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EDMUND G. BROWN JR., Governor
CHARLTON H. BONHAM, Director

Public Hearing (3/20/13)
Bay-Delta Plan SED
Deadline: 3/29/13 by 12 noon

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March 28, 2013

Charles Hoppin, Chair
State Water Resources Control Board
1001 I Street
Sacramento, CA 95814

Subject: Comments regarding the Substitute Environmental Document in Support of Potential Changes 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

Dear Mr. Hoppin:

The California Department of Fish and Wildlife (Department or CDFW) appreciates the opportunity to review and comment on the State Water Resources Control Board's (SWRCB) "Draft Substitute Environmental Document in Support of Potential Changes 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" (SED). CDFW recognizes the tremendous effort you and your staff have put into developing this environmental document and, in particular, your staff's efforts to welcome and consider input from all stakeholders.

The Department also acknowledges that while its mission focuses on the fish and wildlife and ecological values related to river flows and water quality, the SWRCB, ultimately, must balance multiple beneficial uses in your deliberations. Notwithstanding these distinct regulatory roles, we both reckon with the fact that in the last 100 years the San Joaquin River (SJR) and its tributaries have been tasked to provide more services than are sustainable. Even with the expenditure of hundreds of millions of dollars on various restoration projects to address a wide variety of other stressors, the SJR cannot regain its ecological integrity and provide sustainable salmon fisheries without more flow. While various state and federal programs will continue to address non-flow stressors, the SWRCB has the opportunity to establish the flows that are essential to balancing beneficial uses by supporting and maintaining ecosystem functions. These ecosystem functions, which can only be achieved with increased flows, include: lateral and longitudinal connections, as well as the formation and re-formation of a diverse channel and floodplain.

Along with the SWRCB, the Department, both in its role as a Public Trust Agency and as a Responsible Agency, has dedicated significant resources to support the development of flow criteria for the Bay-Delta. For example, the Sacramento-San Joaquin Delta Reform Act of 2009 tasked both CDFW and SWRCB to use the best available science to develop the flow criteria for the Delta ecosystem necessary to protect public trust resources. The Department produced its "Quantifiable Biological Objectives and Flow Criteria for Aquatic and Terrestrial Species of

Concern Dependent on the Delta" in November 2010 and your agency produced the "Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem" (Flow Criteria Report) in August 2010. These two reports evaluated the best available scientific information to determine the flows necessary to protect the Sacramento-San Joaquin Delta ecosystem.

The Department strongly agrees with the SWRCB that percent of unimpaired flow (UIF) from each SJR tributary (Stanislaus, Tuolumne, and Merced Rivers) best achieves instream flow protection through preserving the shape and variability of the natural hydrograph.

However, while the SED's preferred alternative may provide more flow in a more natural flow regime than under current conditions, the preferred alternative will not provide the ecological functions necessary to reestablish and maintain the SJR's ecosystem, support the salmon doubling narrative objective, or protect the fish and wildlife beneficial uses established by the 2006 Bay-Delta Plan. The Department provides its comments to assist the SWRCB to revise the SED to more accurately describe the impacts of a 14-day averaging and of any flow less than the SWRCB's Flow Criteria Report's 60 percent UIF.

The Department also recommends that the SWRCB revise the draft Water Quality Control Plan's (Plan) Program of Implementation to more clearly articulate the bounds and expectations of a number of key design elements of the draft Plan's adaptive management framework including, but not limited to, establishing (1) SMART (Specific, Measurable, Achievable, Relevant, and Time-Fixed) objectives; (2) management triggers, performance measures, and time frames; (3) adequate process for implementing and evaluating higher flows; (4) an anticipated governance structure with clear roles, responsibilities, authorities, and a processes for decision-making and dispute resolution; and (5) an expanded incorporation of independent science review and advice.

The Department's general and chapter-specific comments are attached hereto. The Department will continue to work with you and your staff to develop a flow regime that protects and maintains fish and wildlife beneficial uses of the Sacramento-San Joaquin Delta. It is also important to emphasis that the Department will also remain committed to working directly with the agricultural and water user communities engaged in your proceeding. We remain hopeful that all parties might be able to find common ground.

If you have any questions, please feel free to contact John Shelton at (559) 243-4014 ext. 233 or at <John.Shelton@wildlife.ca.gov>.

Sincerely,

Scott Cantrell

Scott Cantrell
Chief, Water Branch

Enclosure

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I. The SED Does Not Establish By Substantial Evidence That 35% Unimpaired Flow On A 14-Day Running Average Will Protect Fish And Wildlife Beneficial Uses.

The State Water Resources Control Board (SWRCB) Substitute Environmental Document's (SED) Preferred Alternative would, if adopted, establish a February through June flow requirement of 35% unimpaired flow on a 14-day running average from three-east side salmon bearing tributaries – Merced, Tuolumne, and Stanislaus Rivers. SED, Executive Summary, p. ES-2; Appendix K, p.3. Although components of the SED are based on sound scientific knowledge, the SED does not establish by substantial evidence that the Preferred Alternative will protect the fish and wildlife beneficial uses established by the current 2006 Bay-Delta Plan.[1] The California Department of Fish and Wildlife[2] (Department or CDFW) respectfully makes this determination based on the best available science which has established 60% of the unimpaired flow of the San Joaquin River (SJR) would protect public trust resources.

Based upon our review of the SED, the Preferred Alternative of 35% unimpaired flow provides only minor increases in flow over current baseline conditions. The SWRCB's 2010 Report, "*Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem*" (Flow Criteria Report), determined 60% unimpaired flow from the entire SJR watershed above Vernalis was needed to protect and ensure viable LSJR native fish populations and the ecosystem functions and services upon which they rely (SWRCB 2010). It is important to note that this is not simply a reduction from 60% to 35%. The 2010 Flow Criteria Report determination referred to 60% of the unimpaired flow of the entire SJR watershed (as measured at Vernalis), whereas the SED's Preferred Alternative proposes 35% of the unimpaired flow from just three tributaries to the SJR, a much smaller geographic scope.

The scientific information provided in the SED reinforces the need for a natural flow regime with flows significantly higher than existing values, but does not include an analysis that shows how the Preferred Alternative would support key aquatic life stages or restore ecological functions. To be clear, the Department agrees with the SWRCB that a percent of unimpaired flow from each tributary (Stanislaus, Tuolumne, and Merced Rivers) to the SJR is a useful metric for achieving instream

[1] The Bay-Delta Plan protects the following fish and wildlife beneficial uses: cold freshwater habitat (COLD); migration of aquatic organisms (MIGR); spawning, reproduction, and/or early development (SPWN); wildlife habitat (WILD); and rare, threatened, or endangered species (RARE). State Water Resources Control Board (SWRCB), Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, December 13, 2006. (2006 Bay-Delta Plan).

[2] The California Department of Fish and Wildlife underwent a name change from California Department of Fish and Game in January, 2013. For past documents filed under our previous name, we list "CDFG" instead of "CDFW" to facilitate matching those documents to the referenced literature.

flow protection. We also support the concept of preserving the shape and variability of the natural hydrograph based on the growing body of natural flow regime work by Poff et al. (1997) and Bunn and Arthington (2002), among others. For an ecosystem to maintain components, such as keystone species and ecological functions, it must retain a hydrology that reflects historic processes. As such, a flow regime that captures features of the natural flow regime will contribute to the support of a healthy aquatic ecosystem.

1) 35% Unimpaired Flow Is Not Sufficient to Contribute to the Salmon Doubling Objective or Enhance the Conditions of Aquatic Resources.

The SED's analysis does not show how the Preferred Alternative of 35% unimpaired flow will contribute to the salmon doubling objective[3] or will sustain ecosystem functions and services even with the support of all other proposed non-flow restoration measures in the basin. Instead, the analysis in the SED shows that the flow regime in the Preferred Alternative is only slightly better than existing conditions, which have consistently been found to be negatively impacting aquatic ecosystem functions and services. The negligible improvement provided by the Preferred Alternative is illustrated in the SED's Appendix C, *Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives*, Table 2.4, which is included below.

Table 2.4. Unimpaired and Observed Flow Statistics by Water Year Type for 1930 to 1955 and 1984 to 2009

	1930-1955			1984 - 2009			
	# Years (year)	Unimpaired Flow (TAF)	Observed Flow (TAF)	# Years (year)	Unimpaired Flow (TAF)	Observed Flow (TAF)	Observed Flow as Percentage of Unimpaired Flow
Average of All Years	26	5,900	3,520	26	6,070	2,900	45
Median of All Years	26	5,400	2,760	26	4,580	1,720	46
Average of Wet Years	6	9,490	7,160	8	10,750	5,450	50
Average of AN Years	7	7,070	4,320	3	6,820	4,240	61
Average of BN Years	6	4,350	1,670	1	4,990	1,360	27
Average of Dry Years	4	3,410	1,350	5	4,140	1,490	38
Average of Critical Years	3	2,450	960	9	2,840	1,150	42
Wettest of Years	(1938)	13,370	10,840	(1995)	13,680	8,490	84[1]
Driest of Years	(1931)	1,680	680	(1987)	2,160	660	16[2]

[1] Highest percentage of unimpaired flow
[2] Lowest percentage of unimpaired flow.

The period from 1930 to 1955 is representative of conditions where total reservoir storage volume in the SJR basin ranged from 1.5 MAF to 2.2 MAF, or 27% to 39% of the long-term median annual unimpaired flow in the basin. The period from 1984 to 2009 is representative of current conditions, with reservoir storage of 7.6 MAF to 7.8 MAF, or 135% to 138% of the long-term median annual unimpaired flow in the basin.

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[3] The Bay-Delta Plan's water quality objectives for fish and wildlife beneficial uses include, among other objectives, the salmon protection narrative objective to double the natural production of Chinook salmon from the average production of 1967-1991. 2006 Bay-Delta Plan, p. 14.

Specifically, the last column in Table 2.4 reports Observed Flow as Percentage of Unimpaired Flow for the 1984 to 2009 time period. The averages for each water type in this time frame range from 61% to 27%, with the Average and Median of All Years being 45% and 46%, respectively. CDFW assumes the values given for Observed Flow as Percentage of Unimpaired Flow are the result of dividing Observed Flow (TAF) by Unimpaired Flow (TAF) for the 1984 to 2009 time period. However, CDFW is unable to confirm the value reported for Median of All Years as 46%. When CDFW computed the unimpaired flow percentage for the second row values, 1,720 TAF divided by 4,580 TAF, it estimated that the Median of All Years is 38%, and not 46% as reported in Table 2.4. The SED's Preferred Alternative of 35% unimpaired flow falls below the unimpaired flow median value of 38%. Although Table 2.4 refers to the whole water year and is not limited to February through June flows, annual unimpaired flow values should be informative in the selection of a LSJR Alternative based on percentage of unimpaired flow. The population numbers of fall-run Chinook salmon in the LSJR watershed is in a state of decline and there is substantial evidence that the fishery is not sustainable under existing flow conditions. In order to move the condition of LSJR fall-run Chinook salmon into a state of abundance, the Preferred Alternative unimpaired flow percentage must at least exceed the annual unimpaired flow median of value 38%. Given the difference in time period, annual verses February through June, CDFW still recommends the Preferred Alternative needs to exceed the percent magnitude of the median annual unimpaired flow volume of 38% to ensure improvement over current conditions for salmon.

Appendix K of the SED indicates that, if selected by the SWRCB, the Preferred Alternative would be implemented along with other organizations' management actions to meet the LSJR fish and wildlife flow objectives. However, without additional flow, other non-flow actions will not compensate for the inadequacy of the Preferred Alternative. The State and Federal government, along with local agencies and many other organizations have completed numerous gravel augmentation, riparian revegetation, and channel and floodplain restoration projects on the San Joaquin, Stanislaus, Tuolumne, and Merced Rivers, many of these projects funded by the Department's Ecosystem Restoration Program[3] (ERP) and the Anadromous Fish Restoration Program.[4] Moreover, interested parties have also invested a tremendous amount of resources in designing, installing and maintaining fish screens.

Specific examples of non-flow actions include ERP funding for projects to reduce predator impacts and improve survival of juvenile salmonids in the SJR Watershed. For instance, the ERP funded three projects on the Merced River and six projects on the Tuolumne River, which filled in mining pits and isolated deep pools to eliminate predator habit. In total, the ERP has awarded over $13 million for these ecosystem

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[3] *See* California Department of Fish and Wildlife (CDFW), http://www.dfg.ca.gov/erp/grants_projects.asp (last visited March 25, 2013).
[4] *See* U.S. Fish and Wildlife Service (USFWS), http://www.fws.gov/stockton/afrp/ (last visited March 25, 2013).

restoration projects. The San Joaquin River Restoration Program (SJRRP) is another example of coordinated restoration actions with a significant non-flow component.[5] The SJRRP objective is to re-establish spring-run and fall-run Chinook salmon and steelhead along the mainstem SJR above the confluence of the Merced River. The SJRRP is the result of a September 2006 Settlement and includes commitments from the U.S. Departments of the Interior and Commerce, the Natural Resources Defense Council (NRDC), and the Friant Water Users Authority (FWUA) to provide sufficient fish habitat in the SJR below Friant Dam near Fresno, California.

As long as funding remains available, the Department will continue to support and implement non-flow, habitat projects in the hopes of achieving sufficient benefits from these measures to help enhance the conditions of aquatic resources. However, without significant improvements to instream flows, implementation of non-flow measures will not meet the salmon doubling objective or protect fish and wildlife beneficial uses.

2) A 14-Day Running Average Will Diminish Natural Flow Regime Attributes

The SED determined that "35 percent of unimpaired flow is required from February through June from each of the Merced, Tuolumne, and Stanislaus Rivers on a 14-day running average, unless otherwise approved by the State Water Board through the adaptive management framework" [emphasis added]. SED, Appendix K, p. 3. However, a 14-day averaging period does not retain many of the attributes of the natural flow regime that the SWRCB has identified as being important to protect a wide variety of ecosystem processes. The Department notes that the averaging period used to determine the percentage of unimpaired flow will influence all attributes of the flow regime (i.e., magnitude, frequency, duration, timing and rate of change). For example, a 14-day running average, as prescribed in the SED, will significantly diminish the magnitude or eliminate short duration attributes of the flow regime (e.g., pulse flows associated with storm events) that provide important services (e.g., hydrogeomorphic processes, migration cues), thereby greatly reducing the variability inherent in a more natural flow regime. In addition, as the length of the averaging period increases the timing of the peak flows is delayed to a greater extent. Figure 1 demonstrates the consequences of implementing the 14-day running average on the Tuolumne River in 2002.

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[5] *See* San Joaquin River Restoration Program, http://www.restoresjr.net/(last visited March 25, 2013).

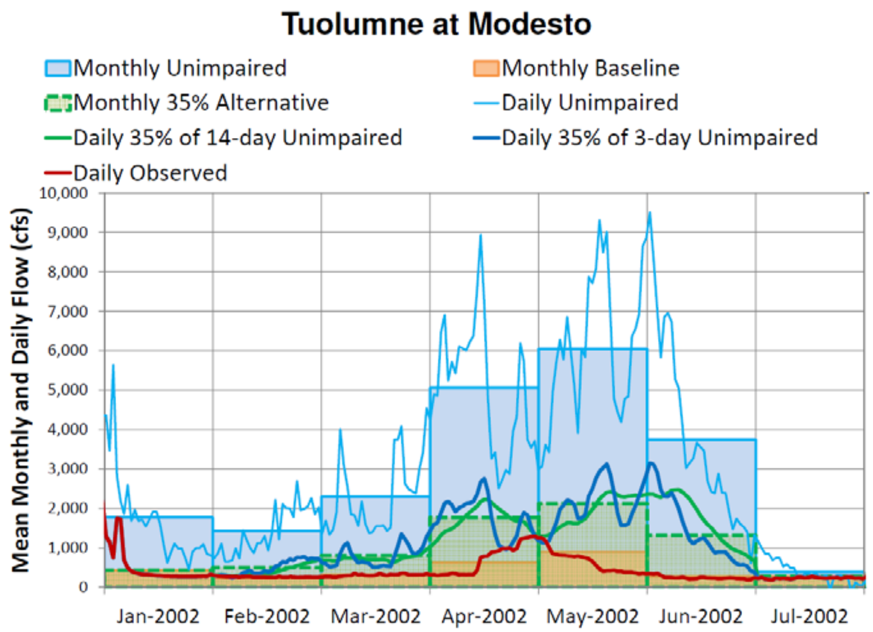

Figure 1. Tuolumne River at Modesto (2002) – Daily Average Unimpaired Flow and 35 Percent of Unimpaired Flow Determined Using 3- and 14-day Averaging Periods. Source: Grober and Satkowski 2013.[6]

As shown in Figure 1, using a 14-day running average in 2002 would have delayed and dampened high flow events on the Tuolumne River. This is counter to the objective of providing natural variability and pattern which is inherent in requiring a percentage of the unimpaired hydrograph. Based on our analysis, the Department does not consider a 14-day running average protective of fish and wildlife beneficial uses.

In February of 2011, the Department recommended that the SWRCB develop a system that does not rely on forecasting information and provided several figures that illustrated a possible approach, albeit with several caveats (3-day running average with a 3-day lag) (CDFW 2011). Operating to averaging periods shorter than 14 days is already occurring in other parts of the system, as required by current Bay-Delta Plan objectives. The Department recommends that the SWRCB require use of a 3-day running average to preserve a greater proportion of the intra-annual variability necessary to achieve the salmon doubling objective and protect fish and wildlife beneficial uses.

II. The SED's Analysis Of Impacts On Diverse Beneficial Uses Should Be Broadened To Adequately Consider Public Trust Resources.

Although the Department recognizes the SWRCB must consider diverse beneficial uses, the Department also notes that the SWRCB has an affirmative duty to take the

[6] The Delta Science Program and the UC Davis Center for Aquatic Biology and Aquaculture (CABA) Seminar: What is a Natural Hydrograph in Regulated Rivers? The science of Natural Functional Flows to the Delta (January 18, 2013) http://deltacouncil.ca.gov/science-event-detail/8179.

public trust into account in the planning and allocation of water resources, and to protect public trust uses whenever feasible. Water Code § 13241; *National Audobon Society v. Superior Court* (1983) 33 Cal. 23d 419, 466 [189 Cal. Rptr. 346]. To fulfill these obligations, the Department requests that the SWRCB broaden and deepen its impact analyses to reflect: (1) the current trend of aquatic system decline and how increased flows enhancing the entire SJR watershed ecosystem are necessary to reverse the current trend; (2) the economic benefits of a sustainable aquatic ecosystem; and (3) that the SED likely overstates the alternatives' economic impacts to agriculture.

1) **The SED Should Expand Its Discussion Of The Current Trend Of Aquatic System Decline And How Increased Flows Enhancing The Entire SJR Watershed Ecosystem Are Necessary To Reverse The Current Trend.**

The best available science suggests that prior management decisions have not adequately addressed the needs of public trust fishery resources and, as a result, those resources are in decline. Best available science demonstrates that current flows are insufficient to protect public trust resources within the SJR basin or the Bay Delta (SWRCB 2010). As the SED's "Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives" details, the current ecological condition is declining and non-sustainable. SED, Appendix C. One particularly stark metric of this decline is that salmonid populations are not only at historically low numbers in the SJR basin but also show a continuing downward trend (CDFG 2010a and 2011, and USDOI 2011).

The declining trend of the SJR basin watershed's ecosystems detrimentally impacts the Delta's ecosystem. The Department has previously observed that flows within the SJR watershed and the South Delta are inextricably linked (CDFG 2010c). As the scope of the SED correctly reflects, evaluation of flow alternatives must recognize the SJR and its tributaries provide many ecological services to the Delta, just as the Delta provides services back to the SJR. The disruption of flow connectivity between tributary watersheds and the Bay Delta resulting from construction of rim dams has created a severely impaired ecosystem with fish species populations trending towards extirpation, degraded water quality, and non-native invasive species thriving.

The SED needs to consider how increased flows sufficient to enhance the entire SJR watershed ecosystem (rather than a single species during a specific timeframe) are necessary to reverse the current trend. For example, in addition to the known impacts to juvenile fall-run Chinook salmon during the February to June time frame, there is substantial evidence of significant impacts to aquatic species in other time periods. The Department recommends the SED's LSJR alternatives should more fully examine impacts beyond the February through June time frame as well as the complete suite of ecological services impacted by flows. In support of such services, the Department has recommended flows for protecting other uses in addition to those necessary for fall-run juvenile out-migration in prior submissions (CDFG

2010b). We summarize other important life stages for fall- run Chinook salmon (and Splittail) along with ecological mechanisms and critical periods for fish protection in Table 1.

Table 1: Critical Periods of Flow Protection for San Joaquin River species as adapted from page 4 of CDFG 2010b and page 33 of CDFG 2010c.

Priority Species	Life Stage	Mechanism	Time When Water Flows are Most Important	Reference
Chinook salmon (San Joaquin River Basin)	Smolt	Out migration	March – June	Exhibit 1*- page 2; Exhibit 3* -- pages 7-10, 21-35.
Chinook Salmon (San Joaquin river Basin)	Adult	Immigration & Egg Viability	September-December	Table 2 - page 33; CDFW 2010c
Chinook salmon (San Joaquin River tributaries)	Egg/fry	Temperature, dissolved oxygen, upstream barrier avoidance	October – March	Exhibit 3*, pages 2-4; Exhibit 4*
Splittail	Adults	Flood plain inundating flows	January – April	Exhibit 1* – page 2, 13-14
Splittail	Eggs and larvae	Flood plain habitat persistence	January – May	Exhibit 1* – page 3, 13-14

*Exhibits refer to items submitted to the Board as part of CDFG 2010a.

2) The SED Should Expand its Consideration Of The Economic Impacts On Public Trust Fisheries Resources.

The SED should expand its analysis to include available evidence that the economic impact resulting from declining fisheries is significant as measured in total revenue output and sector jobs. Although the SED considered the economic impact on recreational fisheries, it found that recreational fisheries economic "effects [are] not quantified, but [are] expected to be minor." SED, Chapter 18, p. 18-3. According to the SED, "because certain physical impacts on these resources, such as changes in fish populations, cannot be reliably predicted, related economic effects are correspondingly difficult to evaluate with certainty," and "as a result, the analysis of aquatics- and recreation-related economic effects is necessarily more qualitative." SED, Chapter 18, p. 18-14. Unlike the SED's analysis of the economic impact on agriculture, the analysis of impacts on public trust fisheries resources does not consider the economic impact related to revenue output and sector jobs. Moreover, the SED appears to overlook the economic impact of salmon fishery closure on the both recreational and commercial fishing industry.

The following illustrates the available evidence to evaluate the economic impacts of fisheries decline. For example, when the population of fall-run Chinook salmon spawning in the Sacramento River Basin suddenly collapsed, the Pacific Fishery Management Council took the unprecedented step of completely closing the California salmon fishing season in 2008 and 2009. The economic impact of the 2008-2009 closure was significant by several measures.

- Governor Schwarzenegger requested $290M in disaster relief (Schwarzenegger et al. 2008).
- The Governor's Report on 2008 salmon fishery closure losses estimated $255 million in lost output and 2,263 lost jobs.
- The California Department of Fish and Game April 2009 Report indicates that the 2008 salmon fishery closure resulted in $279 million in lost output and 2,690 lost jobs (Morse and Manji 2009).

Table 2 summarizes the estimated cost of this single salmon fishery closure. These data suggest that increasing the sustainability of fisheries may in fact create new jobs.

Table 2: Estimated Economic Impact of Salmon Fishery Closure in 2008 and 2009. (Source of Information: Michael 2010.)

	Income Lost	**Jobs Lost**
Commercial	$47.9 million	961
Recreational	$70.5 million	862
Total	$118.4 million	1,823

3) The SED's Analysis of Agricultural Economic Impacts Should Be Expanded.

Although the SED's model of agricultural economic impacts provides important data, the analysis should be expanded to provide the SWRCB greater context for considering those data. The variance in total economic agricultural output over the 82-year baseline period evaluated is under 7% based on evaluation of Figure G-10 in the SED. The SED's analysis of LSJR alternatives indicates that under most scenarios, changes in total agricultural production and revenues are large in absolute terms (e.g. $5 million losses), but small in relative terms (e.g. a 2% decrease). SED, Appendix G, Page G-26.

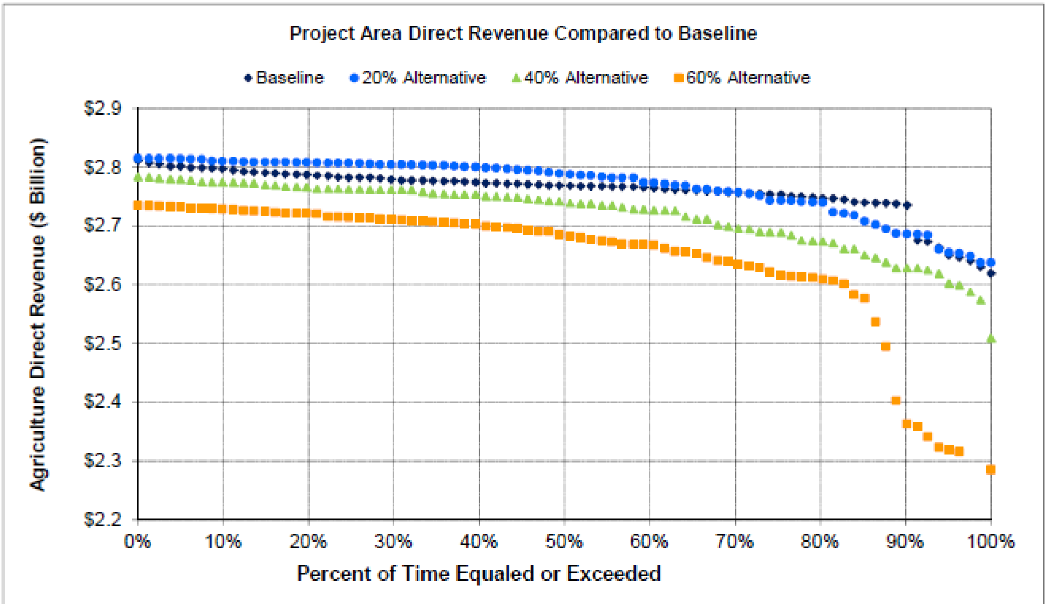

Figure G-10. Exceedance Plot of SWAP Estimates for Total LSJR Watershed Annual Agricultural Revenues for the LSJR Alternatives and the Baseline Across the 82 Years of Simulation

Figure G-10 (taken from page G-26 of the SED) shows that, most of the time, annual agricultural revenues would drop from a baseline of approximately $2.75 to $2.80 billion, to about $30 to $100 million less. In the driest years, revenue would fall $100 to $330 million relative to baseline, depending on the SED LSJR alternative. This would be about 4% to 12% of agricultural revenues.

The average decrease in agricultural revenue under the 60% alternative is 4.5% as reported in Table G-14 in the SED. Agricultural revenues vary approximately 6% per annum in Stanislaus County.[7] Annual variation in total agricultural revenue ranged from a low of 6% to a high of 32% in Stanislaus and Merced Counties between 2000 and 2010.[8,9] Total agricultural revenues increased by 70% in Stanislaus County and by 40% in Merced County during the same period. The 4.5% average decrease in agricultural revenue estimated for the 60% alternative falls within the recent historical range of economic variability within Stanislaus and Merced Counties.

The SED also overstates ripple effects on the regional economy from changes in agricultural revenue (e.g., the fertilizer company, the farm laborer, and all the items

[7] See Stanislaus County Crop Reports, http://www.stanag.org/crop-reports.shtm (last visited March 25, 2013).
[8] *Id.*
[9] *See* Merced County Crop Reports, http://www.co.merced.ca.us/Archive.aspx?AMID=36 (last visited March 25, 2013).

they buy at local businesses, as well as the local sales taxes they pay, etc.), especially over the long-term. It relies on IMPLAN, a regional economic model that allows users to quickly develop economic evaluations using simplistic assumptions. For example, the model assumes fixed factors of production and assumes that producers (e.g. farmers) are unable to adjust *in any way* to changing water supply, prices, or other inputs. SED, Appendix G, p. G-29.

With a stepwise modeling approach it is important to remember there is increasing uncertainty with each successive model, both because they build on each other, and because they increasingly incorporate more moving parts. The agricultural production and revenue model is subject to considerable uncertainties, especially since agriculture can be (and regularly is) subject to significant external factors outside the model. The SED acknowledges using the most conservative assumptions that would produce the maximum economic effects. SED, Appendix G, page G-29. The economic models present only short-run results. While the SED suggests impacts in perpetuity to agricultural revenue, in fact the IMPLAN modeling results are most relevant to the short-term. In the long-term, (which could be as short as five years), farmers adapt, employ new technologies, and shift crops in ways that dampen the impacts. *Id*.

III. Substantial Evidence Demonstrates That 50% - 60% Unimpaired Flow Is Necessary To Meet Department Recommendations For Juvenile Fall-Run Chinook Salmon.

Substantial evidence demonstrates that approximately 50% - 60% unimpaired flow is the minimum necessary to reestablish and sustain fish and wildlife beneficial uses. For example, pursuant to the National Marine Fisheries Service's 2009 Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and State Water Project, unimpaired flows *must be more than 40% to achieve the limited biological purpose of avoiding species jeopardy on the Stanislaus* (NMFS 2009).[10] Similarly, unimpaired flows must be more than 40% to meet the AFRP doubling goals *at least* 60% of the time; notably, doubling of natural production is required by both State and Federal laws (Fish and Game Code §§ 6900 et. seq.; Central Valley Project Improvement Act, 34 U.S.C. §§ 3401 et seq.). However, neither the NMFS RPAs nor the AFRP doubling goals considered the extent of additional flows necessary to reestablish and maintain ecosystem functions and services necessary to achieve and sustain fish and wildlife beneficial uses. As discussed earlier, the SWRCB's staff has previously determined that 60% unimpaired flows are necessary to provide those services and functions (SWRCB 2010).

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[10] The SED characterizes 40% unimpaired flows flows as approximating the volume of flows provided by the NMFS BiOp's RPA. Yet the BiOp establishes those RPAs as necessary *merely to avoid species jeopardy* in the Stanislaus, and, moreover, as adequate to avoid jeopardy only when implemented as one component of a suite of activities and when distributed in a flow pattern that is more geomorphological and biologically efficacious than provided by the Board's 14-day averaging and flow caps.

The conclusion that 50% - 60% of unimpaired flow (February through June) is necessary to reestablish and maintain ecosystem functions and services to sustain fish and wildlife beneficial uses is consistent with, and builds upon, the Department's 2010 recommendations (CDFG 2010a). By way of background, it is important to observe that the Department offered the March 2010 recommendations for a limited purpose; the Department did not intend the recommendations to exhaustively address fish and wildlife beneficial uses at a variety of locations (see CDFG 2010b).

Specifically, the 2010 recommendations were designed to provide an example of how certain flows could be reached at Vernalis (the historic compliance point for WQCP compliance) and did not attempt to describe flows at other locations. In addition, the Department provided its 2010 recommendations to demonstrate the flows necessary to address one life stage of one fish (juvenile fall-run Chinook) species rather than to address Department concerns exhaustively. Acknowledging this limited purpose the Department's 2010 submittal acknowledged that other species as well as ecosystem functions and services that benefit numerous species would require additional flows (CDFG 2010b).

Even for the 2010 recommendations' limited purpose (enhanced flows at one location for one life-stage of one species), the Department reduced its flow recommendations for fish and wildlife beneficial uses by water year type to minimize impacts on other beneficial uses. Thus, in certain water years, even the Department's 2010 recommendations may be *less* than the flows the Department believes are necessary for juvenile fall-run Chinook species.

In addition, the SED reflects a misunderstanding of the Department's 2010 recommendations. The SED's description of CDFW's recommendation equals the total of: (1) the volume of CDFW's recommended pulse flows; and (2) the volume of the base flows for only the time period (March 1st through June 15th) for which CDFW recommended pulse flows. Then the SED distributes that total volume and concludes that amount is approximately 35% unimpaired flows. As described in the following table, the Department's recommendations were for pulse flows *in addition to* a baseline comprised of pre-existing flows from February 1st through June 30th. (See Table 2-4 in the SED for a listing of existing flow requirements). However, the SED did not include within its total volume the water necessary to provide base flows for those months for which CDFW did not recommend the pulse flows. As a result, the SED's total volume did not include the base flow volumes from March 1st – March 31st and from June 16th to June 30th.

Table 1: CDFW Recommended Flow Criteria for Salmon. (From CDFG 2010, pg. 60)

DFG Recommended Flow Criteria for Salmon

Category	Function	Flow (cfs)	Year Type	Months												Citation
				O	N	D	J	F	M	A	M	J	J	A	S	
San Joaquin River	Increase juvenile fall-run Chinook salmon outmigration survival and abundance and provide conditions that will generally produce positive population growth in most years and eventually achieve the doubling goal	1500 (Base)	C				1	1	1	1	1	½				DFG (2010b)
		5500 (Pulse) (4/15-5/15) (Total 7000)								½	½					
		2125 (Base)	D				1	1	1	1	1	½				DFG (2010b)
		4875 (Pulse) (4/11-5/20) (Total 7000)								½	½					
		2258 (Base)	BN				1	1	1	1	1	½				DFG (2010b)
		6242 (Pulse) (4/6-5/25) (Total 8500)								1	1					
		4339 (Base)	AN				1	1	1	1	1	½				DFG (2010b)
		5661 (Pulse) (4/1-5/30) (Total 10000)								1	1					
		6315 (Base)	W				1	1	1	1	1	½				DFG (2010b)
		8685 (Pulse) (3/27-6/4) (Total 15000)							1	1	1	1				
	Minimum adult Chinook salmon attraction flows to decrease straying, increase DO, reduce temperatures, and improve olfactory homing fidelity	At Vernalis: pulse flow: 1000[2]	All	1												

1 = criteria recommended for the whole month
½ = criteria recommended for half of the month

Category	Function	Flow (cfs)	Year Type	Months												Citation
				O	N	D	J	F	M	A	M	J	J	A	S	
Eastside Streams	Mokelumne River flows: Juvenile salmon outmigration	1500[3]	All						1	1						From Flennor et al. 2010
	Eastside stream minimum flows	1060[4]	All	1	1	1	1	1	1	1	1	1	1	1	1	From Flennor et al. 2010
Sacramento River	Increase juvenile salmon outmigration survival and abundance for fall-run Chinook salmon.	At Wilkins Slough: pulse flow: 20,000 cfs for 7 days[5]	All		1	1	1									SWRCB 2010
	Increase juvenile salmon outmigration survival by reducing diversion into Georgiana Slough and the central Delta	At Freeport: 13,000 - 17,000[6]	All		1	1	1	1	1	1	1	1				
	Promote juvenile fall-run salmon outmigration	At Rio Vista: 20000 - 30000								1	1	1				DFG (2010b)
Floodplain	Salmon smolts also benefit from increased food in floodplain habitats.	≥ 30 day floodplain inundation[7]	AN W				1	1	1	1	1					DFG (2010b), SWRCB (2010)

1 = criteria recommended for the whole month

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1 Pulse - up to an additional 28 TAF pulse/attraction flow to bring flows up to a monthly average of 2000 cfs except for a critical year following a critical year. Time period based on real-time monitoring and determined by CalFed Op's group

3 Mokelumne River salmon pulse flows. Such flows aid salmon migrations from and into the lower Mokelumne River. Pulse flows of an average of 1,500 cfs for 2 months (Mar-Apr) for 8 of 10 years (Henson et al. 2007). While the Mokelumne River is not separated from the rest of the eastside streams in the unimpaired flow numbers, flows of this level are seen to exist during 63% of the reported years historically.

4 Eastside stream minimum flows. Such flows would create floodplain habitat, improving local water quality in the Delta and aiding fish migrations in these streams. This is estimated here preliminarily as the 25th percentile unimpaired flows for all 12 months for 9 of 10 years (Moyle *et al.* 2007).

5 Pulse flows should coincide with storm events producing unimpaired flows until monitoring indicates that majority of smolts have moved downstream.

6 Positive flows are needed downstream of confluence with Georgiana Slough while juvenile salmon are present.

7 Flows needed to inundate floodplain habitat vary substantially depending on Sacramento River, San Joaquin River, and in-Delta floodplain habitat (e.g., Fremont Weir in the Yolo Bypass flow can range from 56,000 cfs (existing crest) to 23,100 cfs (the proposed notch) (AR/NHI 1 as cited in SWRCB, 2010).

The SED also does not adequately consider how water management may impact the amount of flow actually available for fish. For example, the SED does not consider that even in those years with a total volume of water equal to the total volume of CDFW's 2010 recommendations, managing the water requires the ability to forecast how much water to save in February and how much to borrow from June. Because water managers are not omnipotent (able to move water immediately) or omniscient (able to know ahead of time with perfect accuracy the type of water year into which they are heading), an adequate annual total volume of water does not necessarily mean that CDFW's 2010 recommendations could be successfully implemented throughout the year. In addition, the SED does not consider whether the adaptive management process would make available the maximum amount of unimpaired flow for fish.

The following graphs demonstrate that substantially more than 35% unimpaired flows is necessary to meet the Department's actual 2010 recommendations. Chapter 3 of the SED (page 3-13, Figure 3-2) provides an exceedance plot depicting the Board's interpretation of the Department's flow recommendations (CDFG 2010c). On Figure 1 below, the y-axis shows February through June flow at Vernalis (measured in taf) and the x-axis shows the percent of time flows are equaled or exceeded. This figure then depicts: (1) SED Alternatives 2, 3, and 4; (2) 35% unimpaired flow based on the Board's Water Supply Effects Modeling (WSE); (2) 50% unimpaired flow based on WSE; (3) the Board's characterization of the Department's 2010 recommendations, which characterization mistakenly excludes the volume of some base flows; and (4) the Department's actual 2010 recommendations, which included the base flow volumes from February 1st to June 30th (see CDFG 2010c, p. 60). This graph demonstrates that the Department's recommendations are only achieved with substantial frequency at the 50% flow alternative and the 35% preferred alternative provides substantially less flow than is necessary to achieve CDFW's 2010 recommendations.

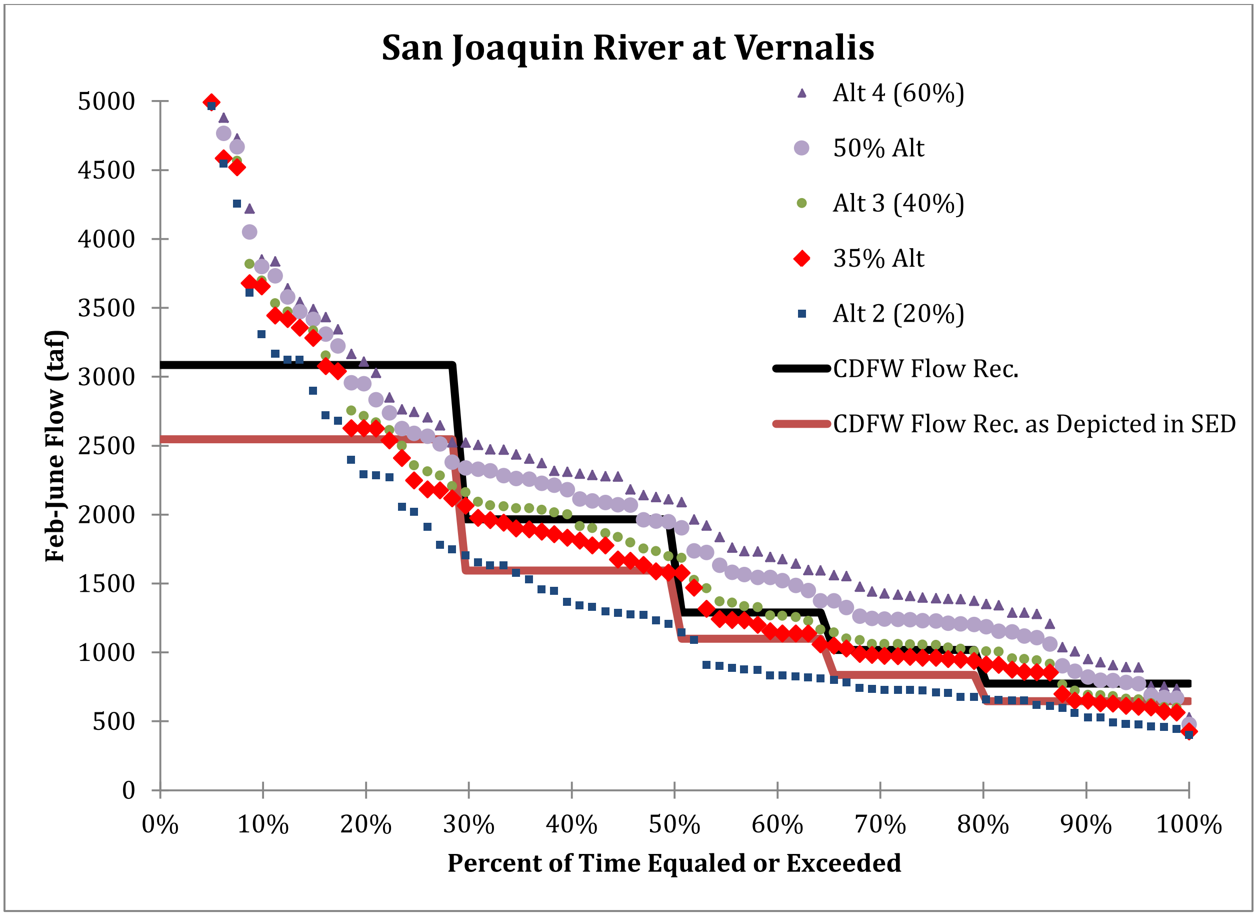


Figure 1: San Joaquin River at Vernalis (modified from Figure 3-2 of the SED). The solid red line depicts the calculated volume of flow based on the SWRCB's misunderstanding of CDFW's 2010 pulse flow recommendations. SED, Table 3-2. CDFW Flow Schedule-Based Recommendations (cubic feet per second). The solid black line is the actual volume of flow needed to achieve CDFW's 2010 recommended flows. Accordingly, the 35% flow (red diamonds) rarely equals or exceeds the volume needed for these pulse flows. In contract, a 50% of unimpaired flow (blue dots) achieves the volume required in most years. SWRCB, WSE_Model_ 12312012, Worksheet Tab Alt%WSEResults, Column MG.

Figures 2 through 6 present CDFW recommended flows during the SWRCB February through June time period for five representative water years along with monthly average values for three LSJR alternatives; the Preferred Alternative (35%), Alternative 4 (60%), and Alternative 3 (40%); the observed flow reported near Vernalis; and an estimate of unimpaired flow measured at Vernalis (DWR 2007). CDFW recommended flows do not near or exceed the estimate of unimpaired flow at Vernalis for any of the sample water years. The Preferred Alternative does not appear to provide enough flow to meet CDFW's recommendations (on an average monthly bases) except for the wettest year type evaluated, 1998. For the critical, dry, below normal and above normal sample water years, CDFW recommended flows represent a percent of the total unimpaired flow estimated at Vernalis ranging from 37 percent of the average May unimpaired flow estimated at Vernalis in the above normal water year 2000 to a maximum value of 76 percent for April of the critically dry year 1994. The Preferred Alternative recommends 35% of the unimpaired flow from the three east side tributaries not including contributory flows from the Upper SJR. It does not appear the Preferred Alternative can provide enough flow volume (on a monthly average bases) to achieve the flows recommended by CDFW except for the wettest water year type.

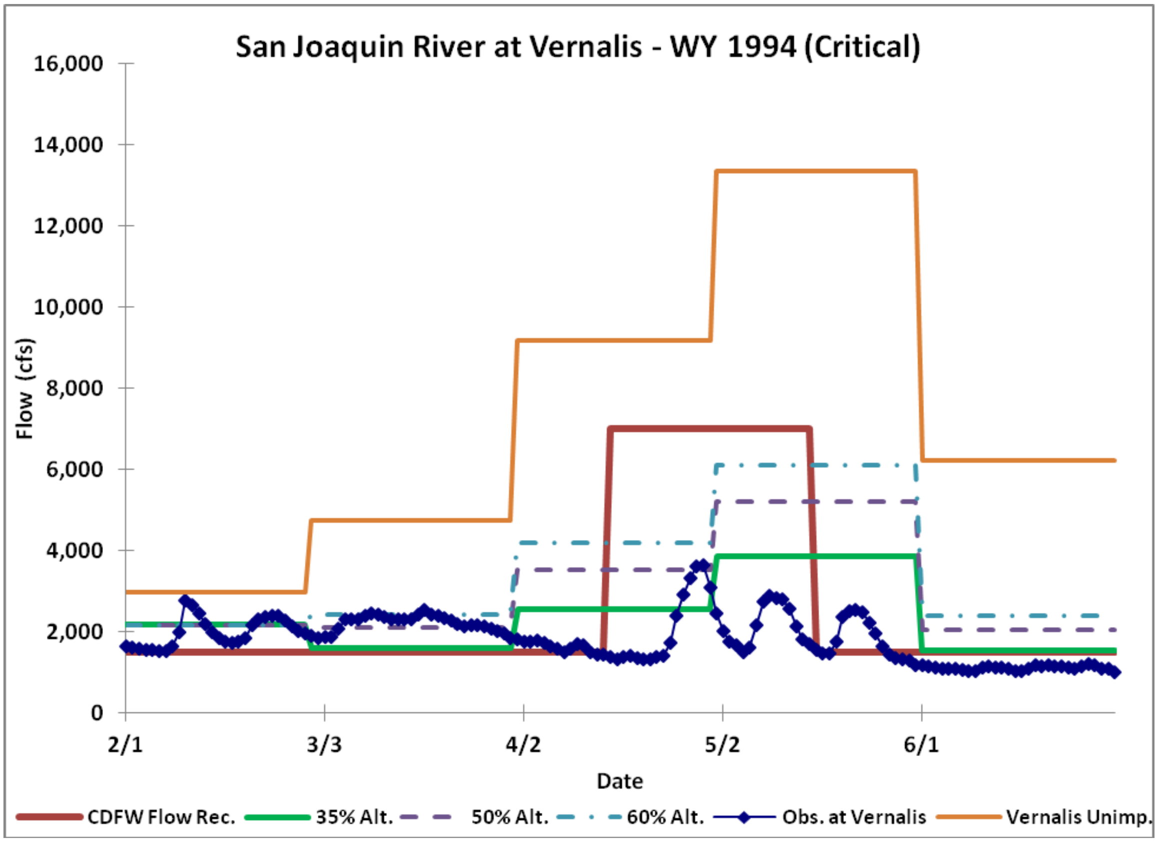


Figure 2: CDFW San Joaquin River Pulse Flow Recommendations as Measured at Vernalis for Water Year 1994, a Critical Water Year. (Obs. = Observed, Rec. = Recommended, and Unimp. = unimpaired). The data for 35% Alternative, 50% Alternative, 60% Alternative and Vernalis Unimpaired was extracted from the SWRCB's Water Supply Effects (WSE) model. The 35% Alt., 50% Alt. and 60% Alt. lines reflect the percent unimpaired from each of the three tributaries (Merced, Tuolumne and Stanislaus Rivers) including baseline accretions to Vernalis. The Vernalis Unimpaired represents the average monthly unimpaired flow in the SJR at Vernalis, including upper SJR above Friant Dam. The red line depicts CDFW's 2010 recommended flows, including the base flows preceding and following the period of pulse flows.

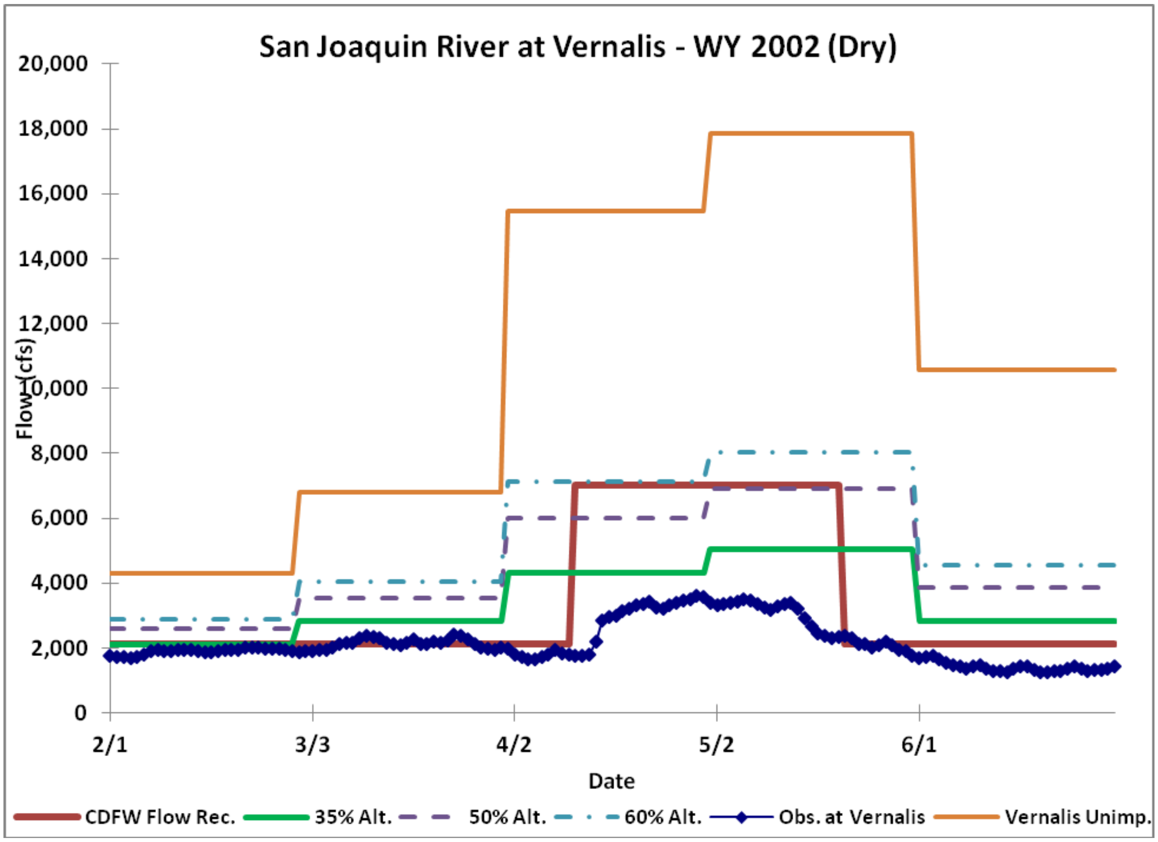


Figure 3: CDFW San Joaquin River Pulse Flow Recommendations as Measured at Vernalis for Water Year 2002, a Dry Water Year. (Obs. = Observed, Rec. = Recommended, and Unimp. = unimpaired). The data for 35% Alternative, 50% Alternative, 60% Alternative and Vernalis Unimpaired was extracted from the SWRCB's Water Supply Effects (WSE) model. The 35% Alt., 50% Alt. and 60% Alt. lines reflect the percent unimpaired from each of the three tributaries (Merced, Tuolumne and Stanislaus Rivers) including baseline accretions to Vernalis. The Vernalis Unimpaired represents the average monthly unimpaired flow in the SJR at Vernalis, including upper SJR above Friant Dam. The red line depicts CDFW's 2010 recommended flows, including the base flows preceding and following the period of pulse flows.

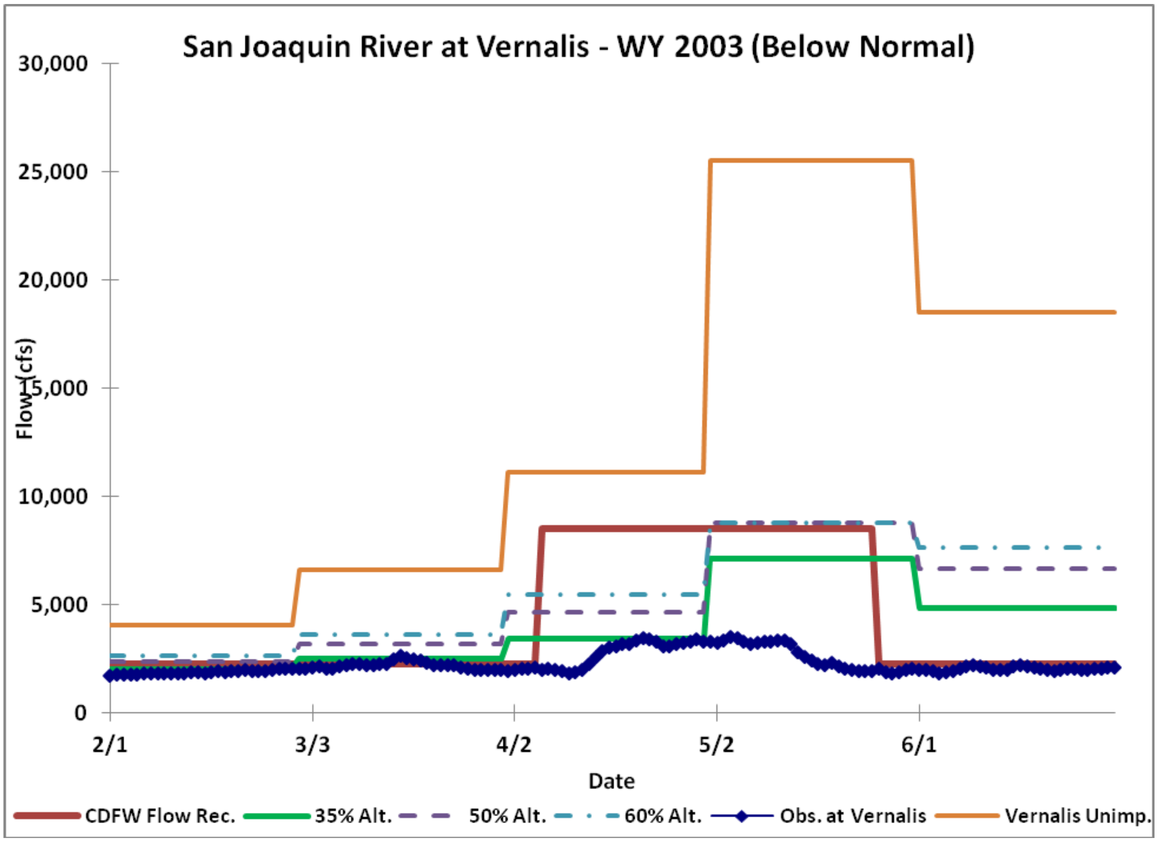


Figure 4: CDFW San Joaquin River Pulse Flow Recommendations as Measured at Vernalis for Water Year 2003, a Below Normal Water Year. (Obs. = Observed, Rec. = Recommended, and Unimp. = unimpaired). The data for 35% Alternative, 50% Alternative, 60% Alternative and Vernalis Unimpaired was extracted from the SWRCB's Water Supply Effects (WSE) model. The 35% Alt., 50% Alt. and 60% Alt. lines reflect the percent unimpaired from each of the three tributaries (Merced, Tuolumne and Stanislaus Rivers) including baseline accretions to Vernalis. The Vernalis Unimpaired represents the average monthly unimpaired flow in the SJR at Vernalis, including upper SJR above Friant Dam. The red line depicts CDFW's 2010 recommended flows, including the base flows preceding and following the period of pulse flows.

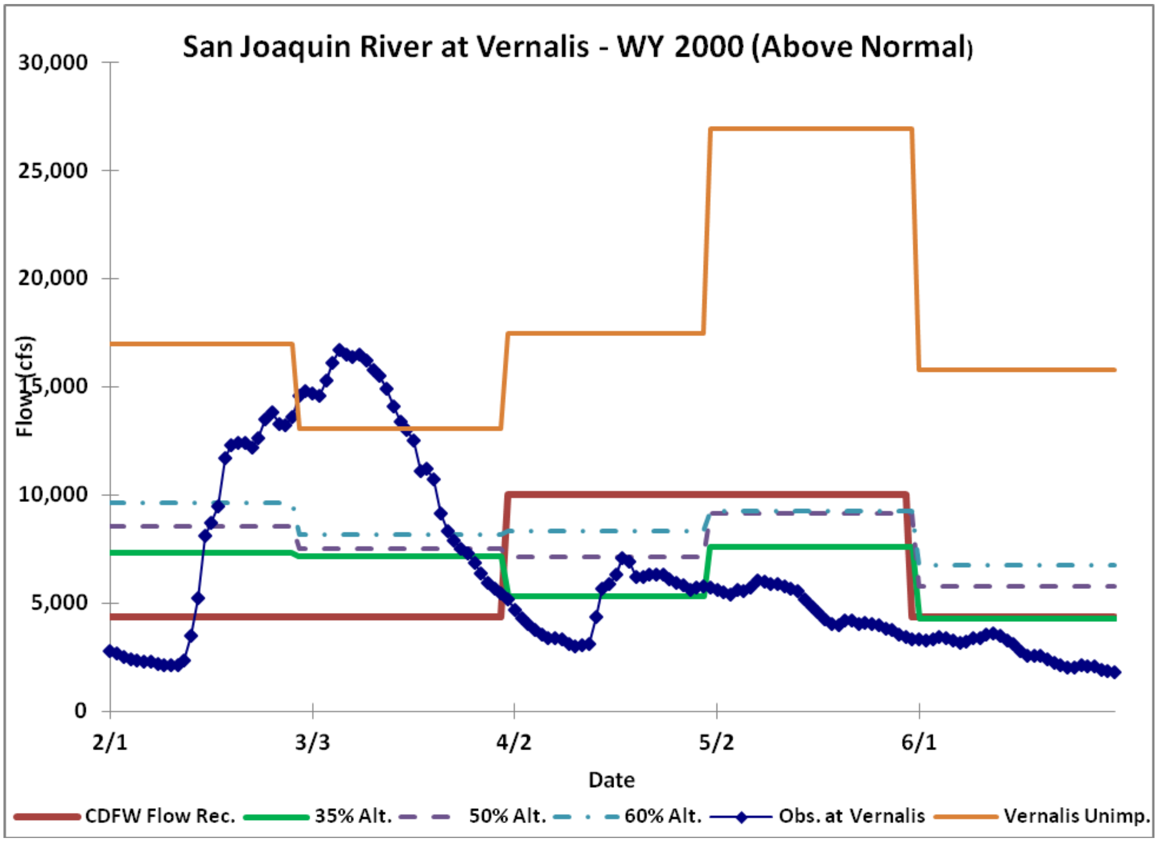


Figure 5: CDFW San Joaquin River Pulse Flow Recommendations as Measured at Vernalis for Water Year 2000, an Above Normal Water Year. (Obs. = Observed, Rec. = Recommended, and Unimp. = unimpaired). The data for 35% Alternative, 50% Alternative, 60% Alternative and Vernalis Unimpaired was extracted from the SWRCB's Water Supply Effects (WSE) model. The 35% Alt., 50% Alt. and 60% Alt. lines reflect the percent unimpaired from each of the three tributaries (Merced, Tuolumne and Stanislaus Rivers) including baseline accretions to Vernalis. The Vernalis Unimpaired represents the average monthly unimpaired flow in the SJR at Vernalis, including upper SJR above Friant Dam. The red line depicts CDFW's 2010 recommended flows, including the base flows preceding and following the period of pulse flows.

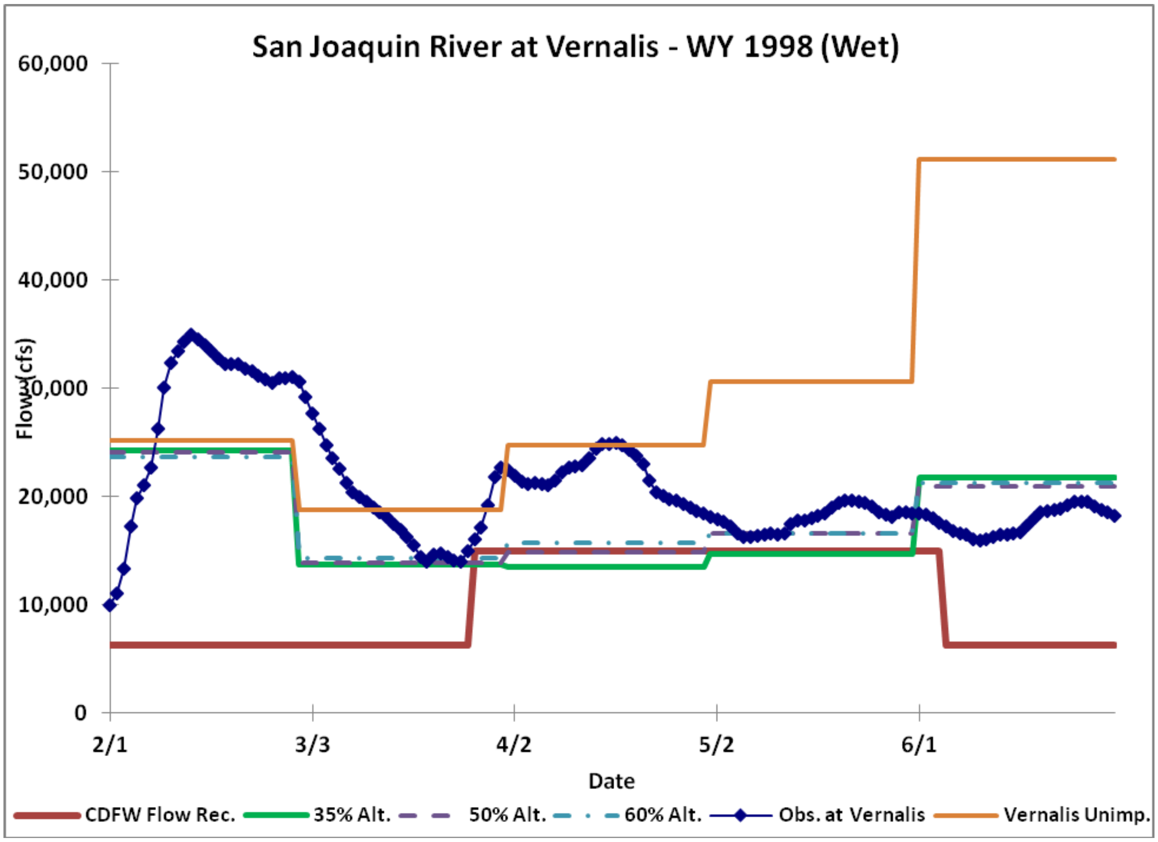


Figure 6: CDFW San Joaquin River Pulse Flow Recommendations as Measured at Vernalis for Water Year 1998, a Wet Water Year. (Obs. = Observed, Rec. = Recommended, and Unimp. = unimpaired). The data for 35% Alternative, 50% Alternative, 60% Alternative and Vernalis Unimpaired was extracted from the SWRCB's Water Supply Effects (WSE) model. The 35% Alt., 50% Alt. and 60% Alt. lines reflect the percent unimpaired from each of the three tributaries (Merced, Tuolumne and Stanislaus Rivers) including baseline accretions to Vernalis. The Vernalis Unimpaired represents the average monthly unimpaired flow in the SJR at Vernalis, including upper SJR above Friant Dam. The red line depicts CDFW's 2010 recommended flows, including the base flows preceding and following the period of pulse flows.

Stream flow has a variety of influences on Chinook life history and population abundance of local (a single river) populations as well as the species overall (entire Central Valley). While stream temperature and quality are directly measurable benefits to increasing flows, many benefits are much more difficult to quantify. For example, if thermal optima for salmonids are exceeded while major predators like exotic striped bass and black bass are just entering their thermal optima, the cold water salmonids can become more vulnerable to predation to warm water predator species. Survival of juvenile salmon is controlled by flow as clearly demonstrated by numerous studies (eg. TID/MID 2005; Newman 2008). While high mortality at lower flow is initiated by changes in health and condition of the fish (Marine and Cech 2004; Foott and Fogerty 2011), the mortality of these sick and weak fish is often seen as predation (basic principle in ecology theory) (eg. Begon, Harper, and Townsend 1990; Genovart, Tavecchia, Bistuer, Parpal, et al. 2010). This predation on the weak is reduced under high flows as demonstrated by Bowen and Bark (2010). Greater flow not only increases available space which modifies predator encounter rates, (Bowen and Bark 2010), but also results in encounter rates being modified by the generally higher turbidities under higher flow conditions (Gregory 1993; Gregory and Levings 1996, 1998). If predation is the end point for fish that are compromised by inadequate living space volume and/or quality, then predation is a secondary consequence of having inadequate habitat quantity and quality. The Department's analysis of temperature in the Merced River using the HEC-5Q SJR basin water temperature model (HEC-5Q model) looking at an estimated increased flow from 35% of unimpaired flow to 50% of unimpaired flow for 2003 (See Figure 7), an above normal water year, resulted in a 1 to 3 degree reduction in temperature. This reduction, which translates to a 35% reduction in exposure to chronic effects from elevated temperature levels, provides better health, greater juvenile survival and additional rearing habitat (CDFG 2011).

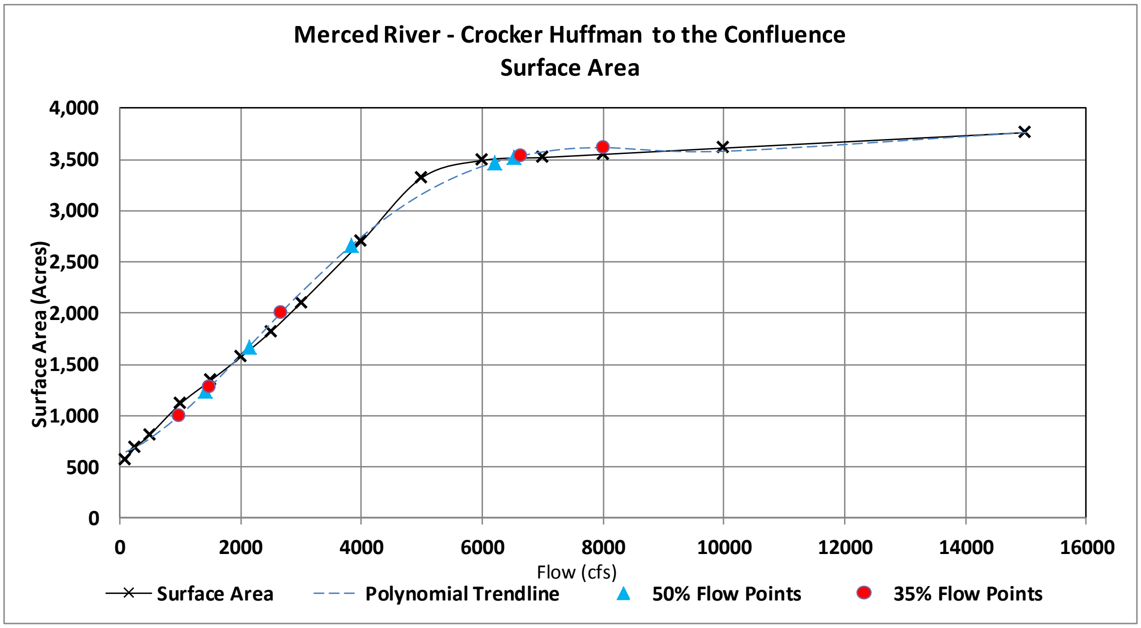
Merced River, 2003 (Above Normal)
HEC-5Q Temperature

	35% UNI	50% UNI	% Improvement
Days Above 62 ºF for young juveniles	8	6	25%
Days Above 65 ºF for older juveniles	60	46	23%
Total Days Above Temp Criteria	68	52	24%
Total Degree-Days above Temp Criteria	199.5	129.9	35%

Figure 7. CDFW temperature comparison of 35% UNI to 50% UNI in the Merced River (2003) using HEC-5Q SJR basin water temperature model (HEC-5Q model).

Figure 8 shows an example of the relationship between flow and the area of the river's wetted surface. Specifically, the figure describes the relationship between flow (cfs) and the wetted surface (acres) for the Merced River downstream of Crocker-Huffman Dam. The years represented by the blue triangles and red circles are, going left to right, 1994 (critically dry), 2002 (dry), 2003 (below normal), 2000 (above normal) and 1998 (wet). CDFW developed this chart (D. Stanton, pers. comm, 2013) from flow to surface width relationships determined at roughly mile intervals by the Army Corps of Engineers' flood flow analyses following the 1997 severe flood event (USACOE 1999), and averaged these flow/width relationships throughout the length from Crocker Huffman downstream to the confluence. We calculated a polynomial trendline to show what the flow to area relationships would be for the maximum 35% and 50% flows for the five water years selected for comparison. Using 2003 as an example (below normal water year and the third blue triangle or red circle shown in the Figure below), the peak flow at the 35% and 50% flow levels is 2,667 and 3,833 cfs, respectively. This difference in flow equates to roughly a 600-acre increase in surface area (i.e. fish habitat). As depicted in the Figure 8 below for the Merced River, this flow-to-area relationship expands quickly and nearly linearly from zero to about 5,000 cfs, and then increases gradually after 6,000 cfs as the river becomes confined so that it continues to increase in depth with little increase in width.

Figure 8. Merced River Surface Area as a Function of Flow



As demonstrated above, even 60% unimpaired flow would not meet the Department's 2010 recommendations in all water type years at all times. Nonetheless, 50% - 60% of unimpaired flow are above the 40% unimpaired flows necessary to avoid jeopardy and, if correctly managed, could substantially advance fish and wildlife beneficial uses.

IV. The SWRCB Should Make The Salmon-Doubling Goal An Explicit Part Of The Proposed LSJR Fish And Wildlife Flow Objective.

The revised Water Quality Control Plan's (WQCP) proposed Lower San Joaquin River (LSJR) fish and wildlife flow objective does not set forth a measureable, quantitative goal. Although the Department supports the proposed narrative objective to "[m]aintain flow conditions…sufficient to support and maintain the natural production of viable native San Joaquin River watershed fish populations migrating through the Delta," as stated in the SED, we are concerned that this narrative objective is open to interpretation and lacks a firm basis from which to determine the effectiveness of the revised flow requirements.

As the proposed objective is currently written, it is unclear what level of improvement in the viability indices and what temporal scale (e.g., annual, multi-year) will be required to determine that management actions have been a success and that the LSJR fish and wildlife flow objective has been achieved. While the proposed narrative objective provides a framework for establishing measurable outcomes through the inclusion of indicators of viability (e.g., "abundance, spatial extent or distribution, genetic and life history diversity, and productivity"), the SED does not to include quantitative targets for these indicators of viability, which could be used to evaluate achievement of the LSJR fish and wildlife flow objective.

The Department recommends that the SWRCB develop water quality objectives for fish and wildlife beneficial uses that are Specific, Measurable, Achievable, Relevant, and Time-fixed (SMART). With respect to the LSJR fish and wildlife flow objective, this would entail inclusion of quantitative targets for the indicators of viability. In addition, quantitative targets for each of the salmon-bearing tributaries (Stanislaus, Tuolumne, and Merced rivers) should be made explicit in the LSJR fish and wildlife flow objective. Specifically, the Department recommends the SWRCB adopt targets to double the number of smolts outmigrating from each of the three-eastside salmon-bearing tributaries and to double the number of smolts surviving migration through the south Delta (CDFG 2011).

State and federal laws require that State and Federal governments take action to double the natural production of anadromous fish populations. Cal. Fish and Game Code §§ 6900 *et seq*; Central Valley Project Improvement Act, 34 U.S.C. §3406(b)(1). The Department's proposed targets are consistent with these statutory requirements and with the narrative objective for salmon protection included in the 1995 Bay-Delta Plan (and retained in the 2006 Bay-Delta Plan), which states: "Water quality conditions shall be maintained, together with other measures in the watershed, sufficient to achieve a doubling of natural production of Chinook salmon from the average production of 1967-1991, consistent with the provisions of State and federal law." 1995 Bay-Delta Plan, pp. 15, 18, 28, 2006 Bay-Delta Plan, p. 14. The Department recommends that the SWRCB develop targets that will work in tandem with the salmon protection narrative objective and with the goals and objectives of state and federal programs such as the Anadromous Fish Restoration Program[11] and the NMFS Recovery Plan for Central Valley Steelhead.

V. The Revised Water Quality Control Plan's Program Of Implementation Does Not Provide Sufficient Detail To Support A Determination That It Will Be Capable Of Achieving The LSJR Fish And Wildlife and Salmon Protection Narrative Objectives.

The SWRCB is required to develop a plan of implementation that sets forth the actions that are necessary to achieve the LSJR fish and wildlife and salmon protection narrative objectives. Water Code § 13050(j)(3), 13242(a). It is the Department's understanding that the SWRCB's intention, with respect to the

[11] USWFS. Final Restoration Plan for the Anadromous Fish Restoration Program, January 2001, http://www.fws.gov/stockton/afrp/SWRCB/B.finalrestplan.pdf (last visited March 25, 2013).

description of adaptive management and the associated monitoring and special-studies program contained within the revised WQCP, is to provide an overarching framework within which to implement water quality objectives. However, the Department is concerned that the revised WQCP's Program of Implementation lacks sufficient information and a number of key attributes that will be necessary to facilitate the timely development and implementation of a workable adaptive management program and the associated San Joaquin River Monitoring and Evaluation Program (SJRMEP).

The Department commends the SWRCB for incorporating the concept of adaptive management into the Program of Implementation. Adaptive management is defined in the 2009 Delta Reform Act as "a framework and flexible decision-making process for ongoing knowledge acquisition, monitoring, and evaluation leading to continuous improvements in management planning and implementation of a project to achieve specified objectives." Water Code § 85052. The structured decision-making process used in adaptive management, involving articulation of objectives, identification of management alternatives, predictions of management consequences, recognition of key uncertainties, and monitoring and evaluation of outcomes, is what differentiates it from a trial and error approach (NRC 2004, Williams 2011). The Department recommends that the SWRCB use the three phase (nine-step) adaptive management process described in Appendix A of the Final Draft Delta Plan (Delta Stewardship Council 2012) as an organizing framework.

As discussed further below, the Department also recommends that the SWRCB revise the Program of Implementation to more clearly articulate the bounds and expectations of a number of key design elements of the revised WQCP's adaptive management framework, including, but not limited to, (1) need for SMART objectives; (2) need for management triggers, performance measures, and time frames; (3) adequate process for implementing and evaluating higher flows; (4) an anticipated governance structure with clear roles, responsibilities, authorities, and processes for decision-making and dispute resolution; and (5) an expanded incorporation of independent science review and advice.

1) The Program Of Implementation Should Be Based On Smart Management Objectives.

Our previous comment discusses how the proposed LSJR fish and wildlife flow objective does not include a measurable, quantitative target. In the absence of explicit and measurable objectives, adaptive management is not feasible (Williams et al. 2009). The Department recommends that the SWRCB develop water quality objectives for fish and wildlife beneficial uses that are SMART (Specific, Measureable, Achievable, Relevant, and Time-fixed). In addition, the Department recommends that the SWRCB establish SMART objectives for specific management actions prior to their implementation. Such objectives would reflect the intended outcome of the actions. Establishing objectives with quantitative targets will provide a basis through which to evaluate the effectiveness of actions implemented to achieve the LSJR fish and wildlife flow objective and salmon protection narrative objective.

2) Management Triggers, Performance Measures, And Time Frames Are An Integral Part Of The Adaptive Management Process.

Management triggers identify a point that signifies the system may not be performing as expected and signals a need to evaluate the status of the resource, on-going activities, and potential management actions aimed at improving performance (Trulio et al. 2007). Performance measures use a specific indicator or set of indicators to assess program performance (Dahm et al. 2009). Adaptive management actions should also have a planned time frame that includes when to adapt (Delta Stewardship Council 2012). Such time frames must take into account the amount of time within which the outcomes (e.g., biological responses) associated with management actions could realistically be detected, based on current understanding of the system and its uncertainties.

As an example, the draft WQCP states that "to inform implementation actions, State Water Board staff will work with the COG and interested persons to develop procedures for an adaptive management process…[t]he procedures shall allow the COG or its members to propose annual adaptive management of flows during the February through June period by preparing a proposed adaptive management plan, subject to approval by the Executive Director." Appendix K, p. 4. Such proposals should include a time frame identifying the duration over which the proposed activity and associated monitoring and special studies would likely need to be implemented in order evaluate its effectiveness. Special consideration must be paid to the manner and frequency within which management actions are modified in order to ensure sufficient information can be generated through the San Joaquin River Monitoring and Evaluation Program to facilitate the learning processes that are a cornerstone of adaptive management and support such decisions. While the development of management triggers, performance measures, and time frames is not appropriate at this juncture (i.e., requires that specific management actions be developed), the Department recommends that the Program of Implementation identify them as integral components of the adaptive management program that will be developed prior to implementation.

3) The Adaptive Management Program Should Include An Adequate Process For Implementing And Evaluating Higher Flows.

Adaptive management should be undertaken when opportunities to adapt in response to new information exist such that the reduction of uncertainty can be expected to improve management (Williams 2011, Doremus 2012). With respect to implementation of the proposed LSJR fish and wildlife flow objective, opportunities for adjustments is problematic. Under the draft Program of Implementation, adaptation with respect to flows is limited to what can be accomplished with a "block of water" that represents +/- 10 percent of the selected percentage of unimpaired flow over the period of February through June. Appendix K, pp. 4-5. The Department submits that constraining the ability to evaluate flows outside of this range may limit the ability to evaluate a sufficiently broad range of flows.

Specifically, the revised WQCP states that "[t]he required percentage of unimpaired flow may range between 25 and 45 percent of unimpaired flow from any one tributary over the entire February through June period…" Appendix K, p. 5. The Department notes that constraining the extent to which flows can be modified in this manner (+/- 10 percent) may inhibit the ability to implement management actions/experiments designed to address key uncertainties regarding the role of flows (notably higher flows) and other factors in protecting public trust resources.

For example, an independent scientific review of the Vernalis Adaptive Management Program (VAMP), highlighted this constraint in the following statement:

> "In establishing flow objectives for any future VAMP experimental design for adaptive management investigations, it makes sense to deliberately include more frequent flows at the higher target levels (5,000-7,000 cfs with HORB [Head of Old River Barrier] in place, or 6,000 - 10,000 cfs with no HORB in place) whenever possible. VAMP flows generally have been too restricted in range and have included more low flows than high flow. From an experimental or adaptive management perspective, it is impossible to learn much about effects of higher flows without having a chance to observe survival (and carry out acoustic tagging experiments) at such higher flows" (Dauble et al. 2010).

As demonstrated by the VAMP example, an explicit process designed to facilitate an evaluation of higher flows is needed. In addition, for the reasons explained elsewhere in these comments, the SWRCB should consider a broader adaptive range that encompasses at least the 60 percent of unimpaired flow identified in its 2010 Report titled "Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem" (SWRCB 2010). Moreover, the Department recommends that the, the caps on high flows imposed by the Program of Implementation be evaluated to determine the limitations they may impose on important functions, including channel forming processes and floodplain inundation.

4) The Program Of Implementation Should Include A Clear Governance Structure.

The revised WQCP should more clearly define the roles, responsibilities, and authorities of the entities responsible for designing and implementing the adaptive management process. For instance, how does the composition of the Coordinated Operations Group (COG) differ from the Implementation Workgroup and how do these two entities interact? How will the composition of these groups be

determined? The draft language notes that modifications to the numeric flow requirements in the Program of Implementation, the adaptive management process, and the SJRMEP (both initial construct and future modifications) are subject to approval by the Executive Director. Appendix K, pp. 4-5, 11. What level of authority does the COG have with respect to day to day operations, management decisions, and the various forms of adaptation possible through the adaptive management program? What processes will be put in place to overcome confrontation/lack of consensus within the COG and Implementation Workgroup? How will technical discussions within the COG and Implementation Workgroup regarding scientific matters be buffered from policy and legal influence? The composition of the COG needs to be carefully considered to ensure that no one group has undue influence and the total number of representatives is constrained to a workable number. The Department recommends that the SWRCB consider these questions and provide a more detailed presentation of the anticipated implementation structure.
Figure Z provides an illustrative example of an organizational structure and associated functions for the adaptive management program, expanding on the information currently provided in Appendix K. Figure ZZ provides an example for how the various entities described in Figure Z could be incorporated into the various steps of the adaptive management process described in the Final Draft Delta Plan (Delta Stewardship Council 2012).

A lack of leadership for the complex process of implementing an adaptive approach has been identified as a main factor contributing to widespread difficulties implementing adaptive management (Walters 2007). Walters (2007) noted that in the few instances where implementation of adaptive management occurred, there was at least one singular individual (usually a middle-level staff person from a regulatory agency) who made a very large personal investment of time and energy to make sure that the program actually succeeded. There is also a need for a dedicated, highly skilled team that is responsible for assimilating knowledge acquired through the SJRMEP, as well as other relevant sources, and making recommendations to decision makers regarding programmatic changes (Dahm et al. 2009).

As an example, an entity identified as the Lower San Joaquin River Synthesis Team is incorporated into Figures Z and ZZ. Such a synthesis team could be modeled after the Interagency Ecological Program's Management, Analysis, and Synthesis Team (MAST). A related component is the need to define a sustainable, finance structure capable of fully funding implementation of the adaptive management program, including the SJRMEP, over the long-term.

As written, the linkages between the development of an Implementation Plan by the Implementation Workgroup, an adaptive management process by the COG, and the SJRMEP are not clearly articulated and to some degree appear to be separate and distinct from one another. From an adaptive management perspective, these three activities are tightly linked. For example, for issues amenable to adaptive management, the SWRCB in collaboration with the COG will initiate development of an adaptive management process, including articulating management objectives and identifying a suite of management alternatives and associated uncertainties. Following an evaluation of those alternatives, the Implementation Workgroup will develop an Implementation Plan for submittal to the Executive Director for approval. Prior to implementation of the selected management actions, the SJRMEP will be developed in order to generate information necessary to assess the effectiveness of the selected alternative(s), address key uncertainties, and inform future decision-making and adaptation within the adaptive management process.

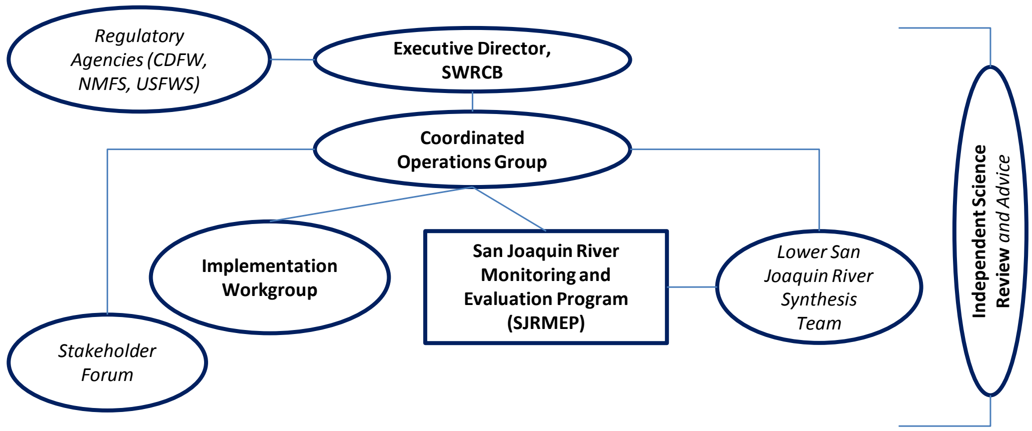
The proposed timelines associated with developing the adaptive management process (within one year following date of Office of Administrative Law [OAL] approval) and Implementation Plan (within 180 days following date of OAL approval) are extremely aggressive. Appendix K, p. 4. Given the complexity and level of effort associated with developing a science-based, workable adaptive management process and associated activities, the Department recommends that these design steps not be delayed until after OAL approval of the revised Bay-Delta Plan. A critical initial step is identifying and engaging the appropriate stakeholders, and then working with those stakeholders to strive for agreement on scope, objectives, and potential management actions (e.g., means of implementing the flow objectives) (Williams et al. 2009). The SWRCB should consider using a bridging organization (Allen et al. 2011) or facilitator to assist with improving communication and cooperation among the stakeholders in order to achieve the necessary agreements in as timely a manner as possible. Additionally, the SWRCB should consider convening a process involving the relevant stakeholders to initiate this planning effort as soon as possible.

The revised WQCP states that "[a]ny adaptive management plan that would modify the total quantity of flow over the entire February through June period <u>must be agreed to by all members of the COG</u> prior to submitting it to the Executive Director" [emphasis added]. Appendix K, pp. 4-5. Given past experiences, such a requirement (agreement by all parties) is likely to stifle opportunities for implementing management experiments and adapting in response to improved understanding. An alternative approach would be to treat consensus as an overarching goal of the COG, but provide a dispute resolution process as a means of moving forward in instances where consensus cannot be reached. In addition, the Department suggests incorporating language to the effect that in instances where a management action(s) contained within the adaptive management program is intended to benefit or may negatively affect a sensitive species and/or its habitat, the Executive Director will consult with the regulatory agency (director of CDFW and/or regional director of NMFS or USFWS) with jurisdiction over that species prior to making a determination regarding approval of the management action.

5) The Program Of Implementation Should Expand The Incorporation Of Independent Science Review and Advice.

Independent scientific review and advice should be a cornerstone of the adaptive management program. The Department commends the SWRCB for indicating that "[e]valuations of monitoring and special studies data shall be subject to regular outside scientific review" Appendix K, p. 11. However, the Department believes that it will be critical to elevate the role of independent science within the adaptive management program. For example, expert review of the SJRMEP, as well individual research activities, prior to initial implementation and at regular intervals (e.g., every five years) thereafter, will help to ensure that the program is of sufficient scientific quality to serve its intended purposes.

Other opportunities to incorporate independent science include annual reviews of project operations and review of proposals to modify management actions. The annual review process currently being implemented in association with the Biological Opinions for the long-term operations of the Central Valley Project and State Water Project provides a model for such activities. These annual reviews, which are conducted by a Delta Science Program Independent Review Panel, are designed to inform NMFS and USFWS as to the efficacy of the water operations and regulatory actions prescribed by their respective Reasonable and Prudent Alternatives (USFWS 2008, NMFS 2009b and Anderson et al. 2012). Another opportunity would be utilize an independent panel(s) to provide independent assessments of the state of science to support decision-making. The Delta Independent Science Board may also be an appropriate entity in some instances, given the requirement that they provide oversight of scientific research, monitoring, and assessment programs that support adaptive management of the Delta through periodic reviews of each of those programs. Water Code § 85280(a)(3).



Executive Director, SWRCB, Functions:
Approval Authority
- **Implementation Plan**
- **Adaptive management process**
- **Modifications to the numeric requirements in the Program of Implementation**
- **SJRMEP (initial construct and future modifications)**

Coordinated Operations Group (COG) Functions:
- *Supported by technical workgroups/teams*
- **Develop** *and facilitate implementation of the* **LSJR adaptive management program**
- *Establish objectives for management actions*
- **Develop and evaluate alternative management actions**
- *Prepare Annual Water Operation Plans*
- **Design SJRMEP** – *multi-year program with annual plans*
- **Develop and recommend changes to management actions and other aspects of the adaptive management program**

San Joaquin River Monitoring and Evaluation Program (SJRMEP) Functions:
- **Effectiveness monitoring**
    - *Track performance measures*
- **Directed research**
- **Preparation of technical reports**
- **Data management**

Stakeholder Forum Function:
- **Provides venue for meaningful input that informs all aspects of the adaptive management cycle**

Regulatory Agencies Functions:
(CDFW Director, NMFS Regional Director, and USFWS Regional Director)
- *Coordinate with SWRCB Executive Director regarding management actions that may affect sensitive species and/or their habitat*

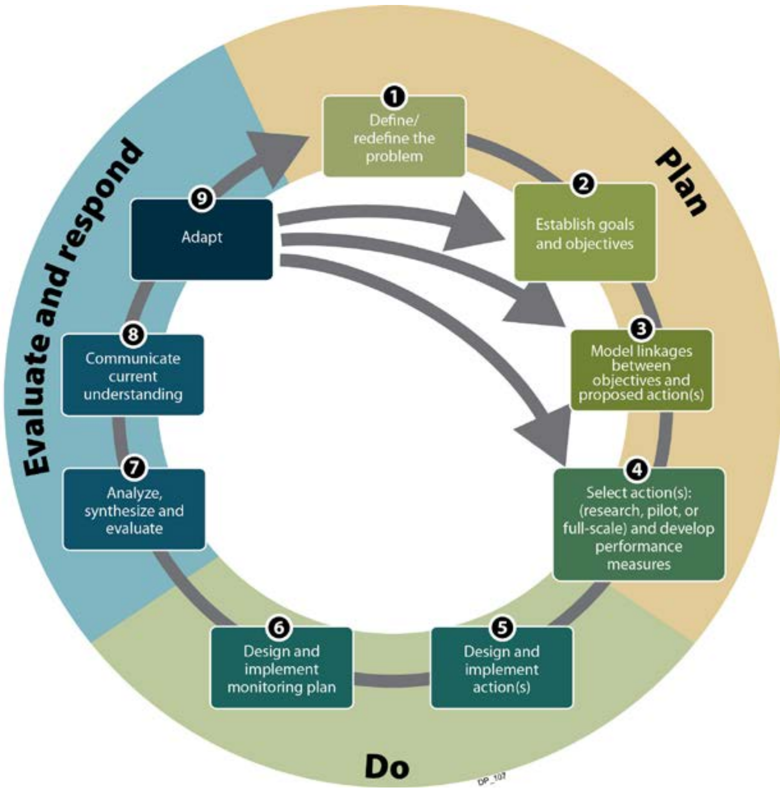
Implementation Workgroup Functions:
(Technical workgroup of the COG)
- **Develop Implementation Plan, including specific measures to achieve, monitor and evaluate compliance with the February – June flow requirements**

Lower San Joaquin River Synthesis Team Functions:
(A technical workgroup of the COG, modeled after the IEP's Management, Analysis, and Synthesis Team [MAST])
- **Assimilate findings from SJRMEP with those from other programs**
- *Translate information into formats that support decision-making*

Independent Science Review *and Advice Functions:*
(facilitated by Delta Science Program)
- *Review SJRMEP – prior to implementation and at regular intervals thereafter, or as needed*
- *Annual* **review** *of operations and* **findings from SJRMEP**
- *Review of proposals to modify management actions*
- *Provide independent assessment of state of science to support decision-making*

Bold – Explicitly included in Appendix K, *Italic* – Not explicitly included in Appendix K
Layout modified from Trulio et al. 2007

Figure Z. Straw proposal of the adaptive management organizational structure and functions



The Delta Plan's Three Phase (Nine-step) Adaptive Management Framework
Source: Delta Stewardship Council 2012

Figure ZZ. Potential roles of the various entities charged with implementing the adaptive management program as they relate to the framework proposed in the Final Draft Delta Plan (DSC 2012).

STEP 1
SWRCB and Coordinated Operations Group (COG)

STEP 2
SWRCB – LSJR fish and wildlife flow and salmon protection narrative objectives, with incorporation of quantitative targets, serve as overarching objectives
COG with support from technical workgroups - develop SMART objectives for specific management actions

STEP 3
COG with support from technical workgroups (e.g., Implementation Workgroup)

STEP 4
COG with support from technical workgroups (e.g., Implementation Workgroup)
Approval authority - SWRCB Executive Director

STEP 5
Design - COG with support from technical workgroups (e.g., Implementation Workgroup)
Implementation - Project operators (e.g., USBR, TID, MID)

STEP 6
San Joaquin River Monitoring and Evaluation Program (SJRMEP)
Design – COG with support from technical workgroups
Implementation – Responsible parties to be determined
Independent science – Program review, prior to implementation and regular intervals thereafter
Approval authority – SWRCB Executive Director

STEP 7
Technical reports – SJRMEP
Synthesis – LSJR Synthesis Team (a technical workgroup of the COG)
Independent science – Annual review of operations and findings from the SJRMEP

STEP 8
SJRMEP and LSJR Synthesis Team

STEP 9
Recommendations – COG with support of technical workgroups
Independent science – review of proposals to modify management actions, provide assessment of state of science to support decision-making
Regulatory coordination – CDFW, NMFS, and USFWS
Approval authority – SWRCB Executive Director

Stakeholder Forum – Provide venues for meaningful input that informs all aspects of the adaptive management cycle

VI. Chapter Specific Comments

Bay-Delta Plan Phase I Substitute Environmental Document (SED)
CDFW Chapter-Specific Comments

Comment Number	Chapter	Page	Chapter-Specific Comments
1	ES	ES-2, ES-3	Section ES2, third paragraph, states that "[t]he SED relies upon recent scientific studies that conclude a higher and more variable flow regime is needed in the salmon bearing tributaries to the SJR to protect fish migrating to the Delta." Further below, Section ES2.3, Summary of Impacts, the SED determines that the Preferred LSJR Alternative would "generally increase mean annual river flows relative to baseline conditions, with that increase occuring mainly in the spring months." As stated in CDFW's first General Comment, CDFW has concluded, based on the data and analysis provided, that providing 35% unimpaired flow would not be protective of SJR salmonids and would not achieve the proposed LSJR fish and wildlife flow objective.
2	2	2-15	The first paragraph states: “[t]he median flows (50 percent cumulative) can be used to characterize generally the seasonal runoff pattern.” However, CDFW's analysis shows that the median flow values for the Merced River do not appear to generally characterize the seasonal runoff pattern in all water year types. To understand how representative median flows may be of the seasonal runoff pattern, CDFW converted the 50% Cumulative Percentile unimpaired flows from Table 2-8 to cubic feet per second and plotted these values against daily unimpaired flows for two representative years on the Merced River - 1998 a wet water year and 1994 a critically dry water year (see Figures 2-1 and 2-2, respectively, in Attachment A). CDFW notes that the daily flow data for the Merced is based on prorated inflow data from Lake McClure. As a result of using a multi-year average median flow technique, the Merced Monthly Median flows (1994-2009) presented in Table 2-8 of the SED do not appear to characterize or replicate the seasonal runoff pattern of the unimpaired hydrograph for the wet water year of 1998 (see Figure 2-1). The median flows appear to reasonably estimate the seasonal runoff pattern for the dry water year of 1994 (see Figure 2-2). The SWRCB should further evaluate reliance on median flows (based on averaging monthly flows over the 1984-2009 period on the Merced River) to charactierize seasonal runoff patterns. One potential method could be to compare seasonal hydrographs by water year type to detect trends in the LSJR watershed.
3	2	2-15	The second paragraph states: “[t]he median historical annual river flow was 398 TAF. The average historical flow was 452 TAF/y for these years, slightly higher than the median.” The percent difference between 398 and 425 is 12%. Strike the word “slightly" and report the percent difference.
4	2	2-20	The first paragraph states: “[t]he median flows (50 percent cumulative) can be used to characterize generally the seasonal runoff pattern." However, CDFW's analysis shows that the median flow values for the Tuolumne River do not appear to generally characterize the seasonal runoff pattern in all water year types. To understand how representative median flows may be of the seasonal runoff pattern, CDFW converted the 50% Cumulative Percentile unimpaired flows from Table 2-12 to cubic feet per second and plotted these values against daily unimpaired flows for two representative years on the Tuolumne River - 1998 a wet water year and 1994 a critically dry water year (see Figures 2-3 and 2-4, respectively, in Attachment A). CDFW notes that the daily flow data for the Tuolumne is based on prorated inflow data from the Lake McClure. As a result of using a multi-year average median flow technique, the Tuolumne Monthly Median flows (1994-2009) presented in Table 2-12 of the SED do not appear to characterize or replicate the seasonal runoff pattern of the unimpaired hydrograph for the wet water year of 1998 (see Figure 2-3). The median flows appear to reasonably estimate the seasonal runoff pattern for the dry water year of 1994 (see Figure 2-4). The SWRCB should further evaluate reliance on median flows (based on averaging monthly flows over the 1984-2009 period on the Tuolumne River) to charactierize seasonal runoff patterns. One potential method could be to compare seasonal hydrographs by water year type to detect trends in the LSJR watershed.
5	2	2-20	The paragraph states "[t]he distribution of annual unimpaired flow ranges from 839 TAF (10 percent value) to 3,268 TAF (90 percent value), with a median runoff of 1,514 TAF. The average unimpaired flow was 1,851 TAF/y, slightly more than the median runoff." The percent difference between 1,514 TAF and 1,851 TAF is 18%. Suggest striking the word "slightly" and reporting the percent difference.

6	2	2-27	The first paragraph states: “[t]he median flows (50 percent cumulative) can be used to characterize generally the seasonal runoff pattern.” However, CDFW's analysis shows that the median flow values for the Stanislaus River do not appear to generally characterize the seasonal runoff pattern in all water year types. To understand how representative median flows may be of the seasonal runoff pattern, CDFW converted the 50% Cumulative Percentile unimpaired flows from Table 2-17 to cubic feet per second and plotted these values against daily unimpaired flows for two representative years on the Stanislaus River- 1998 a wet water year and 1994 a critically dry water year (see Figures 2-5 and 2-6, respectively, in Attachment A). CDFW notes that the daily flow data for the Stanislaus is based on prorated inflow data from the Lake McClure. As a result of using a multi-year average median flow technique, the Stanislaus Monthly Median flows (1994-2009) presented in Table 2-12 of the SED do not appear to characterize or replicate the seasonal runoff pattern of the unimpaired hydrograph for the wet water year of 1998 (see Figure 2-5). The median flows appear to reasonably estimate the seasonal runoff pattern for the dry water year of 1994 (see Figure 2-6). The SWRCB should further evaluate reliance on median flows (based on averaging monthly flows over the 1984-2009 period on the Stanislaus River) to charactierize seasonal runoff patterns. One potential method could be to compare seasonal hydrographs by water year type to detect trends in the LSJR watershed.
7	2	2-27	The second paragraph states: “[t]he median historical annual river flow was 429 TAF. The average historical flow was 611 TAF/y, which is slightly higher than the median.” The percent difference between 429 and 611 is 20%. Suggest striking the word “slightly" and reporting the percent difference.
8	3	All	CDFW recommends the SWRCB provide an updated section to the SED that fully evaluates the Preferred Alternative (35% unimpaired flow) to show how it is protective of SJR salmon during all life stages and contributes to the LSJR Fish and Wildlife Objective.
9	3	3-13	The SED states that "[c]omparison of the exceedance plots for flow at Vernalis in Figure 3-2 indicates that LSJR Alternatives 2, 3, and 4 generally encompass the DFG flow recommendations." The bold line in Figure 3-2 depicts conversion of the base and peak flows recommended by the CDFW (for different water year types for SJR fall-run Chinook salmon smolt production measured at Vernalis to double smolt production at Chipps Island) into volume, where water year types were represented into ranges of percent exceedance. CDFW does not believe that Figure 3-2 accurately depicts the CDFW flow recommendations for the following reasons. First, the SED timeframe is from February to June whereas the CDFW pulse flow recommendations cover a shorter time period, March 1 to June 15. Second, the resulting volume (for any water year type) converted from the CDFW recommended flows does not represent a February through June time period. Third, converting flow (measured in cubic feet per second) into volume (measured in thousands of acre-feet) assumes volume can be applied instantaneously within the SWRCB's February through June time period. CDFW notes that volume in excess of what is depicted by the bold line in Figure 3-2 is more than likely necessary to achieve the flows recommended by CDFW. The bold line in Figure 3-2 was constructed based on the base flow time period to calculate the volume contribution of the recommended base flows. The SWRCB should at a minimum expand the days of base flow recommended by CDFW, from 107 days (March 1 through June 15) to 150 days (February 1 through June 30), to equal the number of days used to develop the exceedence points when converting the CDFW flow recommendations into volume.
10	3	3-23	The second paragraph states: "[t]he result is a balance in which the time the alternatives are not satisfying the recommendations is offset by the time the alternatives exceed the recommendations. The LSJR alternatives may not satisfy each flow recommendation all the time, but the flow schedule–based recommendations are satisfied the majority of the time.” The bold lines in Figure 3-1 through 3-7 represent minimum flow values recommended by various agencies and organizations. Because recommended flows were converted into instantaneous flow values, the exceedence points expressed by volume must all be greater than the minimum flow values recommended to be protective. A positive volumetric offset should be added to all the exceedence points to account for the reasonable application (management) of flows over time.

11	5	5-2	The first full paragraph states "Significant impacts would result if the LSJR or SDWQ alternatives would substantially reduce river flows relative to baseline such that existing flow values (e.g., benefits) are reduced, substantially reduce (i.e., greater than 5 percent of the maximum demand) annual surface water supply diversions relative to baseline, violate salinity or temperature water quality objectives, or substantially degrade water quality such that it does not protect agricultural beneficial uses or results in an increased concentration of 303(d) pollutants." An increase in unimpaired flow in the LSJR watershed will reduce the potential to supply water diversions. It is not clear how the increase in unimpaired flow downstream of the rim dams can degrade water quality such that it does not protect agricultural beneficial uses or result in an increased concentration of 303(d) pollutants. Does the SWRCB assume 303(d) pollutant levels increase as rim dam storage lowers? Suggest revising the sentence to indicate LSJR alternatives that result in an increase in unimpaired flow may reduce water surface availability.
12	5	5-50	Section 5.3.1 summarizes federal laws related to water supply, surface hydrology and water quality, but does not include Clean Water Act Section 401, Water Quality Certification, which should be added. Currently, there are two active Federal Energy Regulatory Commission (FERC) relicensing proceedings in the SJR basin: the Don Pedro (Tuolumne River) Hydroelectric Project No. 2299 and the Merced River Hydroelectric Project No. 2179. These two hydropower projects significantly and adversely impact fish and wildlife, particularly native anadromous fish populations. Before FERC can issue a new license, the operators of both the Don Pedro and Merced River hydropower facilities must obtain water quality certification from the SWRCB pursuant to the Federal Clean Water Act (CWA) (33 U.S.C. § 1341(a)(1)). As a Trustee Agency, CDFW provides input to SWRCB staff throughout FERC relicensing proceedings to ensure protection of beneficial uses protected by the Bay-Delta Plan, such as (1) cold freshwater habitat (COLD), (2) migration of aquatic organisms (MIGR), (3) spawning, reproduction, and/or early development (SPWN), and (4) wildlife habitat (WILD). The SWRCB should add the Clean Water Act Section 401 to Chapter 5, Regulatory Setting, 5.3.1 Federal.
13	5	5-64	The SED is inconsistent when considering other times of year in the impact analysis sections. While some impacts such as those on agricultural revenue and hydropower generation address impacts year round, others are analyzed only during the February through June time frame. Water quality is an example of a resource analyzed using an inadequate time frame. When evaluating the impacts on water temperature, the impacts are only evaluated for the months of February to June when the proposed LSJR Alternatives would be implemented. The impact of reduced reservoir releases July through September on river water temperature is not considered. As both the Tuolumne and the Merced Rivers are already listed as impaired for water temperature (Chapter 5, Table 5-4, page 5-13), this omission is problematic. The Department recommends the SWRCB expand the SED analysis of water quality impacts to address year round and annual consequences consistent with the analysis of agricultural and energy resources.
14	7	General	The February through June time frame is not sufficient for an analysis of impacts to aquatic resources. Aquatic resources are present within the Bay-Delta and eastside tributaries year round and thus subject to flow impacts year-round. While a promising step, implementing an alternative based on providing a percentage of unimpaired flow February through June cannot fully support the beneficial uses of the Bay-Delta's aquatic resources. The SED's Table 7-4, Geographic and Seasonal Occurrence of Indicator Species, on page 7-28, suggests that impacts based on a larger window than February through June were considered. However, this is not supported in the SED impacts determination. As an example, impairment of water temperature is an impact on aquatic resources that tends to be very significant in the summer and early fall months, but is not captured in the scope of AQUA-11. Please refer to Figure 7-1 in Attachment A, a periodicity table prepared by CDFW with the time frame of the SED impacts analysis overlaid on top, for an illustration of the disconnect between the SED analysis and aquatic ecology in the Bay-Delta. To be meaningful, an analysis of impacts to fall-run Chinook, for example, must include an examination of what will happen to fall attraction flows. These flows are important to ensure adult salmon can return to their natal streams, and that the water quality and quantity they encounter is sufficient to support the beneficial use of migration (e.g. no dissolved oxygen barriers that physically block migration or low flows that obscure the scent of natal streams). CDFW recommends the SED aquatic impacts analysis be expanded to include significant impacts that occur as a result of implementing a LSJR alternative outside of the February through June window.

15	7	General	When comparing the preferred alternative to baseline conditions, the SED did not adequately consider what the current conditions reflect with respect to protection of aquatic species and attainment of the relevant water quality objectives. Current water management practices have resulted in direct evidence for cause and effect relationships of water temperature limiting salmonid populations in the SJR tributaries. CDFW has presented substantial evidence demonstrating that the temperature impairments in the SJR and eastside, salmon-bearing tributaries (CDFW 2007, CDFW 2010a, CDFW 2010b) (refer to Tables 7-2 and 7-3, in Attachment A), which ultimately led to segments of these rivers being listed on the SWRCB's 2008-2010 303(d) list of impaired water bodies (USEPA 2011). Increasing outflow during the spring time period, without analyzing or adjusting diversion rates could result in disastrous conditions for aquatic species during the remaining times of the year, above what is already being realized by SJR salmonids. Without an evaluation of the effects of the proposed alternative through the entire year, that recognizes both the current operating conditions and the level of protection being met, the SED does not adequately evaluate the impacts associated with implementing the preferred alternative to meet the LSJR fish and wildlife flow and salmon protection narrative objectives.
16	7	General	The SED's sections describing rainbow trout/steelhead does not correctly describe rainbow trout. Coastal rainbow trout (*Oncorhynchus mykiss irideus*) are a species that have a very complex life history which has been shown to result in over 30 life cycle variations. The terms "rainbow trout" and "resident rainbow trout" are often used to identify non-anadromous forms of *O. mykiss* . This convention is confusing and technically inaccurate because "rainbow trout" is the common name of the biological species *O. mykiss* , and the term "resident," used in this sense, ignores other, non-anadromous life-history forms and migratory behaviors. In the SED, the term "rainbow trout" should refer to the biological species *O. mykiss* regardless of life history. The term "non-anadromous" should be used to refer collectively to all life-history types other than anadromy. Anadromous (or steelhead) and resident *O. mykiss* did not arise from two distinct evolutionary lines. The factors that influence the choices between migrating to the ocean and remaining in freshwater are complex and based on a number of biological and environmental cues. In the anadromous waters of the Central Valley (CV), wild anadromous and resident forms of *O. mykiss* are intermixed. It is estimated that with the construction of the impassable dams, over 80% of the historic habitat is no longer available. The *O. mykiss* populations located in the tributaries above the dams/reservoirs are of coastal rainbow trout ancestry, however due to extensive, widespread stocking, movement, and hybridization, coastal rainbows stocks in the reservoirs and tributaries may have been genetically altered. There are genetic studies that indicate that historic stocks of coastal rainbow trout are present in the upper CV tributaries above the rim dams. From a regulatory perspective, CDFW manages and protects all wild (non-hatchery origin) *O. mykiss* in anadromous waters as single species population. If the SRWCB intends to identify the different *O. mykiss* life histories, CDFW recommends rewriting the section to better clarify the life history strategies. These statements are summarized primarily from the following references: CDFG Steelhead Restoration and Management Plan for California (Jackson and McEwan 1996); Central Valley Steelhead -Fish Bulletin 179 (McEwan 2001); Genetics of Central Valley O. mykiss populations: drainage and watershed scale analyses (Nielsen et al. 2005); and Population genetic structure of Oncorhynchus mykiss in the California Central Valley (Garza and Pearse, 2008).
17	7	7-1	To the list of specific mechanisms used in this chapter to evaluate impacts of the LSJR alternatives on aquatic resources, CDFW recommends adding the following mechanism: "Changes in flow such that fish are exposed to different water quality conditions (e.g. water temperature and dissolved oxygen), leading to changes in species composition." CDFW recommends adding this analysis of changes in species composition throughout the chapter wherever the range of impacts is identified (in Section 7.4, for example).

18	7	7-1	To the list of specific mechanisms used in this chapter to evaluate impacts of the LSJR alternatives on aquatic resources, CDFW also recommends adding "Changes in operations at the Merced River Fish Hatchery." The Merced River Hatchery is a mitigation aquaculture facility intended to compensate for the loss of access to upstream habitat for native anadromous species occupying the Bay-Delta Plan area. The surface water source for the Merced River Hatchery, the Merced River, is proposed for 303(d) listing as temperature impaired in the Central Valley Region Board Resolution R5-2009-0059. Implementing the LSJR Alternatives could impact the water quantity and quality of this facility's water supply and, subsequently, its ability to meet mitigation goals. This additional analysis would need to be carried throughout the chapter wherever the range of impacts is identified (in Section 7.4, for example).
19	7	7-3	Table 7-1 summarizes impacts of changes in flows February through June. CDFW agrees that spring time flows are very important for native aquatic species (Meehan, M.K. and T.C Bjorn, 1991). CDFW also agrees that, due to the seasonal nature of competing water demands, spring time flows are a highly impaired portion of the hydrograph. However, as noted previously, indicator aquatic resources are present in the basin throughout the entire year. The spawning, rearing, and migration life stages referred to in the AQUA-3 impact do not just occur February through June. Water quantity and quality are key limiting factors for aquatic resources from July through January as well. For example, in October and November fall flows provide an essential attraction function for fall-Run Chinook adults returning to spawn in the tributaries (Bjorn, T.C. and D. W. Reiser, 1991 and Murphy, M.L. 1995). Similarly, water temperature is a limiting factor year round, with Central Valley steelhead requiring cold water refugia outside the February through June period and impaired water temperatures increasing disease risks for cold-water species regardless of month (Sniezko 1973 and 1974).
20	7	7-4	In Table 7-1, under AQUA 4, the analysis concludes that under LSJR Alternatives 2, 3 and 4 changes in exposure of fish to stressful temperatures would not occur. This is misleading as the analysis also notes under LSJR Alternatives 3 and 4 water temperatures would decrease. CDFW recommends changing this section of the conclusion for LSJR Alternatives 3 and 4 to "reductions in exposure to stressful temperatures will occur."
21	7	7-5	In Table 7-1, under AQUA-7, the analysis of impacts from flow fluctuations is based on changes in depth of one foot or more using a baseline of average monthly flows (table 7-19). Reliance on monthly flows does not address the magnitude nor frequency of daily flow fluctuations. Daily flow fluctuations have the potential to significantly impact indicator aquatic species. During spawning seasons, for example, a six hour drop in water level that exposes redds or a 3-day low flow that results in a spike in water temperatures can significantly reduce egg viability (Groot and Margolis 1991). CDFW recommends using a daily time step to analyze the impact on redds from flow fluctuations.
22	7	7-6	In Table 7-1, under AQUA 9, the SED incorrectly concludes there is no substantial impact to food availability from increased floodplain inundation. Increased floodplain inundation will significantly increase food production and food availability (i.e. result in a significant positive effect) (Moyle, P.B., Crain, P.K. and Whitener, K. 2007).
23	7	7-12	Table 7-2, Special Status Fish Species, does not include two species of concern for the State which occur in the basin: Red Hills Roach and Kern Brook Lamprey. CDFW recommends these two species be added to Table 7-2 of the SED.
24	7	7-17	The first full paragraph concludes: "Non-hatchery stocks of rainbow trout that have anadromous components within them are found in the upper Sacramento River and its tributaries, Mill, Deer, and Butte creek, and the Feather, Yuba, American, Mokelumne and Calaveras Rivers (McEwan 2001). " This statement is misleading. Non-hatchery stocks (also referred to as wild or naturally spawning) of rainbow trout located in anadromous waters of the Central Valley are a single stock of *O. mykiss* which can produce both anadromous and resident forms. The anadromous and resident forms are of the same genetic stock. Resident O. mykiss are not a reproductively isolated group and are capable of breeding with and producing anadromous forms. CDFW recommends rewriting this sentence, as follows: "Wild (non-hatchery origin) stocks of coastal rainbow trout are present throughout the upper Sacramento River and its tributaries including Mill, Deer, and Butte Creeks, and the Feather, Yuba, American, Mokelumne, and Calaveras Rivers. Both anadromous and resident forms have been observed within these waters and represent the unique and complex life cycle of the coastal rainbow trout population in the Central Valley."

25	7	7-18, 7-25	The analysis of green and white sturgeon is incomplete because it does not adequately: (1) disclose baseline information regarding sturgeon; (2) describe the universe of established expert knowledge regarding sturgeon as well as what is not known with certainty regarding the impacts of water temperature, water clarity, sediment movements, and contaminants upon sturgeon and the species' predators; or (3) use published conceptual models of green and white sturgeon and analytical tools such as DRERIP to evaluate changes in flow, temperature, spawning area and egg survival. Good resources to utilize in expanding this section is "Life History Conceptual Model for North American Green Sturgeon (Acipenser medirostris)" prepared by Joshua A. Israel and A. Pete Klimley, and "Life History Conceptual Model for White Sturgeon (Acipenser transmontanus)" prepared by J. Israel, A. Drauch, and M. Gingras (2009).
26	7	7-23	CDFW recommends rewriting this section to better represent the life histories of rainbow trout. As currently written, the rainbow trout background information does not clearly define rainbow trout and steelhead classifications. This section blurs the lines between resident and anadromous rainbow trout in anadromous waters, and rainbow trout located above rim dams.
27	7	7-29	The fifth paragraph states: "Steelhead were thought to have been extirpated from their entire historical range in the San Joaquin Valley, but current populations consisting of anadromous and resident forms survive in the Stanislaus, Tuolumne, and Merced Rivers (NMFS 2009). None of these populations are considered to be viable at this time (Lindley et al. 2007)." CDFW disagrees with the statement that "none" of the steelhead populations are considered viable. The reference from Lindley et al. 2007 is misrepresented. The SED also makes the following statement: "There is no evidence to suggest that the Central Valley steelhead ESU is at low risk of extinction, or that there are viable populations of steelhead anywhere in the ESU." Prior to that statement, the SED states: "There are almost no data with which to assess the status of any of the 81 Central Valley steelhead populations described by Lindley et al. (2006). With few exceptions, therefore, Central Valley steelhead populations are classified as data deficient." Based on these statements and the previous statement made in the SED, on page 7-17, "Until recently, Central Valley steelhead were thought to be extirpated from the SJR Basin. However, recent monitoring has detected small self-sustaining populations of steelhead in the Stanislaus, Mokelumne, and Calaveras Rivers, and other streams previously thought to be devoid of steelhead (McEwan 2001, Zimmerman et al. 2008)," the authors do not have adequate data to support this statement and are speculating that there are no viable populations. CDFW recommends removing the sentence stating that "none" of the steelhead populations are considered viable and any other sentence which is not supported by data.
28	7	7-32	The SED includes Sacramento pikeminnnow in a discussion of nonnative predators. Sacramento pikeminnow is a native species; therefore, this section should be rewritten to clarify it addresses all predatory fish, not just nonnatives.
29	7	7-35	The section on Introduced Species and Predation states that "[p]redation by introduced bass is considered a primary factor limiting survival of juvenile Chinook salmon in the lower Tuolumne River." The SED cites a study from 1989-90. CDFW notes the subject study had several limitations, and is not appropriate as the sole source of information for a complex and somewhat controversial topic. As an example of the 1989-90 study limitations, the interactions between low flows, high water temperatures, lack of access to floodplain or riparian cover and predation were not examined, resulting in overly simplistic conclusions. At a minimum, CDFW recommends removing the label of "primary" from this section of the SED discussion. We also recommend expanding this section with a more complete discussion of predation within aquatic ecosystems. Please refer to CDFW's February 7, 2011 letter to the SWRCB for additional information regarding the role of predation in the San Joaquin River basin.
30	7	7-39	The Hatchery Operations section describes the Merced River Hatchery as the only fish hatchery in the SJR basin. CDFW notes that traditionally the Mokelumne River Fish Hatchery is considered part of the San Joaquin River Basin system. We recommend SWRCB clarify the subject statement to avoid the apparent omission of the Mokelumne River facility.
31	7	7-40	The paragraph describing diseases within the Merced River has an important omission. CDFW recommends it include information on proliferative kidney disease (PKD). The SWRCB can refer back to the references cited in this section of the SED for greater detail on PKD.
32	7	7-42	The wording in the section on disease within the LSJR is inaccurate. The SED describes *Ceratomyxa shasta* (*C. shasta*) as a tubifex worm. In fact, *C. shasta* is a myxosporidian. The tubifex worm is an intermediate host for *C. shasta* while salmonids are the primary host. CDFW recommends this section be amended to more accurately reflect the disease's lifecycle.

33	8	8-22	Under the heading of BIO-1, several CDFW polices are missing from this section. We recommend adding DFG Code Section 1389 Preservation and Enhancement which reads, in part, that the preservation and enhancement of riparian habitat is a primary concern of all state agencies whose activities impact riparian habitat. Another policy that should be included in this analysis is the DFG Section 1385, California Riparian Habitat Conservation Act. These policies recognize California's rivers, wetlands, and waterways and the fisheries and wildlife habitat they provide, are valuable and finite resources, and the preservation and enhancement of riparian habitat shall be a primary concern of all state agencies whose activities impact riparian habitat.
34	8	8-22	Chapter 8 analyzes whether the alternatives have a substantial adverse effect on riparian habitat or other sensitive terrestrial communities identified in local or regional plans, policies, regulations or by CDFW or USFWS. Under Alternative 2 (20% unimpaired flow), in the Aquatic and Terrestrial chapters, the SED indicates Stanislaus flows would be reduced with significant and unavoidable impacts to spawning rearing and migration habitat. Similarly, the SED indicates that Alternative 2 with lower spring median monthly flows would substantially affect existing riparian or sensitive terrestrial species. While a slight improvement, the 35% unimpaired preferred alternative still implies a negative trend for remaining wetland acreage which is already at less than 10% of historical extent and riparian acreage which is at less than 2% of historical extent. CDFW notes the 35% unimpaired flow level proposed for the Stanislaus River is not consistent with the riparian preservation and conservation policies for the state referred to in the previous comment. There are a range of impacts from reduced flow on riparian and aquatic ecosystems, depending on the intensity and duration of time of the depletion. The effects of moderate or episodic flow depletions on riparian and aquatic ecosystems can be subtle, ranging from transient physiological stress to structural and functional changes involving reductions in species richness and primary productivity, and increases in nonnative species. Significant depletions of surface and groundwater can lead to dewatering of the channel and floodplain, resulting in a variety of structural and functional changes, including the mortality of riparian vegetation and aquatic biota, destabilization of channel banks, and the encroachment of upland vegetation and non-native weeds into the riparian zone (Auble et al. 1997 and 2005, Innis et al. 2000, Kondolf and Curry 1986, Rood and Mahoney 1990, Scott et al. 1999).
35	8	8-36	The SED states that "the LSJR alternatives would likely have a beneficial effect on some special status species, particularly to the extent that increased flows encourage additional riparian habitat establishment" and this is consistent with the ESA, CESA, and the USFWS recovery plans. However, as noted in the previous comment, the Preferred Alternative (35% unimpaired flow) for the Stanislaus River is not consistent with these recovery plans and impacts to sensitive or listed species could occur. CDFW recommend the SWRCB rewrite this conclusion clarifying it is only LSJR Alternatives 3 (40%) and 4 (60%) which can be considered consistent with riparian preservation and conservation policies of interest to all state agencies.
36	14	14-16	As noted previously, the SED is inconsistent when considering times of year other than February through June in the impact analysis sections. As an example, in Chapter 14, the SED assumes a decrease in hydropower production and increased groundwater pumping during the summer months of July through September under the LSJR Flow Alternatives "due to less water being released from the major reservoirs as a result of reduced diversion downstream." This seasonal shift in energy resources is not found to have significant impact on the reliability of California's electric grid. However, the SED concludes implementation of LSJR Alternatives 3 or 4 would result in significantly increased greenhouse gas (GHG) emissions due, in part, to an increased need for power generation at non-hydropower facilities. This impact analysis is based on a year-round, or annual, perspective as the SED notes there will actually be greater hydropower generation under LSJR Alternatives 3 or 4 February through June and only less generation beginning in July. CDFW recommends that consideration of expected impacts from July through January as a consequence of implementing the LSJR Alternatives be applied to the biological resources as well.

37	14	14-20	The SED makes conservative assumptions and likely over-estimates the need to increase power generation at non hydropower facilities. It is both reasonable and foreseeable that hydropower operators will upgrade facilities and could modify operations to take advantage of higher instream flow requirements February through June and compensate by drawing down reservoirs during summertime to maintain acceptable generation. For additional details on existing facilities and the potential for future mitigation measures, refer to the Pre-Application Documents (PAD) provided to FERC by the hydropower operators undergoing relicensing: Turlock Irrigation District and Modesto Irrigation District (collectively, the Districts) (2011) and Merced Irrigation District (2008). CDFW recommends the SWRCB specifically note the presented analysis of impacts to hydropower generation assumes a worst case scenario of no compensating facility upgrades and acknowledges the potential for likely upgrades. The following excerpts illustrate the magnitude of potential upgrades: "The Districts have evaluated the potential for upgrading the 40-year-old Units 1, 2 and 3. At this time, the Districts believe it is likely that an upgrade to the turbines will be proposed . . . [t]he maximum flow increase through each unit would be approximately 400 cfs." (Turlock Irrigation District and Modesto Irrigation District 2011, page 3-34). "At this time, Licensee believes it is highly likely that at least the McSwain Energy Recovery Unit will be proposed for inclusion in the Project in the new license . . . The new unit would enable the Project to generate incremental energy when flows in the Merced River are either below the minimum or above the maximum hydraulic capacity of the existing McSwain Powerhouse turbine-generator unit. As currently planned, the new unit would have a maximum capacity of about 500 cfs. . ." (Merced Irrigation District 2008, page 6-33).
38	14	14-25	The SED assumes the need to compensate for the loss of hydropower production, along with increased energy consumption for groundwater pumping, will contribute to a significant and unavoidable impact of increased greenhouse gas (GHG) emissions under LSJR Alternatives 3 and 4. Though not explicitly stated, the analysis also includes the conservative assumption that existing hydropower facilities will not adapt to predictable changes in water supply. However, as noted previously, those operations and facilities are likely to change in light of the issuance of new FERC licenses. New licenses are currently anticipated in spring 2016 for Don Pedro Hydroelectric Project and spring 2014 for Merced River Hydroelectric Project.
39	14	14-26	The SED lists potential mitigation measures to address the impact of increased GHG emissions. CDFW recommends adding the potential to reduce the expected loss of hydropower during summer months from implementing LSJR Alternatives 3 and 4 by increasing efficiency of existing hydropower facilities and operations to the list. The potential mechanisms for implementing this mitigation measure include CWA Section 401 conditions required by the SWRCB to mitigate impacts on hydropower generation and minimize increases in GHG emissions.
40	17	17-5	The first full paragraph states: "Generally, LSJR Alternatives 3 or 4 require higher unimpaired flow on the Merced and Tuolumne Rivers (and the Stanislaus River for LSJR Alternative 4) when compared to baseline. Thus, these alternatives result in significant and unavoidable impacts on resources that require water for beneficial uses other than fish and wildlife, such as surface water supply for irrigation, agricultural resources, service providers, and energy resources and climate change. These alternatives would also result in significant and unavoidable impacts on groundwater resources because of decreased surface water diversions that would likely be augmented by increase in groundwater pumping." If the water source for water supply of the above listed beneficial uses is replaced by groundwater pumping then there is an impact to the groundwater resource, but water supply itself and the beneficial uses relying on that supply would not be impacted by merely replacing the source of water from surface diversions to groundwater, a potential impact of LSJR Alternatives 3 and 4. Impacts to groundwater resources are described in Section 17.4.4. Recommend removing third sentence in first full paragraph.

41	17	17-6	The last paragraph states: "LSJR Alternative 3 and 4 would have significant and unavoidable impacts on groundwater resources. The magnitude of the significance is related to the amount of expected groundwater pumping needed to replace the lost surface water diversions under each of the alternatives." This statement implies increasing instream flow for fish and wildlife impacts water supply and groundwater resources simultaneously. If surface water diversions are simply replaced with groundwater there is no impact to water supply. There is a potential impact to groundwater supply, but there is also a potential benefit to lessening surface water supply (reduced evaporation). Recommend striking this paragraph and revise it to describe the benefits and potential impacts of offsetting surface water diversion with groundwater pumping.
42	18	18-2 to 18-3, 18-14, 18-23	The SED overlooked substantial evidence that the economic impact resulting from declining fisheries is significant as measured in total revenue output and sector jobs. Although the SED considered the economic impact on recreational fisheries, it found that recreational fisheries economic "effects [are] not quantified, but [are] expected to be minor." SED, Chapter 18, p. 18-3. According to the SED, "because certain physical impacts on these resources, such as changes in fish populations, cannot be reliably predicted, related economic effects are correspondingly difficult to evaluate with certainty," and "as a result, the analysis of aquatics- and recreation-related economic effects is necessarily more qualitative." SED, Chapter 18, p. 18-14. Unlike the SED's analysis of the economic impact on agriculture, the analysis of impacts on public trust fisheries resources does not consider the economic impact related to revenue output and sector jobs. Moreover, the SED appears to overlook the economic impact of salmon fishery closure on both the recreational and commercial fishing industries. CDFW recommends the SWRCB develop a more detailed analysis of the economic effects of the LSJR alternatives on the recreational and commercial fishing industries using, for example, available evidence of the economic impacts of fisheries decline. By way of example, when the population of spawning Sacramento River Chinook suddenly collapsed, the Pacific Fishery Management Council took the unprecedented step of completely closing the California salmon fishing season in 2008 and 2009. The economic impact of the 2008-2009 closure was significant by several measures. The University of Pacific has estimated the cost of the single 2008-2009 salmon fishery closure to include: (1) $47.9 million in lost commercial income and 961 lost commercial jobs; and (2) $70.5 million in lost recreational income and 862 lost recreational jobs (Michael 2010).
43	18	18-2 to 18-3, 18-14, 18-23	The Department also recommends that the SED expand its consideration of the economic benefits of increasing the sustainability of the fisheries. For example, increasing the sustainability of fisheries (both commercial and recreational) likley generates more jobs and may in fact generate a positive employment over a sustained period of time.
44	20	20-14	The first paragraph states: "Because the Preferred LSJR Alternative flows are not less than the minimum flow values in more than ten percent of the 82 years if simulation, the Preferred LSJR Alternative would have a less than-significant-impact on water quality due to increasing contaminate concentrations (WQ-4)." No reference is provided for the ten percent threshold when considering significance of impact to water quality. If the ten percent threshold was developed by the SWRCB as a 'rule of thumb', please explain this rationale further or consider striking the sentence altogether and replacing it with the following: "Because the Preferred LSJR Alternative flows are not less than the minimum flow values in the majority of the 82 years simulated, SWRCB believes the Preferred LSJR Alternative would have a less than-significant-impact on water quality due to increasing contaminate concentrations (WQ-4)."
45	20	20-15	The second full paragraph states: "Significant impacts would result from substantial reductions in flows (i.e. reduction in monthly median flows of 10 percent or more)." Impacts refer to impacts on aquatic resources resulting from substantial changes in quantity of spawning, rearing, and migration habitat resulting from changes in flows. The SWRCB is using percent reduction in monthly median flows to measure impacts to three different salmonid life stages (spawning, rearing, and migration). CDFW is concerned with the accuracy in using a monthly model to weigh impacts to spawning, rearing, and migration habitat. If the flow schedule-based approach is based on a recognized method, the SWRCB should provide the reference or rationale.

46	20	20-16	The second full paragraph states: "Significant impacts related to redd dewatering and fish stranding were assumed when there were substantial increases (10 percent or more) in the occurrence of February and March flows dropping by more than an average of 1 foot per month." Redd dewatering can be expressed as a function of wetted area. The SED correlates wetted area reduction to depth reduction. The SWRCB recognizes that wetted surface area analyses have been evaluated in the three tributaries (Appendix C, 3-36) to estimate wetted areas under different flow conditions. How was the threshold of one-foot per month determined to weigh impacts to redds? The Department recommends that the SED provide a rationale for the threshold development.
47	20	20-16	Evaluating the effects of redd dewatering and fish stranding losses based on average monthly flow does not accurately capture the effects on aquatic species.
48	20	20-16	Table 20-10 (Percent of Time Greater than 1 foot Decrease in Depth from Previous Month for the Stanislaus River) shows that implementing the recommended alternatives would result in a reduction in Stanislaus River flows, which in turn would result in increased occurrences of one-foot decreases in depth when compared to the baseline. Recommending new flow standards that negatively effect current flow standards that are based on a jeopardy biological opinion contravene the intent of the Bay-Delta Plan update.
49	20	20-20	The second full paragraph states: "Significant increases in groundwater pumping (more than 5 percent) increase would be assumed to result in significant impacts to groundwater resources." Page 1 of Chapter 9, Groundwater Resources, states that impacts to groundwater elevations and aquifer storage cannot be determined with certainty. Therefore, there is no technical basis for a 5 percent threshold. The SWRCB should consider striking the sentence quoted above and replacing it with the following: "The Preferred LSJR Alternative will result in increased groundwater pumping impacting groundwater resources."
50	App. C	2-1 & 2-2	Last sentence of the first paragraph states: "[a]s described in Section 2.2.2, unimpaired flows are estimated on a monthly basis for water years 1922 to 2003 by DWR, and for the purpose of this analysis, are considered to adequately portray the natural flow regime." Figures 2.1 and 2.2, on page 2-2, present annual hydrographs for a sample wet year (2005) and a sample dry year (2008) for the Stanislaus River. In a dry year like 2008, the range of flow in cubic feet per second (cfs) for the month of April was approximately from 1,800 cfs to 3,000 cfs or 1,200 cfs. In the wet year 2005, flows ranged from approximately 2,950 cfs to 4,800 cfs or 1,850 cfs. The range of flows for the months of March and May in 2008 and 2005 were far greater. For example, flows ranged by approximately 9,700 cfs in March 2005. Flows estimated on a monthly basis do not depict the natural variability of the flow (within a month) when compared to the historical hydrographs shown in Figures 2.1 and 2.2. The SWRCB should reconsider reliance on monthly data and consider using a shorter time step such as average daily data to meet the proposed narrative objective goal to "[m]aintain…flows that mimic the natural hydrographic conditions to which native fish are adapted."
51	App. C	2-12	The last column in Table 2.4. (Unimpaired and Observed Flow Statistics by Water Year Type for 1930 to 1955 and 1984 to 2009) reports Observed Flow as Percentage of Unimpaired Flow for the 1984 to 2009 time period. The averages for each water type in this time frame range from 61% to 27%, with the Average and Median of All Years being 45% and 46%, respectively. CDFW assumes the values given for Observed Flow as Percentage of Unimpaired Flow are the result of dividing Observed Flow (TAF) by Unimpaired Flow (TAF) for the 1984 to 2009 time period. However, CDFW is unable to confirm the value reported for Median of All Years as 46%. When CDFW computed the unimpaired flow percentage for the second row values, 1,720 TAF divided by 4,580 TAF, it estimated that the Median of All Years is 38%, and not 46% as reported in Table 2.4. The SED's Preferred Alternative of 35% unimpaired flow falls below the unimpaired flow median value of 38%. Although Table 2.4 refers to the whole water year and is not limited to February through June flows, annual unimpaired flow values should be informative in the selection of a LSJR Alternative based on percentage of unimpaired flow. The current and historical condition for fall-run Chinook salmonids in the LSJR watershed is in a state of decline. In order to move the condition of salmonids into a state of abundance, the Preferred Alternative unimpaired flow percentage must exceed the annual unimpaired flow median of 38%.

52	App. C	5-58 & 5-59	The last paragraph states: "[b]ecause a monthly flow value is the combination of all of the physical and biological effects resulting from a river's flow in a specified month, the actual relationships between flow (cfs) and flow value are unknown." The SED uses monthly flow values (median flow values) to weigh impacts of different LSJR Alternatives. Monthly values cannot express flow variability (occurring on a time step shorter than a month). SWRCB's ability to weigh impacts of the various alternatives on the seasonal flow variability as displayed Figures 2.1 and 2.2 Chapter 2 of Appendix C, is limited by its use of monthly data. CDFW is not aware of how the SWRCB evaluated the impacts to flow variability. CDFW recommends SWRCB state after the quoted sentence that the SED cannot weigh the impacts of the LSJR alternatives on flow variability because of the limitations of a monthly time step model.
53	App F.1	F.1-16	The SED states, in bullet 3, that user defined inputs to the WSE model include the following: "Monthly maximum and minimum flows for each eastside tributary, based on tributary channel capacities and flood control limits and minimum acceptable fish-habitat flows (constant values were used for each tributary)." The SED did not consider impacts to fish-habitat when developing maximum flows. The SED considered minimum flows only to protect fish. CDFW flow recommendations presented in Table 3-2 give a base flow (minimum) and a peak flow (maximum). Migratory fish species benefit from peak flow events that provide flood plain inundation for rearing, migratory cues for juveniles, and channel forming processes. The SED suggests that flows limited to median values supply adequate benefit to fish and channel forming processes. To more accurately consider impacts to fish and wildlife beneficial uses, the SWRCB should include an analysis of the magnitude and frequency of maximum flows needed to develop a minimum threshold for maximum flows.
54	App F.1	F.1-19, Figures F.1-(1-3) (d)	The last paragraph states "Figure F.1-1...graph d) shows the pattern of January storage and water supply diversions that was selected for the WSE model case (lines) with CALSIM baselines values shown for reference." It is unclear how the model case (lines) were drawn or point positions selected. The model case (lines) appear to be 'trend lines' used to establish a regression relationship used later to develop the storage-diversion rule-curve. Figures L-1 (Appendix L) present trend lines depicting the relationship between Maximum Daily Average Flow and Associated Monthly Average Flow. Figure L-1 includes correlation coefficients (R2-values) indicating the confidence of the trend lines. The SWRCB should add R2-values to Figures F.1-(1-3) (d) to indicate confidence of regression or explain point position selection used to draw model case (lines).
55	G	G-26, Figure G-10	The SED's analysis of LSJR alternatives indicatess that under most scenarios, changes in total agricultural production and revenues are large in absolute terms (e.g. $50 million losses), but small in relative terms (e.g. a 2% decrease). Figure G-10 (on page G-26 of the SED) shows that, most of the time, annual agricultural revenues would drop from a baseline of approximately $2.75 to $2.80 billion, to about $30 to $100 million less. In the driest years, revenue would fall $100 to $330 million relative to baseline, depending on the SED LSJR alternative. This would be about 4% to 12% of agricultural revenues. Under the 60% of unimpaired flow alternative, agricultural revenue would decline less than 5% for 70% of the time. If adjustments to the fixed percentage approach were made during dry years, these marginal declines would extend even further, beyond 70% of the time. To put a 5% decline into perspective, agricultural revenues, which are affected by commodity prices as well as water supply, weather, and other factors, typically vary about 6% per year, up and down, in Stanislaus County. Based on the Department's analysis of the crop report data provided by Stanislaus and Merced Counties, between 2000 and 2010, annual variation in total agricultural revenue ranged from a 6% decrease to a 32% increase. Individual variation among different crops was far greater than this. On the whole, total agricultural revenues increased 70% during the period in Stanislaus County and 40% in Merced County (even adjusting to constant dollars). County crop report information available at: http://www.stanag.org/crop-reports.shtm and http://www.co.merced.ca.us/Archive.aspx?AMID=36.

56	G	G-29	The SED overstates ripple effects on the regional economy from changes in agricultural revenue (e.g., the fertilizer company, the farm laborer, and all the items they buy at local businesses, as well as the local sales taxes they pay, etc.), especially over the long-term. It relies on IMPLAN, a regional economic model that allows users to quickly develop economic evaluations. For example, the model assumes fixed factors of production and assumes that producers (e.g. farmers) are unable to adjust in any way to changing water supply, prices, or other inputs. SED, Appendix G, p. G-29. The results are presented both in terms of dollars of economic activity and employment. In general, the results conclude that regional economic impacts amplify the agricultural revenue impacts by approximately 75%. Under the 40% of unimpaired flow alternative, employment declines by 4% or less 90% of the time, in the agricutlural and related sectors. Although the SED acknowldges that the modeling overstates economic impacts to agriculture, ("[i]n reality, businesses are always adapting to changing conditions"), the inclusion of the analysis without more detailed anlaysis of its asssumptions over-states the alternatives' economic impacts on agriculture.
57	G	G-30	The summary of results section of Appendix G does not provide a time frame for duration of estimated impacts. In fact, the economic models utilized present results that are most relevant to short-term conditions. CDFW recommends the SED more explicitly state this limitation to avoid the impression that the estimated levels of impact will continue in perpetuity. A much more realistic scenario is that after a few years, the agricultural community will adapt, employ new technologies, and shift crops in ways that dampen the impacts described in the model.
58	J	J-4	In Section J.2, Energy Generation Effects, the SED compares energy generation from the various facilities on the eastside tributaries under each of the LSJR Alternatives against the amount generated under baseline conditions. CDFW notes that there is great operational flexibility in operating these hydropower facilities. As an example, the Don Pedro Hydroelectric facility on the Tuolumne River currently has significant reservoir carryover capacity at the end of each water year (at least 500 thousand acre-feet (TAF) as noted in the SED. However, based on information provided by the Turlock Irrigation District and Modesto Irrigation District at a December 7, 2012 relicensing workshop on a Don Pedro Hydroelectric Project Operational Model (TuolumneDailyModel (Version 1.01).xlsx), from 1971 to 2009, the end-of-September carryover storage at Don Pedro Reservoir averaged 1,422 TAF or almost three times the “target” of 500 TAF. It is our understanding that maintaining large carryover volumes within the reservoir is a discretionary action taken by the Districts to reduce the risk of less than full water deliveries in consecutive dry years. CDFW recommends the SWRCB identify the potential for alternative end-of-September carryover practices when developing future CWA Section 401 water quality certification conditions.
59	J	J-8	This section of the SED describes the pattern of total monthly energy generation to establish a baseline. CDFW recommends this section include a reference to the ongoing FERC relicensing proceedings on both the Tuolumne and Merced Rivers. During the relicensing proceedings, both the Don Pedro and Merced Hydroelectric facilities have noted the intent to upgrade their facility equipment. (For additional details on potential for upgrades, refer to the Pre-Application Documents provided to FERC by the hydropower operators undergoing relicensing, (i.e. the Turlock Irrigation District and Modesto Irrigation District (2011) and Merced Irrigation District (2008)). Such upgrades would increase hydropower capacity and minimize spring-time spill (or “wasted water”) during implementation of the LSJR fish and wildlife objectives on the Tuolumne and Merced Rivers. These increases in capacity would minimize the reduction in annual energy generation associated with implementation of any of the analyzed LSJR flow alternatives without lessening the benefits to aquatic resources.
Revised Water Quality Control Plan			
60	App. K	General	The SED's proposed LSJR fish and wildlife flow objectives and associated program of implementation do not include changes to flow objectives outside of the February through June time frame. CDFW is concerned that the February through June time frame may miss key ecological services and functions and may not be comprehensive enough to fully protect SJR salmon during their complete life cycle. CDFW recommends the SWRCB conduct a more comprehensive analysis of year-round flow objectives in order to evaluate the full suite of potential trade-offs and consequences of implementing changes in the Bay-Delta Plan. This would assist in the development of flow alternatives that effectively protect fish and wildlife beneficial uses during all life stages.

61	App. K	1, Table 3	The revised Water Quality Control Plan's (WQCP) proposed LSJR fish and wildlife flow objective does not include a measureable, quantitative outcome, and therefore is subjective, open to interpretation, and does not provide a firm basis from which to determine the effectiveness of the revised flow requirements. CDFW recommends that the SWRCB develop water quality objectives for fish and wildlife beneficial uses that are Specific, Measureable, Achievable, Relevant, and Time-fixed (SMART). With respect to the LSJR fish and wildlife flow objective, this would entail inclusion of quantitative targets for the indicators of viability. In addition, quantitative targets for each of the salmon-bearing tributaries (Stanislaus, Tuolumne, and Merced rivers) should be made explicit for the existing narrative salmon protection objective (doubling goal). Specifically, CDFW recommends the adoption of targets to double the number of smolts outmigrating from each of the salmon-bearing tributaries and to double the number of smolts surviving migration through the south Delta. These targets would be consistent with the anadromous fish doubling goals of the Central Valley Project Improvement Act (CVPIA) and with the goals and objectives of state and federal programs currently being implemented under the Anadromous Fish Restoration Program (AFRP).
62	App. K	3	The revised WQCP states that “[i]t is the State Water Board’s intention that an agency’s implementation of the narrative LSJR flow objective, including implementation through flow requirements imposed in a FERC process, will serve to meet any responsibility to contribute to the LSJR inflow component of the Delta outflow objective in this plan that would be otherwise imposed on that agency. The State Water Board, however, may further consider and reallocate responsibility for implementing the Delta outflow objective in any subsequent proceeding, including a water right proceeding.” This language implies that, at least initially, the LSJR basin contribution to Delta outflow will be set before the Delta outflow objectives have been determined. This suggests the use of a precautionary principle wherein the flows in the LSJR basin are initially implemented at the upper end of the adaptive range until such time as it is determined that the desired outcomes (e.g., viable native fish populations, ecological fair share contributions from the various tributaries in relation to Delta outflow) can be achieved at a flow regime with reduced water supply impacts. Especially given that the adaptive range suggested in the SED already incorporates a balancing of beneficial uses. This also reflects the need for increased opportunities to evaluate the effects of higher flows with respect to achieving the proposed LSJR fish and wildlife flow and salmon protection narrative objectives.
63	App. K	4	Annual Adaptive Management of February through June Flow Requirements: The revised WQCP states that "….State Water Board staff will work with the COG [Coordinated Operations Group] and interested persons to develop procedures for an adaptive management process to be submitted for approval by the Executive Director within one year following the date of OAL's [Office of Administrative Law] approval of this amendment to the Bay-Delta Plan." Given the complexity and level of effort associated with developing a science-based, workable adaptive management program, CDFW recommends that this design step not be delayed until after OAL approval of the revised Bay-Delta Plan. A critical initial step is identifying and engaging the appropriate stakeholders, and then working with those stakeholders to strive for agreement on scope, objectives, and potential management actions (e.g., means of implementing the flow objectives) (Williams et al. 2009). In addition, CDFW recommends that the SWRCB use the three-phase (nine step) adaptive management process described in the Delta Stewardship Council's Final Draft Delta Plan (Delta Stewardship Council 2012) as an organizing framework for the adaptive management process it develops and implements.

64	App. K	4, 5	The revised WQCP also states as follows: "[a]ny adaptive management plan that would modify the total quantity of flow over the entire February through June period must be agreed to by all members of the COG prior to submitting it to the Executive Director." Such a requirement (agreement by all parties) is likely to stifle opportunities for implementing management experiments and adapting in response to improved understanding. An alternative approach would be to treat consensus as an overarching goal of the COG, but provide a dispute resolution process as a means of moving forward in instances where consensus cannot be reached. CDFW recommends incorporating language that states that in instances where a management action(s) contained within the adaptive management plan is intended to benefit or may negatively affect a sensitive species and/or its habitat, the Executive Director will consult with the regulatory agency (director of CDFW and/or regional director of NMFS or USFWS) with jurisdiction over that species prior to making a determination regarding approval of the plan.
65	App. K	4, 5	It is unclear whether the "total quantity of flow over the entire February through June period" requiring consensus of the COG is based on the preferred alternative amount (35% unimpaired flow) or the adaptive management range (+/- 10%) encompassing the preferred alternative. The SWRCB should specify what "total quantity of flow" entails.
66	App. K	5	Long-term Adaptive Management of February through June Flow Requirement: The revised WQCP states that "[t]he required percentage of unimpaired flow may range between 25 and 45 percent of unimpaired flow from any one tributary over the entire February through June period…" Constraining the extent to which flows can be modified in this manner (+/- 10%) may inhibit the ability to implement management actions/experiments designed to address key uncertainties regarding the role of flows (notably higher flows) and other factors in protecting public trust resources. An independent scientific review of the Vernalis Adaptive Management Program (VAMP) (Dauble et al. 2010) highlighted this constraint in the following statement: "In establishing flow objectives for any future VAMP experimental design for adaptive management investigations, it makes sense to deliberately include more frequent flows at the higher target levels … whenever possible. VAMP flows generally have been too restricted in range and have included more low flows than high flow. From an experimental or adaptive management perspective, it is impossible to learn much about effects of higher flows without having a chance to observe survival (and carry out acoustic tagging experiments) at such higher flows." An explicit process designed to facilitate an evaluation of higher flows is needed. In addition, the SWRCB should consider a broader adaptive range that encompasses at least the 60 percent of unimpaired flow identified in its Delta Flow Criteria report (SWRCB 2010).
67	App. K	5	October Flow Requirements: CDFW recommends that the SWRCB not delay reevaluating of the October pulse flow requirements. To realize the intended benefit of an increase in spring flows (February -June), SJR salmon need to be able benefit from adequate flows and other habitat conditions during other stages of their life cycle as well. To fully determine the adequacy of implementing the Preferred LSRJ Alternative (35% unimpared flow) and the potential to meet the LSJR objectives, CDFW suggests that the SED be revised to better evaluate the effects of the recommended changes on SJR salmon throughout their life cycle and under current operating conditions. Specifically, the adult migration (escapement) period should be evaluated. In addition, the evaluation should address the need to constrain diversions at the State Water Project (SWP) and Central Valley Project (CVP) export facilities coincident with the October pulse flow to allow for a hydrologic connection between the waters of the LSJR Basin and those of the San Francisco Bay to improve conditions for adult escapement. Flows during the fall provide important olfactory cues for salmon attraction/migration. The revised WQCP includes October pulse/attraction flow requirements for up to an additional 28 thousand acre-feet (TAF) in order to meet a monthly average of 2,000 cfs for all water year types, with the exception of when a critical water year follows a critical water year. Recent modeling runs completed in support of the Bay Delta Conservation Plan planning process (ICF 2012, Appendix 5.C, Attachment C, Tables C.A-20 and C.A-33) (See Tables K-1 and K-2, in Attachment A) show that while existing conditions (EBC2, which includes the USFWS [2008] RPA Fall X2 Action) on average meet the fall pulse flow requirement on the San Joaquin River at Vernalis, those flows are often not realized further downstream to an adult salmon escaping to San Joaquin River basin. CALSIM modeling runs show that San Joaquin River flows at Antioch are negative, on average, during the September, October, November, and December months (see Table K- 2). (Comment continues below.)

68	App. K	5	CDFW also notes that Marston et al. (2012) found that during the period of 1979 to 2008 (30 years) the average October and November daily QWEST flows (San Joaquin River flows past Jersey Point) were positive in only half of the years (15 of 30 years) (See Table K-3 in Atachment A). In the latter half of that period (1994-2008), average October and November daily QWEST flows were positive in only five years. A negative QWEST flow means that the SJR is flowing 'backward' (i.e., upstream) and tends to occur when the combined exports of the SWP and CVP exceed the flow in the SJR (Marston et al. 2012). Additionally, Marston et al. (2012) found that during the fall time period, for the years 1979 to 2007, Delta pumping facilities diverted on average 340% of the total inflow volume that entered the Delta from the SJR. The SWRCB, in coordination with state and federal fish agencies, should consider the following recommendations from Marston et al. (2012) pertaining to research needs related to salmon escapement to the SJR basin: • Evaluate whether or not increasing fall south Delta inflows (pulse or base) from each of the tributaries in the SJR basin could reduce SJR salmon stray rates to a natural level (< 5%). Each stream's fall flow contribution might also be managed to be proportional to its unimpaired watershed runoff size (i.e., ecological fair share contribution). This could ensure that each river provides equitable homing cues. Further research on such tributary effects is probably just as important as further monitoring of the effects of exports. Further research is also needed regarding the implementation of the San Joaquin River Restoration Program (SJRRP 2011) and how these new fall flows influence SJR salmon straying. • Studies to determine how the following pairing of factors influences SJR salmon stray rates: (1) the relative roles of south Delta exports and SJR flow; (2) the timing of pulse flows and export reductions; and (3) the role of pulse flows versus base flows. • Monitor the homing success and movement timing of adult SJR salmon into and through the Delta and SJR tributaries. The analysis of salmon migration patterns and stray rates should include water quality indices such as water temperature and dissolved oxygen concentration as well as for flow and exports in the Delta. The role of tidal action influence upon stray rates should also be considered.

69	App. K	6	Flow Requirements at Other Times of Year: The revised WQCP states that the SWRCB "will require monitoring and special studies...during FERC processes to be conducted to determine what, if any, flow requirements should be established for these time frames [July-September and November-January] to achieve the narrative LSJR flow objective." CDFW acknowledges that the ongoing FERC proceedings on the Merced and Tuolumne River provide opportunities to implement actions designed to protect fish and wildlife beneficial uses beyond the February through June time frame. However, FERC's makes its decisions pursuant to the Federal Power Act (16 U.S.C. §§ 791(a)-8259(r); that statute's requirements are not identical to, or a substitute for, the scientific documentation and analyses required by the SWRCB pursuant to CEQA, Porter-Cologne and the federal Clean Water Act. As a consequence, FERC proceedings require very active and independent SWRCB staff participation to ensure adequate information is obtained to inform potential changes to the narrative LSJR flow objectives and program of implementation, and other changes to the Bay Delta Plan. For example, the need for the SWRCB to play a significant role is reflected in the SWRCB's Investigative Order, dated January 28, 2011, for Second Year Studies for the Merced River Hydroelectric Project. In the Cover Letter of that Investigative Order, the SWRCB noted: "[t]he study plans approved by the Commission [FERC] for the relicensing proceeding have not been adequate due to their limited geographic scope and lack of studies to address impacts on fisheries resources, including fisheries habitat, and cumulative impacts to water quality downstream of the Project. Such information is needed to develop the conditions for the Section 401 water quality certification to assure the Merced ID's Project operations under a new Commission license comply with the Clean Water Act." Another example of divergent informational needs is found in the December 22, 2011 FERC Office of Energy Projects' Study Plan Determination for the Don Pedro Project on the Tuolumne River. In that determination, FERC did not require the Turlock and Modesto Irrigation Districts to conduct a Bioenergetics Study requested by both the SWRCB and CDFW. The SWRCB recommended the study to analyze alternative instream flow/temperature regime effects on juvenile salmonid growth, abundance, and survival in the lower Tuolumne River. Without the SWRCB intervention, this information will not be developed during the Don Pedro relicensing proceeding. If the SWRCB intends to rely on FERC proceedings to build a scientific basis for informing the development of instream flow objectives, continual oversight will be necessary to ensure an adequate record. Even with active SWRCB participation in the ongoing FERC relicensings, the geographic scope of FERC proceedings on tributary systems typically does not extend beyond the confluence of the main stem rivers. The FERC proceedings on the Merced and Tuolumne Rivers cannot be relied on to inform development of flow objectives at downstream points within the southern Delta itself, such as Vernalis or the Stockton Deep Water Ship Channel.
70	App. K	6	Actions by the Regional Water Quality Control Boards: The SED should explicitly identify the efforts on the part of the Central Valley Water Board to design and implement a regional monitoring program for contaminants in the Delta. While the geographic scope of this effort is primarily within the legal Delta, planning documents envision opportunities to extend beyond the legal Delta to accommodate the interests of specific potential partners and to support coordination with other regional monitoring efforts (Bernstein and Jabusch 2012). Maintaining water quality (e.g., dissolved oxygen, temperature, pesticides) sufficient to support salmonids and other native fish will be a critical component of achieving the proposed narrative LSJR fish and wildlife flow objective.
71	App. K	7	Actions by Other Entities: The SED should be specific regarding what, by whom, by what timeframe, and how the actions of other entities should be implemented. The current language is vague and uses terms (e.g., "should") that most likely will not result in the completion of activities that will support the LSJR fish and wildlife objective.
72	App. K	9	Reduce Predator Habitat: The revised WQCP states that "[a]ctions should be taken to identify and, where appropriate, modify these habitat structures to reduce the opportunity for predation on native LSJR fish and other Bay-Delta fish of concern." However, the SED fails to identify the entities who are or would be responsible for implementing the proposed actions. CDFW notes that it participated in pond isolation projects on the Merced and Tuolumne Rivers. These projects were very expensive and lacked sufficient pre and post project data to determine if the projects were successful at reducing predator populations. Data is not available that conclusively shows a reduction in predators. Cost and lack of conclusive data resulted in CDFW focusing on other projects beneficial to native species.

73	App. K	9	Improve Hatchery Programs: The revised WQCP states that "DFG, in coordination with other appropriate entities, should develop and implement improvements to its anadromous fish hatcheries through the Fish and Game Commission policy review process to address impacts from fish hatcheries on wild stocks." CDFW notes that, in June 2012, the California Hatchery Scientific Review Group (California HSRG) released the California Hatchery Review Report (California HSRG 2012). The role of the California HSRG was to weigh available scientific information to produce consensus recommendations for changes in hatchery practices and to provide guidance to policy makers responsible for implementing changes in how California hatcheries are operated. Specialists and experts from all over the state worked to evaluate and make specific recommendations for hatcheries in the Central Valley and the Klamath-Trinity systems. CDFW has convened the Hatchery Review Policy Team, which includes our federal and tribal partners. At our next policy team meeting, the Team will formalize the invitee list for the hatchery-specific coordination teams to evaluate the statewide and hatchery-specific recommendations. CDFW does not know whether the Team will recommend policy changes to the Fish and Game Commission.
74	App. K	10	Reduce Impacts of Introduced Species on Native Species in the Bay-Delta Estuary: The revised WQCP states as follows: "Specifically, under the National Invasive Species Act of 1996 the DFG, USFWS, and NOAA fisheries should continue to pursue programs to determine the impacts of introduced species on native aquatic resources, and potential control measures. The DFG should also continue the efforts under Fish and Game Code section 6430-6439, concerning introduced species." CDFW notes that Fish and Game Code sections 6430-6439 were repealed in 2004. CDFW has responsibilities related to invasive species pursuant to the following sections of the Fish and Game Code (FGC) and California Code of Regulations (CCR) Title 14: (a) FGC sections 2116-2127, 2150-2157, and 2185-2195 are specific to the importation, transportation, and sheltering of restricted live animals; (b) FGC sections 2300-2302 are specific to the aquatic invasive species Caulerpa (marine algae) and dreissenid mussels (quagga and zebra mussels). Section 2300 prohibits the sale, possession, importation, transportation, transfer, release alive, and give away of nine species of Caulerpa in the State. Section 2301 prohibits the possession, importation, shipping, or transport of dreissenid mussels in the State and discusses inspection, decontamination, and quarantine of conveyances that may carry dreissenid mussels. Section 2302 discusses the responsibilities of reservoir owners or managers with respect to implementation of measures to prevent the introduction of dreissenid mussels into reservoirs; (c) FGC sections 6400-6403 are specific to the placement or planting of live fish, fresh and salt water animals, and aquatic plants into waters of the State; (d) FGC sections 15000 et seq. are specific to the operation of aquaculture industries (aquaculture is a vector of invasive species); (e) CCR Title 14, section 671 is specific to the importation, transportation, and possession of live restricted animals and associated permit requirements. This section includes a list of restricted species in California, including those that are considered "detrimental," meaning they pose a threat to native wildlife, the agriculture interests of the state, or to public health and safety. **(Comment continues below.)**
75	App. K	11	The National Invasive Species Act of 1996 (NISA), an amendment to the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA), relates to regulation of ballast water exchange for vessels entering the Great Lakes and other U.S. waters from outside the U.S. Exclusive Economic Zone (EEZ). The NANPCA/NISA does not affect state authority to adopt or enforce aquatic invasive species control measures. The State is mandated to prevent nonindigenous species introductions through ballast water of commercial vessels under the following state laws: the Ballast Management for Control of Nonindigenous Species Act of 1999, the Marine Invasive Species Act of 2003, and the Coastal Ecosystems Protections Act of 2006. Under the Marine Invasive Species Program, the State Lands Commission and CDFW have the primary responsibility for implementing these laws and associated regulations. CDFW recommends that the reference to DFG be removed from the first sentence and the second sentence be revised to reference the appropriate sections of code, as follows: "The CDFW should continue its efforts under the Marine Invasive Species Program; Fish and Game Code sections 2116-2127, 2150-2157, 2185-2195, 2300-2302, 6400-6403, and 15000 et seq.; and California Code of Regulations Title 14, section 671.

76	App. K	10	Review and Modify, if Necessary, Practices Promoting Non-Native Predators: The revised WQCP states that "DFG… should evaluate the appropriateness of existing practices designed to protect and promote non-native predatory fish species (including striped bass) to determine whether changes to those practices would benefit native LSJR and Bay-Delta fish species." CDFW notes that no specific "existing practices" are listed for evaluation. Furthermore, this sentence appears to misconstrue CDFW's practices. CDFW does not "promote" non-native predators. Rather, CDFW protects native species through regulations, law enforcement, research and monitoring. The Fish and Game Commission maintains fishing regulations related to striped bass (CCR Title 14, section 5.75). CDFW recommends that the above quoted sentence be revised to state, as follows: "The California Fish and Game Commission, CDFW, NOAA Fisheries, and the USFWS and other responsible agencies should identify and evaluate the factors limiting native fish success in the LSJR and the Bay-Delta. Responsible agencies should evaluate limiting factors and identify actions to minimize impacts of limiting factors." This section of the revised WQCP also states that "analysis and documentation of the decision-making process for fishing regulation, fish stocking programs, and other decisions...should be made available to the public and other decision makers." CDFW notes that the regulatory process for adopting recreational and commercial fishing regulations is a public process. These regulations are adopted in compliance with the California Administrative Procedure Act (Government Code, section 11340 et seq.) and associated regulations (CCR Title 1, sections 1-280) which are designed to provide the public with a meaningful opportunity to participate in the adoption of state regulations. Consequently, the public and other decision makers have the opportunity to participate in the regulatory process, make recommendations, and review documentation used to support regulatory decisions. Moreover, the public can participate by submitting comments, participating in Fish and Game Commission meetings, or meeting with Fish and Game Commission staff.
77	App. K	10	Reduce Illegal Harvesting: CDFW agrees that agencies, such as CDFW, should take actions to reduce illegal harvesting of native LSJR and Bay-Delta fish species. CDFW's Law Enforcement Division (LED) wardens are actively involved with the enforcement of state and federal regulations in marine and inland waterways. In fact, LED boats and aircrafts patrol state waters (0-3 miles offshore) and the EEZ (3-200 miles offshore) to enforce recreational and fishing regulations. Moreover, LED wardens patrol and investigate inland waterways, including bays, the delta, rivers and streams, to protect salmon and steelhead and their habitats through the monitoring and enforcement of Streambed Alteration Agreements, Timber Harvest Plans, Suction Dredge Permits, and pollution response. CDFW dedicates a significant amount resources in activities meant to reduce the impact of illegal harvesting on fisheries within the Bay-Delta Estuary and watershed.
78	App. K	10	Develop and implement Improvements to Barrier Programs: CDFW agrees that the Program of Implementation should include actions to develop and implement improvements to barrier programs. In response to action IV.1.3 of the NMFS 2009 Biological Opinion (2009 NMFS BO), CDFW is working closely with representatives from USFWS, NMFS, DWR, and USBR to develop variousphysical and non-physical barrier designs to evaluate their effectiveness in reducing adverse impacts on listed fish and their critical habitat. A final report of recommended approaches is to be submitted by USBR or DWR by March 30, 2015. CDFW has also participated in the implementation of pilot projects, resulting from action IV.1.3 of the 2009 NMFS BO, at Georgiana Slough and the Head of Old River. Additionally, CDFW is actively participating in the development of the DRAFT Bay Delta Conservation Plan (BDCP), which contains conservation measures that include installation and operation of physical and non-physical barriers at key locations within the Delta, with the intent of improving conditions for native aquatic species while still meeting current and future water supply demands.

79	App. K	11	Complete a Working Salmonid Life-Cycle model for the LSJR Basin: The revised WQCP states as follows: "DFG in coordination with other appropriate agencies should complete the development of a salmonid life-cycle model for the LSJR basin that predicts population level responses to changes in ecological conditions with reasonable accuracy. The life-cycle models should address flow and non-flow related factors and should undergo regular updating with accompanying peer review." CDFW is currently completing a full life-cycle model (SALSIM 2.0) for fall-run San Joaquin Basin Chinook salmon, covering the rivers, Delta and ocean ecosystems. SalSim 2.0 utilizes empirical data from the SJR watershed to predict how changes in a variety of environmental factors (both flow and non-flow) impact Chinook salmon populations. While developing SALSIM 2.0, CDFW conducted a peer review of the incomplete model to serve as a check to the methods used and allow for incorporating suggestions into the model. This peer review was conducted in January 2012. The peer review report will be made available to the public concurrent with the model's public release. CDFW intends to update the model with current data as that data becomes available and recheck the model's statistical relationships with the current data and recalibrate if necessary.
80	App. K	11	New Special Studies, Monitoring, and Reporting Requirements - LSJR Fish and Wildlife Flow Objectives: The revised WQCP states "[i]n order to inform real time adaptive management and long-term management of flows on the LSJR for the protection of fish and wildlife beneficial uses…" As written, this sentence implies that real time actions will be accomplished within an adaptive management context while long-term management actions will not. This raises a number of issues (a) whether that distinction is purposeful; (b) to what does "real time adaptive management" refer; (c) whether "real time adaptive management" is synonymous with the "annual adaptive management" described earlier (p. 4) in the document - at present, these terms are not adequately differentiated, leading to potential confusion; (d) whether the development and implementation of the San Joaquin River Monitoring and Evaluation Program (SJRMEP) will be phased to coincide with the water right and FERC proceedings; and (e) the level of monitoring and special studies that will be required in the interim. More information concerning a number of factors, including indicators, targets, desired level of precision, and program design, are needed to determine the level of resources that will be required to successfully implement the SJRMEP and to determine whether the SJRMEP will be sufficient to evaluate the effectiveness of actions implemented to achieve the LSJR fish and wildlife flow and salmon protection narrative objectives and inform future decision-making.

Attachment A

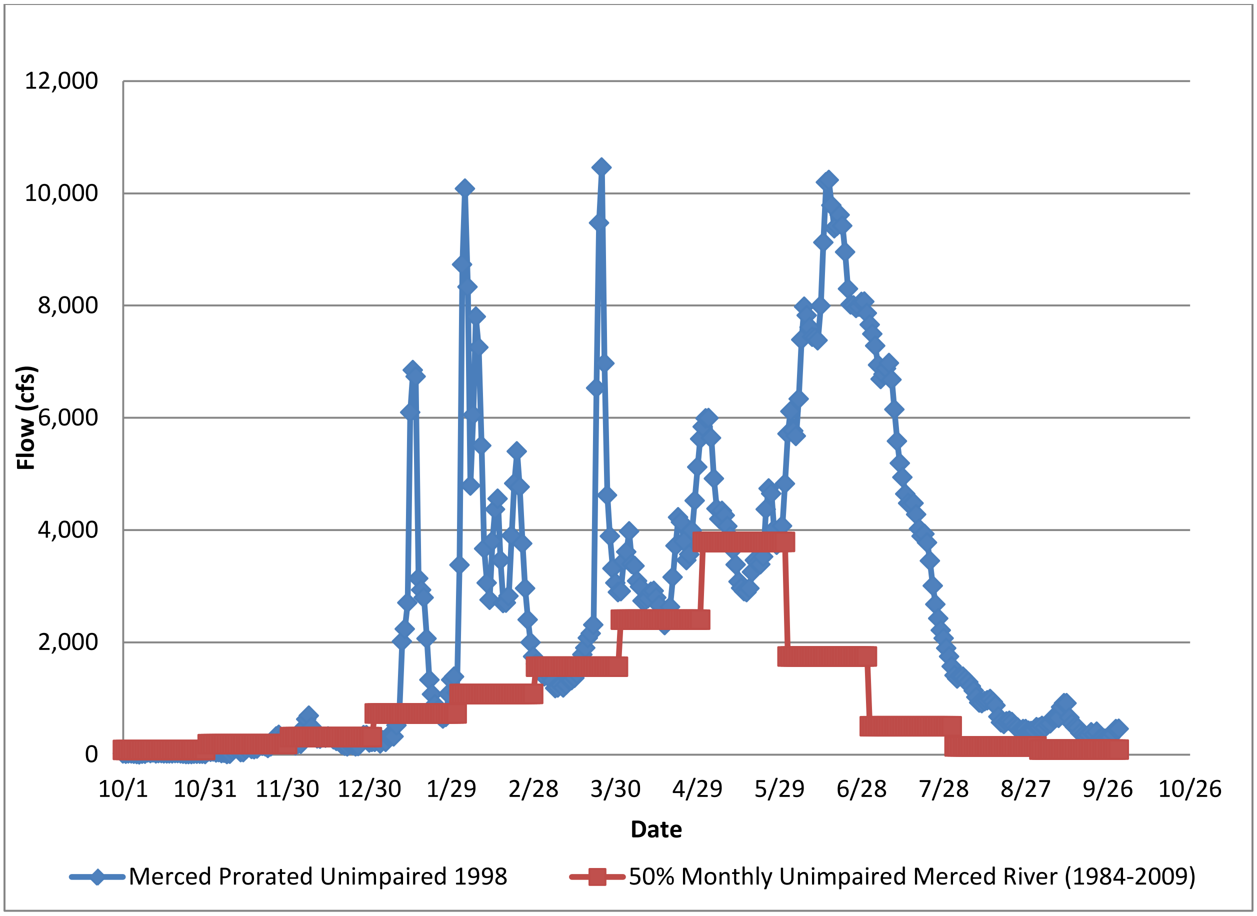


Figure 2-1. 50% Cumulative (Percentile) monthly unimpaired flow values from Table 2-8 of the SED plotted verses daily inflow data from Lake McClure for water year 1998 prorated to the Merced River based on monthly volume.

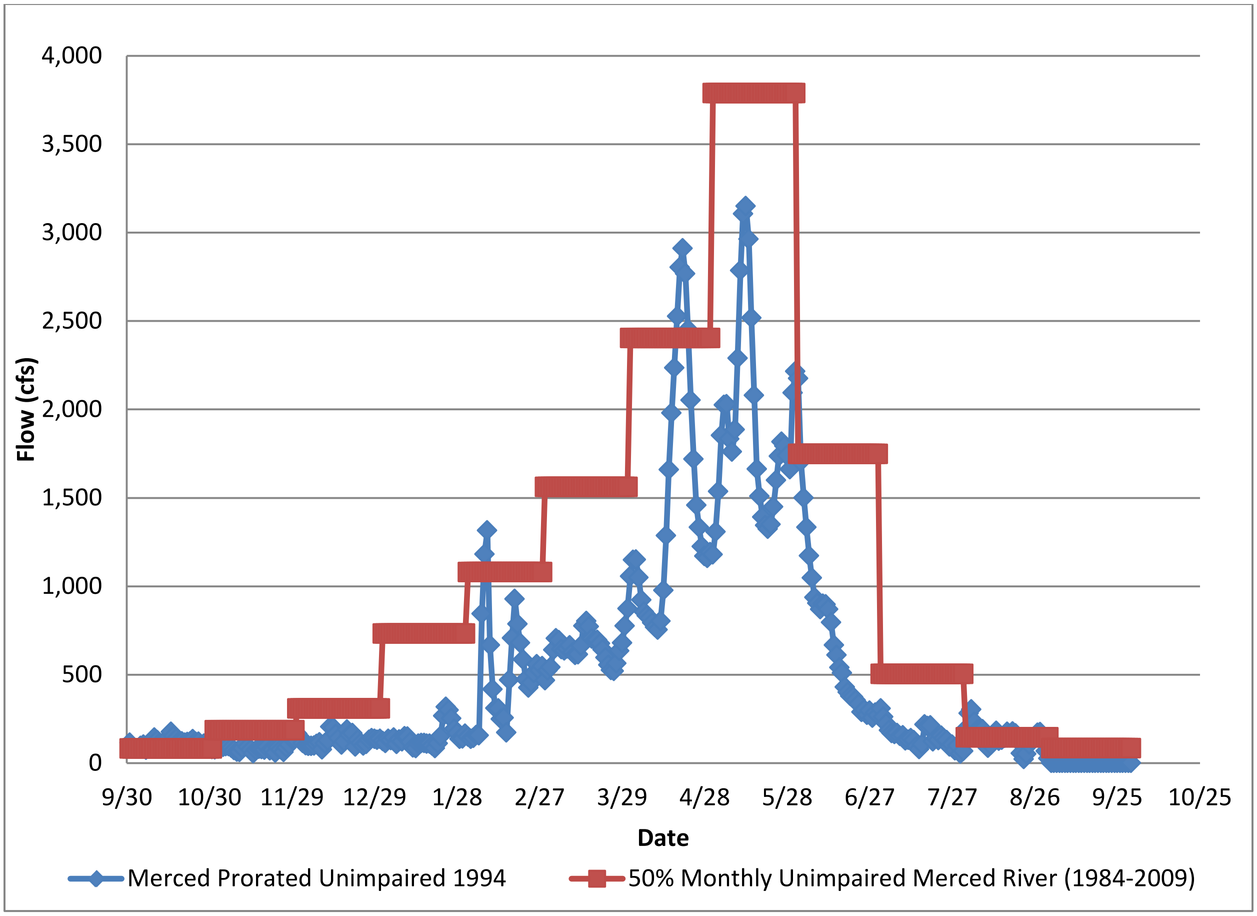


Figure 2-2. 50% Cumulative (Percentile) monthly unimpaired flow values from Table 2-8 of the SED plotted verses daily inflow data from Lake McClure for water year 1994 prorated to the Merced River based on monthly volume.

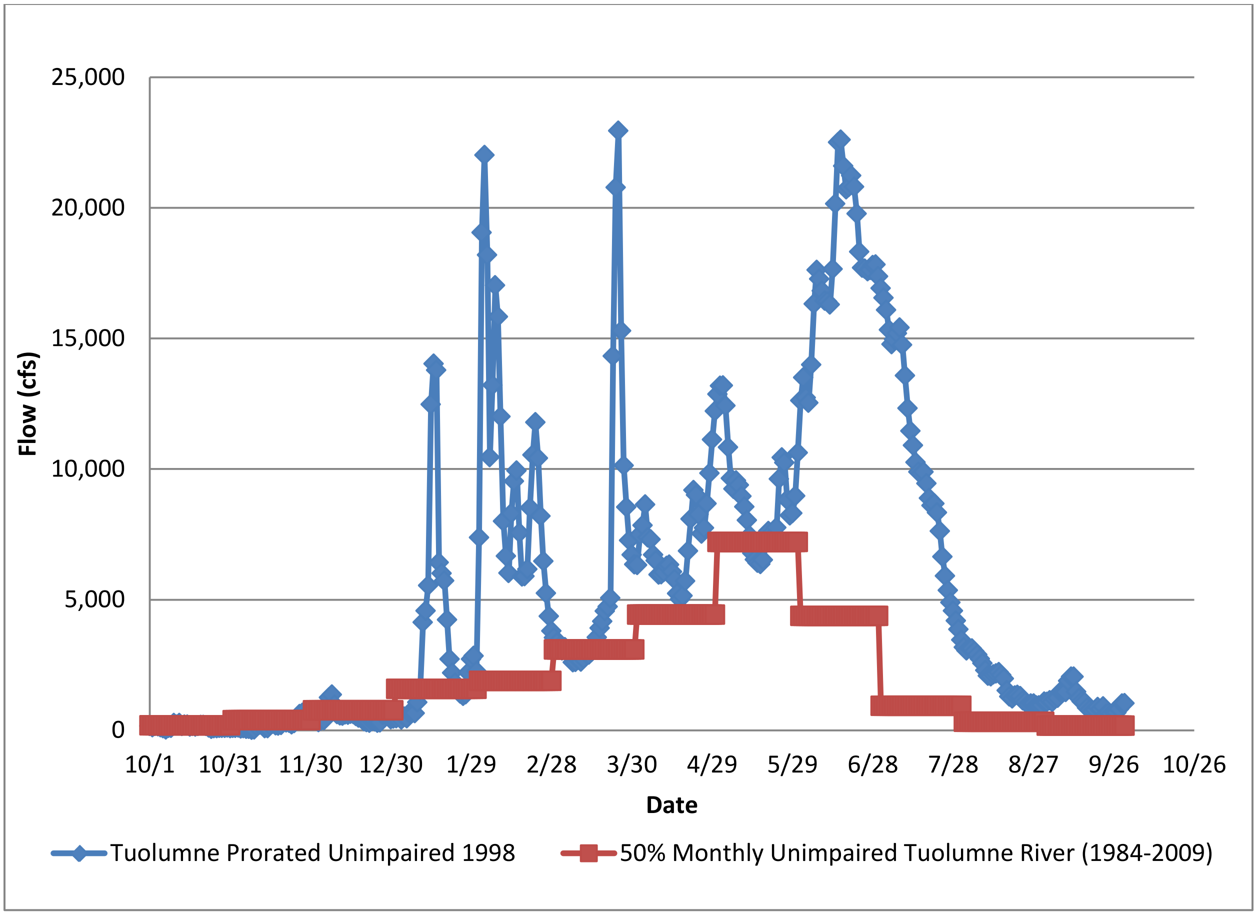


Figure 2-3. 50% Cumulative (Percentile) monthly unimpaired flow values from Table 2-12 of the SED plotted verses daily inflow data from Lake McClure for water year 1998 prorated to the Tuolumne River based on monthly volume.

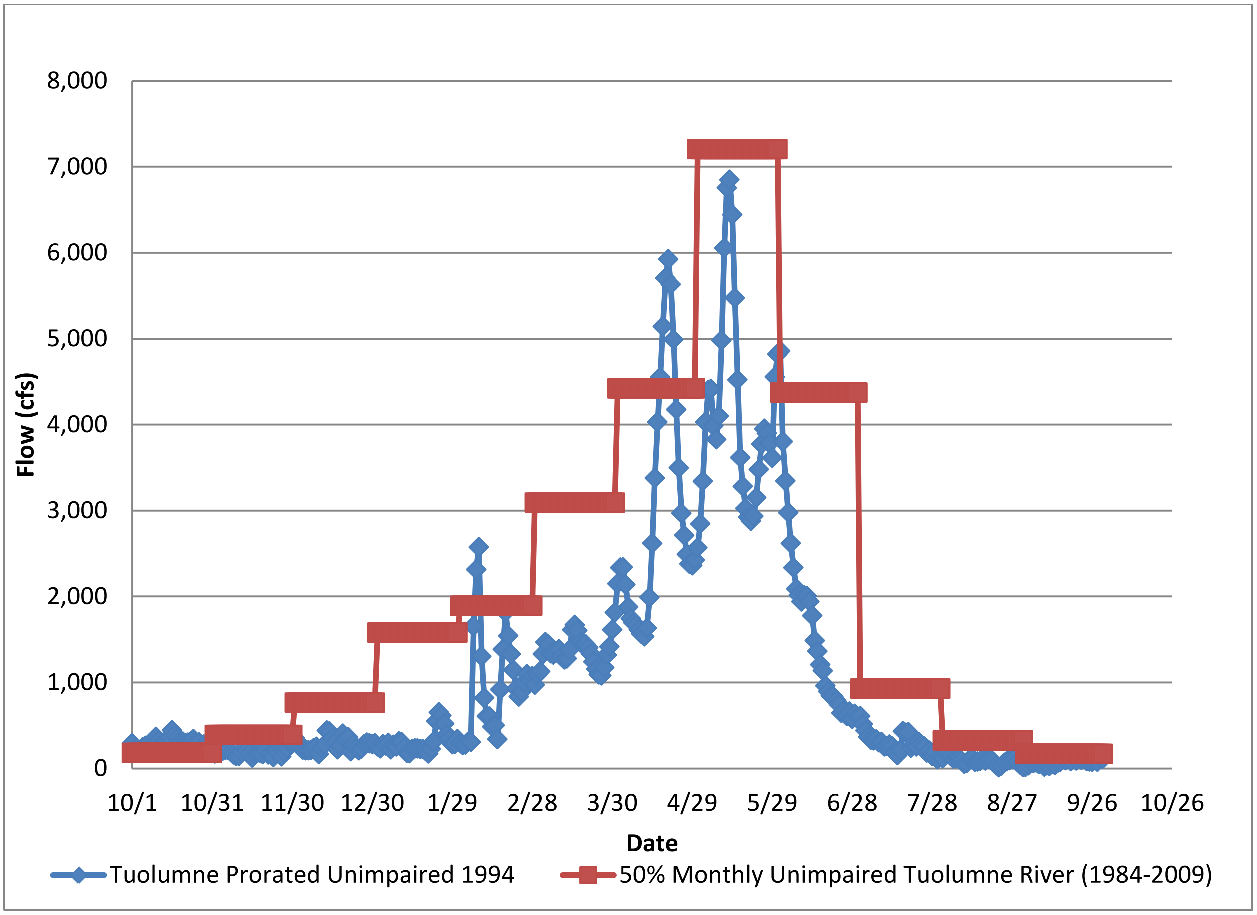


Figure 2-4. 50% Cumulative (Percentile) monthly unimpaired flow values from Table 2-12 of the SED plotted verses daily inflow data from Lake McClure for water year 1994 prorated to the Tuolumne River based on monthly volume.

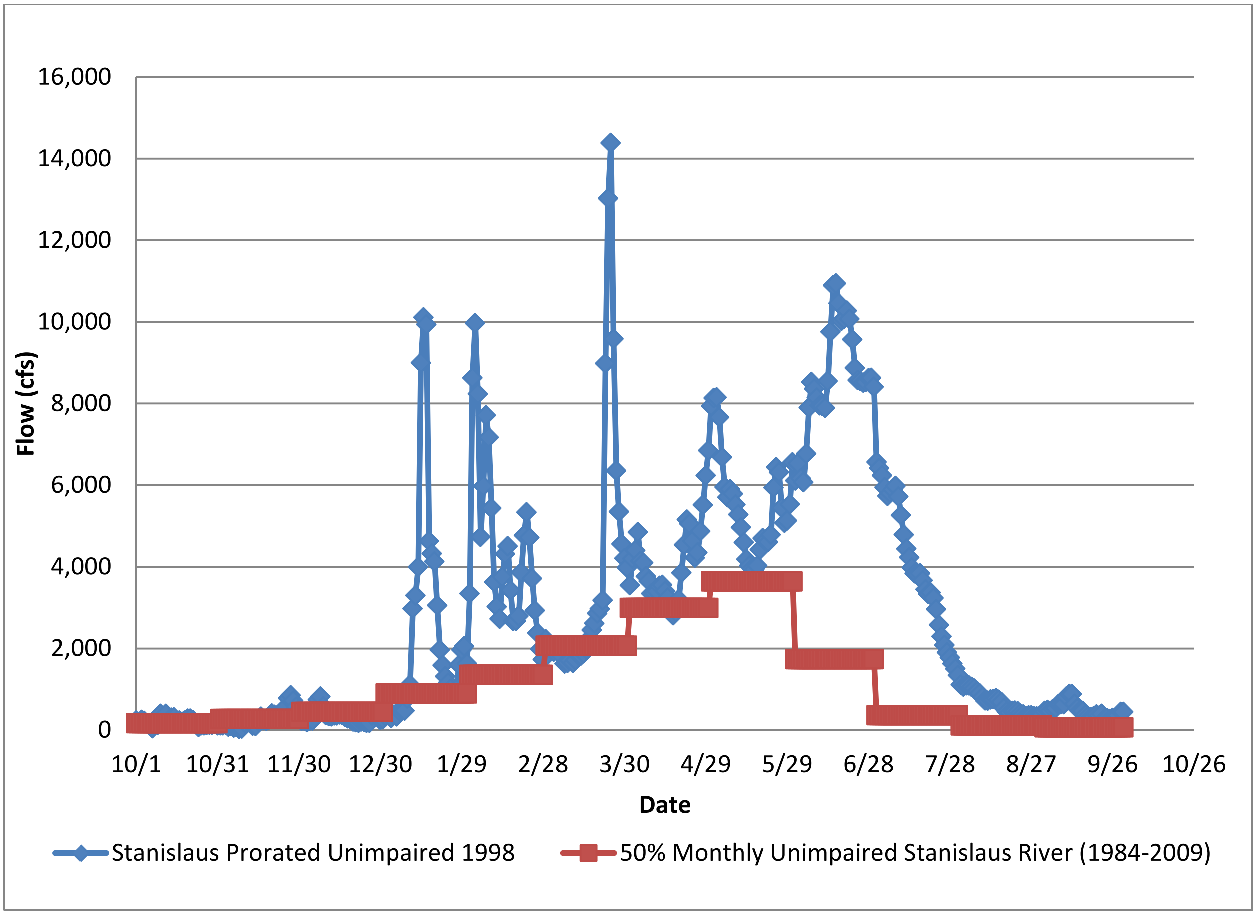


Figure 2-5. 50% Cumulative (Percentile) monthly unimpaired flow values from Table 2-17 of the SED plotted verses daily inflow data from Lake McClure for water year 1998 prorated to the Stanislaus River based on monthly volume.

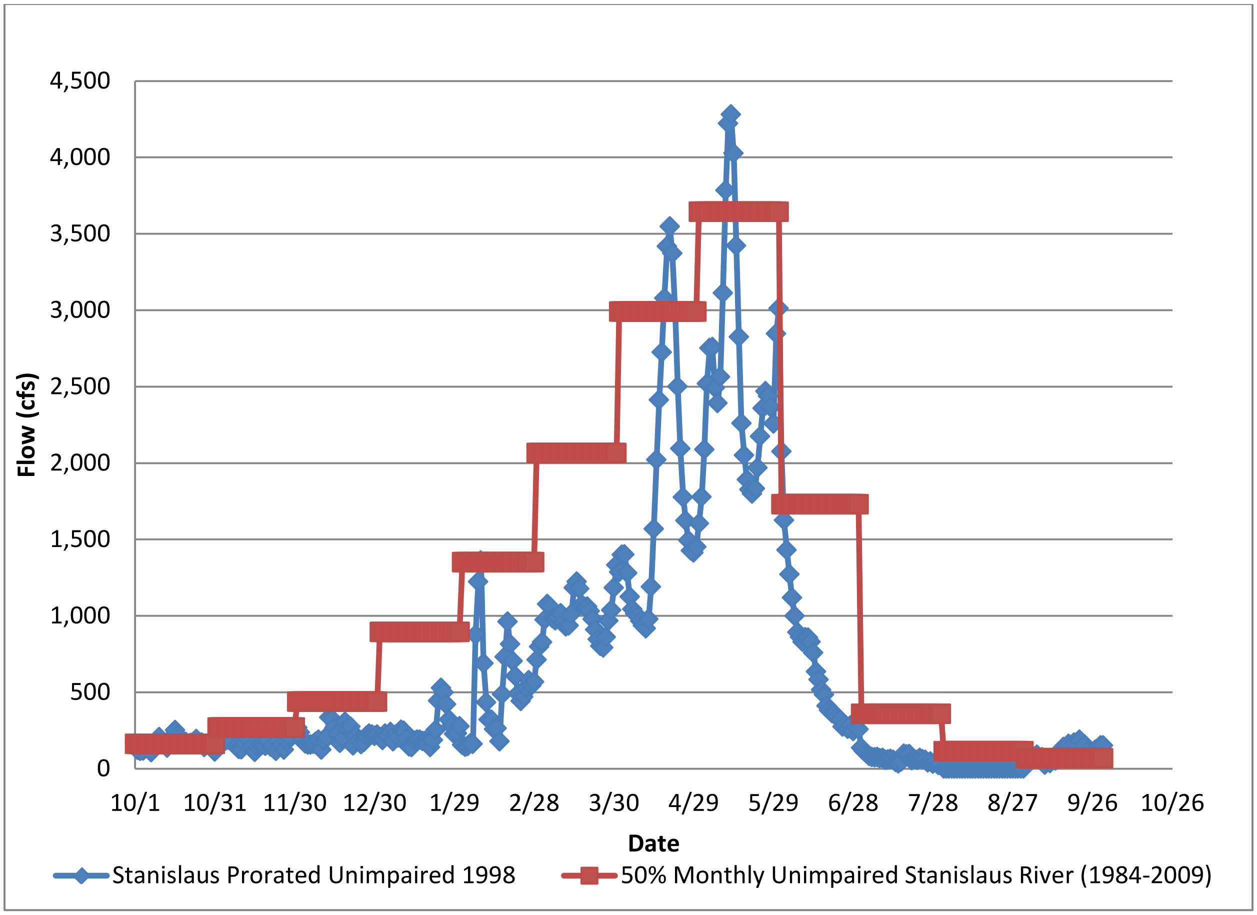


Figure 2-6. 50% Cumulative (Percentile) monthly unimpaired flow values from Table 2-17 of the SED plotted verses daily inflow data from Lake McClure for water year 1994 prorated to the Stanislaus River based on monthly volume.

Attachment A

Figure 7-1 Periodicity Table for Selected Anadromous Fish Species Occurrence within Bay Delta and Lower San Joaquin River with Overlay of SED Evaluation Time Frame.

Sources of information: fall-run, spring-run, sturgeon (Moyle 2002); steelhead (McEwan 2001, Hallock et. al 1961, and Hallock 1989).

Table 7-2. Tuolumne River average (mean) maximum daily water temperatures based on Julian week during the fall-run Chinook salmon migration season (CDFG 2007).

Tuolumne Salmon Migration Impairment Summary								
Max 7DADM Temperature								
	Julian Week							
Year	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**
1998	21.3	17.0	18.1	16.8	16.5	15.8	15.4	15.7
1999	23.5	23.1	22.4	22.3	19.3	18.9	18.0	19.0
2000								
2001	Insufficient Data							
2002	24.3	24.2	24.4	22.5	19.8	19.1	15.9	14.8
2003	25.0	24.3	23.3	22.8	21.8	19.9	18.7	18.4
2004	24.5	23.7	20.9	21.0	19.8	18.2	16.4	14.6
2005	21.8	20.9	21.1	21.5	19.9	19.0	17.3	16.7
Average	**23.4**	**22.2**	**21.7**	**21.2**	**19.5**	**18.5**	**16.9**	**16.5**
Miles of Impaired Spawning Habitat								
	Julian Week							
Year	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**
1998	26	0	6	0	0	0	0	0
1999	43	42	40	37	25	16	0	1
2000								
2001	Insufficient Data							
2002	46	46	47	45	42	37	0	0
2003	42	41	40	40	37	24	11	9
2004	46	48	43	43	40	33	0	0
2005	36	32	33	31	26	14	0	0
Average	**40**	**35**	**35**	**33**	**28**	**21**	**2**	**2**
Percent Impairment (percentage of total miles impaired)								
	Julian Week							
Year	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**
1998	50%	0%	12%	0%	0%	0%	0%	0%
1999	83%	81%	77%	71%	48%	31%	0%	2%
2000								
2001	Insufficient Data							
2002	88%	88%	90%	87%	81%	71%	0%	0%
2003	81%	79%	77%	77%	71%	46%	21%	17%
2004	88%	92%	83%	83%	77%	63%	0%	0%
2005	69%	62%	63%	60%	50%	27%	0%	0%
Average	**77%**	**67%**	**67%**	**63%**	**54%**	**40%**	**4%**	**3%**
Overall Average			**47%**					
Notes: Julian Week = Seven day weekly time periods beginning January 1st annually								
Migration Habitat Temperature Limit = 18 Degrees C								
Temperature Unit (7DADM): Seven Day Average (mean) of daily max temperature								
Impaired Migration Occurs when 7DADM is >18 Degrees C								
Migration Time Period is Approximately 8 Weeks (Sept. 1 through Oct. 31)								
Total Migration Habitat Miles = 52. Yellow indicates impaired miles.								

Table 7-3. Tuolumne River average (mean) maximum daily water temperatures based on Julian week during the fall-run Chinook salmon spawning season (CDFG 2007).

Tuolumne Chinook Salmon Spawning Habitat Temperature Impairment Summary											
Max 7DADM Temperature											
	Julian Week										
Year	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
1998	14.9	14.8	14.4	14.8	14.2	13.0	12.8	12.6	12.4	12.0	12.0
1999	17.3	16.8	15.6	15.4	15.3	14.6	14.2	12.6	12.0	12.0	12.0
2001	22.2	19.6	18.4	16.7	16.2	17.0	18.0	19.0	20.0	21.0	22.0
2002	19.8	19.1	15.9	14.8	13.4	14.0	13.7	13.0	11.8	11.5	11.4
2003	18.9	17.5	16.3	16.5	14.2	14.1	13.7	11.9	11.8	12.6	11.8
2004	19.8	18.2	16.4	14.6	13.3	13.5	13.7	11.9	11.1	11.2	12.4
2005	17.6	16.5	15.1	14.8	14.4	13.8	13.1	12.1	11.6	11.4	11.3
Average	**18.6**	**17.5**	**16.0**	**15.4**	**14.4**	**14.3**	**14.2**	**13.3**	**13.0**	**13.1**	**13.3**
Number of Miles of Impaired Spawning Habitat											
	Julian Week										
Year	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
1998	16	16	15	16	13	1	0	0	0	0	0
1999	19	20	17	19	18	15	15	0	0	0	0
2001	23	24	24	24	24	24	24	21	4	4	4
2002	19	18	16	14	9	13	11	0	0	0	0
2003	24	24	24	24	15	17	14	0	0	0	0
2004	20	19	18	14	7	14	13	0	0	0	0
2005	21	20	19	18	16	11	3	0	0	0	0
Average	**20**	**20**	**19**	**18**	**15**	**14**	**11**	**3**	**1**	**1**	**1**
Percent Impairment (percentage of total miles impaired)											
	Julian Week										
Year	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
1998	67%	67%	63%	67%	54%	4%	0%	0%	0%	0%	0%
1999	79%	83%	71%	79%	75%	63%	63%	0%	0%	0%	0%
2001	96%	100%	100%	100%	100%	100%	100%	88%	17%	17%	17%
2002	79%	75%	67%	58%	38%	54%	46%	0%	0%	0%	0%
2003	100%	100%	100%	100%	63%	71%	58%	0%	0%	0%	0%
2004	83%	79%	75%	58%	29%	58%	54%	0%	0%	0%	0%
2005	88%	83%	79%	75%	67%	46%	13%	0%	0%	0%	0%
Average	**85%**	**84%**	**79%**	**77%**	**61%**	**57%**	**48%**	**13%**	**2%**	**2%**	**2%**
Overall Average						**46%**					
Notes: Julian Week = Seven day weekly time periods beginning January 1st annually											
Spawning Habitat Temperature Limit = 13 Degrees C											
Temperature Unit (7DADM): Seven Day Average (mean) of daily max temperature											
Impaired Spawning Habitat Occurs when 7DADM is >13 Degrees C											
Spawning Time Period is 11 Weeks in Length (Oct. 1 through Dec. 15)											
Total Spawning Habitat Miles = 24. Yellow indicates impaired miles.											

Table K-1. EBC2 flows extracted from Table C.A-20. CALSIM-Simulated Monthly Distribution of San Joaquin River Flows (cfs) at Vernalis (ICF 2012).

	Sep	Oct	Nov	Dec
Min	921	890	1,222	1,274
10%	1,477	1,627	1,609	1,612
20%	1,660	2,028	1,746	1,766
30%	1,748	2,173	1,853	1,835
40%	1,828	2,293	1,957	1,955
50%	1,936	2,524	2,044	2,035
60%	2,269	2,795	2,216	2,114
70%	2,549	2,976	2,368	2,290
80%	2,779	3,154	2,562	2,816
90%	3,254	3,580	2,873	4,284
Max	7,851	7,227	16,468	23,983
Avg	2,314	2,622	2,416	3,178

Table K-2. EBC2 flows extracted from Table C.A-33. CALSIM-Simulated Monthly Distribution of San Joaquin River at Antioch Flow (ICF 2012).

	Sep	Oct	Nov	Dec
Min	-5,705	-6,180	-5,199	-7,468
10%	-4,295	-2,189	-3,967	-5,517
20%	-3,500	-1,110	-2,411	-4,969
30%	-3,149	-519	-1,477	-4,331
40%	-2,766	32.1	-770	-3,355
50%	-2,300	66.9	-238	-2,627
60%	-1,735	335.7	284	-1,592
70%	-441	681.3	643	-803
80%	126	1,025	1,373	1,220
90%	236	1,805	3,056	7,393
Max	8,055	3,130	19,841	35,058
Avg	-1,595	-111	-76.1	-442

Table K-3. Fall Delta hydrodynamic flow data. Source: Marston et al. 2012.

	Average October and November daily flow (cfs/day)							Average 10-day pulse flow (cfs/day)						
Year	SAC	Combined exports	SJR	OMR	XGEO	QWEST	QRIO	SAC Flow	Combined exports	SJR	OMR	XGEO	QWEST	QRIO
1979	13867	6820	2559	-5763	6153	2337	7635	11430	7525	3280	-6358	5439	1345	5785
1980	11111	6601	3681	-4507	4149	624	6493	13320	7910	5065	-5596	5992	2328	6787
1981	21228	5336	1474	-4229	5732	2826	17493	10164	6372	1633	-4771	5068	-148	4841
1982	25275	5678	7587	-3758	7667	12766	18101	23910	7083	8825	-4991	9095	13928	15225
1983	34757	2136	12120	2342	8771	23358	29412	24260	2500	14300	3804	9198	21202	14720
1984	19651	6790	3457	-5035	5906	4052	14705	12900	5789	4709	-4475	5869	6732	7532
1985	10058	7526	2002	-5303	4628	-453	5532	9509	8045	2178	-5745	4294	-1665	5090
1986	14085	7229	3299	-5056	5591	1300	8018	15460	7117	3970	-4965	6619	3083	8340
1987	8830	5702	1457	-4836	4205	-379	4450	7620	5225	1529	-4596	3574	-1041	3629
1988	10318	5876	1199	-5374	4956	-239	5149	7764	3714	1232	-3194	4364	780	2945
1989	14548	10463	1403	-9387	6352	-2870	8081	15580	9942	1506	-8952	6654	-532	9374
1990	7671	3720	1053	-3159	4337	1022	3006	7732	4215	1115	-3675	4355	409	2938
1991	8198	4259	934	-3779	4492	577	3414	7677	5024	1208	-4292	4339	1115	3502
1992	6515	2162	901	-1906	3998	2122	2203	5792	1083	1209	-683	3787	3644	1797
1993	12970	8974	2410	-6601	5483	-1054	7330	15720	11022	3957	-7565	6696	5	9003
1994	8862	5792	1329	-4718	4521	30	4265	6945	4898	1865	-3863	4125	160	2342
1995	13390	6527	4087	-3732	6013	3134	6894	12560	6547	6734	-2472	5770	5385	6285
1996	14072	9980	2703	-7999	5310	-1487	8844	11650	9701	3285	-7756	5503	-1644	5832
1997	13378	9006	2349	-6428	5082	-1121	8557	11870	9422	3273	-6621	4110	-2668	7571
1998	18297	6994	4745	-3940	3262	1255	15162	15340	9335	6945	-5051	2869	-313	12163
1999	13100	9392	2348	-6920	5652	-1733	7310	10720	8207	2612	-5783	5231	-1321	5167
2000	11979	9366	2678	-7896	4277	-2381	7656	11290	9430	3459	-7668	3003	-1894	8698
2001	10301	5856	2048	-5703	4428	426	5814	8159	3798	2954	-3850	4266	2661	3659
2002	10804	6388	1710	-6013	4720	-215	5999	9540	6426	2296	-6545	4111	-1054	5045
2003	11716	7713	1826	-6889	6000	-124	5615	10275	7391	2595	-7283	5733	-19	4170
2004	12431	7716	1693	-5880	5437	393	7196	15080	9346	2597	-6815	6424	2441	9546
2005	14015	10249	2333	-9235	5978	-2558	7678	12090	10274	2951	-9402	5632	-2497	6097
2006	11896	10038	3205	-7490	5673	-1405	6033	10220	9985	4118	-7173	5152	-1655	4652
2007	10266	7044	1639	-5817	5179	-807	4852	9260	6693	2245	-5668	4822	-576	4003
2008	8530	4792	1188	-4029	3597	-471	4797	7529	4625	1426	-3867	4161	-197	3021

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