	11	300
12	800	12	1500	12	1000	12	300	12	300	12	300
13	800	13	1500	13	1000	13	300	13	300	13	300
14	800	14	1500	14	1000	14	300	14	300	14	300
15	800	15	1200	15	1000	15	300	15	300	15	300
16	800	16	1200	16	1000	16	300	16	300	16	300
17	800	17	1200	17	1000	17	300	17	300	17	300
18	800	18	1200	18	1000	18	300	18	300	18	300
19	800	19	1200	19	1000	19	300	19	300	19	300
20	800	20	1200	20	1000	20	300	20	300	20	300
21	800	21	1200	21	1000	21	300	21	300	21	300
22	800	22	1200	22	1000	22	300	22	300	22	300
23	800	23	1200	23	1000	23	300	23	300	23	300
24	800	24	1200	24	750	24	300	24	300	24	300
25	800	25	1200	25	750	25	300	25	300	25	300
26	800	26	1200	26	500	26	300	26	300	26	300
27	1500	27	1200	27	500	27	300	27	300	27	300
28	2300	28	1200	28	500	28	300	28	300	28	300
29	3000	29	1200	29	300	29	300	29	300	29	300
30	3000	30	1200	30	300	30	300	30	300	30	300
		31	1200			31	300	31	300		

Stanislaus River Minimum Fish Flow Schedule
Water Year Type: Wet

OCT	CFS	NOV	CFS	DEC	CFS	JAN	CFS	FEB	CFS	MAR	CFS
1	400	1	300	1	300	1	300	1	300	1	600
2	400	2	300	2	300	2	300	2	300	2	1200
3	400	3	300	3	300	3	600	3	300	3	2400
4	400	4	300	4	300	4	600	4	300	4	5000
5	400	5	300	5	300	5	600	5	600	5	5000
6	400	6	300	6	300	6	600	6	600	6	5000
7	400	7	300	7	300	7	600	7	600	7	5000
8	400	8	300	8	300	8	600	8	600	8	4500
9	400	9	300	9	300	9	300	9	600	9	2400
10	400	10	300	10	300	10	300	10	600	10	1200
11	400	11	300	11	300	11	300	11	300	11	800
12	400	12	300	12	300	12	300	12	300	12	800
13	400	13	300	13	300	13	300	13	300	13	800
14	400	14	300	14	300	14	300	14	300	14	800
15	500	15	300	15	300	15	300	15	300	15	800
16	750	16	300	16	300	16	300	16	300	16	800
17	1000	17	300	17	300	17	300	17	300	17	800
18	1250	18	300	18	300	18	300	18	300	18	800
19	1500	19	300	19	300	19	300	19	300	19	800
20	1500	20	300	20	300	20	300	20	300	20	1200
21	1500	21	300	21	300	21	300	21	300	21	1200
22	1500	22	300	22	300	22	300	22	300	22	1200
23	1500	23	300	23	300	23	300	23	300	23	1200
24	1500	24	300	24	300	24	300	24	300	24	1200
25	1500	25	300	25	300	25	300	25	300	25	800
26	1500	26	300	26	300	26	300	26	300	26	800
27	1500	27	300	27	300	27	300	27	300	27	800
28	1250	28	300	28	300	28	300	28	300	28	800
29	1000	29	300	29	300	29	300			29	800
30	750	30	300	30	300	30	300			30	800
31	500			31	300	31	300			31	800

APR	CFS	MAY	CFS	JUN	CFS	JUL	CFS	AUG	CFS	SEP	CFS
1	800	1	4800	1	1200	1	800	1	400	1	400
2	800	2	4800	2	1200	2	500	2	400	2	400
3	1200	3	4500	3	1200	3	500	3	400	3	400
4	2400	4	4500	4	1200	4	500	4	400	4	400
5	5000	5	4500	5	1200	5	500	5	400	5	400
6	5000	6	2400	6	1200	6	500	6	400	6	400
7	5000	7	1200	7	1200	7	400	7	400	7	400
8	4500	8	800	8	1200	8	400	8	400	8	400
9	3500	9	800	9	1200	9	400	9	400	9	400
10	2400	10	800	10	1200	10	400	10	400	10	400
11	1200	11	800	11	1200	11	400	11	400	11	400
12	800	12	800	12	1200	12	400	12	400	12	400
13	800	13	800	13	1200	13	400	13	400	13	400
14	800	14	800	14	1200	14	400	14	400	14	400
15	800	15	800	15	1200	15	400	15	400	15	400
16	800	16	800	16	1200	16	400	16	400	16	400
17	800	17	800	17	1200	17	400	17	400	17	400
18	800	18	1500	18	1200	18	400	18	400	18	400
19	800	19	1500	19	1000	19	400	19	400	19	400
20	800	20	1500	20	1000	20	400	20	400	20	400
21	800	21	2500	21	1000	21	400	21	400	21	400
22	800	22	2500	22	1000	22	400	22	400	22	400
23	800	23	2500	23	1000	23	400	23	400	23	400
24	800	24	2500	24	1000	24	400	24	400	24	400
25	800	25	2500	25	1000	25	400	25	400	25	400
26	800	26	1500	26	1000	26	400	26	400	26	400
27	800	27	1500	27	1000	27	400	27	400	27	400
28	800	28	1500	28	800	28	400	28	400	28	400
29	1200	29	1500	29	800	29	400	29	400	29	400
30	2400	30	1500	30	800	30	400	30	400	30	400
		31	1500			31	400	31	400		