THE SAN JOAQUIN RIVER AGREEMENT

2000 TECHNICAL REPORT

Vernalis Adaptive Management Plan (VAMP)

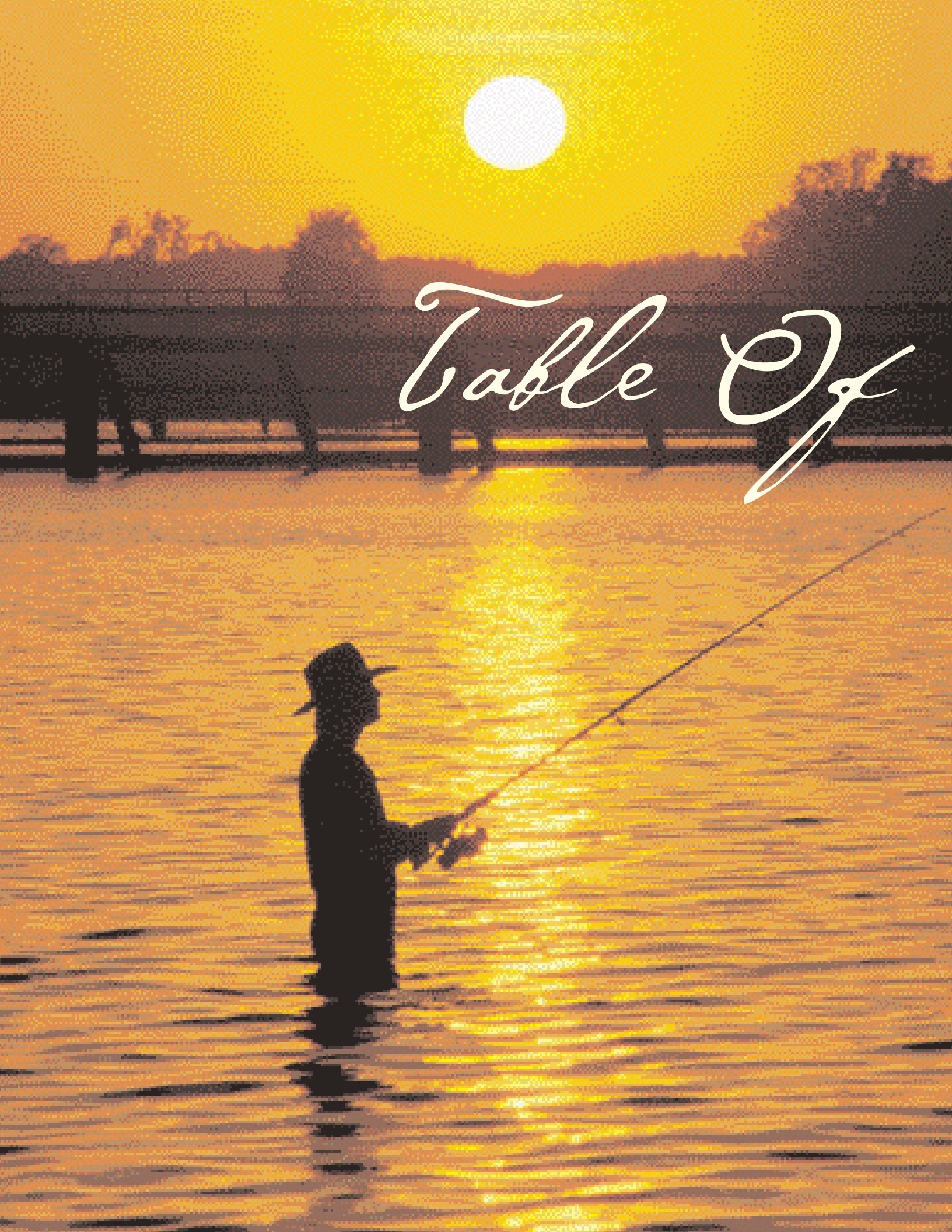


Table Of

Contents.....

Executive Summmary

THE SAN JOAQUIN AGREEMENT

The San Joaquin Agreement (SJRA or Agreement) is the cornerstone of a history-making commitment to implement the State Board's 1995 Water Quality Control Plan (WQCP) for the lower San Joaquin River and the San Francisco Bay-Delta Estuary (Bay-Delta). Using a consensus-based approach, the Agreement united a large and diverse group of agricultural, urban, environmental and governmental interests.

The 2000 Annual Technical Report comprises the consolidated annual San Joaquin River Agreement Operations and Vernalis Adaptive Management Plan (VAMP) Monitoring Report. While exploratory studies were conducted in 1998 and 1999 to help establish the experimental protocols, the VAMP 2000 program represents the first year of formal compliance with State Water Resources Control Board (State Board) Decision 1641 (D-1641). D-1641 requires the preparation of an annual report documenting the implementation and results of the VAMP program.

Specifically, this report includes the following information on the implementation of the Agreement: the hydrologic chronicle; the management of the additional SJRA water; installation, operation, and monitoring of the Head of Old River Barrier (Old River Barrier); results of the juvenile Chinook salmon smolt survival investigations; and, conclusions and recommendations. Condition 4.b of D-1641 directs the Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (USBR) to send the Executive Director of the State Board the results of the fishery monitoring studies on an annual basis and Condition 7 of D-1641 directs Merced, Modesto, Turlock, South San Joaquin and Oakdale irrigation districts to submit a report detailing district operations as a result of the SJRA. By letter dated September 8, 2000, the State Board approved combining these two reports into a single comprehensive report.

A key part of this landmark agreement is the Vernalis Adaptive Management Plan (VAMP). VAMP is designed to protect juvenile Chinook salmon migrating from the San Joaquin River through the Sacramento-San Joaquin Delta. VAMP is also a scientifically recognized experiment to determine how salmon survival rates change in response to alterations in San Joaquin River flows and State Water Project (SWP)/Central Valley Project (CVP) exports and the installation of the Old River Barrier.

VAMP employs an adaptive management strategy to use current knowledge of hydrology and environmental conditions to protect Chinook salmon smolt passage, while gathering information to allow more efficient protection in the future.

In addition to providing improved protection for juvenile Chinook salmon emigrating from the San Joaquin River system, specific experimental objectives of VAMP 2000 included:

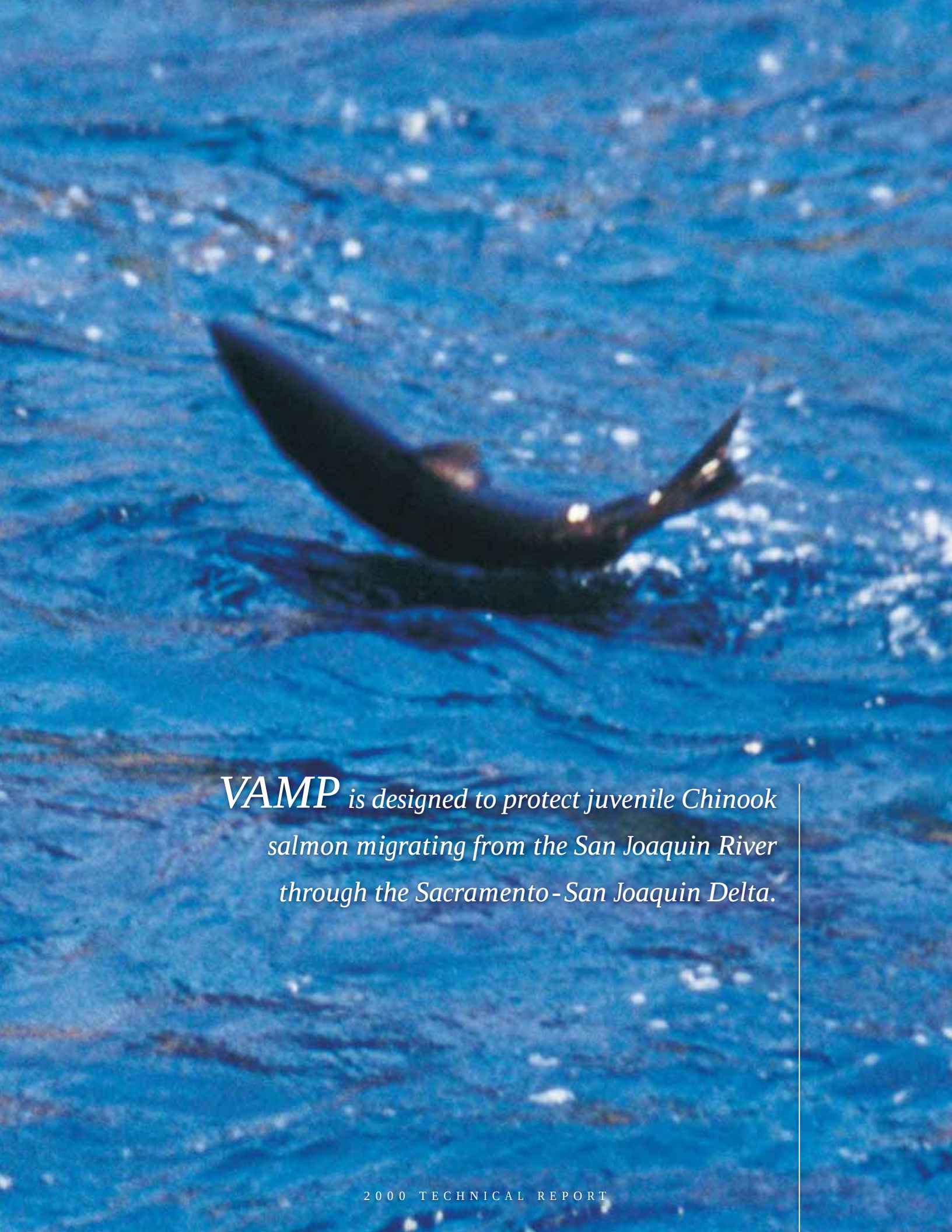
- *Quantification of Chinook salmon smolt survival between Durham Ferry and Jersey Point using recapture locations at Antioch and Chipps Island, under conditions of a San Joaquin River flow at Vernalis of 5,700 cfs, with an installed Head of Old River Barrier, and SWP/CVP export rates of 2,250 cfs; and*
- *Comparison of juvenile Chinook salmon survival between Durham Ferry and Mossdale for use in comparing results of VAMP 2000 with results from earlier survival studies where coded-wire tagged salmon releases occurred at Mossdale.*

A secondary objective of the VAMP 2000 experimental salmon smolt survival studies is the comparison of the survival of juvenile Chinook salmon of Merced and Mokelumne River origin released at Jersey Point.

Based on data gathered during the experimental mark-recapture studies that occurred over a 31-day period in April and May 2000, a set of conclusions and recommendations have been developed. These conclusions and recommendations, described in detail on pages 34–35 of this report, provide guidance and a foundation for design and implementation of future VAMP operations.

Key policy and management conclusions and recommendations derived from VAMP 2000 include:

- *VAMP 2000 is the first year of full implementation of the program. No conclusions on the relative roles of San Joaquin River flow and SWP/CVP exports on juvenile Chinook salmon smolt survival can be made with this documented data. The report recommends that the VAMP experimental test program be continued;*
- *The design and installation of the temporary Old River Barrier in 2000 provided unreliable operations at San Joaquin River flows of 7,000 cfs. The report recommends resolution of concerns regarding the Old River Barrier design and operations and future VAMP test flows be maintained as a high priority item;*
- *Budgeting and planning for the VAMP program should be expanded beyond one year. The report recommends that a three-year plan and budget be developed, including anticipated capital and operation costs, to facilitate VAMP implementation.*



VAMP is designed to protect juvenile Chinook salmon migrating from the San Joaquin River through the Sacramento-San Joaquin Delta.

Introduction

VAMP 2000

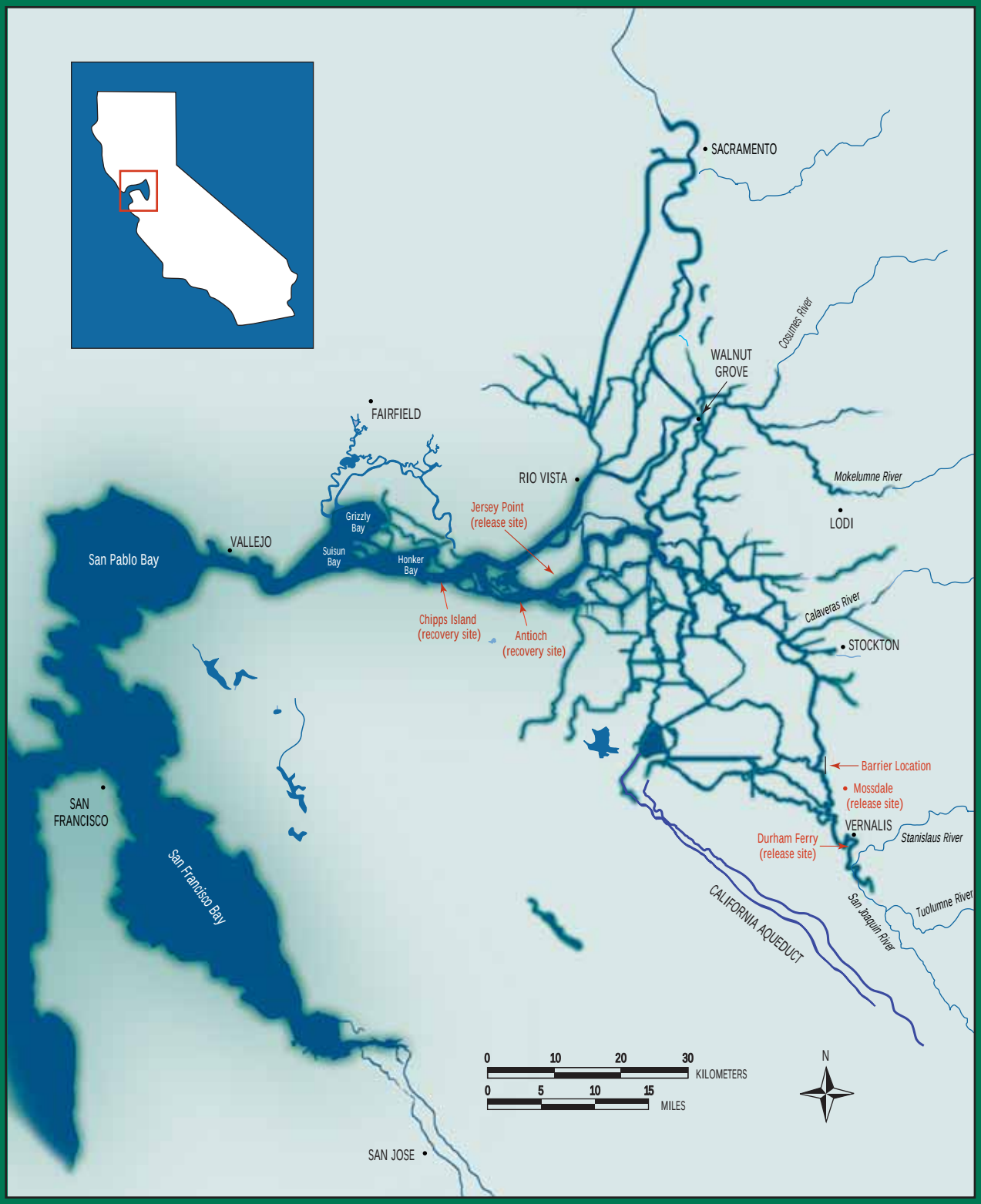
The VAMP experimental design measures salmon smolt survival rates under six different combinations of flow and export rates (see pages 6–13). The experimental design includes two mark-recapture studies performed each year during the mid-April to mid-May out-migration period that provide estimates of salmon survival under each set of conditions. Chinook salmon survival rates under each of the experimental conditions are then calculated based on the numbers of marked salmon released and the number recaptured (see page 28).

EXPERIMENTAL DESIGN ELEMENTS

The VAMP 2000 experimental design included both multiple release locations (Durham Ferry, Mossdale, and Jersey Point), and multiple recapture locations (Antioch, Chipps Island, SWP and CVP salvage operations, and in the ocean fisheries (Figure 1-1). Two sets of releases were made at Durham Ferry and Jersey Point. The use of data from multiple release and recapture locations allows for a more thorough evaluation of juvenile Chinook salmon survival as compared to recapture data from only one sampling location and one series of releases. The VAMP release (Durham Ferry and Jersey Point) and recapture locations (Antioch and Chipps Island) will be consistent from one year to the next, providing a greater opportunity to assess salmon smolt survival over a range of Vernalis flows, SWP/CVP exports, and with and without the presence of the Old River Barrier. Releases at Jersey Point serve as controls for recaptures at Antioch and Chipps Island, thereby allowing the calculation of survival estimates based on the ratio of survival indices from marked salmon recaptured from upstream (e.g., Durham Ferry) and the downstream (control) release at Jersey Point. The use of ratio estimates as part of the VAMP study design substantially reduces the bias associated with differential gear collection efficiency within and among years, improves the precision associated with the individual indices, and improves confidence in differences in salmon smolt survival as a function of Vernalis flows and SWP/CVP exports.

Figure 1.1

SACRAMENTO-SAN JOAQUIN ESTUARY



Location of VAMP 2000 release sites (Durham Ferry, Mossdale, and Jersey Point), recovery locations (Antioch, and Chipps Island), and Upper Old River Barrier location within the Sacramento-San Joaquin River Delta/Estuary.

Hydrologic Planning

VAMP HYDROLOGIC PLANNING & IMPLEMENTATION

This section documents the planning and implementation of the VAMP 2000 investigations as undertaken by the Hydrology Group of the San Joaquin River Technical Committee (SJRTC). Implementation of VAMP is guided by the framework provided in the Agreement and anticipated hydrologic conditions within the watershed.

The Hydrology Group was established for the purpose of forecasting hydrologic conditions and for planning, coordinating, scheduling and implementing the flows required to meet the test flow target in the San Joaquin River near Vernalis. The Hydrology Group is also charged with exchanging information relevant to the forecasted flows, and coordinating with others in the SJRTC, in particular the Biology Group, responsible for planning and implementing the salmon smolt survival study.

Participation in the Hydrology Group is open to all interested parties, with the core membership consisting of the designees of the agencies responsible for the water project operations that would be contributing flow to meet the target flow. In 2000, the agencies belonging to the Hydrology Group included: Merced Irrigation District (Merced), Turlock Irrigation District (TID), Modesto Irrigation District (MID), Oakdale Irrigation District (OID), South San Joaquin Irrigation District (SSJID), San Joaquin River Exchange Contractors (Exchange Contractors), and the U.S. Bureau of Reclamation (USBR). Though not a water provider, the California Department of Water Resources (DWR) was closely involved with the coordination of operations relating to the installation of the Old River Barrier and the planning of Delta exports consistent with the VAMP.

VAMP FLOW AND SWP/CVP EXPORTS

The VAMP investigations are designed to collect data and information on the impacts of San Joaquin River flow and Delta exports (SWP and CVP pumping at the Tracy and Banks pumping plants) on the survival rates of juvenile Chinook salmon emigrating from the San Joaquin River system. The VAMP provides for a 31-day pulse flow at the Vernalis gage during the months of April and May, along with a corresponding reduction in SWP/CVP exports, as shown in Table 2-1. The magnitude of the pulse flow is based on San Joaquin River flow that would occur during the pulse period absent the VAMP, referred to as the existing flow.

Based upon hydrologic conditions, the target flow in a given year could either be increased to the next highest value ("double-step") or the supplemental water requirement could be eliminated entirely. A numerical procedure has been established in the SJRA to determine the target flow. The State Board San Joaquin Valley Water Year Hydrologic Classification ("60-20-20" classification) is given a numerical indicator as shown in Table 2-2.

"Double-step" flow years occur when the sum of last year's numerical indicator and the 90 percent exceedence forecast of the current year's numerical indicator is seven (7) or greater. If the sum of the two previous years' numerical indicators and the 90 percent exceedence forecast of the current year's numerical indicator is four (4) or less, which is an extremely dry period, the San Joaquin River Group Authority (SJRG) members are not required to provide water above the existing flow. The USBR has a continuing obligation to meet San Joaquin River flows pusuant to the March 6, 1995 Biological Opinion.

Under the Agreement, the maximum amount of supplemental water to be provided to meet VAMP target flows in any given year is 110,000 acre-feet. If the VAMP target flow requires more than 110,000 acre-feet of supplemental water (based on the targets outlined in Table 2-1, under double-step conditions, historically up to 157,000 acre-feet of supplemental water may be required), then additional water may be acquired on a willing seller basis.

VAMP 2000 HYDROLOGIC PLANNING

Hydrology Group Meetings

Beginning in February 2000, and continuing until early April, the Hydrology Group held five planning and coordination meetings (February 10; March 2, 16, and 30; and April 6). At these meetings, forecasts of hydrologic and operational conditions on the San Joaquin River and its tributaries were discussed and refined.

Monthly Operation Forecasts

As part of the early planning efforts, monthly operation forecasts were developed by the Hydrology Group to estimate the existing flow at Vernalis. Inflows to the tributary reservoirs used in these forecasts were based on DWR Bulletin 120 runoff forecasts. The monthly operation forecasts used the 90 percent and 50 percent probability of exceedence runoff forecasts. The initial monthly

Table 2.1

VAMP VERNALIS FLOW & DELTA EXPORT TARGETS

EXISTING FLOW (CFS)	VAMP TARGET PULSE FLOW (CFS)	DELTA EXPORT TARGET RATES (CFS)
0 to 1,999	2,000	
2,000 to 3,199	3,200	1,500
3,200 to 4,449	4,450	1,500
4,500 to 5,699	5,700	2,250
5,700 to 7,000	7,000	1,500 or 3,000
Greater than 7,000	Provide stable flow to the extent possible	

Table 2.2

SAN JOAQUIN VALLEY WATER YEAR
HYDROLOGIC CLASSIFICATIONS USED IN VAMP

60-20-20 CLASSIFICATION	VAMP NUMERICAL INDICATOR
Wet	5
Above Normal	4
Below Normal	3
Dry	2
Critical	1

Table 2.3

SUMMARY OF VAMP 2000 MONTHLY FORECASTS

VAMP FORECAST DATE	RUNOFF FORECAST DATE	RUNOFF EXCEEDENCE	VAMP CRITERIA	EXISTING FLOW (CFS)	VAMP TARGET FLOW (CFS)	SUPPLEMENTAL WATER (1,000 ACRE-FEET (AF)
				SPRING PULSE PERIOD (APRIL 15 - MAY 15)		
Feb 09	Feb 01	90 %	Single step	2,895	3,200	19
		50 %	Double step	4,370	5,700	84
Feb 22	Feb 15	90 %	Single step	3,785	4,450	41
		50 %	Double step	4,940	7,000	127

operation forecast was prepared in early February. An additional monthly forecast was prepared using mid-February runoff forecast updates. The monthly forecasts are summarized in Table 2-3. Based upon the early forecast efforts, it was apparent that the planning for the 2000 VAMP would require consideration of a broad range of possibilities.

DAILY OPERATION PLANS

The Hydrology Group developed a daily operation plan beginning in mid-March, updating it as hydrologic conditions and operational requirements changed. The daily operation plans calculated an estimated mean daily flow at Vernalis based on measured flows at the major tributary's control points and in the upper San Joaquin River with the following key assumptions:

(1) The travel times for flows from the tributary measurement points and upper San Joaquin River to the Vernalis gage are assumed as follows:

a. Merced River at Cressey to Vernalis	3 days
b. San Joaquin River above Merced River to Vernalis	2 days
c. Tuolumne River at LaGrange to Vernalis	2 days
d. Stanislaus River below Goodwin Dam (at Orange Blossom Bridge) to Vernalis	2 days

(2) Based upon a review of the historical flow record, the ungaged flow at Vernalis was assumed to be constant throughout the pulse period and equal to the trending value entering the pulse period. By definition, the ungaged flow is that unmeasured flow entering the system between Vernalis and the upstream measuring points and is calculated as follows:

Vernalis Ungaged =

VNS - OBBlag - LGNlag - CRSlag - USJRlag

where:

VNS	=	San Joaquin River near Vernalis
OBBlag	=	Stanislaus River at Orange Blossom Bridge lagged 2 days
LGNlag	=	Tuolumne River at LaGrange lagged 2 days
CRSlag	=	Merced River at Cressey lagged 3 days
USJRlag	=	San Joaquin River above Merced River lagged 2 days (USJR is not gaged but is calculated as the difference between the gaged flows at the San Joaquin River at Newman (NEW) and the Merced River at Stevinson (MST)).

A summary of the daily operation plans developed during the planning of the 2000 VAMP is provided in Table 2-4. Copies of the daily operation plans are provided in Appendix A.

By definition, the VAMP 31-day pulse flow period can occur anytime between April 1 and May 31. Until the pulse flow is specifically defined, it is assumed for the purposes of planning to be April 15 through May 15. Flexibility of dates for the pulse flow period exists so that they coincide with the period of peak salmon out-migration. Other factors, including installation of Old River Barrier, availability of juvenile salmon at the hatchery, and manpower and equipment availability for fish releases and sampling fish also need to be considered in determining the timing of the pulse period.

Early forecasts indicated that 2000 would be a "double-step" year with a flow target of 7,000 cfs and concurrent combined CVP and SWP pumping at Tracy and Banks at 3,000 or 1,500 cfs. From a biological standpoint, 1,500 cfs was the preferred option. A wet February and early March resulted in high San Joaquin River flows and raised concerns about the chances of installing the Old River Barrier. The high San Joaquin River flows also caused speculation that the VAMP period would have to be delayed, however, a sustained dry period with essentially no rainfall in the San Joaquin basin between March 19 and April 12 reduced the forecasted flows such that the VAMP planning returned to the April 15 through May 15 nominal schedule. To ensure that the flows in the San Joaquin River remained below 5,000 cfs during installation of the Old River Barrier, Stanislaus River flows were reduced from 1,500 cfs to approximately 850 cfs. Tuolumne River flows were also reduced from about 1,200 cfs to 420 cfs. Construction of the Old River Barrier began on April 5.

Late March and early April operation plans indicated that supplemental water in excess of 110,000 acre-feet would be required to achieve the target flow of 7,000 cfs for the 31-day pulse flow period. This additional water could be supplied through purchases by the USBR from willing sellers. In preparation for this possibility, the SJRG and USBR prepared a draft Environmental Assessment and Initial Study for additional water acquisition.

By April 13, construction of Old River Barrier was nearly complete and upstream releases for the scheduled VAMP pulse flow had begun, timed to arrive at Vernalis coincident with the April 15 start of the target flow period. However, the flow at Vernalis as measured by USGS on April 13 indicated that the actual flow (3,210 cfs) was about 1,000 cfs less than that being reported on the California Data Exchange Center (CDEC) (4,280 cfs). The revised flow at Vernalis resulted in a revision of the projected existing flow from 5,018 cfs to 4,412 cfs—near the threshold of two VAMP target flows (5,700 cfs and 7,000 cfs). A base flow less than 4,450 cfs requires a target flow of 5,700 cfs and a base flow greater than

Table 2.4

SUMMARY OF VAMP 2000 DAILY OPERATION PLANS

VAMP FORECAST DATE	PULSE PERIOD	ASSUMED UNGAGED FLOW AT VERNALIS (CFS)	EXISTING FLOW (CFS)	VAMP TARGET FLOW (CFS)	SUPPLEMENTAL WATER 1,000 ACRE-FEET (AF)	NOTES
Mar 15	Apr 15–May 15 May 01–May 31	1,000 1,000	6,447 6,184	7,000 7,000	34.9 55.0	
Mar 23	Apr 20–May 20	1,000	4,934	7,000	127.0	Pulse period set at April 20 to May 20 to accomodate Head of Old River Barrier (HORB) construction.
Mar 29	Apr 20–May 20	1,000	4,934	7,000	127.1	
Apr 04	Apr 15–May 15	1,000	4,949	7,000	128.8	Pulse period changed to Apr 15 to May 15 due to revised HORB construction schedule.
Apr 05	Apr 15–May 15	1,000	4,949	7,000	128.8	
Apr 11	Apr 15–May 15	1,000–1,800	5,018	7,000	125.0	
Apr 13	Apr 15–May 15	550–700	4,412	5,700	86.0	Existing flow and ungaged flow at Vernalis reduced significantly due to rating shift at Vernalis gage.
Apr 14	Apr 15–May 15	500	4,320	5,700	89.5	
Apr 17	Apr 15–May 15	500	4,265	5,700	89.5	

4,450 cfs requires a target flow of 7,000 cfs. After convening a special session of the SJRTC to evaluate the latest data, the decision was made to set the VAMP 2000 flow target at 5,700 cfs with a Delta export target of 2,250 cfs. Important to this decision was the need for a target flow that could be sustained for 31 days as opposed to establishing a higher target that could not be sustained during the entire pulse flow period.

Due to travel time considerations, releases were already underway to achieve the earlier 7,000 cfs Vernalis target flow, with a 3,800 cfs fishery study pulse flow under way on the Tuolumne River. In order to move the projected flow at Vernalis closer to the new target of 5,700 cfs without disrupting the Tuolumne River pulse flow, the flow in the Stanislaus River was reduced from 1,500 cfs to 1,100 cfs. Nevertheless, it was still anticipated that the flow at Vernalis would exceed the 5,700 cfs target flow to some degree for the duration of the first Tuolumne River pulse flow test period.

VAMP 2000 IMPLEMENTATION

Operation Conference Calls

During implementation of the VAMP pulse flow, conference calls were conducted on a regular basis to discuss the status of the pulse flow and to make changes to the operation plan if needed. The calls were held at 6:30 a.m. so that potential operational changes could be implemented on that day. Daily conference calls occurred from April 13 through April 19, excluding the weekend, and then every Monday, Wednesday and Friday thereafter through May 12.

Operation Monitoring

During the pulse flow period, supplemental water contributions from San Joaquin tributaries were continuously monitored using the available real-time data. Data at each of the measurement locations (Merced River at Cressey, Tuolumne River below LaGrange Dam, Stanislaus River at Orange Blossom Bridge, San Joaquin River near Vernalis, Merced River at Stevinson, and San Joaquin River at Newman) was compiled by CDEC. Monitoring was necessary to verify that supplemental water deliveries were adhering to tributary allocations contained in the Agreement to the extent possible. An example of the spreadsheet used to monitor the operation is provided in Appendix A.

Operational Highlights

On April 17, a strong storm moved into the San Joaquin basin and produced record or near record amounts of rainfall. It was anticipated that the storm would elevate flows at Vernalis by approximately 1,000 cfs. Preservation of the pulse on the Tuolumne River was deemed more important than modifying operations to attempt to maintain the Vernalis flow target. Since the Old River Barrier was designed to be safe with flows approaching 9,000 cfs, problems were not anticipated. As a result of storm runoff and irrigation cutbacks, the Vernalis flow responded dramatically, increasing to what was initially believed to be about 6,400 cfs. Just as the peak was reached, personnel on site at the Old River Barrier reported that the water level on the San Joaquin River side of the Old River Barrier was far closer to the crest than anticipated, and concern was expressed about the safety of the Old River Barrier at these flows. At nearly the same time, on April 18, USGS measured a flow of 7,140 cfs at the Vernalis gage, 730 cfs higher than the 6,410 cfs being reported on CDEC. As a result of these events, immediate reductions in reservoir releases were implemented. The Tuolumne River flow was reduced by about 1,000 cfs, and the Stanislaus River flow was reduced from 1,100 cfs to 800 cfs. The peak flow passed the Old River Barrier uneventfully, and the Stanislaus River flow was returned to its 1,500 cfs target. However, the slow recession of the storm hydrograph kept flows above the Vernalis target flow of 5,700 cfs for a longer period than expected.

After the effects of the April 17 storm subsided, San Joaquin River flows became fairly stable and predictable for the remainder of the VAMP pulse period. A small storm at the end of the first week in May caused some concern but proved to have a relatively small impact on the flow at Vernalis with an increase in flow of approximately 300 to 400 cfs. From April 15 through April 24, Vernalis flows averaged 6,360 cfs, ranging from 7,060 to 5,760 cfs. From April 25 through May 15, the mean daily flow at Vernalis averaged 5,750 cfs, ranging from 5,230 cfs to 6,050 cfs, a deviation of -8 percent to +6 percent from the target flow of 5,700 cfs.

RESULTS OF VAMP 2000 OPERATIONS

Planning and implementation of the VAMP spring pulse flow operation was accomplished using the best available real-time data which has not been reviewed for accuracy or adjusted for the long range impacts of rating shifts. The final accounting for the VAMP operation is accomplished using provisional mean daily flow data available from USGS and DWR. The provisional data, which is considered to be the best available information, has been reviewed and adjusted for rating shifts but is still considered provisional and is subject to change. To illustrate the differences between real-time and provisional data, plots of the real-time and provisional flows at the primary measuring points are provided in Appendix A.

Daily Vernalis flows during the VAMP 2000 test period are shown in Figure 2-1. The mean daily flow at the Vernalis gage ranged from 5,230 cfs to 7,060 cfs, resulting in an average of 5,869 cfs during the 31-day target flow period. The maximum mean daily flow of 7,060 cfs, which occurred on April 18, was the result of both the large amount of rain that occurred the previous day and the initial flow schedule that was based on a target flow of 7,000 cfs. The average flow for the target flow period absent the VAMP supplemental water was estimated to be 4,815 cfs. Figure 2-1 shows the flow at Vernalis and sources of that flow. Figure 2-2 compares the flow at Vernalis with and without the VAMP pulse flow. The VAMP resulted in a 25 percent increase in flow at Vernalis during the target flow period. A total of 77,680 acre-feet of supplemental water was provided to meet the VAMP target flow. A daily summary of VAMP operations, along with supporting data, is provided in Appendix A.

The combined CVP and SWP export rate averaged 2,155 cfs during the 31-day period, about 4 percent below the target of 2,250 cfs. Figure 2-3 summarizes daily SWP and CVP exports.

SJRG member agencies have entered into the Division Agreement which allocates responsibility of the members for providing VAMP supplemental water. The members may also make additional agreements among themselves regarding delivery of the supplemental water. For VAMP 2000, SJRG contributing agencies agreed to provide the SSJID supplemental water as follows: 54.55 percent by Merced, 15.91 percent by OID, 15.91 percent by MID and 13.64 percent by TID. It was also agreed that the OID supplemental water would be provided entirely by MID due to the 1,500 cfs flow limitation on the Stanislaus River.

The distribution of supplemental water for the VAMP 2000 target flow, compared to the distribution as the Division Agreement, is summarized in Table 2-5.

Figure 2.1

SAN JOAQUIN RIVER NEAR VERNALIS

WITH LAGGED CONTRIBUTIONS FROM PRIMARY SOURCE

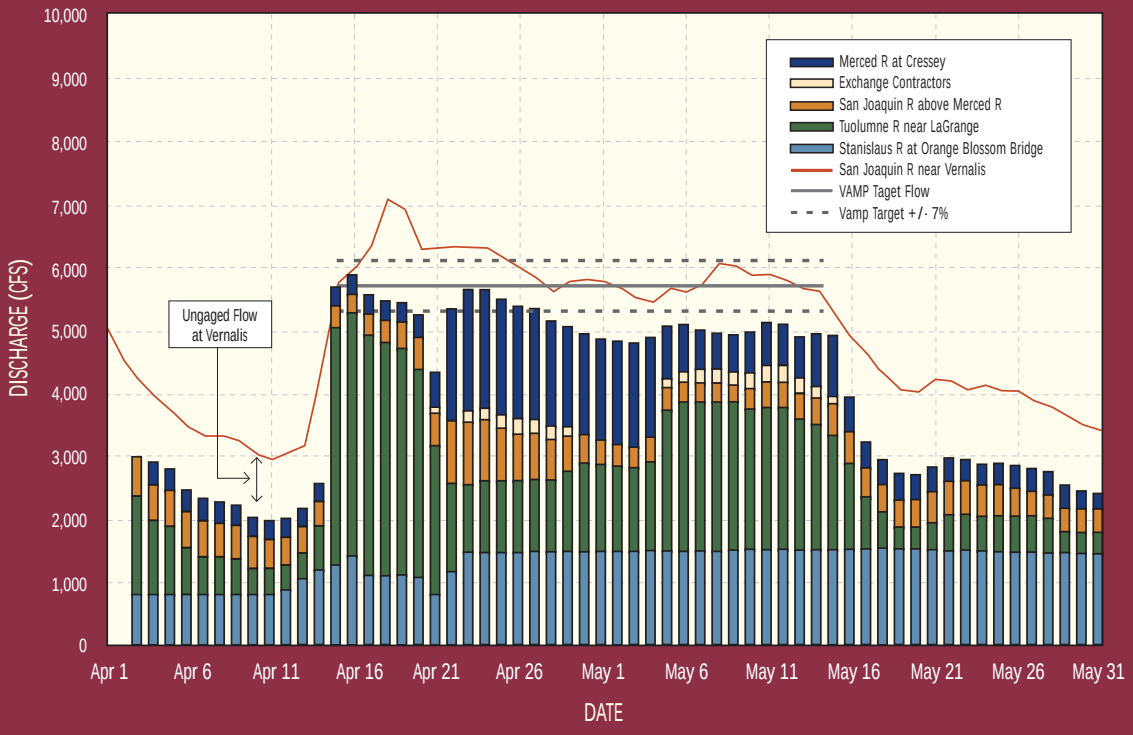


Figure 2.2

SAN JOAQUIN RIVER NEAR VERNALIS

WITH & WITHOUT VAMP

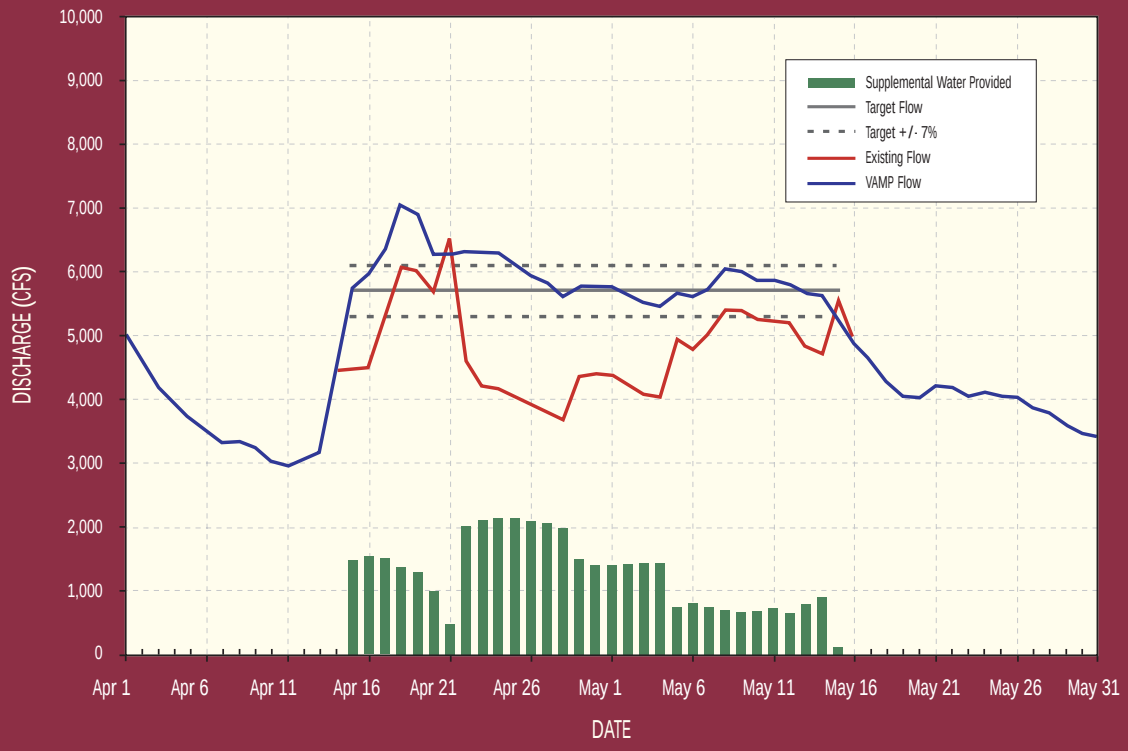


Figure 2.3

FEDERAL & STATE EXPORTS

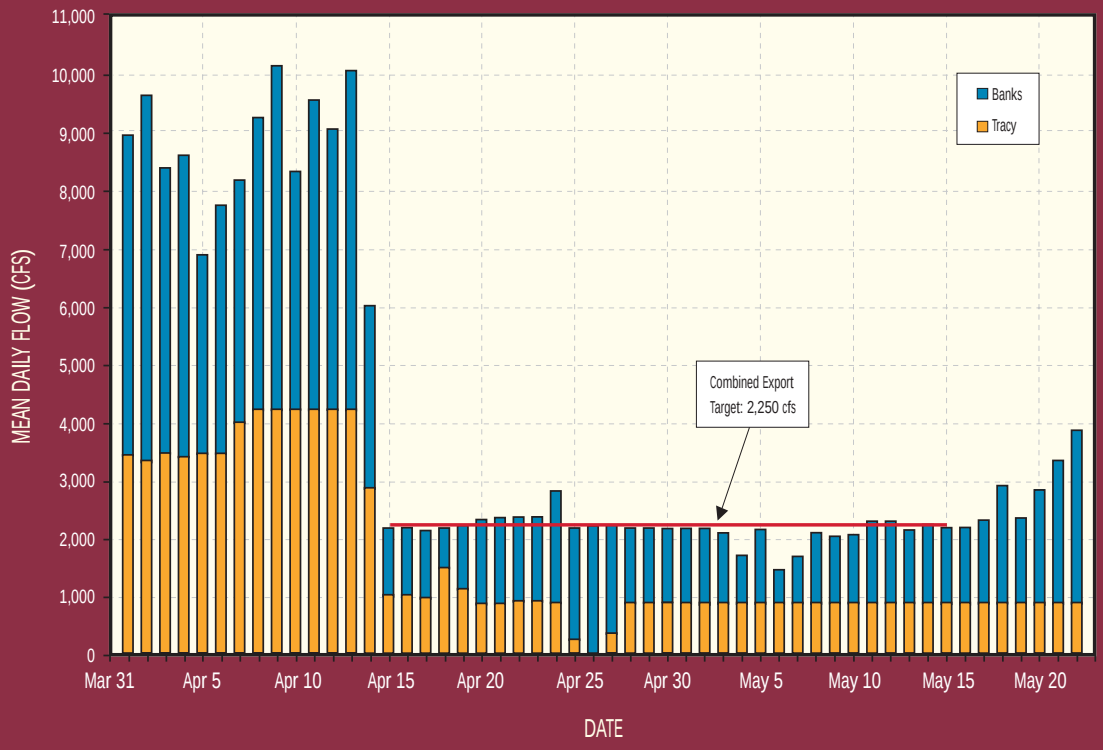
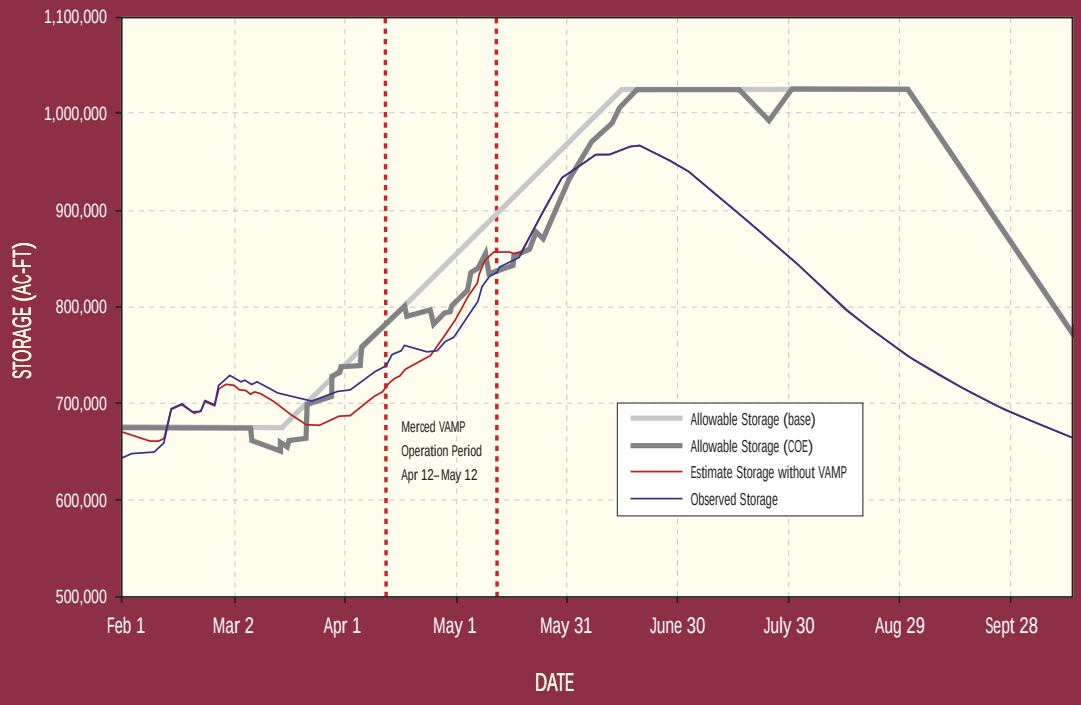


Figure 2.4

STORAGE IMPACTS LAKE McCLURE MERCED RIVER



STORAGE IMPACTS

Supplemental water from the Merced and Tuolumne Rivers was primarily supplied from storage from Lake McClure on the Merced River and from New Don Pedro Reservoir on the Tuolumne River. Therefore, the impacts of VAMP operations can be seen directly as changes in reservoir storage. Due to the extended nature of the VAMP, a 12-year plan, the storage impacts can potentially carry over from year to year. Reservoir storage impacts are reduced or eliminated when the reservoirs make flood control releases.

On the Merced River, flood control releases were required in May, thereby eliminating the storage impacts in Lake McClure that had resulted from the VAMP 2000 operations. Figure 2-4 shows Lake McClure storage with and without the VAMP operation.

On the Tuolumne River, the storage impact of approximately 23,800 acre-feet was reduced to about 7,700 acre-feet due to flood control releases required at the end of September 2000 under the "No VAMP" scenario. This 7,700 acre-feet storage impact will continue until further flood control releases are made. Figure 2-5 shows New Don Pedro Reservoir storage with and without VAMP 2000 operations, assuming the encroachment into the Don Pedro flood control space would have occurred without VAMP releases would have been allowed.

Table 2.5

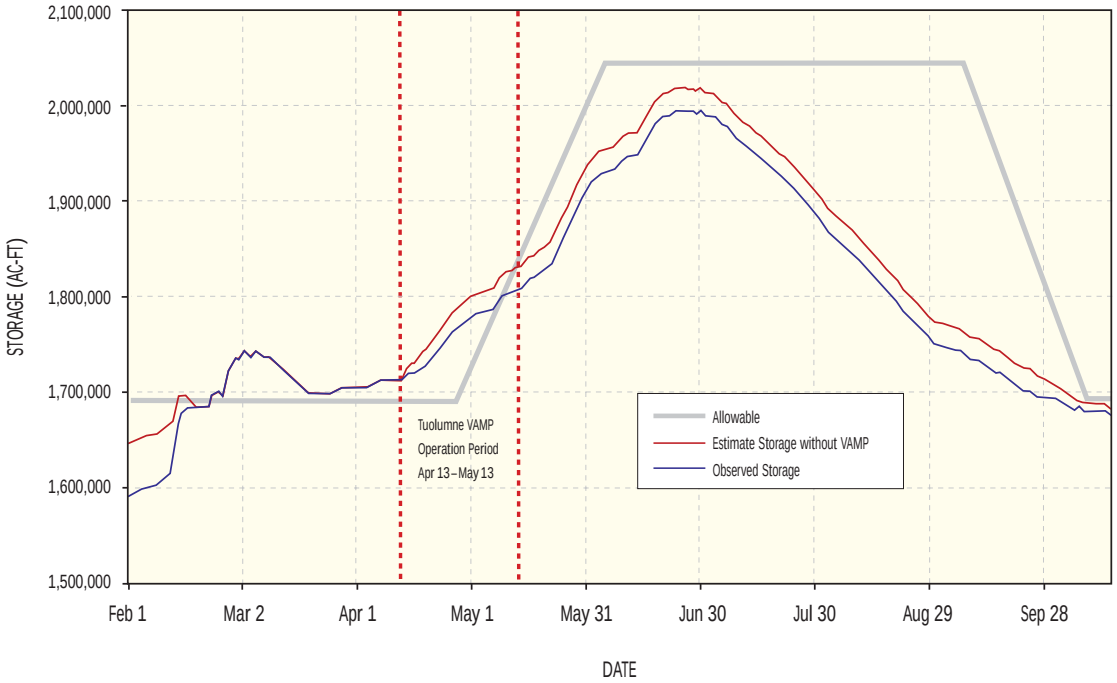
DISTRIBUTION OF 77.68 THOUSANDS ACRE-FEET (TAF) OF SUPPLEMENTAL WATER

AGENCY	DIVISION AGREEMENT DISTRIBUTION (TAF)		SUPPLEMENTAL WATER PROVIDED	DEVIATION FROM DIVISION AGREEMENT
	Base	*Adjusted*		
Merced	41.18	45.16[3]	46.75	+1.59
OID	7.30[1]			
SSJID	7.30[2]			
Exchange Contractors	7.30	7.30	8.28	+0.98
MID	7.30	16.92[4]	15.20	-1.72
TID	7.30	8.30[5]	7.45	-0.85

[1] Provided by MID
[2] Provided by: Merced (54.55%), OID (15.91%), MID (15.91%), TID (13.64%)
[3] Includes 3.98 TAF of SSJID water
[4] Includes 7.30 TAF of OID water and 2.32 TAF of SSJID water
[5] Includes 1.00 TAF of SSJID water

Figure 2.5

STORAGE IMPACTS NEW DON PEDRO RESERVOIR (TUOLUMNE RIVER)



Water Supply

ADDITIONAL WATER SUPPLY ARRANGEMENTS & DELIVERIES

MERCED IRRIGATION DISTRICT (MERCED)

The Agreement includes a provision (Paragraph 8.4) stating, "Merced Irrigation District shall provide, and the USBR shall purchase 12,500 acre-feet of water… during October of all years." This water is referred to as the Fall SJRA Transfer Water. The daily schedule for the SJRA Fall Transfer Water is to be developed by Department of Fish and Game (DFG), United States Fish and Wildlife Services (USFWS) and Merced.

In addition to providing water in the fall of 2000 pursuant to the Agreement, Merced entered into a contract with USBR to transfer up to 25,000 acre-feet of water to be used to benefit wildlife refuges south of the Delta. This additional water transfer is referred to as the Fall 2000 Transfer. The Fall 2000 Transfer water was to be delivered via the SWP, using available excess pumping capacity at the Banks Pumping Plant. Because the likelihood of available pumping capacity decreases near the end of the year, and due to the benefits to salmon returning to spawn in the Merced River or at the Merced River Hatchery, the decision was made to transfer 16,000 acre-feet in October and 9,000 acre-feet in November.

During October, DWR installed a temporary barrier. As part of the land use agreement allowing for the construction of the Old River Barrier, DWR agreed to remove it if the flow in the San Joaquin River, as measured at the Vernalis gage, exceeded 4,500 cfs. This was an important issue in the scheduling of the Fall Transfer Water.

It became evident in the early stages of planning that in order to meet the desired flow schedule for the Fall 2000 Transfer and not put the Old River Barrier at risk, it would be necessary to schedule some of the Fall SJRA Transfer Water outside of October. Additionally, being able to use the transfer water to bolster flows in November and December would be beneficial to the fisheries. Paragraph 8.4.4 of the Agreement stipulates, "Water purchased pursuant to Paragraph 8.4 may be scheduled for months other than October provided Merced, DFG and USFWS all agree." By letter agreement, Merced, DFG and USFWS agreed to exercise Paragraph 8.4 and allow for the release of Fall SJRA Transfer water in November and December.

The initial daily schedule for the Fall SJRA Transfer called for 7,580 acre-feet to be delivered in October and 4,920 acre-feet to be delivered in December. The initial daily schedule for the Fall 2000 Transfer called for 14,310 acre-feet to be provided in October and 10,690 acre-feet in November (for initial daily schedules, see Appendix B).

Due to a lack of available pumping capacity at the Banks Pumping Plant, the Fall 2000 Transfer was terminated on October 31. As a result, a revised transfer schedule was developed, moving the December Fall SJRA Transfer water to October and November (see Appendix B for the revised schedule). The revised Fall SJRA Transfer water schedule, developed October 31, provided for release of 8,770 acre-feet in October and 3,730 acre-feet in November. At the time of termination of the Fall 2000 Transfer, preliminary data indicated that 13,120 acre-feet had been provided in October.

On November 3, it was announced that excess pumping capacity at Banks Pumping Plant would be available beginning November 6, resulting in another revision to the transfer schedule. This revised Fall SJRA Transfer water schedule (Appendix B) resulted in 8,770 acre-feet provided in October, 750 acre-feet in November and 2,980 acre-feet in December. The revised Fall 2000 Transfer schedule provided 13,120 acre-feet in October and 11,650 acre-feet in November. These values are all preliminary and subject to change.

A preliminary summary of Merced additional water transferred to date is provided in Appendix B.

OAKDALE IRRIGATION DISTRICT (OID)

Pursuant to Paragraph 8.5 of the SJRA, "Oakdale Irrigation District shall sell 15,000 acre-feet of water to the USBR in every year of (the) Agreement… In addition to the 15,000 acre-feet, Oakdale will sell the difference between the water made available to VAMP under the SJRGA agreement and 11,000 acre-feet."

Table 3.1

DAILY TABULATION OF OAKDALE IRRIGATION DISTRICT ADDITIONAL WATER RELEASE

PRELIMINARY
SUBJECT TO CHANGE

[1] CVPIA is the acronym for Central Valley Project Improvement Act.

[2] "Section 3406 b (2) of CVPIA states that 800,000 acre-feet of Central Valley Project yield is dedicated to fish and wildlife."

[3] "Section 3406 b (3) of CVPIA is a program to acquire water for fish and wildlife."

As noted on page 10, OID provided 7,300 acre-feet of supplemental water for the year 2000 VAMP, leaving 3,700 acre-feet of "difference" water. Therefore, pursuant to Paragraph 8.5 of the Agreement, OID sold a total of 18,700 acre-feet of water to the USBR in 2000.

The OID additional water (3,700 acre-feet) was made available to the USBR on August 16. The 15,000 acre-feet was released by the USBR between October 17 and November 20. Release of the 3,700 acre-feet of "difference" water commenced on November 20 and was completed on December 10. A daily tabulation of the OID additional water release is provided in Table 3-1.

DATE	GOODWIN DAM RELEASE	[1]PRE CVPIA BASE CONDITION RELEASE	[2]B(2) WATER	OAKDALE ID ADDITIONAL WATER RELEASED BY USBR– [3]B(3) WATER		CUMULATIVE OAKDALE ID ADDITIONAL WATER RELEASED
	(cfs)	(cfs)	(cfs)	(cfs)	(acre-feet)	(acre-feet)
Oct 10	311	300	11			
Oct 11	307	300	7			
Oct 12	307	300	7			
Oct 13	313	300	13			
Oct 14	309	300	9			
Oct 15	305	300	5			
Oct 16	304	300	4			
Oct 17	676	300		376	746	746
Oct 18	1,085	300		785	1,557	2,303
Oct 19	1,108	300		808	1,603	3,905
Oct 20	1,109	300		809	1,605	5,510
Oct 21	1,113	300		813	1,613	7,123
Oct 22	1,060	300		760	1,507	8,630
Oct 23	865	300		565	1,121	9,751
Oct 24	659	300		359	712	10,463
Oct 25	478	300		178	353	10,816
Oct 26	382	300		82	163	10,979
Oct 27	379	300		79	157	11,135
Oct 28	383	300		83	165	11,300
Oct 29	384	300		84	167	11,466
Oct 30	376	300		76	151	11,617
Oct 31	376	300		76	151	11,768
Nov 01	386	300		86	171	11,939
Nov 02	388	300		88	175	12,113
Nov 03	386	300		86	171	12,284
Nov 04	384	300		84	167	12,450
Nov 05	382	300		82	163	12,613
Nov 06	380	300		80	159	12,772
Nov 07	382	300		82	163	12,934
Nov 08	383	300		83	165	13,099
Nov 09	382	300		82	163	13,261
Nov 10	378	300		78	155	13,416
Nov 11	379	300		79	157	13,573
Nov 12	377	300		77	153	13,726
Nov 13	376	300		76	151	13,876
Nov 14	378	300		78	155	14,031
Nov 15	385	300		85	169	14,200
Nov 16	385	300		85	169	14,368
Nov 17	384	300		84	167	14,535
Nov 18	383	300		83	165	14,699
Nov 19	380	300		80	159	14,858
Nov 20	377	300		77	153	15,011
Nov 21	383	300		83	165	15,176
Nov 22	378	300		78	155	15,330
Nov 23	380	300		80	159	15,489
Nov 24	381	300		81	161	15,650
Nov 25	382	300		82	163	15,812
Nov 26	385	300		85	169	15,981
Nov 27	378	300		78	155	16,136
Nov 28	378	300		78	155	16,290
Nov 29	380	300		80	159	16,449
Nov 30	380	300		80	159	16,608
Dec 01	386	275		111	220	16,828
Dec 02	385	275		110	218	17,046
Dec 03	383	275		108	214	17,260
Dec 04	383	275		108	214	17,474
Dec 05	386	275		111	220	17,695
Dec 06	386	275		111	220	17,915
Dec 07	387	275		112	222	18,137
Dec 08	384	275		109	216	18,353
Dec 09	382	275		107	212	18,565
Dec 10	386	275		111	220	18,785
Dec 11	384	275	109			
Dec 12	382	275	107			
Dec 13	381	275	106			
Dec 14	382	275	107			
Dec 15	382	275	107			

Old River Barrier

OLD RIVER BARRIER

In 2000, DWR successfully installed and operated the temporary Old River Barrier that included permitting, engineering design, and a short construction schedule. The spring Old River Barrier is a component of the south Delta Temporary Barriers Project (TBP). The TBP mitigates for low water levels in the south Delta and improves water circulation and quality for agricultural purposes.

The spring Old River Barrier was first constructed in 1992 and again in 1994, 1996, 1997 and 2000. The Old River Barrier was not installed in 1993, 1995 and 1998 due to high San Joaquin River flows. The Old River Barrier was not installed in 1999 due to landowner access problems. The Old River Barrier, a key component of VAMP, is intended to increase San Joaquin River Chinook salmon smolt survival by preventing them from entering Old River.

The Old River Barrier was originally designed to withstand a San Joaquin River flow of about 3,000 cfs. Through the years, the design and installation of Old River Barrier has been revised on several occasions to accommodate different needs. The most recent design of Old River Barrier provides a wider base to withstand significantly higher flows in the San Joaquin River. The 2000 Old River Barrier was equipped with six 48-inch operable culverts and a weir back-filled with clay.

BARRIER DESIGN AND INSTALLATION

The dimensions of the 2000 Old River Barrier were considerably larger than those constructed in past years Figure 4-1. The base width of the Old River Barrier was increased to 100 feet and the crest elevation was raised to ten feet mean sea level (MSL). The top of Old River Barrier was built with a 75-foot wide notch, protected with concrete grid mats and back-filled with clay. The larger Old River Barrier was designed to withstand flow stages up to 8.5 feet MSL. A 7,000 cfs VAMP target flow is likely to fluctuate plus or minus 500 cfs under normal circumstances. This fluctuation could result in stages at Old River Barrier within the minimum freeboard zone. A sudden storm event could raise stages enough to cause the Barrier to overtop. Given the experience with Old River Barrier in 2000, and the current flow rating information for Vernalis, DWR does not recommend the 2000 barrier design for study years when VAMP target flows are 7,000 cfs. Also, to safely construct or remove the Barrier, flows at Vernalis must be held below 5,000 cfs.

To help mitigate anticipated low water levels in the south Delta (downstream of the Barrier) caused by the operation of the Old River Barrier, six operable culverts were installed. Operation of the culverts is controlled by a slide gate control structure located on the upstream side of Old River Barrier (Figure 4-1). DWR relied on daily modeling and field data collection to monitor water levels at three locations within the south Delta to determine when and how long to operate the culverts.

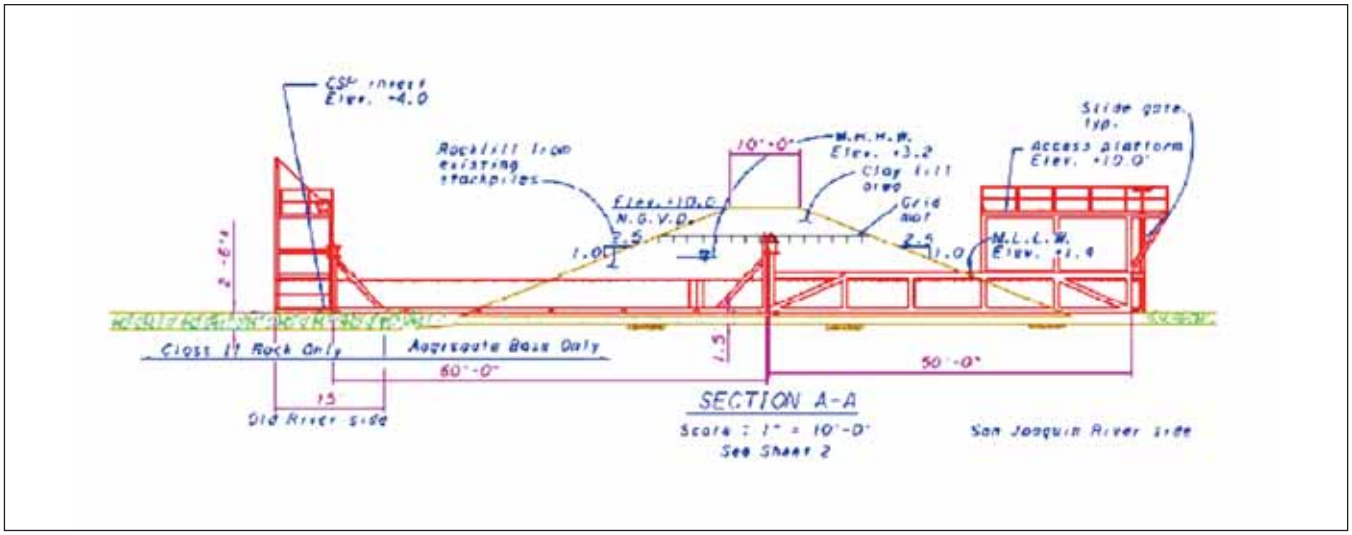
The downstream outlet of each culvert was designed so fyke nets could be attached to evaluate fish passage. DFG staff conducted a fishery-monitoring program as part of the 2000 Old River Barrier operations (for additional information, see page 18).

Because of the increase in the design flow and the addition of the culverts in the Barrier, DWR protected the existing levees adjacent to Old River Barrier with additional riprap. The riprap extended 300 feet downstream of the Old River Barrier on both banks—protecting the levee from erosion that might occur during the culvert operations or during an emergency breaching.

Head of Old River Barrier

Figure 4.1

HEAD OF OLD RIVER BARRIER CROSS SECTION



BARRIER OPERATIONS AND MONITORING PLAN

DWR obtained permits from the Corps of Engineers and the DFG to install and operate six 48-inch diameter culverts in the Old River Barrier. The culverts permitted flow through the Old River Barrier on an as-needed basis, while ensuring improved flows in the mainstem San Joaquin River.

DWR developed a Barrier operations and monitoring plan. Based on the forecast and monitoring of tidal conditions, DWR would determine the number of culverts to be opened at the Old River Barrier so that water levels at Old River near Tracy Road Bridge, Middle River near Howard Road and Grant Line Canal near Tracy Road Bridge would remain above 0.0 feet MSL. As a result of modeling and/or field monitoring of water levels in the south Delta, culvert slide gates were operated and modified four times between April 16 and May 16. On April 17, two culverts were opened and remained open until the Old River Barrier was removed. On April 27 and 28, the third and the fourth culverts were opened, respectively. The last two culverts were opened on May 11, and all six culverts remained open until the Old River Barrier was breached on May 16.

The daily flows diverted through the culverts varied in response to local tidal conditions and San Joaquin River flow conditions. The characteristics of the flow through the culvert are complicated in that the flow is controlled by many variables, including the culvert inlet geometry, slope, size, culvert roughness, and approach and tail water conditions. It is estimated that when the difference in water level across the Old River Barrier is eight feet, the discharge is approximately 150 cfs through each culvert, or a total of about 900 cfs when all six culverts are open.

BARRIER EMERGENCY RESPONSE PLAN

In addition to the operation and monitoring plan, DWR also developed an "Emergency Operations Plan for the Spring 2000 Head of Old River Barrier". In 2000, the plan provided that if the daily flow at Vernalis was measured or forecasted to exceed 8,500 cfs, the Old River Barrier would be removed.

Operation of the Old River Barrier was uneventful with the exception of the first week, as mentioned on page 6. Flow at Vernalis of approximately 7,100 cfs resulted in about 1.8 feet of freeboard remaining on the upstream side of Old River Barrier. During this period, the DWR Division of Flood Management and Division of Engineering evaluated the situation and recommended that the Old River Barrier not be breached. The barrier remained in place until May 15.

SEEPAGE MONITORING

A seepage-monitoring program was initiated in April to evaluate the effects of the operation of the Old River Barrier on seepage and groundwater on Upper Roberts Island.

Three seepage monitoring well sites were chosen on Upper Roberts Island. Each site had two shallow wells, positioned 10 feet and 100 feet from the toe of the levee to monitor seepage gradient to and from the San Joaquin River. In addition, a deeper well was drilled at Site 1 to determine vertical gradients.

Hourly groundwater levels in each well were recorded with an in situ datalogger/transducer.

In addition to the groundwater monitoring wells, a temporary gage was installed in April 2000 to record water surface stages in the San Joaquin River, about 1,500 feet downstream from the Old

River Barrier. Installation of a permanent tide gage is scheduled for late 2001. The water surface stages are compared to groundwater levels on Upper Roberts Island to determine how groundwater levels change relative to changing water level conditions in the San Joaquin River.

The 2000 data for San Joaquin River elevations and groundwater elevations indicates that a strong relationship exists at Site 1, while weaker relationships exist for Sites 2 and 3. There was an almost immediate response between tidal variation and groundwater level fluctuations, indicating water was moving quickly to the islands upper water bearing zones and to the wells. The data indicated however, that while the Old River Barrier was installed in spring 2000, water levels in the wells did not rise high enough to be a concern for farming operations on Upper Roberts Island near the Old River Barrier.

There was an almost immediate response between tidal variation and groundwater level fluctuations, indicating water was moving quickly to the islands upper water bearing zones and to the wells.

FISHERY MONITORING AT THE OLD RIVER BARRIER

Because the potential existed for juvenile Chinook salmon and other fish species to become entrained into the Old River Barrier culverts, fisheries monitoring was designed and conducted by DFG staff. The objectives of fishery monitoring at the Old River Barrier during the 2000 VAMP program were to:

1. Determine the total number of juvenile Chinook salmon and other fish species diverted through the culverts at the Old River Barrier;

2. Determine the entrainment vulnerability of juvenile Chinook salmon during different tidal stages during day and night; and

3. Assess the entrainment loss of coded-wire tagged (CWT) juvenile Chinook salmon released as a result of entrainment in culverts at the Old River Barrier.

Materials and Methods

Nine fyke nets and six live-boxes were constructed for the purpose of sampling in Old River, into the Old River Barrier. Fyke nets, 30 feet in length, were made of ¼-inch braided mesh. The fyke nets were square in cross-section tapering from approximately 48 inches at the mouth to one square foot at the cod end. Each fyke net was equipped with a live box. Live-boxes (15.5 x 19.5 x 36 inches) were constructed of perforated aluminum sheet metal. An aluminum baffle was placed inside each live-box to reduce the flow of water and improve salmon survival.

The mouth of the fyke net was strapped over a 48-inch diameter opening on tracks and lowered down over the culverts out-fall. Rubber flaps were used to seal the spaces between the culvert and the net opening to prevent fish loss. The culverts were slightly twisted during construction of the Old River Barrier and, as a result, the alignment between the net mouth opening and culvert was not exact. Because the alignment was not exact, some leakage of water past the net mouth opening occurred.

Sampling of the live-boxes was accomplished by boat. Most of the time the hydraulic force moving through the net prevented pulling the live-box completely out of the water or from detaching it from the net. As a result, routine inspection of the nets for holes was not possible during sampling.

Operation of two culverts at the Old River Barrier began April 17. Fyke nets were attached to both culvert outlets. While the culverts were being opened, excess bedding material was washed into the fyke nets, immediately filling both nets with small pebbles and rocks. The rock load in both nets during the first few minutes of culvert operation was such that only one net was able to be emptied and retrieved; the second net had to be detached, set adrift, and replaced with another net.

Fyke nets could not be sampled continuously for the duration that the culverts were open. Continuous clogging of nets and live-boxes, coupled with high water velocities through the culverts, placed additional stress on the nets, which eventually tore beyond salvaging. The nets were removed on April 19 and, to prevent scouring and net damage, a heavy-duty vinyl tarp was tied to the bottom of the nets. The modified nets were subsequently used between April 24 and 28. Scouring of the vinyl tarps and damage to the nets persisted until only two good nets remained. Routine sampling was discontinued to preserve the two remaining nets for use in the pending entrainment studies.

Catch-Per-Unit-Effort (CPUE) for unmarked Chinook salmon was calculated as the number collected per hour. For purposes of these calculations, net efficiency was assumed to be 100 percent, regardless of the number of holes and tears that were found in the nets. In reality however, net efficiencies were probably much lower.

A loss index for CWT salmon released upstream of the Old River Barrier as part of VAMP survival studies was calculated from data collected April 17 through 28. Based on the number of CWT

salmon released as part of VAMP at Durham Ferry and Mossdale, and the total number of CWT salmon collected during sampling at the Old River Barrier, an index of CWT salmon loss downstream of the Old River Barrier was calculated as:

$$I = (TC/TR)(TT/ST)$$

Where:

TC Total number of CWT salmon collected

TR Total number of CWT salmon released

TT Total time (hours) during the test period

ST = Total time sampled at the Old River Barrier during the test period

Entrainment Study

One day and one night release of individually marked groups of juvenile Chinook salmon from the Merced River Hatchery were made at two different locations—directly in front of the Old River Barrier and approximately 500 feet upstream of the Old River Barrier in the San Joaquin River—during the low ebb and high flood tidal cycles. A release scheduled to occur on May 4 during the peak low tide was delayed by a few hours due to difficulties in identifying color-marked salmon.

Merced River Hatchery juvenile Chinook salmon were color-marked at the hatchery with either Meta-Jet dye or photonic fluorescent microspheres. The salmon were then transported from the hatchery to the San Joaquin River and placed in 4x10x4 foot live cages lined with 3/16-inch mesh netting. The test fish were held in the live-cages for ten or more hours to both reduce handling stress and observe any mortality before being released.

Groups of approximately 2,000 juvenile salmon were released immediately upstream of the Old River Barrier. Further upstream, the groups consisted of about 3,000 marked salmon. One particular release group of 2,000 fish experienced 92 percent mortality due largely to being accidentally dropped on the riprap bank before being placed in the live-cages.

Night releases during high and low tidal cycles were made during the evening of May 3 and early morning of May 4. Day releases for both tidal cycles were made during the morning and afternoon of May 11.

Though four culverts were in operation during the May 3 and 4 entrainment tests, only two nets were in suitable condition for sampling. The two nets were removed from the culverts after the first study to avoid damage prior to their use in the second entrainment study. During the second entrainment study, all six culverts were in operation, while again only two nets were available and suitable for sampling.

After both entrainment studies were completed, the nets were inspected and found to have only minor holes in them. The percent of color-marked fish recovered in the nets relative to the number released was used as an index of entrainment vulnerability at the Old River Barrier.

Results and Discussion

Throughout the April 17 to May 16 study period, the number of culverts operated at the Old River Barrier and the number of fyke nets installed varied (Table 4-1). The total hours that the culverts were in operation during the April 17 through May 11 sampling period was approximately 1,800 hours. This was the sum of hours that each culvert was in operation. Total sampling time for all fyke nets combined was 374 hours and ranged from 0.83 to 25.4 hours.

Twenty-six fish species were collected in the fyke nets during Old River Barrier fish monitoring (Table 4-2). Chinook salmon (3,813) and white catfish (1,009) were the two most abundant species collected. Very few delta smelt (1) or splittail (5) were collected (Table 4-2).

A total of 3,813 Chinook salmon were collected in the fyke nets at the Old River Barrier culverts, including:

- 499 CWT Chinook salmon
- 631 Unmarked Chinook salmon (Natural)
- 2,683 Color-marked Chinook salmon (Entrainment study)

The CPUE for unmarked Chinook salmon ranged from 0.0 to 18.8 per net per hour, averaging 1.7 fish per hour. The greatest number of unmarked Chinook salmon (245) was collected on May 4. However, this was during the entrainment study and it is possible that some of the color-marks may not have been identified, and were therefore placed in the unmarked (natural) category. The greatest number of CWT salmon (318) was collected on April 18.

The CPUE for CWT salmon was not calculated because of the variability in release dates and sampling dates. Instead, a period of time (April 17–28) when fyke nets were sampling coincident with CWT Chinook salmon releases upstream of the Old River Barrier at Mossdale and Durham Ferry was selected (see Figure 1-1). During this period, CWT salmon releases upstream as part of VAMP and DFG gear effieciency studies at Mossdale, totaled 133,412 fish. The fyke nets sampled for 265 hours between April 17 and 28, while the culverts were in operation for 566 hours. A total of 471 CWT salmon were collected during that period at the Old River Barrier. Assuming the nets were installed long enough for CWT salmon to move beyond the Old River Barrier and that there was no mortality or predation during transit to the Old River Barrier, using an "overestimated" measure of net efficiency (100 percent), an index of entrainment through the culverts was calculated as approximately 0.75 percent. A more exact percentage by release group can be estimated once the tags from the CWT salmon are read.

In 1997, a similar study was performed when two culverts were constructed within the Old River Barrier. The entrainment index for CWT Chinook salmon in 1997 was 0.6 percent. Release and recapture information for the entrainment study is summarized in Table 4-3.

The percent of color-marked salmon collected was extrapolated to account for the number of nets used and culverts operated. The percent recoveries for color-marked Chinook salmon through the culverts ranged from 68.1 to 138.2 percent (see Table 4-3) for those groups released adjacent to the Old River Barrier, and 0.1 to 17.1 percent for those released upstream of the Barrier. The percent recoveries greater than 100 percent suggest that Chinook salmon smolts are probably more susceptible to entrainment by certain culverts.

The largest range in percent recoveries between tides for color-marked salmon occurred during the day, suggesting that juvenile salmon may congregate more during the day and may disperse in the water column during the evening. The percent recoveries of color-marked Chinook salmon were highest for all release groups during the low tide, except for one color-marked group released upstream of the Old River Barrier three hours after the low tide. This group was released during the flood tide, which could have affected the results.

It is evident that color-marked salmon released in front of the Old River Barrier were more vulnerable to entrainment than those released further upstream because they were less able to disperse and avoid the culverts. Therefore, entrainment vulnerability at the 2000 Old River Barrier for natural or CWT salmon migrating downstream in the San Joaquin River is probably better represented by salmon released upstream of the Barrier resulting in greater dispersal and lower percent recoveries (0.1 to 17 percent). This compares to an estimate of 0.75 for the CWT salmon in the monitoring study. Also, the percent recovery for salmon released upstream of the Old River Barrier was not consistent between tidal cycles during day and night releases. This may indicate that there is less influence from tidal cycles on juvenile salmon further upstream of the Old River Barrier, or that there is some degree of loss between upstream releases and the Barrier. The results of this study indicate that tides and the photoperiod may influence Chinook salmon entrainment at the Old River Barrier. A similar study is planned for 2001 with improved net design to increase their longevity and thus, provide for a more continuous sampling downstream of the Old River Barrier. In addition, DFG plans to implement a juvenile Chinook salmon South Delta survival study to monitor migration routes and survival of marked Merced Fish Hatchery juvenile Chinook salmon through South Delta channels downstream of the Old River Barrier.

Table 4.1

CULVERT & NET OPERATION SCHEDULE
AT THE OLD RIVER BARRIER

DATES OF CULVERT OPERATION	NUMBER OF CULVERTS OPERATED	DATES FYKE NETS WERE USED	NUMBER OF FYKE NETS USED
Apr 17– Apr 27	2	Apr 17– Apr 19 & Apr 24– Apr 27	2
Apr 27– Apr 28	3	Apr 27– Apr 28	3
Apr 28– May 11	4	Apr 28 & May 2– May 4	4 2
May 11– May 16	6	May 11	2

Table 4.2

NUMBER OF FISH SPECIES COLLECTED IN FYKE NETS
FROM APRIL 17 THROUGH MAY 11, 2000

American Shad	1
Delta Smelt	**1**
Shimofuri Goby	1
Smallmouth Bass	1
Tule Perch	1
White Crappie	1
Brown Bullhead	2
Black Bullhead	2
Inland Silverside	2
Riffle Sculpin	2
Green Sunfish	3
Largemouth Bass	3
Log Perch	4
Sacramento Blackfish	4
Splittail	**5**
Goldfish	6
Redear Sunfish	8
Striped Bass	9
Black Crappie	10
Bluegill	18
Threadfin Shad	41
Sacramento Sucker	46
Channel Catfish	104
Carp	148
White Catfish	1,009
Total Chinook Salmon	**3,813**
CWT Chinook Salmon	499
Unmarked Chinook Salmon	631
Color-Marked Chinook Salmon	2,683
Total	5,245

Table 4.3

NUMBER OF COLOR-MARKED CHINOOK SALMON RELEASED & PERCENT RECOVERED DURING THE EVENING
(MAY 3 AND 4) & DAY (MAY 11, 2000)

RELEASE LOCATION	NUMBER OF FISH RELEASED	TIDE PHASE AT RELEASE	NUMBER COLLECTED	PERCENT RECOVERED	EXTRAPOLATED PERCENT RECOVERED
Night Releases (May 3 and 4)					
Upstream	3,009	High	93	3.10	6.20
	3,017	Low	16	0.50	1.10
Adjacent	2,014	High	934	46.40	92.80
	157	Low	104	66.20	132.50
Day Releases (May 11)					
Upstream	2,998	High	1	0.03	0.10
	2,999	Low	171	5.69	17.10
Adjacent	2,141	High	486	22.70	68.10
	1,904	Low	877	46.10	138.20

Smolt Survival

VAMP 2000 SALMON SMOLT SURVIVAL INVESTIGATIONS

This section describes the methods used in conducting the VAMP 2000 Chinook salmon survival investigations and presents results of the calculated survival indices and absolute survival rates for juvenile Chinook salmon during the VAMP 2000 test period. Additional data and information related to the salmon survival investigations are presented in Appendix C.

CODED-WIRE TAGGING

Merced River Hatchery Chinook salmon smolts, released as part of VAMP 2000, were coded-wire tagged between March and early April. After the salmon were tagged, they were held in the hatchery for 14 to 21 days before being released. The day before a group of salmon was to be released, a sub-sample of the salmon was measured for length and checked for retention of the coded-wire tags. The sub-sample was typically comprised of 100 to 300 salmon collected from the top, middle, and bottom of the release group's raceway. Each tag code within a release group was held separately at the hatchery with the exception of the three tag codes made up of the second Durham Ferry release that were held together in one section of the raceway. This group was released on April 28.

Though tag retention is usually quite high, as a double check on the tag detector, all salmon from the sub-sample that had no tag detected were sacrificed. These sacrificed salmon were dissected to determine whether they might contain an unmagnetized tag. A separate sub-sample of 25 salmon was sacrificed from each release group; the tags were removed and read to detect any incorrect tag codes in the raceways. The year 2000 tag retention rates were slightly lower than observed in previous years. As a result of the observed tag retention rates, tagging machines will be evaluated prior to VAMP 2001. Old tagging machines require more frequent maintenance and more careful examination to insure the best quality tagging. Table 5-1 summarizes the results of the CWT retention rate and the estimate of the effective numbers of salmon released to calculate survival indices.

CWT RELEASES

CWT salmon from Merced River Hatchery were released at Durham Ferry, Mossdale, and Jersey Point (see Figure 1-1). VAMP 2000 was the first year in which salmon have been released at Durham Ferry, located approximately 11 miles upstream of Mossdale. The release site at Durham Ferry was selected to address the concern that salmon released at Mossdale could disperse into Upper Old River at a higher rate than those originating from the San Joaquin River tributaries during periods when the Old River Barrier was not in place. Releasing the fish at Durham Ferry allowed them to disperse more similarly to juvenile salmon originating from the San Joaquin tributaries. In order to compare the results from one year to the next, the Durham Ferry site will be used in future VAMP survival studies.

CWT salmon were released on April 17 at Durham Ferry, April 18 at Mossdale and April 20 at Jersey Point (see Table 5-1). A second set of releases were made at Durham Ferry on April 28 and at Jersey Point on May 1. Because of the limited number of CWT salmon from the Merced River Hatchery, an additional release was made at Jersey Point on May 1 from the Mokelumne River Hatchery. The use of salmon from the Mokelumne River Hatchery at Jersey Point provided an opportunity to explore the possibility of using further such stock in future years to supplement downstream VAMP releases.

Approximately 75,000 salmon, in three separate tag lots, were released at Durham Ferry, while 50,000, in two tag lots, were released at both Mossdale and Jersey Point (see Table 5-1). While in past years, each release group was trucked from the hatchery and released simultaneously as one large composite group, during VAMP 2000, groups of 25,000 CWT salmon were transported to the sites in separate compartments of the trailer and each tag lot was released five to 15 minutes apart. The group released at Durham Ferry on April 28 had the three tag lots mixed and did not adhere to this protocol.

Merced River Hatchery

Table 5.1

NUMBER OF CODED-WIRE TAGGED JUVENILE CHINOOK SALMON
FROM THE MERCED RIVER HATCHERY RELEASED AS PART OF VAMP 2000.

RELEASE DATE	CWT CODE	RELEASE SITE	AVERAGE FLOW	NUMBER RELEASED	TAG RETENTION RATE	EFFECTIVE NUMBER RELEASED
Apr 17	064563	Durham Ferry	80	26,476	0.924	24,457
Apr 17	060401	Durham Ferry	80	25,980	0.906	23,529
Apr 17	060402	Durham Ferry	80	25,904	0.924	24,177
Apr 18	064401	Mossdale	79	26,391	0.865	23,465
Apr 18	064402	Mossdale	79	25,969	0.858	22,784
Apr 20	064404	Jersey Point	82	26,335	0.981	25,824
Apr 20	064403	Jersey Point	82	26,301	0.971	25,527
Apr 28	0601060915	Durham Ferry	77	28,295	0.947	26,805
Apr 28	0601110814	Durham Ferry	77	25,216	0.947	23,889
Apr 28	0601060914	Durham Ferry	77	25,014	0.947	23,698
May 1	0601061001	Jersey Point	78	26,059	0.981	25,572
May 1	0601061002	Jersey Point	76	26,235	0.940	24,661
April 19–May 3	064405	Mossdale	86	25,798	0.906	23,371

The group released at Jersey Point from the Mokelumne River Hatchery included two 50,000 tag codes, released as a single group of 100,000 salmon.

The water temperature in the hatchery truck and San Joaquin River was measured at the release site immediately prior to release. This information, as well as additional release information, is provided in Table 5-2.

WATER TEMPERATURE MONITORING

The water temperature was monitored during the VAMP 2000 study using individual computerized temperature recorders (e.g., Onset Stowaway Temperature Monitoring/Data Loggers). The water temperature was measured at locations along the longitudinal gradient of the San Joaquin River and interior Delta channels between Durham Ferry and Chipps Island—locations of the migratory pathways for the juvenile Chinook salmon that were released as part of these tests. The water temperature was recorded at 24-minute intervals throughout the period of the VAMP 2000 investigations.

The water temperature was also recorded within the hatchery raceways at both the Merced and Mokelumne River hatcheries coincident with the period when juvenile Chinook salmon were being tagged. The water temperature was also recorded for one release group from each hatchery in the transport truck, and for a two-day post release observation period. Results of water temperature monitoring during the VAMP 2000 study period are summarized in Appendix C.

POST-RELEASE LIVE-CAR STUDIES

Survival and Condition

The post-release survival of marked salmon was evaluated as part of the VAMP program using sub-samples of marked salmon from each release group. Net pen studies were conducted where approximately 200 salmon from each CWT release group were held in live cars for 48 hours after release in order to monitor for any direct and short-term mortality. In addition to the salmon examined in the net pen studies, two groups of 25 salmon from each tag group were evaluated based upon overall condition at release and 48 hours after release. To assess overall condition, fork length in millimeters, weight in grams, eye condition, body color, the presence of fin hemorrhaging, percent scale loss, gill color and vigor were examined. Obvious abnormalities or deformities were also noted.

Table 5.2

VAMP 2000 CODED WIRE TAG RELEASES & RECAPTURES

AT ANTIOCH, CHIPPS ISLAND, & CENTRAL VALLEY PROJECT (CVP), & STATE WATER PROJECT (SWP) FISH FACILITIES

TAG CODE	RELEASE SITE / STOCK	DATE	TRUCK TEMP	RELEASE TEMP (centigrade)	NUMBER RELEASED	AVERAGE SIZE (mm)	NUMBER RECOVERED AT ANTIOCH	PERCENT SAMPLED AT ANTIOCH
06-04-01	Durham Ferry (MRFF)		13.0	14.0	23,529	80	6	0.337
06-04-02	Durham Ferry (MRFF)		13.0	14.0	24,177	80	10	0.337
06-45-63	Durham Ferry (MRFF)		12.5	14.0	24,457	80	11	0.342
	Total	Apr 17			72,163		27	0.342
06-44-01	Mossdale (MRFF)		11.1	13.3	23,465	79	14	0.332
06-44-02	Mossdale (MRFF)		11.1	13.3	22,784	79	16	0.340
	Total	Apr 18			46,249		30	0.340
06-44-03	Jersey Point (MRFF)		12.2	18.0	25,527	82	50	0.325
06-44-04	Jersey Point (MRFF)		11.7	18.0	25,824	82	47	0.327
	Total	Apr 20			51,351		97	0.327
06-01-06-09-14	Durham Ferry (MRFF)		11.1	16.7	23,698	77	8	0.408
06-01-06-09-15	Durham Ferry (MRFF)		11.1	16.7	26,805	77	15	0.313
06-01-11-08-14	Durham Ferry (MRFF)		11.1	16.7	23,889	77	8	0.350
	Total	Apr 28			74,392		31	0.313
06-01-06-10-01	Jersey Point (MRFF)		11.7	17.2	25,572	78	76	0.353
06-01-06-10-02	Jersey Point (MRFF)		11.7	17.2	24,661	76	76	0.315
	Total	May 1			50,233		152	0.315
06-02-53	Jersey Point (MOK)				50,445	87	106	0.355
06-02-54	Jersey Point (MOK)				51,167	85	110	0.353
	Total	May 1			101,612		216	0.355
06-44-05	Mossdale (MRFF)	April 19–May 3	13.0	16.0	23,288	86	9	0.339

NOTE: MRFF denotes Merced River stock.
MOK denotes Mokelumne River stock.

AND SURVIVAL INDICES

SURVIVAL INDEX AT ANTIOCH	GROUP SURVIVAL AT ANTIOCH	NUMBER RECOVERED AT CHIPPS	PERCENT SAMPLED AT CHIPPS	SURVIVAL INDEX AT CHIPPS	GROUP SURVIVAL AT CHIPPS	EXPANDED SALVAGE CVP	EXPANDED SALVAGE SWP
0.054		7	0.26	0.149		24	144
0.088		10	0.261	0.206		24	132
0.095		11	0.259	0.226		12	185
	0.079	28	0.261		0.193		
0.130		9	0.259	0.192		12	213
0.149		9	0.258	0.199		12	220
	0.137	18	0.259		0.195		
0.433		24	0.264	0.463		0	0
0.401		41	0.264	0.782		0	0
	0.416	65	0.264		0.623		
0.059		7	0.256	0.150		12	75
0.128		5	0.254	0.096		24	96
0.069		10	0.264	0.206		12	60
	0.096	22	0.262		0.147		
0.606		48	0.257	0.949		0	3
0.704		30	0.254	0.623		0	3
	0.692	78	0.258		0.782		
0.427		95	0.252	0.971		0	5
0.439		74	0.256	0.734		0	0
	0.431	169	0.254		0.8512		
0.082		7	0.258	0.151		12	144

The eye condition was assessed based on whether the eyes appeared normally shaped or were bulging while the body color was assessed relative to the darkness of the black spot pigmentation on the dorsal side of the fish and its contrast to the green body color. Fin hemorrhaging was judged based on whether there were spots of blood on or at the base of the fins. Percent scale loss was judged on a scale between 0 to 100 percent and gill color was based on lifting the operculum and ranking the darkness of red of the gills. Normal was considered beet red to dark cherry red and poor was considered light red to grayish/whitish in color. Vigor was considered normal if the fish were active and poor if the salmon were lethargic or motionless.

Results of the evaluations of marked fish in the live cars both immediately after release and 48 hours later showed very few abnormalities in the condition characteristics assessed (Appendix C). Of the 1,283 salmon assessed, 10 had no adipose fin clip while 23 were found to have a poor fin clip. A total of nine had deformation, four of which were caudal and five of which were operculum. In summary, the percentage of salmon deformed within the sample group, 0.7, is within the normal range at a hatchery. (S. Foott, personal communication.)

It appears that overall the salmon used for VAMP 2000 survival experiments were healthy and in good condition, though one was found dead in the live-car and another, in addition to most of those in the net pen at the April 17th Durham Ferry release, appeared to have escaped during the 48-hour post-release holding and observation period.

It appears that overall the salmon used for VAMP 2000 survival experiments were healthy and in good condition …

Physiology

Physiological studies were conducted by the USFWS California-Nevada Fish Health Center on VAMP 2000 salmon as reported by Nichols et al. (2000). Tests were conducted on a sub-sample of the salmon smolts released at Durham Ferry, Mossdale and Jersey Point after they had been held in the live cars for approximately 24 hours. Forty-two salmon were sampled at each site, with the exception of those from the first release at Durham Ferry where only 12 were available because the rest escaped from the net pens. The salmon were euthanized with an overdose of tricain methane sulfonate (MS222), and then measured and evaluated using organosomatic analyses. Tissue samples were collected for pathogen and physiological assays. Organosomatic analysis included length, weight, and observations of any abnormalities. Blood samples were processed to determine hematocrit and leukocrit measurements and to collect plasma.

Conditions factors (K) were calculated for each fish based on fork length and weight based on the formula: $K=Wt/L^3 * 10^5$. Kidney tissue was checked for bacterial pathogens and the internal organs were examined for parasites and abnormalities. Samples of gill tissue were assayed for gill Na+, K+ - ATPase levels as an indicator of saltwater readiness (smolting). Plasma glucose and chloride levels were analyzed to determine the ability of the salmon to adapt to stress. Measurements were made using both stressed and unstressed salmon. The "unstressed" salmon were removed from the net pen as quickly as possible and immediately euthanized while the stressed fish were held out of the water for 30 seconds, and sampled after they were allowed to recover for 45 minutes.

On April 13, 60 salmon were sampled at random from the entire hatchery population in the Merced River Hatchery. These salmon were evaluated in terms of organosomatic analysis, ATPase, histology, bacteriology and virology. Stress physiology evaluations were not conducted on salmon from the Merced River Hatchery.

Results from the physiological tests indicated that all release groups appeared healthy with no significant abnormalities. No viral or bacterial pathogens were detected. Early infections of the PKX parasite (early stage of proliferative kidney disease) were detected in two salmon by histology. Stress treatments demonstrated healthy energy reserves and plasma ion levels in all groups examined.

Based on physiological testing, Nichols et al. (2000) reported that, "Eosinophilic granular cells (EGC's) were quite prominent in the lamina propria layer of the intestine and pyloric caeca from approximately half of each sample group. These immunodefensive cells are found in many organs, particularly those in direct contact with the environment such as gill, skin, and digestive tract. They are often associated with parasitic infections and contain both peroxicdase and lysozyme (Sveinbjornsson et al. 1996, Sire and Vernier, 1995). Earlier assumptions that EGC's acted as mast cells have been found to be incorrect as histamine is not present (Sire and Vernier 1995). While it is not unusual to see in adult Chinook, they have not been observed in such high numbers in the intestines of juvenile Chinook salmon from the Sacramento and Klamath rivers. No lesions or parasites were associated with the EGC's found in the Merced River Hatchery salmon."

Not only were these high EGC levels found in Chinook salmon at the Merced River Hatchery, they were also found in samples from the natural stock in the San Joaquin basin (Scott Foott, personal communication). Although Nichols et al. (2000) suggests that the observed high levels of EGC cells in San Joaquin River salmon stocks may be due to genetic differences (Chinook from the San Joaquin basin are at the farthest southern extent of their range), further evaluation of these results may be warranted.

Tag Quality Control

The subset of 25 salmon from each tag group (25 from the April 28 Durham Ferry release group) held in the net pens (50 to 75 per release group) were sacrificed and used to verify tag codes. Though rare, on few occasions in the past, salmon from different release groups have been mixed. It is not certain why the mixing of salmon from different release groups occurs. Additional CWT salmon from each release group have been archived, if needed, to further evaluate VAMP 2000 tag quality control.

CWT SALMON RECAPTURE SAMPLING

CWT salmon were recaptured at Antioch and Chipps Island and at CVP and SWP Fish Salvage Facilities (See Figure 1-1). Juvenile Chinook salmon with adipose fin clips caught at any of these sampling locations and during the Old River Barrier sampling were sacrificed, labeled, and frozen pending CWT processing. An adipose fin clip identifies juvenile Chinook salmon that are CWT. CWT processing and reading was done in the FWS Stockton laboratory for fish recovered at Chipps Island, Antioch, and SWP/CVP salvage facilities. Both the Stockton FWS office and the DFG Region 4 laboratory in Fresno processed marked salmon recovered in the Old River Barrier sampling. CWT salmon released upstream of Mossdale were also recovered in DFG Kodiak trawls at Mossdale. Any CWT's recovered in the Mossdale trawl sampling were processed by DFG Region 4 in Fresno.

CWT processing entails dissecting each tagged fish to obtain the half (0.5 millimeters) and full (1 millimeter) cylindrical tag from its snout. The tags are then "read" under the microscope by determining the code etched on multiple sides of the tag. Tags were read twice, with any discrepancies resolved by a third reader. All tags were archived for future reference.

SWP/CVP Salvage Recapture Sampling

Sampling at the CVP and SWP Fish Salvage Facilities was conducted approximately every two hours. The number of marked salmon collected (raw salvage) were "expanded" based on the number of minutes sampled during each two hour time period. The estimated expanded total number of CWT salmon, from each release group, was obtained by adding together the expanded number of each tag group estimated for each time period. Only the CWT salmon recovered in the raw salvage collections were sacrificed for tag decoding. Expanded salvage does not include losses prior to, and associated with, pre-screen predation, screening, handling and trucking.

Expanded CVP and SWP salvage estimates of marked salmon released as part of the VAMP 2000 studies are shown in Table 5-2. Salvage numbers were low at the CVP and higher at the SWP. The Old River Barrier appears to lessen the number of marked salmon recovered at the CVP as compared to the number recovered at the SWP: in 1999, when the Old River Barrier did not exist, expanded salvage was more similar between the two facilities (Brandes and McLain forthcoming). Results of CWT recaptures for marked salmon released in the San Joaquin River tributary studies are documented in Appendix C.

Antioch Recapture Sampling

Fishery sampling was conducted in the vicinity of Antioch on the lower San Joaquin River (see Figure 1-1) using a Kodiak trawl. The Kodiak trawl has a graded stretch mesh, from 2-inch mesh at the mouth to ¼-inch mesh at the cod-end. Its overall length is 65 feet, and the mouth opening is six feet deep and 25 feet wide. The net was towed between two skiffs, sampling in an upstream direction. Trawls were performed parallel to the left bank, mid-channel, and right bank to sample CWT salmon emigrating from the San Joaquin River. Each sample was approximately 20 minutes in duration.

All fish collected were transferred immediately from the Kodiak trawl to buckets filled with river water, where the fish were held during processing. Data collected during each trawl included identification and measuring the fork length of fish collected, tow start time and duration and location in the channel. Mortality and damage to fish collected was documented to comply with the Endangered Species Act permit compliance.

Juvenile Chinook salmon with an adipose fin clip were retained for later CWT processing while unmarked salmon, steelhead, delta smelt, splittail, and other fish were released at a location downstream of the sampling site immediately after identification, enumeration and measurement.

Sampling at Antioch was initiated April 19 and continued through May 21. Each day between 5:00 a.m. and 9:00 p.m., anywhere from 12 to 29 20-minute tows were conducted. All told, 751 Kodiak trawl samples were collected, representing a total sampling duration of 14,842 minutes. During the sampling, a total of 4,827 unmarked juvenile Chinook salmon and 1,257 salmon with an adipose fin clip (CWT) were collected.

Chipps Island Recapture Sampling

Sampling at Chipps Island (see Figure 1-1) was conducted daily between April 1 and June 19. One shift of trawling (approximately ten, 20-minute tows per day) was conducted between April 1 and April 17 and again between May 21 and June 19. Between April 17 and May 20, two daily shifts (20, 20 minute tows per day) were conducted. The two shifts included dawn and dusk sampling, similar to the sampling regime used in 1998 and 1999.

Prior to 1998, ten 20-minute tows were made per day with sampling beginning at approximately 7:00 a.m. and ending around 12:00 (noon). With the addition of a second shift, the first shift began at daybreak. The second shift began in the late afternoon and concluded just after dark. It was hypothesized, based on an analysis of salmon smolts caught at Jersey Point throughout a 24-hour sampling period in 1997, that the greatest number of salmon would be caught during dawn and dusk. Changing the starting time of the first shift and doubling the effort at Chipps Island was intended to increase the numbers of CWT salmon recaptured and reduce the variability in VAMP survival indices.

The mid-water trawl net, towed at the surface near Chipps Island, had a mouth opening of ten by 30 feet. The net tapered from the mouth to the cod end with its length totaling 82 feet. Net mesh varied from four inches to ¼ inch at the cod end. Lead weights were attached to the bottom rib line of the net and floats attached to the top rib line. A metal depressor door was fastened to each bottom bridle line and an aluminum hydrofoil was fastened to each top bridle line to keep the net orientated and fishing properly.

Sampling at Chipps Island was conducted in three trawl lanes: north, south and middle of the channel. Each lane was generally sampled at least three times per shift, with one lane sampled four times. This was an attempt to sample evenly across the channel to provide the best estimate of the number of marked salmon surviving to Chipps Island.

CWT salmon released as part of the VAMP program were recovered at Chipps Island between April 22 and May 21. During this period, a total of 12,843 unmarked salmon, 1,999 CWT salmon, 97 delta smelt, 1,125 splittail, 11 adipose-clipped steelhead and 20 wild steelhead were recovered. Of the 1,999 CWT salmon recovered, only 211 were from Merced River Hatchery origin released as part of the VAMP study (see Table 5-2). A total of 169 CWT salmon were recovered as part of the Jersey Point release using Mokelumne River fish.

VAMP 2000 CHINOOK SALMON CWT SURVIVAL INDICES

Survival indices were calculated for marked salmon released at Durham Ferry, Mossdale, and Jersey Point and recovered at Chipps Island and Antioch. Survival indices were calculated by dividing the number of CWT salmon recovered by the effective number released and the fraction of time and channel width sampled. The fraction of the channel width sampled at Chipps Island (0.00769) was the net width (30 feet) divided by an estimate of the channel width (3,900 feet). The fraction of the channel width sampled at Antioch (0.01388) was based on the net width (25 feet) used at Antioch divided by an estimate of the channel width (1,800 feet) at Antioch. The fraction of time sampled, at both locations, was calculated based on the number of minutes sampled, between the first and last day of catching each particular tag code or group, divided by the total number of minutes in the time period. The percent of time sampled for the VAMP 2000 release groups at Chipps Island was roughly 26 percent, while at Antioch it ranged between 31 and 41percent.

The survival indices of the separate tag codes are calculated to provide a sense of the variability associated with the index. To generate the survival index for each group, the recovery numbers and release numbers are combined within the group to estimate a composite survival index for the combined tag codes within a release group. This results in a slightly different index than would be generated by taking the mean of the survival indices of the individual tag codes within a group. Although it has not been done, it may now be more appropriate to calculate a mean survival from the two or three independent tag groups released within a group for the 2000 VAMP releases when they were held and released as independent groups.

The survival indices to Antioch and Chipps Island of the CWT salmon released as part of VAMP 2000 are shown in Table 5-2. Survival indices for the composite release groups are summarized in Table 5-3.

Survival indices from the release locations to Antioch were generally lower than those at Chipps Island. This is contrary to what would be expected since Antioch is closer to the release locations than Chipps Island. This may be a result of the marked salmon not being equally distributed or vulnerable to the trawls throughout the 24-hour period and the expansions for effort may be biasing the Chipps Island estimates high. Further evaluation of these differences is warranted.

More important than the raw survival indices between locations are the comparisons of the survival indices within the same recovery location and the trends between the groups using the two recovery locations. The use of absolute survival estimates, where the survival index of the upstream release group is divided by the survival index of the downstream group (recovered at the same location), is most useful for between year comparisons.

The first and second Durham Ferry releases had survival indices at Antioch of 0.08 and 0.10, respectively. Survival indices at Chipps Island were 0.19 and 0.15. The individual tag code survival indices at Antioch and Chipps Island showed overlap within each of the groups and similar values between the two Durham Ferry groups, such that there may be no true difference between the two groups (see Table 5-2). Based on this information, it appears that the two Durham Ferry groups survived at similar rates.

The survival indices of the first and second releases at Jersey Point ranged from 0.42 to 0.69 at Antioch and 0.62 and 0.78 at Chipps Island. The second group released at Jersey Point on May 1 appeared to survive at a higher rate than the first group, based on results from both recovery locations. However, the overlap in individual tag code survival indices at Chipps Island between the two Jersey Point groups suggest that there may not be a true difference between these two releases (see Table 5-2). Recoveries at Antioch suggest that the second Jersey Point release group (May 1) did survive at a higher rate than the first release group (April 18). As part of the VAMP 2000 experimental design, releases were made at both Mossdale and Durham Ferry to determine how survival differed between these two locations. Results of the release at

Table 5.3

SURVIVAL INDICES
CALCULATED FOR VAMP 2000

RELEASE SITE & RELEASE DATE	RECAPTURE SITE	
	Antioch	*Chipps Island*
Durham Ferry: April 17	0.08	0.19
Mossdale: April 18	0.14	0.20
Jersey Point: April 20	0.42	0.62
Durham Ferry: April 28	0.10	0.15
Jersey Point: May 1[1]	0.69	0.78
Jersey Point: May 1[2]	0.43	0.85
Mossdale: April 19–May 3	0.08	0.15

[1] Merced River Hatchery stock [2] Mokelumne River Hatchery stock

Mossdale on April 18 and at Durham Ferry on April 19, using Antioch recoveries, indicated that the survival index was higher from the release at Mossdale (0.14) than for the Durham Ferry release (0.08). This result was expected considering that migration for marked salmon released at Durham Ferry is approximately 11 miles longer than salmon released at Mossdale. In contrast, survival indices calculated based on the recoveries at Chipps Island indicate that there was no substantial or detectable mortality between Durham Ferry (0.19) and Mossdale (0.20). Individual survival indices in the Durham Ferry and Mossdale groups did not overlap between groups using the Antioch recovery indices, but did overlap for Chipps Island recoveries (see Table 5-2). Further exploration to define true differences in survival for Mossdale and Durham Ferry releases would be helpful.

Two sets of releases were made at Mossdale that provide an additional comparison between the two recovery locations. The first group, released on April 18, was released as part of the VAMP 2000 studies. The second group was released between April 19 and May 3 to provide efficiency estimates of the DFG Kodiak trawl used at Mossdale to estimate survival for upstream tributary releases made by the DFG, Region 4. The survival index, for the DFG group released at Mossdale for the trawl effieciency evaluation between April 19 and May 3, would normally be calculated by first subtracting those recovered in the Mossdale trawl. But because so few were actually caught (6), subtracting prior to calculating survival indices was not done. The Antioch survival indices were 0.14 and 0.08, while the survival indices at Chipps Island were 0.20 and 0.15, respectively

for the April 18 and April 19–May 3 Mossdale releases. Both sets of indices support the conclusion that the second release made over the course of 15 days survived at a lower rate than the group released on April 18. No overlap in the individual tag code survival indices between groups for either the Antioch or Chipps Island recoveries existed (see Table 5-2), giving more credence to the conclusion that survival rates were different between the two release groups.

Potential differences between the survival indices for the paired groups of Merced and Mokelumne hatchery salmon released at Jersey Point on May 1 are not as clear. The recoveries at Antioch appeared to show that the Mokelumne River Hatchery stock had a lower survival than the Merced River Hatchery stock. In contrast, recoveries at Chipps Island indicated that survival was higher for the Mokelumne group than for the Merced group. Again, there seemed to be greater overlap within the group survival indices using the Chipps Island recovery information than the Antioch recovery information, giving less confidence in the true differences in the Chipps Island recovery data (see Table 5-2). It is recommended that further investigations and analyses be performed to compare survival for Mokelumne River and Merced River stocks released at Jersey Point, and to further understand why the trends between groups are not consistent between the survival indices generated using Antioch and Chipps Island recoveries.

ABSOLUTE CHINOOK SALMON SURVIVAL ESTIMATES FOR VAMP 2000

Absolute survival rates (or standardized survival) were estimated using the ratio of the survival indices of smolts released at Durham Ferry and Mossdale in relation to those released at Jersey Point. These absolute survival estimates are more powerful for use in comparing survival rates as a function of flow and export rates among years, since the use of ratios between upstream and downstream groups theoretically standardizes for differences in catch efficiency between recovery locations and years. Thus, two independent estimates of absolute survival have been calculated for VAMP 2000 using recoveries at both Chipps Island and Antioch. An additional estimate of absolute survival will be possible from recoveries from the ocean fishery in 2 ½ years following release.

Absolute survival estimates for VAMP 2000 are summarized in Table 5-4, using data from Table 5-2.

These absolute estimates of survival and both sets of recovery information indicate that the April 17 Durham Ferry group survived at a slightly higher rate than the April 28 group. The variability around each estimate is likely such that there is no true difference in survival between the two Durham Ferry releases.

Absolute estimates of survival between Mossdale and Jersey Point were 0.33 based on the Antioch indices versus 0.31 based on the Chipps Island indices indicating a good agreement between survival estimates based on the two separate recovery locations.

Table 5.4

ABSOLUTE CHINOOK SALMON SURVIVAL ESTIMATES FOR VAMP 2000

REACH	RECOVERY SITE	
	Antioch	*Chipps Island*
Durham Ferry to Jersey Point [1]	0.19	0.31
Durham Ferry to Jersey Point [2]	0.14	0.19
Mossdale to Jersey Point [3]	0.33	0.31

[1] April 17 Durham Ferry Release [2] April 28 Durham Ferry Release
[3] April 18 Mossdale Release

Comparison of absolute survival estimates between Mossdale (April 18) and Durham Ferry (April 17) release groups indicated that survival was lower for the Durham Ferry release based on Antioch survival indices, whereas absolute survival indices were similar using the Chipps Island recovery data. This apparent discrepancy in absolute survival between the two recovery locations requires further analysis and investigation. It was hoped that with absolute survival estimates and multiple recovery locations, similar trends in salmon survival would be detected and provide additional support for evaluating the effects of river flow and exports on salmon smolt survival. Inconsistent trends and survival estimates between the two recovery sites may be the result of high variability in one or both sets of recovery data. Further investigation of the variability in survival between the two recovery locations is needed.

TRANSIT TIME

Data on transit times for marked salmon from the release to recapture sites during VAMP 2000 is summarized in tabular and graphic form in Appendix C. CWT salmon released April 17 at Durham Ferry took between five and 18 days to arrive at Antioch and between five and 32 days to arrive at Chipps Island. The April 28 Durham Ferry release arrived at Antioch between six and 21 days and between five and 23 days at Chipps Island. The April 18 Mossdale release took between four and 26 days to arrive at Antioch and between five and 16 days to arrive at Chipps Island. Significant variability was observed between last days of recovery for the April 17 Durham Ferry release group and the Mossdale release group at the Antioch and Chipps Island recovery locations. These differences may reflect variability associated with recovering individual fish when numbers are low toward the end of the group's migration

period. The number of individual recoveries by tag code and the number of minutes towed per day for both Antioch and Chipps Island recoveries are shown in Appendix C.

SURVIVAL ESTIMATES FOR CWT RELEASES MADE IN THE SAN JOAQUIN TRIBUTARIES

CWT salmon releases were made in the San Joaquin River tributaries between April 12 and May 19 as part of the independent fishery investigations. Releases were made in the upper and lower Merced (Hatfield State Park) River, upper Tuolumne River (La Grange) and on the main-stem San Joaquin River just downstream of the confluence with the Tuolumne River (Old Fisherman's Club). Releases were also made on the upper (Knights Ferry) and lower (Two Rivers) Stanislaus River. As mentioned earlier, one additional group was released at Mossdale between April 19 and May 3 to evaluate the efficiency of the DFG trawl at Mossdale used to estimate survival for upstream release groups.

Survival indices for salmon released in the tributaries and recovered at Antioch ranged between 0.02 and 0.12 (Appendix C). No survival indices to Antioch were available for tagged fish released after May 18. Survival indices ranged between 0.02 and 0.13 to Chipps Island and include most of the San Joaquin River tributary releases (Appendix C). Unfortunately, in most cases, the variability in survival indices within a group at each recovery location was large enough that the detection of real differences between upstream and downstream locations may be limited (see Appendix C). The ability to detect differences is a function of the precision and magnitude of the survival measurement. Both factors influence the ability to detect differences between treatment groups.

Inconsistent trends and survival estimates between the two recovery sites may be the result of high variability in one or both sets of recovery data.

Information on the transit time between release and recovery of the CWT groups released in the San Joaquin River mainstem and tributaries at both Antioch and Chipps Island is summarized in Appendix C. As observed for VAMP releases, there was substantial variability in the last days of recovery for the various groups released upstream in the tributaries. Though it was anticipated that it would take longer for the marked salmon to reach Chipps Island because it is further downstream than Antioch, as described throughout this section, based on the last day that salmon were recovered this was not always the case. This may reflect the lower probability of catching the marked salmon at the end of the group's migration period since fewer salmon are available for capture.

DISCUSSION

The data obtained using Chipps Island recovery information gathered in 2000 is shown in relationship to past years data using the same recovery location in Appendix C. The survival ratios obtained in 2000 were relatively high in comparison to other survival ratios measured since survival ratios were compared starting in 1994. Only 1999 and 1995 had higher survival ratio estimates between Mossdale and Jersey Point than that obtained in 2000. Past absolute survival estimates and survival indices between Mossdale and Jersey Point from VAMP 2000 are shown in relationship to Vernalis flow and the presence of an Old River Barrier in Figure 5-1. Simple regression analyses were used to compare absolute survival estimates to river flow at Vernalis. Two regression lines have been developed based on historical survival data with and without the Old River Barrier. Statistically, neither regression is significant.

Evaluating the role of SWP and CVP exports on salmon smolt survival through the South Delta and the affect of the Old River Barrier are key elements of VAMP. Presence of the Old River Barrier affects both the emigration route of salmon smolts and hydraulic conditions in the lower San Joaquin River and Delta that are thought to alter the vulnerability of juvenile salmon to export-related effects.

The role of SWP and CVP exports with the Old River Barrier in place is difficult to determine at this time, in part, because of the few releases made with the Barrier in place and the different permeability of the Barrier when it has been in place. Releases at both Mossdale and Jersey Point have only been made in the three years when the Old River Barrier was in place. In 1994, the Old River Barrier was installed without culverts, while in 1997 the Old River Barrier had two open culverts that passed approximately 300 cfs into Upper Old River. And in 2000, the Old River Barrier had six gated culverts, with two open during the Mossdale and first Durham Ferry release and four open during the second Durham Ferry release. The varying designs and changes to the permeability of the Barrier add noise to the resulting data, making it more difficult to detect the effects of flow and export on salmon survival.

Additional noise is added to the data from changing the upstream release location from Mossdale to Durham Ferry. Future investigations, using releases at both Durham Ferry and Mossdale are needed to assure that releases made at Mossdale and Durham Ferry result in similar survivals so that past data can be used in

evaluating the effects of SWP and CVP exports on salmon survival. If the survivals between the two release locations are not similar, then using only Durham Ferry data will increase the number of years needed to complete the VAMP study. Variation in survival results and trends between the two recovery locations (Antioch and Chipps Island) also adds a level of uncertainty but the benefit of having two rather than only one survival estimate per year is of major value.

However, given this noise, the data to data appears to show that smolt survival between Mossdale/Durham Ferry and Jersey Point increases as exports increase from 1,600 to 2,300 cfs with the Old River Barrier in place (Figure 5-2). This relationship is statistically significant, likely because of small sample size. Figure 5-3 shows salmon survival, river flow (at Stockton) and exports with the Old River Barrier in place. Flow at Stockton was selected for use in these analyses to account for flow diverted from the lower San Joaquin River through the operable culverts at the Old River Barrier. Water diverted through the Old River Barrier directly affects flows downstream within the lower San Joaquin River that need to be taken into account when evaluating the flow—survival relationship for juvenile Chinook salmon emigrating from the San Joaquin River and Delta. Further analysis of San Joaquin River flow measurements and the effects of water diversions through the Old River Barrier need to be taken into account in the analysis and interpretation of VAMP 2000 and subsequent Chinook salmon survival investigations.

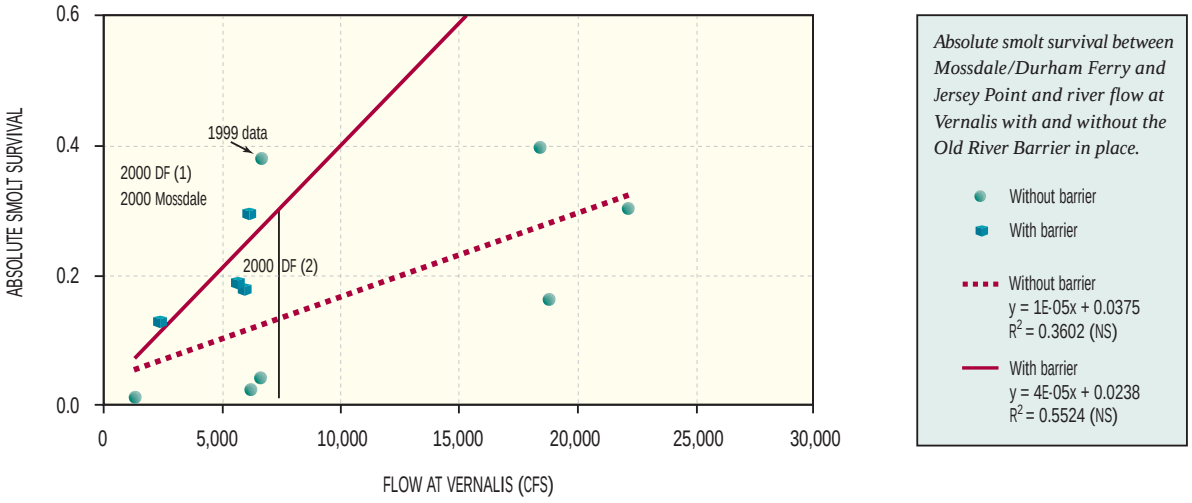
Although the multiple regression is not statistically significant (Figure 5-3), as San Joaquin River flow at Stockton and exports increase, in the narrow range measured, survival between Mossdale and Jersey Point increases. It is difficult to separate the respective roles of the two factors since they are both increasing as survival increases. Typical river flow and exports have a much wider range of variability than those used in the VAMP experiment period.

There have been a number of recent fishery studies conducted to determine the effects of flow, export, and migration route on smolt survival. These studies serve as a foundation for the VAMP studies. The results of these past studies shed some light on the roles of flow, exports, and the barrier in Upper Old River, but are clouded by confounding aspects of the data, which we hope to overcome with more replicates, that should improve our accuracy and precision and allow future conclusions to be better justified. There have been several past studies focused on providing an indirect evaluation of the effect of flows and exports to smolt survival with a barrier for determining absolute survival between Dos Reis and Jersey Point. Paired experiments with salmon from the Merced and Feather River hatcheries have shown that absolute survival is higher for salmon originating from the Merced River Hatchery (Brandes and Pearce, 1998). Studies in 1998, 1999, and 2000 were conducted to determine smolt survival at Chipps Island. Studies of smolt survival through Upper Old River relative to Jersey Point produced low survival indices (Brandes and McLain, 2000). The mixed results of the historical studies support the continuance of additional VAMP studies to support scientific conclusions concerning the role of flow, exports, and the Old River Barrier in smolt survival.

Definitive conclusions about the respective roles of flow and exports on salmon smolt survival are not possible from the VAMP data at this time. It is recommended that further evaluation of VAMP 2000 results occur prior to determining the study plan for VAMP 2001. It is also recommended that VAMP experiments continue. Results of these studies will hopefully provide the information needed to make appropriate management decisions to protect salmon smolts emigrating from the San Joaquin basin.

Figure 5-1

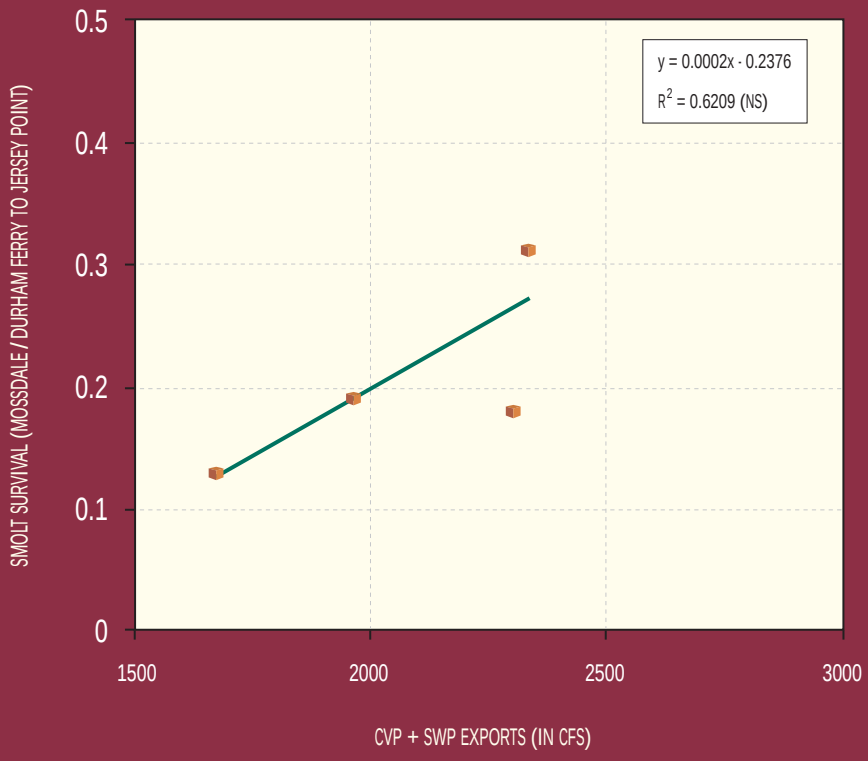
ABSOLUTE SMOLT SURVIVAL



Absolute smolt survival between Mossdale/Durham Ferry and Jersey Point and river flow at Vernalis with and without the Old River Barrier in place.

Figure 5-2

SURVIVAL VS. EXPORTS WITH BARRIER

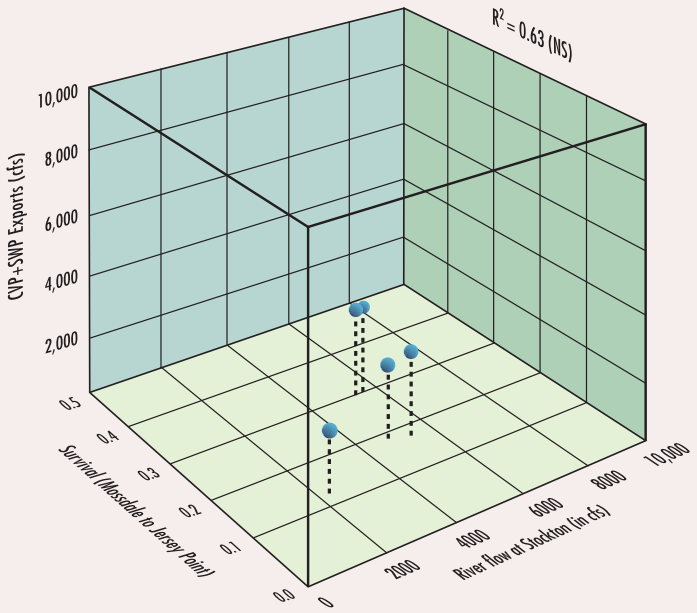


Absolute smolt survival versus CVP+SWP Exports (in cfs) in years with a Barrier in Upper Old River

Figure 5-3

SURVIVAL VS. RIVER FLOW AND EXPORTS

The relationship between the absolute estimate of survival between Mossdale (Durham Ferry) and Jersey Point and San Joaquin River flow at Stockton and CVP+SWP Exports with barrier at Upper Old River.



Conclusions

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS AND RECOMMENDATIONS

The VAMP pulse flow and experimental investigation of juvenile Chinook salmon survival was implemented during spring 2000. The Vernalis target flow was 5,700 cfs, with SWP and CVP export flow of 2,250 cfs. The Old River Barrier was successfully installed and maintained throughout the VAMP test period, but was characterized by variable culvert operations. Estimates of juvenile Chinook salmon smolt survival were calculated based upon releases of CWT juvenile salmon produced in the Merced River Fish Hatchery and released at Durham Ferry, Mossdale, and Jersey Point. Marked salmon were subsequently recaptured in sampling at the Old River Barrier, SWP and CVP export facility salvage, and through intensive fisheries sampling conducted at Antioch and Chipps Island. Based upon the data and experience gained during the VAMP 2000 investigations, conclusions and recommendations have been developed, as summarized in Table 6-1. The conclusions and recommendations include both technical and policy/management issues that will affect the design and implementation of VAMP 2001 operations and investigations.

Table 6.1

SUMMARY OF VAMP 2000 CONCLUSIONS AND RECOMMENDATIONS.

CONCLUSIONS	RECOMMENDATIONS
Technical Elements	
Durham Ferry appears to be an appropriate site for upstream treatment releases.	Use Durham Ferry as the upstream release site in subsequent VAMP studies.
There appeared to be significant mortality between Durham Ferry and Mossdale using Antioch recoveries while survival was similar for the two groups using Chipps Island recoveries.	Do more releases at Mossdale to compare survival differences between Durham Ferry and Mossdale.
Jersey Point appears to be an appropriate downstream release location.	Continue to use Jersey Point as the downstream control group.
Antioch and Chipps Island appear to be suitable as recovery locations. Trends between release groups however, sometimes varied between the two recovery locations.	Use both recapture sites next year. Further evaluations are necessary to determine why trends sometimes differ between locations and to potentially modify methodology/design for 2001 study. Pilot sampling at Benicia may help address these differences between recovery locations.
Releases of 50,000 salmon are adequate at Jersey Point (control release).	Use release groups of 50,000 fish again. Evaluate individual tag codes to determine if smaller releases sizes are appropriate.
Variation was high between the two recapture sites for fish released from Jersey Point.	Paired upstream (treatment) and downstream (control) releases are justified.
Survival indices for Mokelumne and Merced River salmon released at Jersey Point were different, with results differing by recovery locations.	No recommendation is made regarding the use of Mokelumne River fish as a Jersey Point control for VAMP at this time. Redo study and pursue additional analysis.
Further evaluation of the high variance in survival indices and variation of indices between recovery locations may result in changes in techniques and experimental design of the salmon survival investigations to lessen variability.	Solicit peer review from statisticians and CALFED science program. Evaluate bias and ways to lessen variance. Redo power analyses to determine true potential to achieve VAMP goals.
Quantifying salmon movement through the Old River Barrier culverts is difficult and results are unclear.	Refine sampling technique. Explore other study design options. Develop flow measures in Old River. Develop a sound culvert design including effective net attachments to quantify potential impacts.
Policy/Management Elements	
Coordination of project operations was adequate but timing of field measurement at Vernalis needs refinement.	Measure flows at Vernalis site earlier and more frequently. Explore other gaging station sites and flow descriptors.
Design of Old River Barrier in 2000 was inadequate at 7,000 cfs.	High priority for resolution of conflicts between flows and Barrier – develop issue paper.
Old River Barrier seems to have limited impacts on seepage and related issues.	Continue present monitoring.
Budgeting and planning should be expanded beyond one year.	Begin three-year planning. Reevaluate budget to determine if cost savings are possible.
No complementary studies, such as water quality and radio tagging, have been integrated to date into the VAMP framework.	Seek out and support linked studies. Encourage proposal development through CALFED, AFRP, and other funding opportunities. Achieve peer review and set up coordination plan.
Conclusions are not yet possible on the respective roles of San Joaquin River flow and SWP/CVP exports on juvenile Chinook salmon smolt survival.	Continue VAMP test program.

Literature Cited

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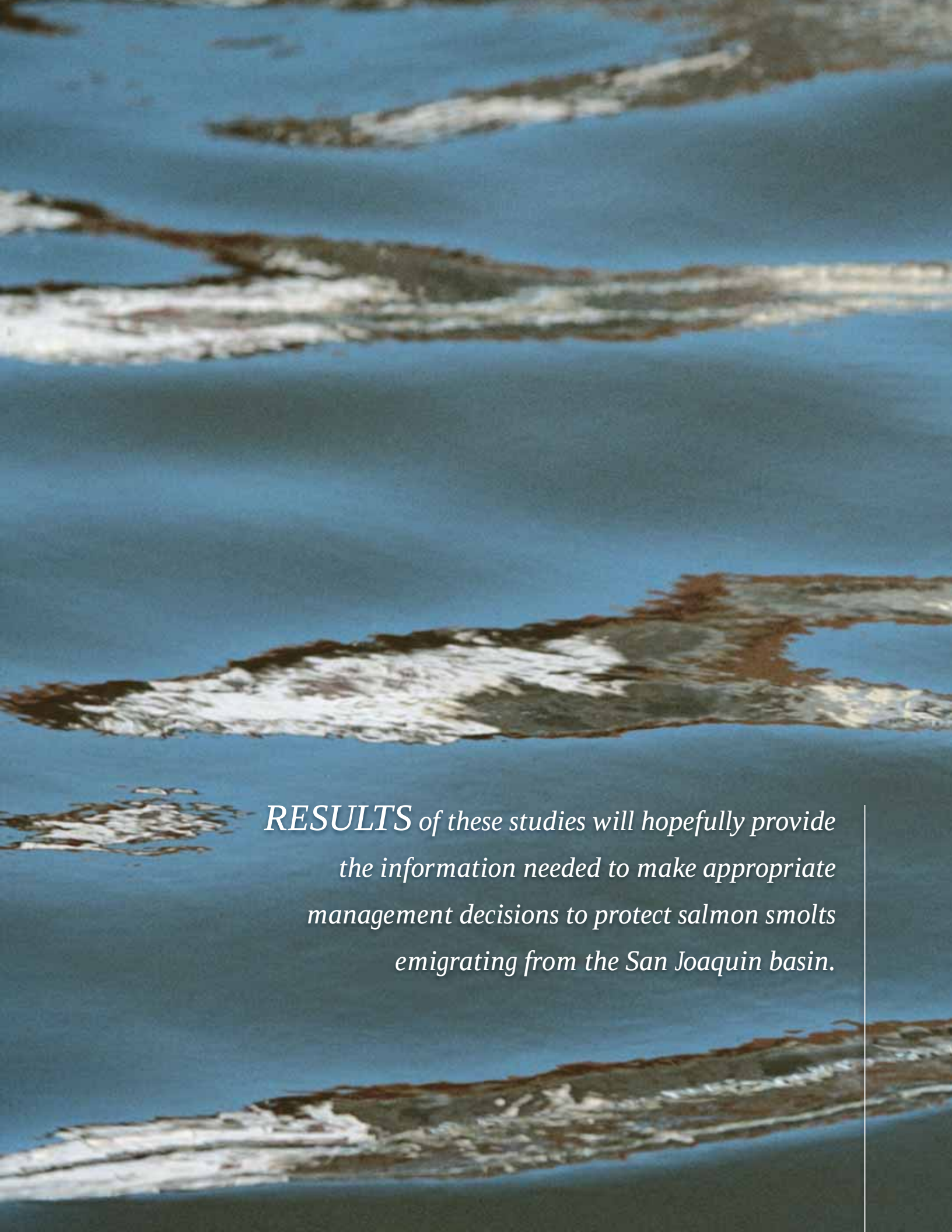


RESULTS of these studies will hopefully provide the information needed to make appropriate management decisions to protect salmon smolts emigrating from the San Joaquin basin.

Signatories

SIGNATORIES TO THE SAN JOAQUIN RIVER AGREEMENT

U.S. BUREAU OF RECLAMATION

U.S. FISH AND WILDLFE SERVICE

CALIFORNIA DEPARTMENT OF WATER RESOURCES

CALIFORNIA DEPARTMENT OF FISH AND GAME

OAKDALE IRRIGATION DISTRICT*

SOUTH SAN JOAQUIN IRRIGATION DISTRICT*

MODESTO IRRIGATION DISTRICT*

TURLOCK IRRIGATION DISTRICT*

MERCED IRRIGATION DISTRICT*

SAN JOAQUIN RIVER EXCHANGE CONTRACTORS WATER AUTHORITY*

- San Luis Canal Company
- Firebaugh Canal Water District
- Central California Irrigation District
- Columbia Canal Company

FRIANT WATER USERS AUTHORITY*

METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

NATURAL HERITAGE INSTITUTE

SAN JOAQUIN RIVER GROUP AUTHORITY

STATE WATER CONTRACTORS

PUBLIC UTILITIES COMMISSION OF THE CITY AND COUNTY OF SAN FRANCISCO*

**San Joaquin River Group Authority Members*

APPENDIX A

VAMP HYDROLOGY & OPERATIONAL INFORMATION

DAILY OPERATION PLAN, MARCH 15

PULSE PERIOD: APRIL 15-MAY 15 · FLOW TARGET: 7,000CFS

	SJR nr Vernalis Existing	VAMP Suppl. flow at Vernalis	SJR nr Vernalis w/VAMP	SJR above Merced R. (2-day lag)	Vernalis Accretion	Merced R . at Cressey Existing	Merced R. at Cressey Suppl.	Merced R. at Cressey w/ VAMP	Exchange Contractors Suppl. (3-day lag)	Tuolumne R. at LaGrange FERC pulse Desired	Tuolumne R. at LaGrange FERC pulse Existing	Tuolumne R. at LaGrange Suppl.	Tuolumne R. at LaGrange w/ VAMP (2-day lag)	Stan. R. blw Goodwin (2-day lag)	Maintain Priority Flow Level M=Merced T=Tuol.
	[calc]	[calc]	[calc]				[calc]	[calc]					[calc]		
	cfs	cfs	cfs	cfs	cfs		cfs	cfs	cfs		cfs	cfs	cfs	cfs	
					250			250		1,500	1,500		1,500	1,500	
			2,400		250			250		1,500	1,500		1,500	1,500	
			2,400		250			250		1,500	1,500		1,500	1,500	
Apr 01	6,650	0	6,650	2,400	1,000	250		250	0	1,500	1,500		1,500	1,500	
Apr 02	6,650	0	6,650	2,383	1,000	250		250	0	1,500	1,500		1,500	1,500	
Apr 03	6,650	0	6,650	2,367	1,000	250		250	0	1,500	1,500		1,500	1,500	
Apr 04	6,633	0	6,633	2,350	1,000	250		250	0	1,500	1,500		1,500	1,500	
Apr 05	6,617	0	6,617	2,333	1,000	250		250	0	1,500	1,500		1,500	1,500	
Apr 06	6,600	0	6,600	2,317	1,000	250		250	0	1,500	1,500		1,500	1,500	
Apr 07	6,583	0	6,583	2,300	1,000	250		250	0	1,500	1,500		1,500	1,500	
Apr 08	6,567	0	6,567	2,283	1,000	250		250	0	1,500	1,500		1,500	1,500	
Apr 09	6,550	0	6,550	2,267	1,000	250		250	0	1,500	1,500		1,500	1,500	
Apr 10	6,533	0	6,533	2,250	1,000	250		250	0	1,500	1,500		1,500	1,500	
Apr 11	6,517	0	6,517	2,233	1,000	250		250	0	1,500	1,500		1,500	1,500	
Apr 12	6,500	0	6,500	2,217	1,000	250	0	250	0	1,500	1,500		1,500	1,500	M
Apr 13	6,483	0	6,483	2,200	1,000	250	0	250	0	1,800	2,050	0	2,050	1,500	M
Apr 14	6,467	0	6,467	2,183	1,000	250	0	250	0	250	2,100	0	2,100	1,500	M
Apr 15	7,000	0	7,000	2,167	1,000	250	0	250	0	3,400	2,200	0	2,200	1,500	M
Apr 16	7,033	0	7,033	2,150	1,000	250	0	250	0	3,400	2,200	0	2,200	1,500	M
Apr 17	7,117	0	7,117	2,133	1,000	250	0	250	0	3,100	2,200	0	2,200	1,500	M
Apr 18	7,100	0	7,100	2,117	1,000	250	0	250	0	3,000	2,200	0	2,200	1,500	M
Apr 19	7,083	0	7,083	2,100	1,000	250	167	417	0	3,000	2,200	0	2,200	1,500	
Apr 20	7,067	0	7,067	2,083	1,000	250	183	433	0	300	2,000	0	2,000	1,500	T
Apr 21	7,050	0	7,050	2,067	1,000	250	200	450	0	300	2,000	0	2,000	1,500	T
Apr 22	6,833	167	7,000	2,050	1,000	250	217	467	0	2,000	2,000	0	2,000	1,500	T
Apr 23	6,817	183	7,000	2,033	1,000	250	233	483	0	1,800	2,000	0	2,000	1,500	T
Apr 24	6,800	200	7,000	2,017	1,000	250	250	500	0	1,000	2,000	0	2,000	1,500	T
Apr 25	6,783	217	7,000	2,000	1,000	250	967	1,217	0	1,000	2,000	0	2,000	1,500	T
Apr 26	6,767	233	7,000	1,983	1,000	250	983	1,233	0	1,000	1,300	0	1,300	1,500	M
Apr 27	6,750	250	7,000	1,967	1,000	250	1,000	1,250	0	1,000	1,300	0	1,300	1,500	M
Apr 28	6,033	967	7,000	1,950	1,000	250	1,017	1,267	0	1,000	1,300	0	1,300	1,500	M
Apr 29	6,017	983	7,000	1,933	1,000	250	1,033	1,283	0	1,000	1,300	0	1,300	1,500	M
Apr 30	6,000	1,000	7,000	1,917	1,000	250	1,050	1,300	0	1,000	1,300	0	1,300	1,500	M
May 01	5,983	1,017	7,000	1,900	1,000	250	1,072	1,322	0	1,000	1,300	0	1,300	1,500	M
May 02	5,967	1,033	7,000	1,878	1,000	250	193	443	0	1,000	1,300	0	1,300	1,500	
May 03	5,950	150	7,000	1,857	1,000	250	215	465	0	1,665	1,800	400	2,200	1,500	T
May 04	5,928	702	7,000	1,835	1,000	250	237	487	0	1,665	1,800	400	2,200	1,500	T
May 05	6,407	593	7,000	1,813	1,000	250	258	508	0	1,665	1,800	400	2,200	1,500	T
May 06	6,385	615	7,000	1,792	1,000	250	280	530	0	1,665	1,800	400	2,200	1,500	T
May 07	6,363	637	7,000	1,770	1,000	250	302	552	0	1,665	1,800	400	2,200	1,500	T
May 08	6,342	658	7,000	1,748	1,000	250	1,023	1,273	0	1,665	1,800	400	2,200	1,500	T
May 09	6,320	680	7,000	1,727	1,000	250	1,045	1,295	0	1,665	1,500	0	1,500	1,500	M
May 10	6,298	702	7,000	1,705	1,000	250	1,067	1,317	0	1,665	1,500	0	1,500	1,500	M
May 11	5,977	1,023	7,000	1,683	1,000	250	108	1,338	0	695	1,500	0	1,500	1,500	M
May 12	5,955	1,045	7,000	1,662	1,000	250	1,110	1,360	0	300	1,500	0	1,500	1,500	T
May 13	5,933	1,067	7,000	1,640	1,000	250		250	0	300	1,500	0	1,500	1,500	T
May 14	5,912	1,088	7,000	1,618	1,000	250		250	0	300	1,500		1,500	1,500	T
May 15	5,890	1,110	7,000	1,597	1,000	250		250	0	300	1,500		1,500	1,500	T
May 16	5,868	0	5,868	1,575	1,000	250		250	0	300	300		300	1,500	
May 17	5,847	0	5,847	1,553	1,000	250		250	0	300	300		300	1,500	
May 18	4,625	0	4,625	1,532	1,000	250		250	0	300	300		300	1,500	
May 19	4,603	0	4,603	1,510	1,000	250		250	0	300	300		300	1,500	
May 20	4,582	0	4,582	1,488	1,000	250		250	0	300	300		300	1,500	
May 21	4,560	0	4,560	1,467	1,000	250		250	0	300	300		300	1,500	
May 22	4,538	0	4,538	1,445	1,000	250		250	0	300	300		300	1,500	
May 23	4,517	0	4,517	1,423	1,000	250		250	0	300	300		300	1,500	
May 24	4,495	0	4,495	1,402	1,000	250		250	0	300	300		300	1,500	
May 25	4,473	0	4,473	1,380	1,000	250		250	0	300	300		300	1,500	
May 26	4,452	0	4,452	1,358	1,000	250		250	0	300	300		300	1,500	
May 27	4,430	0	4,430	1,337	1,000	250		250	0	300	300		300	1,500	
May 28	4,408	0	4,408	1,315	1,000	250		250	0	300	300		300	1,500	
May 29	4,387	0	4,387	1,293	1,000	250		250	0	300	300		300	1,500	
May 30	4,365	0	4,365	1,272	1,000	250		250	0	300	300		300	1,500	
May 31	4,343	0	4,343	1,250	1,000	250		250	0	300	300		300	1,500	
				VAMP 31-day period *											
Mean (cfs)	6,447	567	7,015	1,900			490	740	0		1,760	77	1,837	1,500	
total (KAF)		34.9					30.1		0.0			4.8			

Tuolumne FERC volume (TAF) = 89.9 94.5

* April 15—May 15 Adjusted for lag time

DAILY OPERATION PLAN, MARCH 15

PULSE PERIOD: MAY 1-MAY 31 · FLOW TARGET: 7,000CFS

SJR nr Vernalis Existing	VAMP Suppl. flow at Vernalis	SJR nr Vernalis w/ VAMP	SJR above Merced R. (2-day lag)	Vernalis Accretion	Merced R. at Cressey Existing	Merced R. at Cressey Suppl.	Merced R. at Cressey w/ VAMP	Exchange Contractors Suppl. (3-day lag)	Tuolumne R. at LaGrange FERC pulse Desired	Tuolumne R. at LaGrange FERC pulse Existing	Tuolumne R. at LaGrange Suppl.	Tuolumne R. at LaGrange w/ VAMP (2-day lag)	Stan. R. blw Goodwin (2-day lag)	Maintain Priority Flow Level M=Merced T=Tuol.	
[calc]	[calc]	[calc]				[calc]	[calc]					[calc]			
cfs	cfs	cfs	cfs	cfs		cfs	cfs	cfs		cfs	cfs	cfs	cfs		
			250		250		1,500		1,500			1,500	1,500		
			2,400		250		250		1,500	1,500		1,500	1,500		
			2,400		250		250		1,500	1,500		1,500	1,500		
6,650	0	6,650	2,400	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 01
6,650	0	6,650	2,383	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 02
6,650	0	6,650	2,367	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 03
6,633	0	6,633	2,350	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 04
6,617	0	6,617	2,333	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 05
6,600	0	6,600	2,317	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 06
6,583	0	6,583	2,300	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 07
6,567	0	6,567	2,283	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 08
6,550	0	6,550	2,267	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 09
6,533	0	6,533	2,250	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 10
6,517	0	6,517	2,233	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 11
6,500	0	6,500	2,217	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 12
6,483	0	6,483	2,200	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 13
6,467	0	6,467	2,183	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 14
6,450	0	6,450	2,167	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 15
6,433	0	6,433	2,150	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 16
6,417	0	6,417	2,133	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 17
6,400	0	6,400	2,117	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 18
6,383	0	6,383	2,100	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 19
6,367	0	6,367	2,083	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 20
6,350	0	6,350	2,067	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 21
6,333	0	6,333	2,050	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 22
6,317	0	6,317	2,033	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 23
6,300	0	6,300	2,017	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 24
6,283	0	6,283	2,000	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 25
6,267	0	6,267	1,983	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 26
6,250	0	6,250	1,967	1,000	250	0	250	0	1,500	1,500		1,500	1,500		Apr 27
6,233	0	6,233	1,950	1,000	250	0	250	0	1,500	1,500		1,500	1,500	M	Apr 28
6,217	0	6,217	1,933	1,000	250	0	250	0	1,500	2,350	0	2,350	1,500	M	Apr 29
6,200	0	6,200	1,917	1,000	250	0	250	0	1,500	2,350	0	2,350	1,500	M	Apr 30
7,033	0	7,033	1,900	1,000	250	0	250	0	1,800	2,350	0	2,350	1,500	M	May 01
7,017	0	7,017	1,878	1,000	250	0	250	0	2,500	2,400	0	2,400	1,500	M	May 02
7,000	0	7,000	1,857	1,000	250	15	265	0	3,400	2,400	0	2,400	1,500	M	May 03
7,028	0	7,028	1,835	1,000	250	0	250	0	3,400	2,400	0	2,400	1,500	M	May 04
7,007	0	7,007	1,813	1,000	250	0	250	0	3,100	2,500	0	2,500	1,500		May 05
6,985	15	7,000	1,792	1,000	250	0	250	0	3,000	2,500	0	2,500	1,500	T	May 06
7,063	0	7,063	1,770	1,000	250	2	252	0	3,000	2,500	0	2,500	1,500	T	May 07
7,042	0	7,042	1,748	1,000	250	23	273	0	3,000	2,500	0	2,500	1,500	T	May 08
7,020	0	7,020	1,727	1,000	250	45	295	0	3,000	2,500	0	2,500	1,500	T	May 09
6,998	2	7,000	1,705	1,000	250	67	317	0	2,000	2,500	0	2,500	1,500	T	May 10
6,977	23	7,000	1,683	1,000	250	1,638	1,888	0	1,800	2,500	0	2,500	1,500	T	May 11
6,955	45	7,000	1,662	1,000	250	1,410	1,660	250	1,000	950	0	950	1,500	M	May 12
6,933	67	7,000	1,640	1,000	250	1,432	1,682	250	1,000	950	0	950	1,500	M	May 13
5,362	1,638	7,000	1,618	1,000	250	1,403	1,653	250	1,000	950	0	950	1,500	M	May 14
5,340	1,660	7,000	1,597	1,000	250	1,425	1,675	250	1,000	1,000	0	1,000	1,500	M	May 15
5,318	1,682	7,000	1,575	1,000	250	1,447	1,697	250	1,000	1,000	0	1,000	1,500	M	May 16
5,347	1,653	7,000	1,553	1,000	250	1,468	1,718	250	1,000	1,000	0	1,000	1,500	M	May 17
5,325	1,675	7,000	1,532	1,000	250	0	250	250	1,000	1,000	0	1,000	1,500		May 18
5,303	1,697	7,000	1,510	1,000	250	0	250	250	1,000	1,700	1,300	3,000	1,500	T	May 19
5,282	1,718	7,000	1,488	1,000	250	0	250	250	1,000	1,700	1,300	3,000	1,500	T	May 20
5,960	1,550	7,510	1,467	1,000	250	0	250	250	1,665	1,700	1,300	3,000	1,500	T	May 21
5,938	1,550	7,488	1,445	1,000	250	0	250	0	1,665	1,700	1,300	3,000	1,500	T	May 22
5,917	1,550	7,467	1,423	1,000	250	0	250	0	1,665	1,700	1,300	3,000	1,500	T	May 23
5,895	1,550	7,445	1,402	1,000	250	1,370	1,620	0	1,665	1,700	1,300	3,000	1,500	T	May 24
5,873	1,300	7,173	1,380	1,000	250	1,392	1,642	0	1,665	1,500	0	1,500	1,500	M	May 25
5,852	1,300	7,152	1,358	1,000	250	1,413	1,663	0	1,665	1,500	0	1,500	1,500	M	May 26
5,630	1,370	7,000	1,337	1,000	250	1,435	1,685	0	1,665	1,500	0	1,500	1,500	M	May 27
5,608	1,392	7,000	1,315	1,000	250	1,457	1,707	0	1,665	1,500	0	1,500	1,500	T	May 28
5,587	1,413	7,000	1,293	1,000	250		250	0	1,695	1,500	0	1,500	1,500	T	May 29
5,565	1,435	7,000	1,272	1,000	250		250	0	300	1,500	0	1,500	1,500	T	May 30
5,543	1,457	7,000	1,250	1,000	250		250	0	300	1,500		1,500	1,500	T	May 31
VAMP 31-day period *															
6,184	895	7,079				563	813	81		1,816	252	2,068	1,500		Mean (cfs)
	55.0					34.6		5.0			15.5				total (KAF)

Tuolumne FERC volume (TAF) = 89.9 89.9

* April 15– May 15 Adjusted for lag time

DAILY OPERATION PLAN, MARCH 23

PULSE PERIOD: APRIL 20-MAY 20 · FLOW TARGET: 7,000CFS

	SJR nr Vernalis Existing	VAMP Suppl. flow at Vernalis	SJR nr Vernalis w/ VAMP	SJR above Merced R. (2-day lag)	Vernalis Accretion	Merced R. at Cressey Existing	Merced R. at Cressey Suppl.	Merced R. at Cressey w/ VAMP	Exchange Contractors Suppl. (3-day lag)	Tuolumne R. at LaGrange FERC pulse Desired	Tuolumne R. at LaGrange FERC pulse Existing	Tuolumne R. at LaGrange Suppl.	Tuolumne R. at LaGrange w/ VAMP (2-day lag)	Stan. R. blw Goodwin (2-day lag)	Maintain Priority Flow Level M=Merced T=Tuol.
	[calc]	[calc]	[calc]				[calc]	[calc]					[calc]		
	cfs	cfs	cfs	cfs	cfs		cfs	cfs	cfs		cfs	cfs	cfs	cfs	
Apr 01				1,477	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 02				1,432	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 03				1,359	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 04	5,382	0	5,382	1,292	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 05	5,309	0	5,309	1,158	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 06	5,242	0	5,242	1,042	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 07	5,108	0	5,108	997	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 08	4,992	0	4,992	952	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 09	4,947	0	4,947	900	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 10	4,902	0	4,902	940	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 11	4,850	0	4,850	938	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 12	4,890	0	4,890	861	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 13	4,888	0	4,888	779	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 14	4,811	0	4,811	724	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 15	4,729	0	4,729	669	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 16	4,674	0	4,674	659	1,000	250		250		1,500	1,500		1,500	1,200	
Apr 17	4,619	0	4,619	620	1,000	250	2,355	2,605	300	1,500	1,500		1,500	1,200	M
Apr 18	4,609	0	4,609	595	1,000	250	2,369	2,619	300	600	600	400	1,000	1,500	M
Apr 19	4,570	0	4,570	581	1,000	250	2,359	2,609	320	600	600	400	1,000	1,500	M
Apr 20	3,945	3,055	7,000	571	1,000	250	2,351	2,601	340	600	600	400	1,000	1,500	M
Apr 21	3,931	3,069	7,000	559	1,000	250	2,362	2,612	400	600	600	400	1,000	1,500	M
Apr 22	3,921	3,079	7,000	488	1,000	250	2,364	2,614	420	600	600	400	1,000	1,500	M
Apr 23	3,909	3,091	7,000	466	1,000	250	2,372	2,622	0	600	600	400	1,000	1,500	M
Apr 24	3,838	3,162	7,000	478	1,000	250	67	317	0	1,400	1,400	0	1,400	1,500	
Apr 25	3,816	3,184	7,000	483	1,000	250	79	329	0	2,300	2,300	1,400	3,700	1,500	T
Apr 26	4,628	2,372	7,000	471	1,000	250	106	356	0	2,300	2,300	1,400	3,700	1,500	T
Apr 27	5,533	1,467	7,000	444	1,000	250	107	357	0	2,300	2,300	1,400	3,700	1,500	T
Apr 28	5,521	1,479	7,000	443	1,000	250	105	355	0	2,300	2,300	1,400	3,700	1,500	T
Apr 29	5,494	1,506	7,000	445	1,000	250	93	343	0	2,300	2,300	1,400	3,700	1,500	T
Apr 30	5,493	1,507	7,000	457	1,000	250	84	334	200	2,300	2,300	1,400	3,700	1,500	T
May 01	5,495	1,505	7,000	466	1,000	250	1,768	2,018	300	2,200	2,200	1,300	3,500	1,500	M
May 02	5,507	1,493	7,000	482	1,000	250	1,778	2,028	300	1,500	1,500	200	1,700	1,500	M
May 03	5,416	1,584	7,000	472	1,000	250	1,776	2,026	300	1,500	1,500	200	1,700	1,500	M
May 04	4,732	2,268	7,000	474	1,000	250	1,796	2,046	300	1,500	1,500	200	1,700	1,500	M
May 05	4,722	2,278	7,000	454	1,000	250	1,813	2,063	300	1,500	1,500	200	1,700	1,500	M
May 06	4,724	2,276	7,000	437	1,000	250	1,847	2,097	300	1,500	1,500	200	1,700	1,500	M
May 07	4,704	2,296	7,000	403	1,000	250	324	574	300	1,500	1,500	200	1,700	1,500	
May 08	4,687	2,313	7,000	426	1,000	250	230	480	400	2,200	2,200	1,000	3,200	1,500	T
May 09	4,653	2,347	7,000	420	1,000	250	239	489	400	2,200	2,200	1,000	3,200	1,500	T
May 10	5,376	1,624	7,000	411	1,000	250	224	474	400	2,200	2,200	1,000	3,200	1,500	T
May 11	5,370	1,630	7,000	426	1,000	250	309	559	300	2,200	2,200	1,000	3,200	1,500	T
May 12	5,361	1,639	7,000	441	1,000	250	321	571	300	2,200	2,200	1,000	3,200	1,500	T
May 13	5,376	1,624	7,000	429	1,000	250	328	578	300	2,200	2,200	1,000	3,200	1,500	T
May 14	5,391	1,609	7,000	422	1,000	250	1,303	1,553	100	2,200	2,200	1,000	3,200	1,500	M
May 15	5,379	1,621	7,000	447	1,000	250	1,307	1,557	100	2,000	2,000	400	2,400	1,500	M
May 16	5,372	1,628	7,000	443	1,000	250	1,308	1,558	400	2,000	2,000	400	2,400	1,500	M
May 17	5,197	1,803	7,000	442	1,000	250	1,419	1,669	500	2,000	2,000	100	2,100	1,500	T
May 18	5,193	1,807	7,000	431	1,000	250		250		1,900	1,900	0	1,900	1,500	T
May 19	5,192	1,808	7,000	431	1,000	250		250		1,200	1,200		1,200	1,500	T
May 20	5,081	1,919	7,000	414	1,000	250		250		720	720		720	1,500	T
May 21	4,381	0	4,381	395	1,000	250		250		300	300		300	1,500	
May 22	3,884	0	3,884	393	1,000	250		250		300	300		300	1,500	
May 23	3,445	0	3,445	372	1,000	250		250		300	300		300	1,500	
May 24	3,443	0	3,443	389	1,000	250		250		300	300		300	1,500	
May 25	3,422	0	3,422	397	1,000	250		250		300	300		300	1,500	
May 26	3,439	0	3,439	398	1,000	250		250		300	300		300	1,500	
May 27	3,447	0	3,447	365	1,000	250		250		300	300		300	1,500	
May 28	3,448	0	3,448	326	1,000	250		250		300	300		300	1,500	
May 29	3,415	0	3,415	337	1,000	250		250		300	300		300	1,500	
May 30	3,376	0	3,376	343	1,000	250		250		300	300		300	1,500	
May 31	3,387	0	3,387	332	1,000	250		250		300	300		300	1,500	
	VAMP 31-day period *														
Mean (cfs)	4,934	2,066	7,000				1,138	1,388	245		1,719	684	2,403	1,500	
total (KAF)		127.0					69.9		15.0			42.0			

Construction period for the Old River Barrier.

Pulse flow period and tributary flow to meet the pulse flow.

Tuolumne FERC volume (TAF) = 89.9 89.9

* April 15 – May 15 Adjusted for lag time

DAILY OPERATION PLAN, MARCH 29

PULSE PERIOD: APRIL 20-MAY 20 · FLOW TARGET: 7,000CFS

SJR nr Vernalis Existing	VAMP Suppl. flow at Vernalis	VAMP Cum. Suppl. Flow	SJR nr Vernalis w/ VAMP	SJR above Merced R. (2-day lag)	Vernalis Accretion	Merced R. at Cressey Existing	Merced R. at Cressey Suppl.	Merced R. at Cressey w/ VAMP (3-day lag)	Exchange Contractors Suppl. (3-day lag)	Tuolumne R. at LaGrange FERC pulse Desired	Tuolumne R. at LaGrange FERC pulse Existing	Tuolumne R. at LaGrange Suppl.	Tuolumne R. at LaGrange w/VAMP (2-day lag)	Stan. R. blw Goodwin (2-day lag)	Maintain Priority Flow Level M=Mercede T=Tuol.	
[calc]	[calc]	[calc]	[calc]				[calc]	[calc]					[calc]			
cfs	cfs	TAF	cfs	cfs	cfs		cfs	cfs	cfs		cfs	cfs	cfs	cfs		
				1,480	1,000	250		250		1,500	1,500		1,500	1,200		Apr 01
				1,430	1,000	250		250		1,500	1,500		1,500	1,200		Apr 02
				1,360	1,000	250		250		1,500	1,500		1,500	1,200		Apr 03
5,380	0		5,380	1,290	1,000	250		250		1,500	1,500		1,500	1,200		Apr 04
5,310	0		5,310	1,160	1,000	250		250		1,500	1,500		1,500	1,200		Apr 05
5,240	0		5,240	1,040	1,000	250		250		1,500	1,500		1,500	1,200		Apr 06
5,110	0		5,110	1,000	1,000	250		250		1,500	1,500		1,500	1,200		Apr 07
4,990	0		4,990	950	1,000	250		250		1,500	1,500		1,500	1,200		Apr 08
4,950	0		4,950	900	1,000	250		250		1,500	1,500		1,500	1,200		Apr 09
4,900	0		4,900	940	1,000	250		250		1,500	1,500		1,500	1,200		Apr 10
4,850	0		4,850	940	1,000	250		250		1,500	1,500		1,500	1,200		Apr 11
4,890	0		4,890	860	1,000	250		250		1,500	1,500		1,500	1,200		Apr 12
4,890	0		4,890	780	1,000	250		250		1,500	1,500		1,500	1,200		Apr 13
4,810	0		4,810	720	1,000	250		250		1,500	1,500		1,500	1,200		Apr 14
4,730	0		4,730	670	1,000	250		250		1,500	1,500		1,500	1,200		Apr 15
4,670	0		4,670	660	1,000	250	1,100	1,350		1,500	1,500		1,500	1,200		Apr 16
4,620	0		4,620	620	1,000	250	2,350	2,600	300	1,500	1,500		1,500	1,200	M	Apr 17
4,610	0		4,610	600	1,000	250	2,370	2,620	300	600	600	400	1,000	1,500	M	Apr 18
4,570	1,100	0	5,670	580	1,000	250	2,360	2,610	320	600	600	400	1,000	1,500	M	Apr 19
3,950	3,050	6	7,000	570	1,000	250	2,350	2,600	340	600	600	400	1,000	1,500	M	Apr 20
3,930	3,070	12.1	7,000	560	1,000	250	2,360	2,610	400	600	600	400	1,000	1,500	M	Apr 21
3,920	3,080	18.2	7,000	490	1,000	250	2,160	2,410	420	600	600	400	1,000	1,500	M	Apr 22
3,910	3,090	24.4	7,000	470	1,000	250	1,370	1,620	0	600	600	600	1,200	1,500	M	Apr 23
3,840	3,160	30.6	7,000	480	1,000	250	0	250	0	1,400	1,400	1,000	2,400	1,500		Apr 24
3,820	3,180	37.0	7,000	480	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T	Apr 25
4,630	2,370	41.7	7,000	470	1,000	250	10	260	0	2,300	2,300	1,500	3,800	1,500	T	Apr 26
5,530	1,500	44.6	7,030	440	1,000	250	10	260	0	2,300	2,300	1,500	3,800	1,500	T	Apr 27
5,520	1,500	47.6	7,020	440	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T	Apr 28
5,490	1,510	50.6	7,000	450	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T	Apr 29
5,490	1,510	53.6	7,000	460	1,000	250	880	1,130	200	2,300	2,300	1,500	3,800	1,500	T	Apr 30
5,500	1,500	56.6	7,000	470	1,000	250	1,870	2,120	300	2,200	2,200	500	2,700	1,500	M	May 01
5,510	1,500	59.5	7,010	480	1,000	250	1,880	2,130	300	1,500	1,500	100	1,600	1,500	M	May 02
5,420	1,580	62.7	7,000	470	1,000	250	1,880	2,130	300	1,500	1,500	100	1,600	1,500	M	May 03
4,730	2,270	67.2	7,000	470	1,000	250	1,900	2,150	300	1,500	1,500	100	1,600	1,500	M	May 04
4,720	2,280	71.7	7,000	450	1,000	250	1,910	2,160	300	1,500	1,500	100	1,600	1,500	M	May 05
4,720	2,280	76.2	7,000	440	1,000	250	1,900	2,150	300	1,500	1,500	100	1,600	1,500	M	May 06
4,700	2,300	80.8	7,000	400	1,000	250	720	970	300	1,500	1,500	150	1,650	1,500		May 07
4,690	2,310	85.4	7,000	430	1,000	250	230	480	400	2,200	2,200	600	2,800	1,500	T	May 08
4,650	2,350	90.0	7,000	420	1,000	250	240	490	400	2,200	2,200	1,000	3,200	1,500	T	May 09
5,380	1,620	93.2	7,000	410	1,000	250	220	470	400	2,200	2,200	1,000	3,200	1,500	T	May 10
5,370	1,630	96.5	7,000	430	1,000	250	310	560	300	2,200	2,200	1,000	3,200	1,500	T	May 11
5,360	1,640	99.7	7,000	440	1,000	250	320	570	300	2,200	2,200	1,000	3,200	1,500	T	May 12
5,380	1,620	102.9	7,000	430	1,000	250	330	580	300	2,200	2,200	1,000	3,200	1,500	T	May 13
5,390	1,610	106.1	7,000	420	1,000	250	1,300	1,550	100	2,200	2,200	1,000	3,200	1,500	M	May 14
5,380	1,620	109.3	7,000	450	1,000	250	1,310	1,560	100	2,000	2,000	400	2,400	1,500	M	May 15
5,370	1,630	112.6	7,000	440	1,000	250	1,310	1,560	400	2,000	2,000	400	2,400	1,500	M	May 16
5,200	1,800	116.2	7,000	440	1,000	250	1,420	1,670	500	2,000	2,000	100	2,100	1,500	T	May 17
5,190	1,810	119.7	7,000	430	1,000	250	700	950		1,900	1,900	0	1,900	1,500	T	May 18
5,190	1,810	123.3	7,000	430	1,000	250		250		1,200	1,200		1,200	1,500	T	May 19
5,080	1,920	127.1	7,000	410	1,000	250		250		720	720		720	1,500	T	May 20
4,380	700		5,080	400	1,000	250		250		300	300		300	1,500		May 21
3,880	0		3,880	390	1,000	250		250		300	300		300	1,500		May 22
3,450	0		3,450	370	1,000	250		250		300	300		300	1,500		May 23
3,440	0		3,440	390	1,000	250		250		300	300		300	1,500		May 24
3,420	0		3,420	400	1,000	250		250		300	300		300	1,500		May 25
3,440	0		3,440	400	1,000	250		250		300	300		300	1,500		May 26
3,450	0		3,450	370	1,000	250		250		300	300		300	1,500		May 27
3,450	0		3,450	330	1,000	250		250		300	300		300	1,500		May 28
3,420	0		3,420	340	1,000	250		250		300	300		300	1,500		May 29
3,380	0		3,380	340	1,000	250		250		300	300		300	1,500		May 30
3,390	0		3,390	330	1,000	250		250		300	300		300	1,500		May 31
VAMP 31-day period *																
4,934	2,068		7,002				1,138	1,388	245		1,719	685	2,405	1,500		Mean (cfs)
	127.1						70.0		15.0			42.1				total (KAF)

Tuolumne FERC volume (TAF) = 91.2 91.2

* April 15 – May 15 Adjusted for lag time

Construction period for the Old River Barrier.

Pulse flow period and tributary flow to meet the pulse flow.

DAILY OPERATION PLAN, APRIL 4

PULSE PERIOD: APRIL 15-MAY 15 · FLOW TARGET: 7,000CFS

	SJR nr Vernalis Existing	VAMP Suppl. flow at Vernalis	VAMP Cum. Suppl. Flow	SJR nr Vernalis w/ VAMP	SJR above Merced R. (2-day lag)	Vernalis Accretion	Merced R. at Cressey Existing	Merced R. at Cressey Suppl.	Merced R. at Cressey w/ VAMP (3-day lag)	Exchange Contractors Suppl. (3-day lag)	Tuolumne R . at LaGrange FERC pulse Desired	Tuolumne R. at LaGrange FERC pulse Existing	Tuolumne R. at LaGrange Suppl.	Tuolumne R. at LaGrange w/ VAMP (2-day lag)	Stan. R. blw Goodwin (2-day lag)	Maintain Priority Flow Level M=Merced T=Tuol.
	[calc]	[calc]	[calc]	[calc]				[calc]	[calc]					[calc]		
	cfs	cfs		cfs	cfs	cfs		cfs	cfs	cfs		cfs	cfs	cfs	cfs	
Mar 29							250		250		2,519	2,519		2,519	800	
Mar 30							250		250		2,628	2,628		2,628	800	
Mar 31							250		250		2,039	2,039		2,039	800	
Apr 01	4,678			4,678	1,480	1,000	250		250		1,567	1,567		1,567	800	
Apr 02	4,089			4,089	1,430	1,000	250		250		1,126	1,126		1,126	800	
Apr 03	5,097			5,097	1,360	1,000	250		250		1,000	1,000		1,000	800	
Apr 04	4,606			4,606	1,290	1,000	250		250		1,000	1,000		1,000	800	
Apr 05	4,410			4,410	1,160	1,000	250		250		1,000	1,000		1,000	800	
Apr 06	4,340			4,340	1,040	1,000	250		250		1,000	1,000		1,000	800	
Apr 07	4,210			4,210	1,000	1,000	250		250		1,000	1,000		1,000	800	
Apr 08	4,090			4,090	950	1,000	250		250		1,000	1,000		1,000	800	
Apr 09	4,050			4,050	900	1,000	250		250		1,000	1,000		1,000	800	
Apr 10	4,000			4,000	940	1,000	250		250		1,000	1,000		1,000	800	
Apr 11	3,950			3,950	938	1,000	250		250		1,000	1,000		1,000	800	
Apr 12	3,990			3,990	861	1,000	250	0	250	0	1,400	1,400		1,400	800	M
Apr 13	3,988			3,988	779	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T
Apr 14	4,311			4,311	724	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T
Apr 15	5,829	1,500	3	7,329	669	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T
Apr 16	5,774	1,500	6	7,274	659	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T
Apr 17	5,719	1,500	9	7,219	620	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T
Apr 18	5,709	1,500	12	7,209	595	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T
Apr 19	5,670	1,500	15	7,170	581	1,000	250	1,279	1,529	300	2,200	2,200	1,500	3,700	1,500	T
Apr 20	5,645	1,500	18	7,145	571	1,000	250	2,691	2,941	300	600	600	1,500	2,100	1,500	T
Apr 21	5,531	1,500	21	7,031	559	1,000	250	2,762	3,012	300	600	600	100	700	1,500	
Apr 22	3,921	3,079	27	7,000	488	1,000	250	2,784	3,034	300	600	600	100	700	1,500	
Apr 23	3,909	3,091	33	7,000	466	1,000	250	2,872	3,122	300	600	600	100	700	1,500	
Apr 24	3,838	3,162	39	7,000	478	1,000	250	2,067	2,317	300	600	600	0	600	1,500	M
Apr 25	3,816	3,184	46	7,000	483	1,000	250	2,079	2,329	300	600	600	800	1,400	1,500	M
Apr 26	3,828	3,172	52	7,000	471	1,000	250	2,056	2,306	250	600	600	800	1,400	1,500	M
Apr 27	3,833	3,167	58	7,000	444	1,000	250	2,057	2,307	250	1,500	1,500	0	1,500	1,500	M
Apr 28	3,821	3,179	65	7,000	443	1,000	250	2,055	2,305	250	1,500	1,500	0	1,500	1,500	M
Apr 29	4,694	2,306	69	7,000	445	1,000	250	2,043	2,293	250	1,500	1,500	0	1,500	1,500	M
Apr 30	4,693	2,307	74	7,000	457	1,000	250	2,034	2,284	250	1,500	1,500	0	1,500	1,500	M
May 01	4,695	2,305	78	7,000	466	1,000	250	2,018	2,268	250	1,500	1,500	0	1,500	1,500	M
May 02	4,707	2,293	83	7,000	482	1,000	250	1,378	1,628	200	1,500	1,500	0	1,500	1,500	M
May 03	4,716	2,284	87	7,000	472	1,000	250	376	626	200	2,200	2,200	0	2,200	1,500	T
May 04	4,732	2,268	92	7,000	474	1,000	250	396	646	200	2,200	2,200	1,000	3,200	1,500	T
May 05	5,422	1,578	95	7,000	454	1,000	250	463	713	150	2,200	2,200	1,000	3,200	1,500	T
May 06	5,424	1,576	98	7,000	437	1,000	250	547	797	100	2,200	2,200	1,000	3,200	1,500	T
May 07	5,404	1,596	101	7,000	403	1,000	250	624	874	0	2,200	2,200	1,000	3,200	1,500	T
May 08	5,387	1,613	104	7,000	426	1,000	250	630	880	0	2,200	2,200	1,000	3,200	1,500	T
May 09	5,353	1,647	108	7,000	420	1,000	250	839	1,089	0	2,200	2,200	1,000	3,200	1,500	T
May 10	5,376	1,624	111	7,000	411	1,000	250	924	1,174	300	2,000	2,000	1,000	3,000	1,500	T
May 11	5,370	1,630	114	7,000	426	1,000	250	1,309	1,559	300	2,000	2,000	600	2,600	1,500	
May 12	5,161	1,839	118	7,000	441	1,000	250	1,621	1,871	300	2,000	2,000	200	2,200	1,500	
May 13	5,176	1,824	121	7,000	429	1,000	250		250		1,900	1,900	0	1,900	1,500	
May 14	5,191	1,809	125	7,000	422	1,000	250		250		500	500		500	1,500	
May 15	5,079	1,921	129	7,000	447	1,000	250		250		500	500		500	1,500	
May 16	3,672	0		3,672	443	1,000	250		250		300	300		300	1,500	
May 17	3,697	0		3,697	442	1,000	250		250		300	300		300	1,500	
May 18	3,493	0		3,493	431	1,000	250		250		300	300		300	1,500	
May 19	3,492	0		3,492	431	1,000	250		250		300	300		300	1,500	
May 20	3,481	0		3,481	414	1,000	250		250		300	300		300	1,500	
May 21	3,481	0		3,481	395	1,000	250		250		300	300		300	1,500	
May 22	3,464	0		3,464	393	1,000	250		250		300	300		300	1,500	
May 23	3,445	0		3,445	372	1,000	250		250		300	300		300	1,500	
May 24	3,443	0		3,443	389	1,000	250		250		300	300		300	1,500	
May 25	3,422	0		3,422	397	1,000	250		250		300	300		300	1,500	
May 26	3,439	0		3,439	398	1,000	250		250		300	300		300	1,500	
May 27	3,447	0		3,447	365	1,000	250		250		300	300		300	1,500	
May 28	3,448	0		3,448	326	1,000	250		250		300	300		300	1,500	
May 29	3,415	0		3,415	337	1,000	250		250		300	300		300	1,500	
May 30	3,376	0		3,376	343	1,000	250		250		300	300		300	1,500	
May 31	3,387	0		3,387	332	1,000	250		250		300	300		300	1,500	
	VAMP 31-day period *															
Mean (cfs)	4,949	2,095		7,044				1,223	1,473	173		1,694	700	2,394	1,500	
total (KAF)		128.8						75.2		10.6			43.0			

Construction period for the Old River Barrier.

Pulse flow period and tributary flow to meet the pulse flow.

Tuolumne FERC volume (TAF) = 89.9 91.2

* April 15 – May 15 Adjusted for lag time

DAILY OPERATION PLAN, APRIL 5

PULSE PERIOD: APRIL 15-MAY 15 · FLOW TARGET: 7,000CFS

SJR nr Vernalis Existing	VAMP Suppl. flow at Vernalis	VAMP Cum. Suppl. Flow	SJR nr Vernalis w/ VAMP	SJR above Merced R. (2-day lag)	Vernalis Accretion	Merced R. at Cressey Existing	Merced R. at Cressey Suppl.	Merced R. at Cressey w/ VAMP (3-day lag)	Exchange Contractors Suppl. (3-day lag)	Tuolumne R. at LaGrange FERC pulse Desired	Tuolumne R. at LaGrange FERC pulse Existing	Tuolumne R. at LaGrange Suppl.	Tuolumne R. at LaGrange w/VAMP (2-day lag)	Stan. R. blw Goodwin (2-day lag)	Maintain Priority Flow Level M=Merced T=Tuol.	
[calc]	[calc]	[calc]	[calc]				[calc]	[calc]					[calc]			
cfs	cfs		cfs	cfs	cfs		cfs	cfs	cfs		cfs	cfs	cfs	cfs		
						250		250		2,519	2,519		2,519	800		Mar 29
						250		250		2,628	2,628		2,628	800		Mar 30
						250		250		2,039	2,039		2,039	800		Mar 31
4,678			4,678	1,480	1,000	250		250		1,567	1,567		1,567	800		Apr 01
4,089			4,089	1,430	1,000	250		250		1,126	1,126		1,126	800		Apr 02
5,097			5,097	1,360	1,000	250		250		1,182	1,182		1,182	800		Apr 03
4,606			4,606	1,290	1,000	250		250		738	738		738	800		Apr 04
4,592			4,592	1,160	1,000	250		250		1,000	1,000		1,000	800		Apr 05
4,078			4,078	1,040	1,000	250		250		1,000	1,000		1,000	800		Apr 06
4,210			4,210	1,000	1,000	250		250		1,000	1,000		1,000	800		Apr 07
4,090			4,090	950	1,000	250		250		1,000	1,000		1,000	800		Apr 08
4,050			4,050	900	1,000	250		250		1,000	1,000		1,000	800		Apr 09
4,000			4,000	940	1,000	250		250		1,000	1,000		1,000	800		Apr 10
3,950			3,950	938	1,000	250		250		1,000	1,000		1,000	800		Apr 11
3,990			3,990	861	1,000	250	0	250	0	1,400	1,400		1,400	800	M	Apr 12
3,988			3,988	779	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T	Apr 13
4,311			4,311	724	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T	Apr 14
5,829	1,500	3	7,329	669	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T	Apr 15
5,774	1,500	6	7,274	659	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T	Apr 16
5,719	1,500	9	7,219	620	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T	Apr 17
5,709	1,500	12	7,209	595	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T	Apr 18
5,670	1,500	15	7,170	581	1,000	250	879	1,129	300	2,200	2,200	1,500	3,700	1,500	T	Apr 19
5,645	1,500	18	7,145	571	1,000	250	1,991	2,241	300	600	600	1,900	2,500	1,500	T	Apr 20
5,531	1,500	21	7,031	559	1,000	250	2,062	2,312	300	600	600	800	1,400	1,500		Apr 21
3,921	3,079	27	7,000	488	1,000	250	2,084	2,334	300	600	600	800	1,400	1,500		Apr 22
3,909	3,091	33	7,000	466	1,000	250	2,072	2,322	300	600	600	800	1,400	1,500		Apr 23
3,838	3,162	39	7,000	478	1,000	250	2,067	2,317	300	600	600	800	1,400	1,500	M	Apr 24
3,816	3,184	46	7,000	483	1,000	250	2,079	2,329	300	600	600	800	1,400	1,500	M	Apr 25
3,828	3,172	52	7,000	471	1,000	250	2,056	2,306	250	600	600	800	1,400	1,500	M	Apr 26
3,833	3,167	58	7,000	444	1,000	250	2,057	2,307	250	1,500	1,500	0	1,500	1,500	M	Apr 27
3,821	3,179	65	7,000	443	1,000	250	2,055	2,305	250	1,500	1,500	0	1,500	1,500	M	Apr 28
4,694	2,306	69	7,000	445	1,000	250	2,043	2,293	250	1,500	1,500	0	1,500	1,500	M	Apr 29
4,693	2,307	74	7,000	457	1,000	250	2,034	2,284	250	1,500	1,500	0	1,500	1,500	M	Apr 30
4,695	2,305	78	7,000	466	1,000	250	2,018	2,268	250	1,500	1,500	0	1,500	1,500	M	May 01
4,707	2,293	83	7,000	482	1,000	250	1,478	1,728	100	1,500	1,500	0	1,500	1,500	M	May 02
4,716	2,284	87	7,000	472	1,000	250	676	926	100	2,200	2,200	0	2,200	1,500	T	May 03
4,732	2,268	92	7,000	474	1,000	250	696	946	100	2,200	2,200	800	3,000	1,500	T	May 04
5,422	1,578	95	7,000	454	1,000	250	713	963	100	2,200	2,200	800	3,000	1,500	T	May 05
5,424	1,576	98	7,000	437	1,000	250	747	997	100	2,200	2,200	800	3,000	1,500	T	May 06
5,404	1,596	101	7,000	403	1,000	250	724	974	100	2,200	2,200	800	3,000	1,500	T	May 07
5,387	1,613	104	7,000	426	1,000	250	630	880	200	2,200	2,200	800	3,000	1,500	T	May 08
5,353	1,647	108	7,000	420	1,000	250	639	889	200	2,200	2,200	800	3,000	1,500	T	May 09
5,376	1,624	111	7,000	411	1,000	250	524	774	300	2,000	2,000	1,000	3,000	1,500	T	May 10
5,370	1,630	114	7,000	426	1,000	250	509	759	300	2,000	2,000	1,000	3,000	1,500		May 11
5,161	1,839	118	7,000	441	1,000	250	521	771	300	2,000	2,000	1,000	3,000	1,500		May 12
5,176	1,824	121	7,000	429	1,000	250		250		1,900	1,900	1,100	3,000	1,500		May 13
5,191	1,809	125	7,000	422	1,000	250		250		500	500		500	1,500		May 14
5,079	1,921	129	7,000	447	1,000	250		250		500	500		500	1,500		May 15
3,672	0		3,672	443	1,000	250		250		300	300		300	1,500		May 16
3,697	0		3,697	442	1,000	250		250		300	300		300	1,500		May 17
3,493	0		3,493	431	1,000	250		250		300	300		300	1,500		May 18
3,492	0		3,492	431	1,000	250		250		300	300		300	1,500		May 19
3,481	0		3,481	414	1,000	250		250		300	300		300	1,500		May 20
3,481	0		3,481	395	1,000	250		250		300	300		300	1,500		May 21
3,464	0		3,464	393	1,000	250		250		300	300		300	1,500		May 22
3,445	0		3,445	372	1,000	250		250		300	300		300	1,500		May 23
3,443	0		3,443	389	1,000	250		250		300	300		300	1,500		May 24
3,422	0		3,422	397	1,000	250		250		300	300		300	1,500		May 25
3,439	0		3,439	398	1,000	250		250		300	300		300	1,500		May 26
3,447	0		3,447	365	1,000	250		250		300	300		300	1,500		May 27
3,448	0		3,448	326	1,000	250		250		300	300		300	1,500		May 28
3,415	0		3,415	337	1,000	250		250		300	300		300	1,500		May 29
3,376	0		3,376	343	1,000	250		250		300	300		300	1,500		May 30
3,387	0		3,387	332	1,000	250		250		300	300		300	1,500		May 31
VAMP 31-day period *																
4,949	2,095		7,044				1,076	1,326	177		1,694	842	2,535	1,500		Mean (cfs)
	128.8						66.2		10.9			51.8				total (KAF)

Construction period for the Old River Barrier.

Pulse flow period and tributary flow to meet the pulse flow.

Tuolumne FERC volume (TAF) = 91.2 91.2

* April 15 – May 15 Adjusted for lag time

DAILY OPERATION PLAN, APRIL 11

PULSE PERIOD: APRIL 15-MAY 15 · FLOW TARGET: 7,000CFS

	SJR nr Vernalis Existing	VAMP Suppl. flow at Vernalis	VAMP Cum. Suppl. Flow	SJR nr Vernalis w/ VAMP	SJR above Merced R. (2-day lag)	Vernalis Accretion	Merced R. at Cressey Existing	Merced R. at Cressey Suppl.	Merced R. at Cressey w/ VAMP (3-day lag)	Exchange Contractors Suppl. (3-day lag)	Tuolumne R. at LaGrange FERC pulse Desired	Tuolumne R. at LaGrange FERC pulse "Modified"	Tuolumne R. at LaGrange Suppl.	Tuolumne R. at LaGrange w/ VAMP (2-day lag)	Stan. R. blw Goodwin (2-day lag)	Maintain Priority Flow Level M=Merced T=Tuol.
	[calc]	[calc]	[calc]	[calc]				[calc]	[calc]					[calc]		
	cfs	cfs		cfs	cfs	cfs		cfs	cfs	cfs		cfs	cfs	cfs	cfs	
Mar 29							660		660		2,519	2,519		2,519	846	
Mar 30							636		636		2,628	2,628		2,628	846	
Mar 31							606		606		2,039	2,039		2,039	846	
Apr 01	6,145			6,145	894	2,011	588		588		1,567	1,567		1,567	846	
Apr 02	5,745			5,745	843	2,224	599		599		1,126	1,126		1,126	846	
Apr 03	5,406			5,406	822	1,493	613		613		1,182	1,182		1,182	846	
Apr 04	5,181			5,181	839	1,778	601		601		738	738		738	851	
Apr 05	4,944			4,944	846	1,495	596		596		626	626		626	860	
Apr 06	4,738			4,738	937	1,697	376		376		616	616		616	831	
Apr 07	4,603			4,603	1,001	1,670	307		307		572	572		572	816	
Apr 08	4,598			4,598	977	1,618	309		309		406	406		406	826	
Apr 09	4,522			4,522	950	1,757	301		301		376	376		376	831	
Apr 10	4,315			4,315	925	1,799	304		304		396	396		396	878	
Apr 11	4,266			4,266	938	1,800	250		250		396	396		396	1,200	
Apr 12	4,300			4,300	861	1,800	250	0	250	0	396	396		396	1,500	M
Apr 13	4,638			4,638	779	1,800	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T+M
Apr 14	4,807			4,807	724	1,800	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T+M
Apr 15	5,829	1,500	3	7,329	669	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T+M
Apr 16	5,774	1,500	6	7,274	659	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T+M
Apr 17	5,719	1,500	9	7,219	620	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T+M
Apr 18	5,709	1,500	12	7,209	595	1,000	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T+M
Apr 19	5,670	1,500	15	7,170	581	1,000	250	779	1,029	100	2,300	2,300	1,500	3,800	1,500	T
Apr 20	5,645	1,500	18	7,145	571	1,000	250	1,791	2,041	200	1,100	1,000	1,800	2,800	1,500	T
Apr 21	5,631	1,500	21	7,131	559	1,000	250	1,812	2,062	250	600	600	1,100	1,700	1,500	
Apr 22	4,321	2,679	26	7,000	488	1,000	250	1,784	2,034	300	600	600	1,100	1,700	1,500	
Apr 23	3,909	3,091	32	7,000	466	1,000	250	1,772	2,022	300	600	600	1,100	1,700	1,500	
Apr 24	3,838	3,162	39	7,000	478	1,000	250	1,767	2,017	300	600	600	1,100	1,700	1,500	M
Apr 25	3,816	3,184	45	7,000	483	1,000	250	1,779	2,029	300	600	600	1,100	1,700	1,500	M
Apr 26	3,828	3,172	51	7,000	471	1,000	250	1,806	2,056	300	600	600	1,100	1,700	1,500	M
Apr 27	3,833	3,167	57	7,000	444	1,000	250	1,807	2,057	300	1,500	1,500	200	1,700	1,500	M
Apr 28	3,821	3,179	64	7,000	443	1,000	250	1,805	2,055	300	1,500	1,500	200	1,700	1,500	M
Apr 29	4,694	2,306	68	7,000	445	1,000	250	1,793	2,043	300	1,500	1,500	200	1,700	1,500	M
Apr 30	4,693	2,307	73	7,000	457	1,000	250	1,784	2,034	300	1,500	1,500	200	1,700	1,500	M
May 01	4,695	2,305	77	7,000	466	1,000	250	1,768	2,018	300	1,500	1,500	200	1,700	1,500	M
May 02	4,707	2,293	82	7,000	482	1,000	250	1,278	1,528	200	1,500	1,500	200	1,700	1,500	M
May 03	4,716	2,284	87	7,000	472	1,000	250	476	726	200	2,200	2,300	0	2,300	1,500	T
May 04	4,732	2,268	91	7,000	474	1,000	250	496	746	200	2,200	2,300	800	3,100	1,500	T
May 05	5,522	1,478	94	7,000	454	1,000	250	513	763	200	2,200	2,300	800	3,100	1,500	T
May 06	5,524	1,476	97	7,000	437	1,000	250	547	797	200	2,200	2,300	800	3,100	1,500	T
May 07	5,504	1,496	100	7,000	403	1,000	250	524	774	200	2,200	2,300	800	3,100	1,500	T
May 08	5,487	1,513	103	7,000	426	1,000	250	530	780	200	2,200	2,300	800	3,100	1,500	T
May 09	5,453	1,547	106	7,000	420	1,000	250	539	789	200	2,200	2,300	800	3,100	1,500	T
May 10	5,476	1,524	109	7,000	411	1,000	250	1,024	1,274	300	2,200	2,300	800	3,100	1,500	T
May 11	5,470	1,530	112	7,000	426	1,000	250	1,009	1,259	300	1,900	2,200	300	2,500	1,500	
May 12	5,461	1,539	115	7,000	441	1,000	250	1,021	1,271	300	1,800	2,200	300	2,500	1,500	
May 13	5,376	1,624	118	7,000	429	1,000	250		250		1,800	2,150	350	2,500	1,500	
May 14	5,391	1,609	121	7,000	422	1,000	250		250		1,550	300		300	1,500	
May 15	5,329	1,671	125	7,000	447	1,000	250		250		800	300		300	1,500	
May 16	3,472	0		3,472	443	1,000	250		250		300	300		300	1,500	
May 17	3,497	0		3,497	442	1,000	250		250		300	300		300	1,500	
May 18	3,493	0		3,493	431	1,000	250		250		300	300		300	1,500	
May 19	3,492	0		3,492	431	1,000	250		250		300	300		300	1,500	
May 20	3,481	0		3,481	414	1,000	250		250		300	300		300	1,500	
May 21	3,481	0		3,481	395	1,000	250		250		300	300		300	1,500	
May 22	3,464	0		3,464	393	1,000	250		250		300	300		300	1,500	
May 23	3,445	0		3,445	372	1,000	250		250		300	300		300	1,500	
May 24	3,443	0		3,443	389	1,000	250		250		300	300		300	1,500	
May 25	3,422	0		3,422	397	1,000	250		250		300	300		300	1,500	
May 26	3,439	0		3,439	398	1,000	250		250		300	300		300	1,500	
May 27	3,447	0		3,447	365	1,000	250		250		300	300		300	1,500	
May 28	3,448	0		3,448	326	1,000	250		250		300	300		300	1,500	
May 29	3,415	0		3,415	337	1,000	250		250		300	300		300	1,500	
May 30	3,376	0		3,376	343	1,000	250		250		300	300		300	1,500	
May 31	3,387	0		3,387	332	1,000	250		250		300	300		300	1,500	
	VAMP 31-day period *															
Mean (cfs)	5,018	2,029		7,048				974	1,224	195		1,763	860	2,623	1,500	
total (KAF)		125						59.9		12.0			52.9			

Actual Value
Barrier Construction
Stability Target

Tuolumne FERC volume (TAF) = 89.95 (33 days) 89.95 (31 days)

* April 15 – May 15 Adjusted for lag time

DAILY OPERATION PLAN, APRIL 13

PULSE PERIOD: APRIL 15-MAY 15 · FLOW TARGET: 7,000CFS

SJR nr Vernalis Existing	VAMP Suppl. flow at Vernalis	VAMP Cum. Suppl. Flow	SJR nr Vernalis w/VAMP	SJR above Merced R. (2-day lag)	Vernalis Accretion	Merced R. at Cressey Existing	Merced R. at Cressey Suppl.	Merced R. at Cressey w/VAMP (3-day lag)	Exchange Contractors Suppl. (3-day lag)	Tuolumne R. at LaGrange FERC pulse Desired	Tuolumne R. at LaGrange FERC pulse Existing	Tuolumne R. at LaGrange Suppl.	Tuolumne R. at LaGrange w/VAMP (2-day lag)	Stan. R. blw Goodwin (2-day lag)	Maintain Priority Flow Level M=Merced T=Tuol.	
[calc]	[calc]	[calc]	[calc]				[calc]	[calc]					[calc]			
cfs	cfs		cfs	cfs	cfs		cfs	cfs	cfs		cfs	cfs	cfs	cfs		
						660		660		2,519	2,519		2,519	846		Mar 29
						636		636		2,628	2,628		2,628	846		Mar 30
						606		606		2,039	2,039		2,039	846		Mar 31
4,438			4,438	894	304	588		588		1,567	1,567		1,567	846		Apr 01
4,055			4,055	843	534	599		599		1,126	1,126		1,126	846		Apr 02
4,653			4,653	822	740	613		613		1,182	1,182		1,182	846		Apr 03
4,403			4,403	839	1,000	601		601		738	738		738	851		Apr 04
4,177			4,177	846	728	596		596		626	626		626	860		Apr 05
3,985			3,985	937	944	376		376		616	616		616	831		Apr 06
3,838			3,838	1,001	905	307		307		572	572		572	816		Apr 07
3,828			3,828	985	848	309		309		406	406		406	826		Apr 08
3,533			3,533	955	768	301		301		376	376		376	831		Apr 09
3,256			3,256	925	732	304		304		396	396		396	878		Apr 10
3,065			3,065	581	594	302		302		395	395		395	1,071		Apr 11
3,049			3,049	459	549	423	0	423	0	737	737		737	1,200	M	Apr 12
3,186			3,186	418	835	326	0	326	0	2,300	2,300	1,479	3,779	1,275	T+M	Apr 13
3,398			3,398	451	700	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T+M	Apr 14
5,116	1,479	3	6,595	447	700	250	0	250	0	2,300	2,300	1,500	3,800	1,200	T+M	Apr 15
5,277	1,500	6	6,777	443	700	250	0	250	0	2,300	2,300	1,400	3,700	1,100	T+M	Apr 16
4,897	1,500	9	6,397	439	700	250	0	250	0	2,300	2,300	1,300	3,600	1,100	T+M	Apr 17
4,643	1,400	12	6,043	436	550	250	768	1,018	0	2,300	2,300	1,300	3,600	1,100	T+M	Apr 18
4,639	1,300	14	5,939	432	550	250	772	1,022	100	2,300	2,300	300	2,600	1,100	T	Apr 19
4,636	1,300	17	5,936	428	550	250	1,476	1,726	200	1,100	1,000	1,100	2,100	1,500	T	Apr 20
4,632	1,068	19	5,700	424	550	250	1,680	1,930	200	600	600	700	1,300	1,500		Apr 21
3,728	1,972	23	5,700	420	550	250	1,684	1,934	200	600	600	500	1,100	1,500		Apr 22
3,324	2,376	28	5,700	416	550	250	1,588	1,838	300	600	600	500	1,100	1,500		Apr 23
3,320	2,380	32	5,700	412	550	250	1,592	1,842	300	600	600	500	1,100	1,500	M	Apr 24
3,316	2,384	37	5,700	408	550	250	1,596	1,846	300	600	600	500	1,100	1,500	M	Apr 25
3,312	2,388	42	5,700	404	550	250	1,500	1,750	0	600	600	500	1,100	1,500	M	Apr 26
3,308	2,392	46	5,700	400	550	250	1,504	1,754	0	1,500	1,500	0	1,500	1,500	M	Apr 27
3,304	2,396	51	5,700	396	550	250	1,507	1,757	0	1,500	1,500	0	1,500	1,500	M	Apr 28
4,200	1,500	54	5,700	393	550	250	1,511	1,761	0	1,500	1,500	0	1,500	1,500	M	Apr 29
4,196	1,504	57	5,700	389	550	250	1,515	1,765	0	1,500	1,500	0	1,500	1,500	M	Apr 30
4,193	1,507	60	5,700	385	550	250	1,519	1,769	0	1,500	1,500	0	1,500	1,500	M	May 01
4,189	1,511	63	5,700	381	550	250	723	973		1,500	1,500	0	1,500	1,500	M	May 02
4,185	1,515	66	5,700	377	550	250	527	777	100	2,200	2,300		2,300	1,500	T	May 03
4,181	1,519	69	5,700	373	550	250	431	681	200	2,200	2,300	100	2,400	1,500	T	May 04
4,977	723	71	5,700	369	550	250	335	585	300	2,200	2,300	100	2,400	1,500	T	May 05
4,973	727	72	5,700	365	550	250	339	589	300	2,200	2,300	100	2,400	1,500	T	May 06
4,969	731	74	5,700	361	550	250	343	593	300	2,200	2,300	100	2,400	1,500	T	May 07
4,965	735	75	5,700	357	550	250	347	597	300	2,200	2,300	100	2,400	1,500	T	May 08
4,961	739	76	5,700	353	550	250	350	600	300	2,200	2,300	100	2,400	1,500	T	May 09
4,957	743	78	5,700	350	550	250	354	604	300	2,200	2,300	100	2,400	1,500	T	May 10
4,953	747	79	5,700	346	550	250	358	608	300	1,900	2,200	200	2,400	1,500		May 11
4,950	750	81	5,700	342	550	250	362	612	300	1,800	2,200	200	2,400	1,500		May 12
4,846	854	83	5,700	338	550	250		250		1,800	2,150	250	2,400	1,500		May 13
4,842	858	84	5,700	334	550	250		250		1,550	300		300	1,500		May 14
4,788	912	86	5,700	330	550	250		250		800	300		300	1,500		May 15
2,934	0		2,934	443	550	250		250		300	300		300	1,500		May 16
2,930	0		2,930	442	550	250		250		300	300		300	1,500		May 17
3,043	0		3,043	431	550	250		250		300	300		300	1,500		May 18
3,042	0		3,042	431	550	250		250		300	300		300	1,500		May 19
3,031	0		3,031	414	550	250		250		300	300		300	1,500		May 20
3,031	0		3,031	395	550	250		250		300	300		300	1,500		May 21
3,014	0		3,014	393	550	250		250		300	300		300	1,500		May 22
2,995	0		2,995	372	550	250		250		300	300		300	1,500		May 23
2,993	0		2,993	389	550	250		250		300	300		300	1,500		May 24
2,972	0		2,972	397	550	250		250		300	300		300	1,500		May 25
2,989	0		2,989	398	550	250		250		300	300		300	1,500		May 26
2,997	0		2,997	365	550	250		250		300	300		300	1,500		May 27
2,998	0		2,998	326	550	250		250		300	300		300	1,500		May 28
2,965	0		2,965	337	550	250		250		300	300		300	1,500		May 29
2,926	0		2,926	343	550	250		250		300	300		300	1,500		May 30
2,937	0		2,937	332	550	250		250		300	300		300	1,500		May 31
VAMP 31-day period *																
4,412	1,400		5,813				796	1,054	143		1,763	481	2,228	1,439		Mean (cfs)
	86						49.0		8.8			29.6				total (KAF)

Actual Value
Barrier Construction
Stability Target

Tuolumne FERC volume (TAF) = 89.95 (33 days) 89.95 (31 days)

* April 15 – May 15 Adjusted for lag time

DAILY OPERATION PLAN, APRIL 14

PULSE PERIOD: APRIL 15-MAY 15 · FLOW TARGET: 7,000CFS

	SJR nr Vernalis Existing	VAMP Suppl. flow at Vernalis	VAMP Cum. Suppl. Flow	SJR nr Vernalis w/VAMP	SJR above Merced R. (2-day lag)	Vernalis Accretion	Merced R. at Cressey Existing	Merced R. at Cressey Suppl.	Merced R. at Cressey w/VAMP (3-day lag)	Exchange Contractors Suppl. (3-day lag)	Tuolumne R. at LaGrange FERC pulse Desired	Tuolumne R. at LaGrange FERC pulse Existing	Tuolumne R. at LaGrange Suppl.	Tuolumne R. at LaGrange w/VAMP (2-day lag)	Stan. R. blw Goodwin (2-day lag)	Maintain Priority Flow Level M=Merced T=Tuol.
	[calc]	[calc]	[calc]	[calc]				[calc]	[calc]					[calc]		
	cfs	cfs	TAF	cfs	cfs	cfs		cfs	cfs	cfs		cfs	cfs	cfs	cfs	
Apr 01					894	304	300		300		1,567	1,567		1,567	846	
Apr 02					843	534	300		300		1,126	1,126		1,126	846	
Apr 03					822	740	300		300		1,182	1,182		1,182	846	
Apr 04	4,122			4,122	839	1,007	300		300		738	738		738	851	
Apr 05	3,885			3,885	846	735	300		300		626	626		626	860	
Apr 06	3,678			3,678	937	950	300		300		616	616		616	831	
Apr 07	3,543			3,543	1,001	911	307		307		572	572		572	816	
Apr 08	3,523			3,523	985	839	309		309		416	416		416	819	
Apr 09	3,385			3,385	955	696	301		301		407	407		407	853	
Apr 10	3,246			3,246	925	719	304		304		397	397		397	878	
Apr 11	3,085	0		3,085	581	561	302	0	302		395	395		395	1,071	
Apr 12	3,040	0		3,040	459	539	317	0	317	0	737	737		737	1,200	M
Apr 13	3,191	0		3,191	418		326	0	326	0	2,300	2,300	1,480	3,780	1,275	T+M
Apr 14	3,998	0	0	3,998	414	1,300	250	0	250	0	2,300	2,300	1,500	3,800	1,500	T+M
Apr 15	4,810	1,480	3	6,290	411	500	250	0	250	0	2,300	2,300	1,500	3,800	1,100	T+M
Apr 16	5,040	1,500	5.9	6,540	407	500	250	0	250	0	2,300	2,300	1,400	3,700	1,100	T+M
Apr 17	4,561	1,500	8.9	6,061	403	500	250	0	250	0	2,300	2,300	1,300	3,600	1,100	T+M
Apr 18	4,557	1,400	11.7	5,957	400	500	250	154	404	100	2,300	2,300	1,300	3,600	1,100	T+M
Apr 19	4,553	1,300	14.2	5,853	396	500	250	858	1,108	100	2,300	2,300	500	2,800	1,500	T
Apr 20	4,550	1,300	16.8	5,850	392	500	250	1,562	1,812	200	1,100	1,400	700	2,100	1,500	T
Apr 21	4,946	754	18.3	5,700	389	500	250	1,765	2,015	200	600	800	500	1,300	1,500	
Apr 22	4,042	1,658	21.6	5,700	385	500	250	1,869	2,119	200	600	800	300	1,100	1,500	
Apr 23	3,439	2,262	26.1	5,700	381	500	250	1,823	2,073	250	600	800	200	1,000	1,500	
Apr 24	3,435	2,265	30.6	5,700	377	500	250	1,476	1,726	300	600	800	200	1,000	1,500	M
Apr 25	3,431	2,269	35.1	5,700	374	500	250	1,480	1,730	300	600	800	500	1,300	1,500	M
Apr 26	3,427	2,273	39.6	5,700	370	500	250	1,484	1,734	0	600	800	500	1,300	1,500	M
Apr 27	3,424	2,276	44.1	5,700	366	500	250	1,487	1,737	0	1,500	1,500	100	1,600	1,500	M
Apr 28	3,420	2,280	48.6	5,700	363	500	250	1,491	1,741	0	1,500	1,500	100	1,600	1,500	M
Apr 29	4,116	1,584	51.8	5,700	359	500	250	1,495	1,745	0	1,500	1,500	100	1,600	1,500	M
Apr 30	4,113	1,587	54.9	5,700	355	500	250	1,498	1,748	0	1,500	1,500	100	1,600	1,500	M
May 01	4,109	1,591	58.1	5,700	352	500	250	1,502	1,752	0	1,500	1,500	100	1,600	1,500	M
May 02	4,105	1,595	61.2	5,700	348	500	250	706	956	0	1,500	1,500	100	1,600	1,500	M
May 03	4,102	1,598	64.4	5,700	344	500	250	309	559	200	2,200	2,400	0	2,400	1,500	T
May 04	4,098	1,602	67.6	5,700	341	500	250	313	563	200	2,200	2,400	200	2,600	1,500	T
May 05	4,994	706	69.0	5,700	337	500	250	217	467	300	2,200	2,400	200	2,600	1,500	T
May 06	4,991	709	70.4	5,700	333	500	250	221	471	300	2,200	2,400	200	2,600	1,500	T
May 07	4,987	713	71.8	5,700	330	500	250	224	474	300	2,200	2,400	200	2,600	1,500	T
May 08	4,983	717	73.2	5,700	326	500	250	228	478	300	2,200	2,400	200	2,600	1,500	T
May 09	4,980	721	74.7	5,700	322	500	250	232	482	300	2,200	2,400	200	2,600	1,500	T
May 10	4,976	724	76.1	5,700	318	500	250	635	885	300	2,200	2,400	200	2,600	1,500	T
May 11	4,972	728	77.5	5,700	315	500	250	1,039	1,289	300	1,900	1,900	300	2,200	1,500	
May 12	4,968	732	79.0	5,700	311	500	250	1,143	1,393	400	1,800	1,400	400	1,800	1,500	
May 13	4,465	1,235	81.4	5,700	307	500	250	500	750		1,800	800	800	1,600	1,500	
May 14	3,961	1,739	84.9	5,700	304	500	250		250		1,550	300	500	800	1,500	
May 15	3,357	2,343	89.5	5,700	300	500	250		250		800	300		300	1,500	
May 16	2,854	1,000		3,854		500	250		250		300	300		300	1,500	
May 17	2,850	0		2,850		500	250		250		300	300		300	1,500	
May 18	2,550	0		2,550		500	250		250		300	300		300	1,500	
May 19	2,550	0		2,550		500	250		250		300	300		300	1,500	
May 20	2,550	0		2,550		500	250		250		300	300		300	1,500	
May 21	2,550	0		2,550		500	250		250		300	300		300	1,500	
May 22	2,550	0		2,550		500	250		250		300	300		300	1,500	
May 23	2,550	0		2,550		500	250		250		300	300		300	1,500	
May 24	2,550	0		2,550		500	250		250		300	300		300	1,500	
May 25	2,550	0		2,550		500	250		250		300	300		300	1,500	
May 26	2,550	0		2,550		500	250		250		300	300		300	1,500	
May 27	2,550	0		2,550		500	250		250		300	300		300	1,500	
May 28	2,550	0		2,550		500	250		250		300	300		300	1,500	
May 29	2,550	0		2,550		500	250		250		300	300		300	1,500	
May 30	2,550	0		2,550		500	250		250		300	300		300	1,500	
May 31	2,550	0		2,550		500	250		250		300	300		300	1,500	
	VAMP 31-day period *															
Mean (cfs)	4,320	1,456		5,776				813	1,068	147		1,761	496	2,257	1,441	
total (KAF)		89.5						50.0		9.0			30.5			

Pulse flow period

Tributary test flow periods

Green Type *Actual flow*

DAILY OPERATION PLAN, APRIL 17

PULSE PERIOD: APRIL 15-MAY 15 · FLOW TARGET: 7,000CFS

SJR nr Vernalis Existing	VAMP Suppl. flow at Vernalis	VAMP Cum. Suppl. Flow	SJR nr Vernalis w/VAMP	SUR above Merced R. (2-day lag)	Vernalis Accretion	Merced R. at Cressey Existing	Merced R. at Cressey Suppl.	Merced R. at Cressey w/VAMP (3-day lag)	Exchange Contractors Suppl. (3-day lag)	Tuolumne R. at LaGrange FERC pulse Desired	Tuolumne R. at LaGrange FERC pulse Existing	Tuolumne R. at LaGrange Suppl.	Tuolumne R. at LaGrange w/VAMP (2-day lag)	Stan. R. blw Goodwin (2-day lag)	Maintain Priority Flow Level M=Merced T=Tuol.	
[calc]	[calc]	[calc]	[calc]				[calc]	[calc]					[calc]			
cfs	cfs	TAF	cfs	cfs	cfs		cfs	cfs	cfs		cfs	cfs	cfs	cfs		
				894	304	300		300		1,567	1,567		1,567	846		Apr 01
				843	534	300		300		1,126	1,126		1,126	846		Apr 02
				822	740	300		300		1,182	1,182		1,182	846		Apr 03
4,122			4,122	839	1,007	300		300		738	738		738	851		Apr 04
3,885			3,885	846	735	300		300		626	626		626	860		Apr 05
3,678			3,678	937	950	300		300		616	616		616	831		Apr 06
3,543			3,543	1,001	911	307		307		572	572		572	816		Apr 07
3,523			3,523	985	839	309		309		416	416		416	819		Apr 08
3,385			3,385	955	696	301		301		407	407		407	853		Apr 09
3,246			3,246	925	719	304		304		397	397		397	878		Apr 10
3,085	0		3,085	581	561	302	0	302		395	395		395	1,071		Apr 11
3,040	0		3,040	459	539	317	0	317	0	737	737		737	1,200	M	Apr 12
3,191	0		3,191	418	840	326	0	326	0	2,300	2,300	1,480	3,780	1,275	T+M	Apr 13
4,195	0	0	4,195	389	1,497	331	0	331	0	2,300	2,300	1,543	3,843	1,434	T+M	Apr 14
3,852	1,480	3	5,332	417	-458	339	0	339	0	2,300	2,300	1,503	3,803	1,109	T+M	Apr 15
3,969	1,543	6.0	5,512	454	-480	353	0	353	0	2,300	2,300	1,385	3,685	1,104	T+M	Apr 16
4,657	1,503	9.0	6,160	403	500	250	0	250	0	2,300	2,300	1,300	3,600	1,100	T+M	Apr 17
4,697	1,385	11.7	6,082	400	500	250	150	400	100	2,300	2,300	1,300	3,600	1,100	T+M	Apr 18
4,656	1,300	14.3	5,956	396	500	250	860	1,110	200	2,300	2,300	500	2,800	1,500	T	Apr 19
4,550	1,300	16.9	5,850	392	500	250	1,560	1,810	200	1,100	1,400	700	2,100	1,500	T	Apr 20
4,946	750	18.4	5,696	389	500	250	1,770	2,020	250	600	800	500	1,300	1,500		Apr 21
4,042	1,760	21.9	5,802	385	500	250	1,870	2,120	300	600	800	250	1,050	1,500		Apr 22
3,439	2,260	26.3	5,699	381	500	250	1,820	2,070	300	600	800	200	1,000	1,500		Apr 23
3,435	2,270	30.8	5,705	377	500	250	1,480	1,730	300	600	800	200	1,000	1,500	M	Apr 24
3,431	2,370	35.5	5,801	374	500	250	1,480	1,730	200	600	800	500	1,300	1,500	M	Apr 25
3,427	2,320	40.1	5,747	370	500	250	1,480	1,730	100	600	800	500	1,300	1,500	M	Apr 26
3,424	2,280	44.7	5,704	366	500	250	1,490	1,740	0	1,500	1,500	100	1,600	1,500	M	Apr 27
3,420	2,180	49.0	5,600	363	500	250	1,490	1,740	0	1,500	1,500	100	1,600	1,500	M	Apr 28
4,116	1,680	52.3	5,796	359	500	250	1,490	1,740	0	1,500	1,500	100	1,600	1,500	M	Apr 29
4,113	1,590	55.5	5,703	355	500	250	1,500	1,750	0	1,500	1,500	100	1,600	1,500	M	Apr 30
4,109	1,590	58.6	5,699	352	500	250	1,500	1,750	0	1,500	1,500	100	1,600	1,500	M	May 01
4,105	1,590	61.8	5,695	348	500	250	710	960	0	1,500	1,500	100	1,600	1,500	M	May 02
4,102	1,600	65.0	5,702	344	500	250	310	560	100	2,200	2,400	0	2,400	1,500	T	May 03
4,098	1,600	68.1	5,698	341	500	250	310	560	200	2,200	2,400	200	2,600	1,500	T	May 04
4,994	710	69.5	5,704	337	500	250	220	470	300	2,200	2,400	200	2,600	1,500	T	May 05
4,991	610	70.8	5,601	333	500	250	220	470	300	2,200	2,400	200	2,600	1,500	T	May 06
4,987	710	72.2	5,697	330	500	250	220	470	300	2,200	2,400	200	2,600	1,500	T	May 07
4,983	720	73.6	5,703	326	500	250	230	480	300	2,200	2,400	200	2,600	1,500	T	May 08
4,980	720	75.0	5,700	322	500	250	230	480	300	2,200	2,400	200	2,600	1,500	T	May 09
4,976	720	76.4	5,696	318	500	250	640	890	300	2,200	2,400	200	2,600	1,500	T	May 10
4,972	730	77.9	5,702	315	500	250	1,040	1,290	300	1,900	1,900	300	2,200	1,500		May 11
4,968	730	79.3	5,698	311	500	250	1,140	1,390	200	1,800	1,400	400	1,800	1,500		May 12
4,465	1,240	81.8	5,705	307	500	250	500	750		1,800	800	800	1,600	1,500		May 13
3,961	1,740	85.3	5,701	304	500	250		250		1,550	300	500	800	1,500		May 14
3,357	2,140	89.5	5,497	300	500	250		250		800	300		300	1,500		May 15
2,854	1,000		3,854		500	250		250		300	300		300	1,500		May 16
2,850	0		2,850		500	250		250		300	300		300	1,500		May 17
2,550	0		2,550		500	250		250		300	300		300	1,500		May 18
2,550	0		2,550		500	250		250		300	300		300	1,500		May 19
2,550	0		2,550		500	250		250		300	300		300	1,500		May 20
2,550	0		2,550		500	250		250		300	300		300	1,500		May 21
2,550	0		2,550		500	250		250		300	300		300	1,500		May 22
2,550	0		2,550		500	250		250		300	300		300	1,500		May 23
2,550	0		2,550		500	250		250		300	300		300	1,500		May 24
2,550	0		2,550		500	250		250		300	300		300	1,500		May 25
2,550	0		2,550		500	250		250		300	300		300	1,500		May 26
2,550	0		2,550		500	250		250		300	300		300	1,500		May 27
2,550	0		2,550		500	250		250		300	300		300	1,500		May 28
2,550	0		2,550		500	250		250		300	300		300	1,500		May 29
2,550	0		2,550		500	250		250		300	300		300	1,500		May 30
2,550	0		2,550		500	250		250		300	300		300	1,500		May 31
VAMP 31-day period *																
4,265	1,456		5,721				813	1,077	147		1,761	496	2,257	1,439		
	89.5						50.0		9.0			30.5				

Mean (cfs)
total (KAF)

Pulse flow period

Tributary test flow periods

Green Type *Actual flow*

VERNALIS ADAPTIVE MANAGEMENT PLAN (VAMP)

	Merced R. at Cressey (3-day log)									Tuolumne R. Near La Grange (2-day log)									Stanislaus R. blw Goodwin Dam (2-day log)								
	SCHEDULED				OBSERVED					SCHEDULED				OBSERVED					SCHEDULED				OBSERVED				
	Existing	Suppl.	Total Flow	Cum. Suppl.	Existing	Ramping	Suppl.	Total Flow	Cum. Suppl.	Existing	Suppl.	Total Flow	Cum. Suppl.	Existing	Ramping	Suppl.	Total Flow	Cum. Suppl.	Existing	Suppl.	Total Flow	Cum. Suppl.	Existing	Suppl.	Total Flow	Cum. Suppl.
	(cfs)	(cfs)	(cfs)	(TAF)	(cfs)	(cfs)	(cfs)	(cfs)	(TAF)	(cfs)	(cfs)	(cfs)	(TAF)	(cfs)		(cfs)	(cfs)	(AF)	(cfs)	(cfs)	(cfs)	(AF)	(cfs)	(cfs)	(cfs)	(AF)
Apr 01	250	0	250		300	0	0	300		1,567	0	1,567		1,570	0	0	1,570		846	0	800		850	0	850	
Apr 02	250	0	250	0.0	300	0	0	300	0	1,126	0	1,126	0.0	1,130	0	0	1,130	0.0	846	0	800	0	850	0	850	0
Apr 03	250	0	250	0.0	300	0	0	300	0	1,182	0	1,182	0.0	1,180	0	0	1,180	0.0	846	0	800	0	850	0	850	0
Apr 04	250	0	250	0.0	300	0	0	300	0	738	0	738	0.0	740	0	0	740	0.0	851	0	800	0	850	0	850	0
Apr 05	250	0	250	0.0	300	0	0	300	0	626	0	626	0.0	630	0	0	630	0.0	860	0	800	0	860	0	860	0
Apr 06	250	0	250	0.0	300	0	0	300	0	616	0	616	0.0	620	0	0	620	0.0	831	0	800	0	830	0	830	0
Apr 07	250	0	250	0.0	310	0	0	310	0	572	0	572	0.0	570	0	0	570	0.0	816	0	800	0	820	0	820	0
Apr 08	250	0	250	0.0	310	0	0	310	0	416	0	416	0.0	420	0	0	420	0.0	819	0	800	0	820	0	820	0
Apr 09	250	0	250	0.0	310	0	0	310	0.0	407	0	407	0.0	410	0	0	410	0.0	853	0	800	0	860	0	860	0
Apr 10	250	0	250	0.0	300	0	0	300	0.0	397	0	397	0.0	400	0	0	400	0.0	878	0	800	0	890	0	890	0
Apr 11	250	0	250	0.0	300	0	0	300	0.0	395	0	395	0.0	400	0	0	400	0.0	1,071	0	1,000	0	1,070	0	1,070	0
Apr 12	250	0	250	0.0	290		0	290	0.0	737	0	737	0.0	740	440	0	740	0.0	1,200	0	1,200	0	1,200	0	1,200	0
Apr 13	250	0	250	0.0	300		0	300	0.0	2,300	1,480	3,780	2.9	2,300		1,480	3,780	2.9	1,275	0	1,500	0	1,280	0	1,280	0
Apr 14	250	0	250	0.0	310		0	310	0.0	2,300	1,500	3,800	5.9	2,300		1,540	3,840	6.0	1,500	0	1,500	0	1,430	0	1,430	0
Apr 15	250	0	250	0.0	310		0	310	0.0	2,300	1,500	3,800	8.9	2,300		1,500	3,800	9.0	1,100	0	1,100	0	1,110	0	1,110	0
Apr 16	250	0	250	0.0	330		0	330	0.0	2,300	1,400	3,700	11.7	2,300		1,390	3,690	11.7	1,100	0	1,100	0	1,100	0	1,100	0
Apr 17	250	0	250	0.0	380		0	380	0.0	2,300	1,300	3,600	14.2	2,300		1,310	3,610	14.3	1,100	0	1,100	0	1,120	0	1,120	0
Apr 18	250	150	400	0.3	250		290	540	0.6	2,300	1,300	3,600	16.8	2,300		990	3,290	16.3	1,100	0	1,100	0	1,080	0	1,080	0
Apr 19	250	1,550	1,800	3.4	250		1,470	1,720	3.5	2,300	200	2,500	17.2	2,300		70	2,370	16.4	950	0	950	0	870	0	870	0
Apr 20	250	1,550	1,800	6.4	250		1,650	1,900	6.8	1,400	100	1,500	17.4	1,400		0	1,370	16.4	1,250	0	1,250	0	1,170	0	1,170	0
Apr 21	250	1,550	1,800	9.5	250		1,590	1,840	9.9	800	300	1,100	18.0	800		260	1,060	16.9	1,500	0	1,500	0	1,500	0	1,500	0
Apr 22	250	1,550	1,800	12.6	250		1,570	1,820	13.0	800	300	1,100	18.6	800		320	1,120	17.6	1,500	0	1,500	0	1,490	0	1,490	0
Apr 23	250	1,480	1,730	15.5	250		1,550	1,800	16.1	800	300	1,100	19.2	800		330	1,130	18.2	1,500	0	1,500	0	1,490	0	1,490	0
Apr 24	250	1,480	1,730	18.5	250		1,560	1,810	19.2	800	300	1,100	19.8	800		330	1,130	18.9	1,500	0	1,500	0	1,480	0	1,480	0
Apr 25	250	1,480	1,730	21.4	250		1,470	1,720	22.1	800	300	1,100	20.4	800		290	1,090	19.5	1,500	0	1,500	0	1,510	0	1,510	0
Apr 26	250	1,490	1,740	24.4	250					800	300	1,100	21.0	800					1,500	0	1,500	0		0		0
Apr 27	250	1,490	1,740	27.3	250					1,500	0	1,500	21.0	1,500					1,500	0	1,500	0		0		0
Apr 28	250	1,490	1,740	30.3	250					1,500	0	1,500	21.0	1,500					1,500	0	1,500	0		0		0
Apr 29	250	1,500	1,750	33.2	250					1,500	0	1,500	21.0	1,500					1,500	0	1,500	0		0		0
Apr 30	250	1,500	1,750	36.2	250					1,500	0	1,500	21.0	1,500					1,500	0	1,500	0		0		0
May 01	250	710	960	37.6	250					1,500	0	1,500	21.0	1,500					1,500	0	1,500	0		0		0
May 02	250	200	450	38.0	250					1,500	500	2,000	22.0	1,500					1,500	0	1,500	0		0		0
May 03	250	0	250	38.0	250					2,400	0	2,400	22.0	2,400					1,500	0	1,500	0		0		0
May 04	250	0	250	38.0	250					2,400	50	2,450	22.1	2,400					1,500	0	1,500	0		0		0
May 05	250	0	250	38.0	250					2,400	50	2,450	22.2	2,400					1,500	0	1,500	0		0		0
May 06	250	0	250	38.0	250					2,400	50	2,450	22.3	2,400					1,500	0	1,500	0		0		0
May 07	250	0	250	38.0	250					2,400	50	2,450	22.4	2,400					1,500	0	1,500	0		0		0
May 08	250	0	250	38.0	250					2,400	50	2,450	22.5	2,400					1,500	0	1,500	0		0		0
May 09	250	50	300	38.1	250					2,400	50	2,450	22.6	2,400					1,500	0	1,500	0		0		0
May 10	250	250	500	38.6	250					2,400	0	2,400	22.6	2,400					1,500	0	1,500	0		0		0
May 11	250	450	700	39.5	250					1,900	300	2,200	23.2	1,900					1,500	0	1,500	0		0		0
May 12	250	800	1,050	41.1	250					1,400	700	2,100	24.6	1,400					1,500	0	1,500	0		0		0
May 13	250	400	650	41.9	250					800	900	1,700	26.3	800					1,500	0	1,500	0		0		0
May 14	250	0	250	41.9	250					300	500	800	27.3	300					1,500	0	1,500	0		0		0
May 15	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 16	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 17	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 18	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 19	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 20	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 21	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 22	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 23	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 24	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 25	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 26	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 27	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 28	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 29	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 30	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0
May 31	250	0	250	41.9	250					300	0	300	27.3	300					1,500	0	1,500	0		0		0

TRACKING OF SPRING PULSE FLOW 2000

	Exchange Contractors (3-day log)				Upper SJR		SJR Accretions		San Joaquin R. at Vernalis										
	SUPPLEMENTAL								SCHEDULED					OBSERVED					
	Scheduled	Cum. Scheduled	Observed	Cum. Observed	Forecast	Observed	Forecast	Observed	Existing	Suppl.	Total	Target	Cum. Suppl.	Existing	Ramping	Suppl.	Total	Cum. Suppl.	
	(cfs)	(TAF)	(cfs)	(TAF)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(TAF)	(cfs)	(cfs)	(cfs)	(cfs)	(AF)	
	0		0		894	900	304	300						5,090			5,090		Apr 01
	0	0.0	0	0.0	843	840	534	530						4,690			4,690		Apr 02
	0	0.0	0	0.0	822	820	740	730						4,350			4,350		Apr 03
	0	0.0	0	0.0	839	840	1,007	1,000	4,072	0	4,072			4,120	0	0	4,120		Apr 04
	0	0.0	0	0.0	846	850	735	730	3,835	0	3,835		0.0	3,880	0	0	3,880	0	Apr 05
	0	0.0	0	0.0	937	940	950	950	3,628	0	3,628		0.0	3,680	0	0	3,680	0.0	Apr 06
	0	0.0	0	0.0	1,001	1,000	911	900	3,493	0	3,493		0.0	3,540	0	0	3,540	0.0	Apr 07
	0	0.0	0	0.0	985	980	839	830	3,473	0	3,473		0.0	3,520	0	0	3,520	0.0	Apr 08
	0	0.0	0	0.0	955	950	696	700	3,335	0	3,335		0.0	3,390	0	0	3,390	0.0	Apr 09
	0	0.0	0	0.0	925	930	719	720	3,189	0	3,189		0.0	3,250	0	0	3,250	0.0	Apr 10
	0	0.0	0	0.0	581	580	561	600	3,026	0	3,026		0.0	3,130	0	0	3,130	0.0	Apr 11
	0	0.0	0	0.0	459	460	539	580	2,989	0	2,989		0.0	3,110	0	0	3,110	0.0	Apr 12
	0	0.0	0	0.0	418	420	840	850	3,137	0	3,137		0.0	3,200	0	0	3,200	0.0	Apr 13
	0	0.0	0	0.0	414	390	1,300	1,590	3,946	0	3,946		0.0	3,850	440	0	4,290	0.0	Apr 14
	0	0.0	0	0.0	411	420	500	-210	4,743	1,480	6,223	5,700	2.9	4,080		1,480	5,560	2.9	Apr 15
	0	0.0	0	0.0	407	460	500	-70	4,964	1,500	6,464	5,700	5.9	4,350		1,540	5,890	6.0	Apr 16
	0	0.0	0	0.0	403	490	500	680	4,561	1,500	6,061	5,700	8.9	4,820		1,500	6,320	9.0	Apr 17
	100	0.2	100	0.2	400	550	500	1,490	4,557	1,400	5,957	5,700	11.7	5,660		1,390	7,050	11.7	Apr 18
	200	0.6	200	0.6	500	570	1,400	1,380	5,453	1,300	6,753	5,700	14.2	5,620		1,310	6,930	14.3	Apr 19
	200	1.0	200	1.0	392	660	1,300	830	5,350	1,300	6,650	5,700	16.8	5,240		990	6,230	16.3	Apr 20
	200	1.4	200	1.4	646	780	1,500	1,700	5,500	450	5,950	5,700	17.7	5,790		460	6,250	17.2	Apr 21
	200	1.8	200	1.8	636	750	1,100	1,160	4,392	1,850	6,242	5,700	21.4	4,610		1,670	6,280	20.5	Apr 22
	200	2.2	200	2.2	625	640	1,000	830	4,196	2,050	6,246	5,700	25.4	4,160		2,110	6,270	24.7	Apr 23
	200	2.6	200	2.6	615	600	900	860	4,086	2,050	6,136	5,700	29.5	4,150		2,110	6,260	28.9	Apr 24
	200	3.0	200	3.0	605	570	800	790	3,975	2,050	6,025	5,700	33.6	3,970		2,100	6,070	33.0	Apr 25
	100	3.2			595		800		3,965	1,980	5,945	5,700	37.5						Apr 26
	0	3.2			584		800		3,955	1,980	5,935	5,700	41.4						Apr 27
	0	3.2			574		800		3,945	1,980	5,925	5,700	45.4						Apr 28
	0	3.2			564		800		4,634	1,590	6,224	5,700	48.5						Apr 29
	0	3.2			554		800		4,624	1,490	6,114	5,700	51.5						Apr 30
	0	3.2			543		800		4,614	1,490	6,104	5,700	54.4						May 01
	100	3.4			533		800		4,604	1,500	6,104	5,700	57.4						May 02
	200	3.8			523		800		4,593	1,500	6,093	5,700	60.4						May 03
	200	4.2			513		800		4,583	1,210	5,793	5,700	62.8						May 04
	200	4.6			502		800		5,473	300	5,773	5,700	63.4						May 05
	200	5.0			492		800		5,463	250	5,713	5,700	63.9						May 06
	200	5.4			482		800		5,452	250	5,702	5,700	64.4						May 07
	200	5.8			472		800		5,442	250	5,692	5,700	64.9						May 08
	200	6.1			461		800		5,432	250	5,682	5,700	65.4						May 09
	300	6.7			451		800		5,422	250	5,672	5,700	65.9						May 10
	200	7.1			441		800		5,411	250	5,661	5,700	66.3						May 11
	100	7.3			431		800		5,401	250	5,651	5,700	66.8						May 12
	0	7.3			420		800		4,891	850	5,741	5,700	68.5						May 13
	0	7.3			410		800		4,381	1,350	5,731	5,700	71.2						May 14
	0	7.3			400		800		3,770	1,800	5,570	5,700	74.8						May 15
	0	7.3			0		500		2,960	0	2,960		74.8		0				May 16
	0	7.3			0		500		2,950	0	2,950		74.8		0				May 17
	0	7.3			0		500		2,550	0	2,550		74.8		0				May 18
	0	7.3			0		500		2,550	0	2,550		74.8		0				May 19
	0	7.3			0		500		2,550	0	2,550		74.8		0				May 20
	0	7.3			0		500		2,550	0	2,550		74.8		0				May 21
	0	7.3			0		500		2,550	0	2,550		74.8		0				May 22
	0	7.3			0		500		2,550	0	2,550		74.8		0				May 23
	0	7.3			0		500		2,550	0	2,550		74.8		0				May 24
	0	7.3			0		500		2,550	0	2,550		74.8		0				May 25
	0	7.3			0		500		2,550	0	2,550		74.8		0				May 26
	0	7.3			0		500		2,550	0	2,550		74.8		0				May 27
	0	7.3			0		500		2,550	0	2,550		74.8		0				May 28
	0	7.3			0		500		2,550	0	2,550		74.8		0				May 29
	0	7.3			0		500		2,550	0	2,550		74.8		0				May 30
	0	7.3			0		500		2,550	0	2,550		74.8		0				May 31

*Pulse period average: 6406.6667

COMPARISON OF "REAL-TIME" AND PROVISIONAL FLOWS

Merced River Near Cressey

Merced River Near Stevinson

COMPARISON OF "REAL-TIME" AND PROVISIONAL FLOWS

San Joaquin River Near Newman

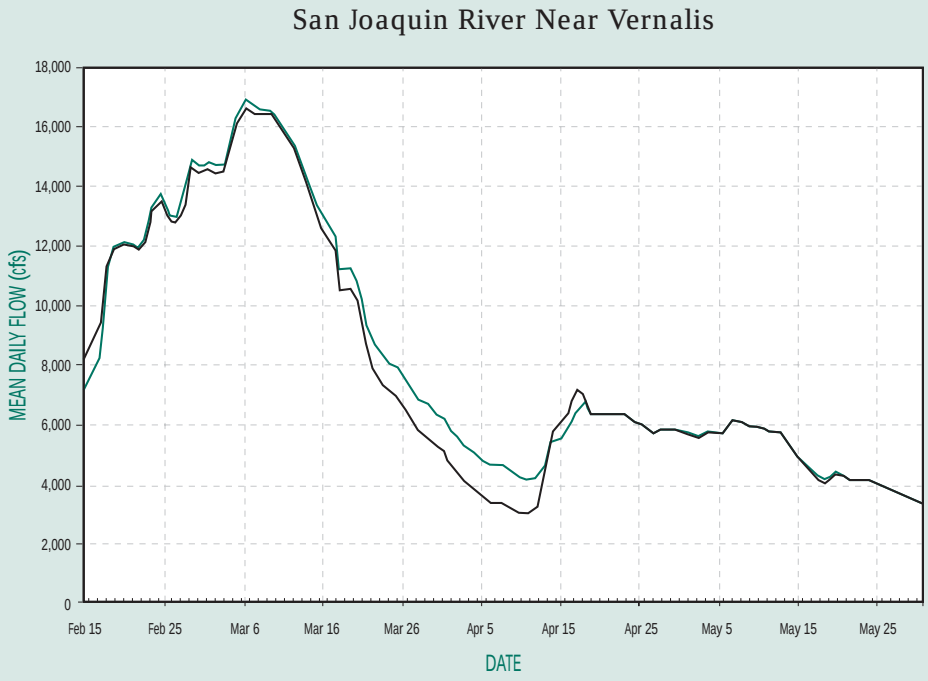
San Joaquin River Above Merced River

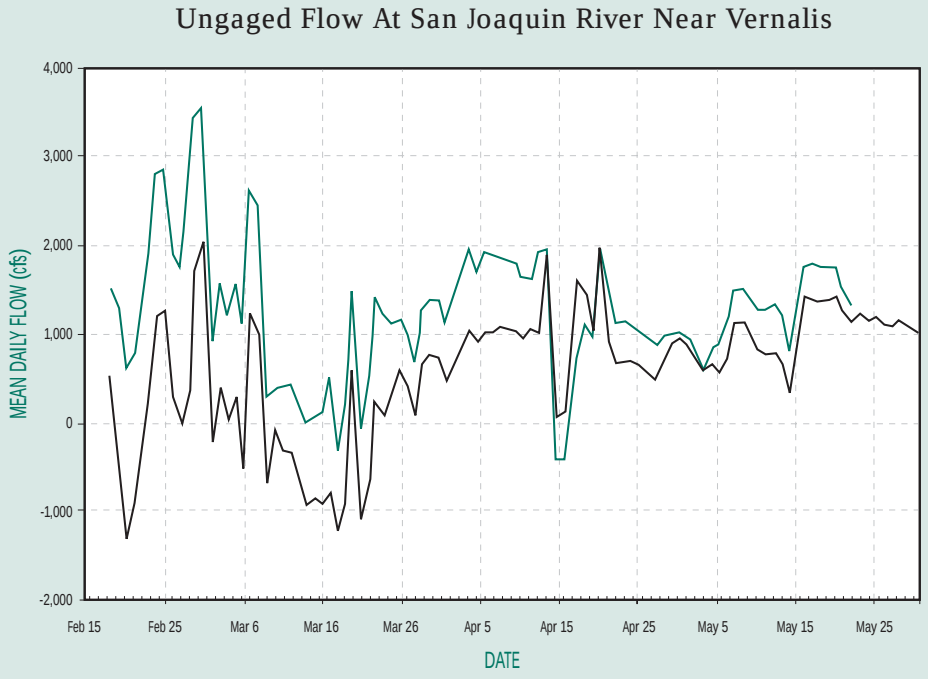
COMPARISON OF "REAL-TIME" AND PROVISIONAL FLOWS

Tuolumne River Near LaGrange

Stanislaus River At Blossom Ridge

COMPARISON OF "REAL-TIME" AND PROVISIONAL FLOWS





ACCOUNTING OF SUPPLEMENTAL WATER CONTRIBUTIONS

HYDROLOGY SUBGROUP OF THE SAN JOAQUIN RIVER TECHNICAL COMMITTEE · PULSE FLOW PERIOD: APRIL 15-MAY 15

	Merced R. at Cressey (3 day Travel Time to Vernalis)				Tuolumne R. blw LaGrange Dam (2 day Travel Time to Vernalis)				Stanislaus R. at Orange Blossom Br. (2 day Travel Time to Vernalis)				Exch. Contractors (3 day Travel Time)		San Joaquin R. at Vernalis			
Date	Existing Flow (cfs)	Observed Flow (cfs)	Supplemental Water (cfs)	(TAF)	Existing Flow (cfs)	Observed Flow (cfs)	Supplemental Water (cfs)	(TAF)	Existing Flow (cfs)	Observed Flow (cfs)	Supplementa Water (cfs)	(TAF)	Supplemental Water (cfs)	(TAF)	Existing Flow (cfs)	Observed Flow (cfs)	Supplemental Water (cfs)	(TAF)
Apr 01	342	342			1,580	1,580			1,500	800					5,050	5,050		
Apr 02	340	340			1,200	1,200			1,500	796					4,580	4,580		
Apr 03	342	342			1,110	1,110			1,500	791					4,200	4,200		
Apr 04	328	328			768	768			1,500	788					3,940	3,940		
Apr 05	322	322			626	626			1,500	796					3,700	3,700		
Apr 06	306	306			616	616			1,500	807					3,490	3,490		
Apr 07	297	297			575	575			1,500	820					3,340	3,340		
Apr 08	297	297			404	403			1,500	830					3,340	3,340		
Apr 09	288	288			390	387			1,500	835					3,260	3,260		
Apr 10	288	288			393	390			1,500	885					3,050	3,050		
Apr 11	284	284			391	388			1,500	1,080					2,960	2,960		
Apr 12	297	297	0	0.00	688	683			1,500	1,210			0	0.00	3,050	3,050		
Apr 13	303	303	0	0.00	2,300	3,780	1,480	2.94	1,500	1,290	0	0	0	0.00	3,180	3,180		
Apr 14	306	306	0	0.00	2,300	3,830	1,530	3.03	1,500	1,440	0	0	0	0.00	4,460	4,460		
Apr 15	310	310	0	0.00	2,300	3,800	1,500	2.98	1,500	1,120	0	0	0	0.00	4,480	5,750	1,480	2.94
Apr 16	323	323	0	0.00	2,300	3,670	1,370	2.72	1,500	1,120	0	0	0	0.00	4,500	5,970	1,530	3.03
Apr 17	377	377	0	0.00	2,300	3,580	1,280	2.54	1,500	1,130	0	0	0	0.00	5,230	6,350	1,500	2.98
Apr 18	250	556	306	0.61	2,300	3,290	990	1.96	1,500	1,090	0	0	100	0.20	6,070	7,060	1,370	2.72
Apr 19	250	1,780	1,530	3.03	2,300	2,360	60	0.12	1,500	800	0	0	199	0.39	6,010	6,920	1,280	2.54
Apr 20	250	1,910	1,660	3.29	1,100	1,380	280	0.56	1,500	1,190	0	0	200	0.40	5,710	6,290	990	1.96
Apr 21	250	1,870	1,620	3.21	800	1,040	240	0.48	1,500	1,500	0	0	200	0.40	6,524	6,290	466	0.92
Apr 22	250	1,830	1,580	3.13	800	1,110	310	0.61	1,490	1,490	0	0	236	0.47	4,620	6,320	2,009	3.98
Apr 23	250	1,780	1,530	3.03	800	1,120	320	0.63	1,490	1,490	0	0	251	0.50	4,210	6,310	2,100	4.17
Apr 24	250	1,750	1,500	2.98	800	1,110	310	0.61	1,490	1,490	0	0	245	0.49	4,170	6,300	2,130	4.22
Apr 25	250	1,660	1,410	2.80	800	1,120	320	0.63	1,520	1,520	0	0	236	0.47	4,020	6,120	2,136	4.24
Apr 26	250	1,600	1,350	2.68	800	1,120	320	0.63	1,510	1,510	0	0	138	0.27	3,910	5,950	2,091	4.15
Apr 27	250	1,570	1,320	2.62	1,300	1,250	0	0.00	1,510	1,510	0	0	0	0.00	3,810	5,830	2,065	4.10
Apr 28	250	1,590	1,340	2.66	1,300	1,370	70	0.14	1,510	1,510	0	0	0	0.00	3,700	5,630	1,966	3.90
Apr 29	250	1,640	1,390	2.76	1,300	1,350	50	0.10	1,510	1,510	0	0	0	0.00	4,360	5,760	1,488	2.95
Apr 30	250	1,660	1,410	2.80	1,300	1,320	20	0.04	1,520	1,520	0	0	0	0.00	4,400	5,790	1,390	2.76
May 01	250	1,570	1,320	2.62	1,300	1,320	20	0.04	1,510	1,510	0	0	0	0.00	4,380	5,770	1,390	2.76
May 02	250	857	607	1.20	1,300	1,410	110	0.22	1,510	1,510	0	0	129	0.26	4,260	5,670	1,410	2.80
May 03	250	744	494	0.98	2,200	2,210	10	0.02	1,520	1,520	0	0	178	0.35	4,090	5,520	1,430	2.84
May 04	250	611	361	0.72	2,200	2,330	130	0.26	1,520	1,520	0	0	249	0.49	4,030	5,460	1,430	2.84
May 05	250	582	332	0.66	2,200	2,330	130	0.26	1,520	1,520	0	0	234	0.46	4,943	5,660	746	1.48
May 06	250	586	336	0.67	2,200	2,330	130	0.26	1,530	1,530	0	0	231	0.46	4,796	5,620	802	1.59
May 07	250	646	396	0.79	2,200	2,290	90	0.18	1,540	1,540	0	0	266	0.53	5,029	5,720	740	1.47
May 08	250	678	428	0.85	2,200	2,220	20	0.04	1,540	1,540	0	0	273	0.54	5,388	6,050	696	1.38
May 09	250	629	379	0.75	2,200	2,230	30	0.06	1,540	1,540	0	0	247	0.49	5,384	6,010	657	1.30
May 10	250	648	398	0.79	2,200	2,220	20	0.04	1,550	1,550	0	0	241	0.48	5,264	5,880	682	1.35
May 11	250	821	571	1.13	1,900	2,040	140	0.28	1,540	1,540	0	0	202	0.40	5,212	5,870	731	1.45
May 12	1,362	971	0	0.00	1,800	1,940	140	0.28	1,550	1,550			119	0.24	5,201	5,800	646	1.28
May 13	1,716	522			1,800	1,770	0	0.00	1,540	1,540					4,832	5,670	779	1.55
May 14	1,930	406			1,550	1,330			1,550	1,550					4,709	5,620	913	1.81
May 15	1,833	399			800	785			1,560	1,560					5,551	5,230	119	0.24
May 16	1,398	409			300	527			1,570	1,570					4,870	4,870		
May 17	1,416	377			300	312			1,540	1,540					4,590	4,590		
May 18	1,600	382			300	307			1,540	1,540					4,280	4,280		
May 19	1,690	371			300	419			1,520	1,520					4,050	4,050		
May 20	1,702	338			300	570			1,500	1,500					4,020	4,020		
May 21	1,692	345			300	570			1,510	1,510					4,210	4,210		
May 22	635	354			300	566			1,490	1,490					4,190	4,190		
May 23	391	356			300	568			1,480	1,480					4,050	4,050		
May 24	250	346			300	570			1,480	1,480					4,110	4,110		
May 25	346	346			300	572			1,470	1,470					4,040	4,040		
May 26	326	326			300	543			1,460	1,460					4,020	4,020		
May 27	263	263			300	319			1,460	1,460					3,870	3,870		
May 28	250	248			300	323			1,450	1,450					3,770	3,770		
May 29	250	238			300	323			1,450	1,450					3,610	3,610		
May 30	250	231			300	322			1,430	1,430					3,480	3,480		
May 31	250	229			300	319			1,420	1,420					3,400	3,400		
Total Supplemental Water (TAF):				46.75				22.65				0.0		8.28				77.68
															Pulse period average:		4,815	5,869

Observed Flow Sources:
Merced River at Cressey (CA DWR B05155): DWR San Joaquin District, provisional data received 6/13/00
Tuolumne River below LaGrange Dam near LaGrange (USGS 11289650): USGS, provisional data dated 6/9/00
San Joaquin River near Vernalis (USGS 11303500): USGS, provisional data dated 6/9/00
Stanislaus River at Orange Blossom Bridge (CA DWR B03175): DWR San Joaquin District, provisional data received 6/13/00

APPENDIX B

FALL WATER TRANSFER AND DELIVERY INFORMATION

INITIAL DAILY SCHEDULE, OCTOBER 19

(OCTOBER 1–NOVEMBER 16) · SJRA AND FALL 2000 TRANSFER WATER SCHEDULE

	SJRA Transfer Water			Fall 2000 Transfer Water					
	Shaffer Br/Cressey Base Flow for SJRA Transfer Water	SJRA Transfer Water Schedule	SJRA Transfer Water	Shaffer Br/Cressey Base Flow for Fall 2000 Transfer Water [1] + [2]	Fall 2000 Transfer Water Schedule – RIVER	Shaffer Br/Cressey Target Flow [4] + [5]	Fall 2000 Transfer Water Schedule – BYPASS	Fall 2000 Transfer Water [5] + [7]	Fall 2000 Transfer Balance
	(cfs)	(cfs)	(acre-ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(acre-ft)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Oct 01	0	0	30	0	30	0	0	0	0
Oct 02	30	0	0	30	0	30	0	0	0
Oct 03	30	0	0	30	0	30	0	0	0
Oct 04	30	0	0	30	0	30	0	0	0
Oct 05	30	0	0	30	0	30	0	0	0
Oct 06	30	0	0	30	0	30	0	0	0
Oct 07	30	0	0	30	0	30	0	0	0
Oct 08	30	0	0	30	0	30	0	0	0
Oct 09	30	0	0	30	0	30	0	0	0
Oct 10	30	0	0	30	0	30	0	0	0
Oct 11	30	0	0	30	0	30	0	0	0
Oct 12	30	0	0	30	0	30	0	0	0
Oct 13	30	0	0	30	0	30	0	0	0
Oct 14	30	0	0	30	0	30	0	0	0
Oct 15	30	397	787	427	0	427	0	0	0
Oct 16	85	760	2,295	845	0	845	0	0	0
Oct 17	85	760	3,802	845	0	845	0	0	0
Oct 18	85	760	5,310	845	0	845	0	0	0
Oct 19	85	500	6,301	585	0	585	0	0	0
Oct 20	85	380	7,055	465	0	465	0	0	0
Oct 21	85	265	7,581	350	235	585	0	235	466
Oct 22	85	0	7,581	85	915	1,000	0	915	2,281
Oct 23	85	0	7,581	85	915	1,000	0	915	4,096
Oct 24	85	0	7,581	85	915	1,000	0	915	5,911
Oct 25	85	0	7,581	85	915	1,000	0	915	7,726
Oct 26	85	0	7,581	85	915	1,000	0	915	9,540
Oct 27	85	0	7,581	85	800	885	0	800	11,127
Oct 28	85	0	7,581	85	605	690	0	605	12,327
Oct 29	85	0	7,581	85	400	485	0	400	13,121
Oct 30	85	0	7,581	85	300	385	0	300	13,716
Oct 31	85	0	7,581	85	300	385	0	300	14,311
Nov 01	220	0	7,581	220	155	375	50	205	14,717
Nov 02	220	0	7,581	220	155	375	50	205	15,124
Nov 03	220	0	7,581	220	155	375	50	205	15,531
Nov 04	220	0	7,581	220	155	375	50	205	15,937
Nov 05	220	0	7,581	220	155	375	50	205	16,344
Nov 06	220	0	7,581	220	155	375	50	205	16,750
Nov 07	220	0	7,581	220	155	375	50	205	17,157
Nov 08	220	0	7,581	220	155	375	50	205	17,564
Nov 09	220	0	7,581	220	150	370	50	200	17,960
Nov 10	220	0	7,581	220	150	370	50	200	18,357
Nov 11	220	0	7,581	220	150	370	50	200	18,754
Nov 12	220	0	7,581	220	150	370	50	200	19,150
Nov 13	220	0	7,581	220	150	370	50	200	19,547
Nov 14	220	0	7,581	220	150	370	50	200	19,944
Nov 15	220	0	7,581	220	150	370	50	200	20,340
Nov 16	220	0	7,581	220	100	320	100	200	20,737

INITIAL DAILY SCHEDULE, OCTOBER 19

(NOVEMBER 17–DECEMBER 31) · SJRA AND FALL 2000 TRANSFER WATER SCHEDULE

	SJRA Transfer Water			Fall 2000 Transfer Water					
	Shaffer Br/Cressey Base Flow for SJRA Transfer Water	SJRA Transfer Water Schedule	SJRA Transfer Water	Shaffer Br/Cressey Base Flow for Fall 2000 Transfer Water [1] + [2]	Fall 2000 Transfer Water Schedule – RIVER	Shaffer Br/Cressey Target Flow [4] + [5]	Fall 2000 Transfer Water Schedule – BYPASS	Fall 2000 Transfer Water [5] + [7]	Fall 2000 Transfer Balance
	(cfs)	(cfs)	(acre-ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(acre-ft)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Nov 17	220	0	7,581	220	100	320	100	200	21,134
Nov 18	220	0	7,581	220	100	320	100	200	21,531
Nov 19	220	0	7,581	220	100	320	100	200	21,927
Nov 20	220	0	7,581	220	100	320	100	200	22,324
Nov 21	220	0	7,581	220	100	320	100	200	22,721
Nov 22	220	0	7,581	220	100	320	100	200	23,117
Nov 23	220	0	7,581	220	100	320	100	200	23,514
Nov 24	220	0	7,581	220	100	320	50	150	23,812
Nov 25	220	0	7,581	220	100	320	0	100	24,010
Nov 26	220	0	7,581	220	100	320	0	100	24,208
Nov 27	220	0	7,581	220	100	320	0	100	24,407
Nov 28	220	0	7,581	220	100	320	0	100	24,605
Nov 29	220	0	7,581	220	100	320	0	100	24,803
Nov 30	220	0	7,581	220	100	320	0	100	25,002
Dec 01	220	80	7,739	300	0	300	0	0	25,002
Dec 02	220	80	7,898	300	0	300	0	0	25,002
Dec 03	220	80	8,057	300	0	300	0	0	25,002
Dec 04	220	80	8,216	300	0	300	0	0	25,002
Dec 05	220	80	8,374	300	0	300	0	0	25,002
Dec 06	220	80	8,533	300	0	300	0	0	25,002
Dec 07	220	80	8,692	300	0	300	0	0	25,002
Dec 08	220	80	8,850	300	0	300	0	0	25,002
Dec 09	220	80	9,009	300	0	300	0	0	25,002
Dec 10	220	80	9,168	300	0	300	0	0	25,002
Dec 11	220	80	9,326	300	0	300	0	0	25,002
Dec 12	220	80	9,485	300	0	300	0	0	25,002
Dec 13	220	80	9,644	300	0	300	0	0	25,002
Dec 14	220	80	9,802	300	0	300	0	0	25,002
Dec 15	220	80	9,961	300	0	300	0	0	25,002
Dec 16	220	80	10,120	300	0	300	0	0	25,002
Dec 17	220	80	10,278	300	0	300	0	0	25,002
Dec 18	220	80	10,437	300	0	300	0	0	25,002
Dec 19	220	80	10,596	300	0	300	0	0	25,002
Dec 20	220	80	10,754	300	0	300	0	0	25,002
Dec 21	220	80	10,913	300	0	300	0	0	25,002
Dec 22	220	80	11,072	300	0	300	0	0	25,002
Dec 23	220	80	11,230	300	0	300	0	0	25,002
Dec 24	220	80	11,389	300	0	300	0	0	25,002
Dec 25	220	80	11,548	300	0	300	0	0	25,002
Dec 26	220	80	11,706	300	0	300	0	0	25,002
Dec 27	220	80	11,865	300	0	300	0	0	25,002
Dec 28	220	80	12,024	300	0	300	0	0	25,002
Dec 29	220	80	12,182	300	0	300	0	0	25,002
Dec 30	220	80	12,341	300	0	300	0	0	25,002
Dec 31	220	80	12,500	300	0	300	0	0	25,002

	Oct	Nov	Dec	Total
SJRA Transfer Water (TAF):	7.58	0.00	4.92	12.50
Fall 2000 Transfer Water (TAF):	14.31	10.69	0	25.00

REVISED SCHEDULE #1, OCTOBER 31

(OCTOBER 1–NOVEMBER 16) · SJRA AND FALL 2000 TRANSFER WATER SCHEDULE

	SJRA Transfer Water			Fall 2000 Transfer Water					
	Shaffer Br/Cressey Base Flow for SJRA Transfer Water	SJRA Transfer Water Schedule	SJRA Transfer Water	Shaffer Br/Cressey Base Flow for Fall 2000 Transfer Water [1] + [2]	Fall 2000 Transfer Water Schedule – RIVER	Shaffer Br/Cressey Target Flow [4] + [5]	Fall 2000 Transfer Water Schedule – BYPASS	Fall 2000 Transfer Water [5] + [7]	Fall 2000 Transfer Balance
	(cfs)	(cfs)	(acre-ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(acre-ft)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Oct 01	30	0	0	30	0	30	0	0	0
Oct 02	30	0	0	30	0	30	0	0	0
Oct 03	30	0	0	30	0	30	0	0	0
Oct 04	30	0	0	30	0	30	0	0	0
Oct 05	30	0	0	30	0	30	0	0	0
Oct 06	30	0	0	30	0	30	0	0	0
Oct 07	30	0	0	30	0	30	0	0	0
Oct 08	30	0	0	30	0	30	0	0	0
Oct 09	30	0	0	30	0	30	0	0	0
Oct 10	30	0	0	30	0	30	0	0	0
Oct 11	30	0	0	30	0	30	0	0	0
Oct 12	30	0	0	30	0	30	0	0	0
Oct 13	30	0	0	30	0	30	0	0	0
Oct 14	30	0	0	30	0	30	0	0	0
Oct 15	30	397	787	427	0	427	0	0	0
Oct 16	85	760	2,295	845	0	845	0	0	0
Oct 17	85	760	3,802	845	0	845	0	0	0
Oct 18	85	760	5,310	845	0	845	0	0	0
Oct 19	85	500	6,301	585	0	585	0	0	0
Oct 20	85	380	7,055	465	0	465	0	0	0
Oct 21	85	265	7,581	350	235	585	0	235	466
Oct 22	85	0	7,581	85	915	1,000	0	915	2,281
Oct 23	85	0	7,581	85	915	1,000	0	915	4,096
Oct 24	85	0	7,581	85	915	1,000	0	915	5,911
Oct 25	85	0	7,581	85	915	1,000	0	915	7,726
Oct 26	85	0	7,581	85	915	1,000	0	915	9,540
Oct 27	85	0	7,581	85	800	885	0	800	11,127
Oct 28	85	0	7,581	85	605	690	0	605	12,327
Oct 29	85	0	7,581	85	400	485	0	400	13,121
Oct 30	85	300	8,176	385	0	385	0	0	13,121
Oct 31	85	300	8,771	385	0	385	0	0	13,121
Nov 01	220	155	9,078	375	0	375	0	0	13,121
Nov 02	220	125	9,326	345	0	345	0	0	13,121
Nov 03	220	100	9,525	320	0	320	0	0	13,121
Nov 04	220	75	9,673	295	0	295	0	0	13,121
Nov 05	220	75	9,822	295	0	295	0	0	13,121
Nov 06	220	75	9,971	295	0	295	0	0	13,121
Nov 07	220	75	10,120	295	0	295	0	0	13,121
Nov 08	220	75	10,268	295	0	295	0	0	13,121
Nov 09	220	75	10,417	295	0	295	0	0	13,121
Nov 10	220	75	10,566	295	0	295	0	0	13,121
Nov 11	220	75	10,715	295	0	295	0	0	13,121
Nov 12	220	75	10,863	295	0	295	0	0	13,121
Nov 13	220	75	11,012	295	0	295	0	0	13,121
Nov 14	220	75	11,161	295	0	295	0	0	13,121
Nov 15	220	75	11,310	295	0	295	0	0	13,121
Nov 16	220	40	11,389	260	0	260	0	0	13,121

REVISED SCHEDULE #1, OCTOBER 31
(NOVEMBER 17–DECEMBER 31) · SJRA AND FALL 2000 TRANSFER WATER SCHEDULE

	SJRA Transfer Water			Fall 2000 Transfer Water					
	Shaffer Br/Cressey Base Flow for SJRA Transfer Water	SJRA Transfer Water Schedule	SJRA Transfer Water	Shaffer Br/Cressey Base Flow for Fall 2000 Transfer Water [1] + [2]	Fall 2000 Transfer Water Schedule – RIVER	Shaffer Br/Cressey Target Flow [4] + [5]	Fall 2000 Transfer Water Schedule – BYPASS	Fall 2000 Transfer Water [5] + [7]	Fall 2000 Transfer Balance
	(cfs)	(cfs)	(acre-ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(acre-ft)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Nov 17	220	40	11,468	260	0	260	0	0	13,121
Nov 18	220	40	11,548	260	0	260	0	0	13,121
Nov 19	220	40	11,627	260	0	260	0	0	13,121
Nov 20	220	40	11,706	260	0	260	0	0	13,121
Nov 21	220	40	11,786	260	0	260	0	0	13,121
Nov 22	220	40	11,865	260	0	260	0	0	13,121
Nov 23	220	40	11,944	260	0	260	0	0	13,121
Nov 24	220	40	12,024	260	0	260	0	0	13,121
Nov 25	220	40	12,103	260	0	260	0	0	13,121
Nov 26	220	40	12,182	260	0	260	0	0	13,121
Nov 27	220	40	12,262	260	0	260	0	0	13,121
Nov 28	220	40	12,341	260	0	260	0	0	13,121
Nov 29	220	40	12,420	260	0	260	0	0	13,121
Nov 30	220	40	12,500	260	0	260	0	0	13,121
Dec 01	220	0	12,500	220	0	220	0	0	13,121
Dec 02	220	0	12,500	220	0	220	0	0	13,121
Dec 03	220	0	12,500	220	0	220	0	0	13,121
Dec 04	220	0	12,500	220	0	220	0	0	13,121
Dec 05	220	0	12,500	220	0	220	0	0	13,121
Dec 06	220	0	12,500	220	0	220	0	0	13,121
Dec 07	220	0	12,500	220	0	220	0	0	13,121
Dec 08	220	0	12,500	220	0	220	0	0	13,121
Dec 09	220	0	12,500	220	0	220	0	0	13,121
Dec 10	220	0	12,500	220	0	220	0	0	13,121
Dec 11	220	0	12,500	220	0	220	0	0	13,121
Dec 12	220	0	12,500	220	0	220	0	0	13,121
Dec 13	220	0	12,500	220	0	220	0	0	13,121
Dec 14	220	0	12,500	220	0	220	0	0	13,121
Dec 15	220	0	12,500	220	0	220	0	0	13,121
Dec 16	220	0	12,500	220	0	220	0	0	13,121
Dec 17	220	0	12,500	220	0	220	0	0	13,121
Dec 18	220	0	12,500	220	0	220	0	0	13,121
Dec 19	220	0	12,500	220	0	220	0	0	13,121
Dec 20	220	0	12,500	220	0	220	0	0	13,121
Dec 21	220	0	12,500	220	0	220	0	0	13,121
Dec 22	220	0	12,500	220	0	220	0	0	13,121
Dec 23	220	0	12,500	220	0	220	0	0	13,121
Dec 24	220	0	12,500	220	0	220	0	0	13,121
Dec 25	220	0	12,500	220	0	220	0	0	13,121
Dec 26	220	0	12,500	220	0	220	0	0	13,121
Dec 27	220	0	12,500	220	0	220	0	0	13,121
Dec 28	220	0	12,500	220	0	220	0	0	13,121
Dec 29	220	0	12,500	220	0	220	0	0	13,121
Dec 30	220	0	12,500	220	0	220	0	0	13,121
Dec 31	220	0	12,500	220	0	220	0	0	13,121

	Oct	Nov	Dec	Total
SJRA Transfer Water (TAF):	7.58	0.00	4.92	12.50
Fall 2000 Transfer Water (TAF):	14.31	10.69	0	25.00

REVISED SCHEDULE #2, NOVEMBER 3

(OCTOBER 1–NOVEMBER 16) · SJRA AND FALL 2000 TRANSFER WATER SCHEDULE

	SJRA Transfer Water			Fall 2000 Transfer Water					
	Shaffer Br/Cressey Base Flow for SJRA Transfer Water	SJRA Transfer Water Schedule	SJRA Transfer Water	Shaffer Br/Cressey Base Flow for Fall 2000 Transfer Water [1] + [2]	Fall 2000 Transfer Water Schedule – RIVER	Shaffer Br/Cressey Target Flow [4] + [5]	Fall 2000 Transfer Water Schedule – BYPASS	Fall 2000 Transfer Water [5] + [7]	Fall 2000 Transfer Balance
	(cfs)	(cfs)	(acre-ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(acre-ft)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Oct 01	30	0	0	30	0	30	0	0	0
Oct 02	30	0	0	30	0	30	0	0	0
Oct 03	30	0	0	30	0	30	0	0	0
Oct 04	30	0	0	30	0	30	0	0	0
Oct 05	30	0	0	30	0	30	0	0	0
Oct 06	30	0	0	30	0	30	0	0	0
Oct 07	30	0	0	30	0	30	0	0	0
Oct 08	30	0	0	30	0	30	0	0	0
Oct 09	30	0	0	30	0	30	0	0	0
Oct 10	30	0	0	30	0	30	0	0	0
Oct 11	30	0	0	30	0	30	0	0	0
Oct 12	30	0	0	30	0	30	0	0	0
Oct 13	30	0	0	30	0	30	0	0	0
Oct 14	30	0	0	30	0	30	0	0	0
Oct 15	30	397	787	427	0	427	0	0	0
Oct 16	85	760	2,295	845	0	845	0	0	0
Oct 17	85	760	3,802	845	0	845	0	0	0
Oct 18	85	760	5,310	845	0	845	0	0	0
Oct 19	85	500	6,301	585	0	585	0	0	0
Oct 20	85	380	7,055	465	0	465	0	0	0
Oct 21	85	265	7,581	350	235	585	0	235	466
Oct 22	85	0	7,581	85	915	1,000	0	915	2,281
Oct 23	85	0	7,581	85	915	1,000	0	915	4,096
Oct 24	85	0	7,581	85	915	1,000	0	915	5,911
Oct 25	85	0	7,581	85	915	1,000	0	915	7,726
Oct 26	85	0	7,581	85	915	1,000	0	915	9,540
Oct 27	85	0	7,581	85	800	885	0	800	11,127
Oct 28	85	0	7,581	85	605	690	0	605	12,327
Oct 29	85	0	7,581	85	400	485	0	400	13,121
Oct 30	85	300	8,176	385	0	385	0	0	13,121
Oct 31	85	300	8,771	385	0	385	0	0	13,121
Nov 01	220	155	9,078	375	0	375	0	0	13,121
Nov 02	220	125	9,326	345	0	345	0	0	13,121
Nov 03	220	100	9,525	320	0	320	0	0	13,121
Nov 04	220	0	9,525	220	125	345	0	125	13,369
Nov 05	220	0	9,525	220	125	345	0	125	13,617
Nov 06	220	0	9,525	220	125	345	100	225	14,063
Nov 07	220	0	9,525	220	125	345	100	225	14,509
Nov 08	220	0	9,525	220	125	345	100	225	14,955
Nov 09	220	0	9,525	220	125	345	100	225	15,402
Nov 10	220	0	9,525	220	125	345	100	225	15,848
Nov 11	220	0	9,525	220	125	345	100	225	16,294
Nov 12	220	0	9,525	220	125	345	100	225	16,740
Nov 13	220	0	9,525	220	125	345	100	225	17,187
Nov 14	220	0	9,525	220	125	345	100	225	17,633
Nov 15	220	0	9,525	220	125	345	100	225	18,079
Nov 16	220	0	9,525	220	125	345	100	225	18,526

REVISED SCHEDULE #2, NOVEMBER 3

(NOVEMBER 17–DECEMBER 31) · SJRA AND FALL 2000 TRANSFER WATER SCHEDULE

	SJRA Transfer Water			Fall 2000 Transfer Water					
	Shaffer Br/Cressey Base Flow for SJRA Transfer Water	SJRA Transfer Water Schedule	SJRA Transfer Water	Shaffer Br/Cressey Base Flow for Fall 2000 Transfer Water [1] + [2]	Fall 2000 Transfer Water Schedule – RIVER	Shaffer Br/Cressey Target Flow [4] + [5]	Fall 2000 Transfer Water Schedule – BYPASS	Fall 2000 Transfer Water [5] + [7]	Fall 2000 Transfer Balance
	(cfs)	(cfs)	(acre-ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(acre-ft)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Nov 17	220	0	9,525	220	125	345	100	225	18,972
Nov 18	220	0	9,525	220	125	345	100	225	19,418
Nov 19	220	0	9,525	220	125	345	100	225	19,864
Nov 20	220	0	9,525	220	125	345	100	225	20,311
Nov 21	220	0	9,525	220	125	345	100	225	20,757
Nov 22	220	0	9,525	220	125	345	100	225	21,203
Nov 23	220	0	9,525	220	125	345	100	225	21,650
Nov 24	220	0	9,525	220	125	345	100	225	22,096
Nov 25	220	0	9,525	220	125	345	100	225	22,542
Nov 26	220	0	9,525	220	125	345	100	225	22,988
Nov 27	220	0	9,525	220	125	345	100	225	23,435
Nov 28	220	0	9,525	220	125	345	100	225	23,881
Nov 29	220	0	9,525	220	125	345	100	225	24,327
Nov 30	220	0	9,525	220	125	345	100	225	24,774
Dec 01	220	50	9,624	270	0	270	0	0	24,774
Dec 02	220	50	9,723	270	0	270	0	0	24,774
Dec 03	220	50	9,822	270	0	270	0	0	24,774
Dec 04	220	50	9,921	270	0	270	0	0	24,774
Dec 05	220	50	10,020	270	0	270	0	0	24,774
Dec 06	220	50	10,120	270	0	270	0	0	24,774
Dec 07	220	50	10,219	270	0	270	0	0	24,774
Dec 08	220	50	10,318	270	0	270	0	0	24,774
Dec 09	220	50	10,417	270	0	270	0	0	24,774
Dec 10	220	50	10,516	270	0	270	0	0	24,774
Dec 11	220	50	10,616	270	0	270	0	0	24,774
Dec 12	220	50	10,715	270	0	270	0	0	24,774
Dec 13	220	50	10,814	270	0	270	0	0	24,774
Dec 14	220	50	10,913	270	0	270	0	0	24,774
Dec 15	220	50	11,012	270	0	270	0	0	24,774
Dec 16	220	50	11,111	270	0	270	0	0	24,774
Dec 17	220	50	11,211	270	0	270	0	0	24,774
Dec 18	220	50	11,310	270	0	270	0	0	24,774
Dec 19	220	50	11,409	270	0	270	0	0	24,774
Dec 20	220	50	11,508	270	0	270	0	0	24,774
Dec 21	220	50	11,607	270	0	270	0	0	24,774
Dec 22	220	50	11,706	270	0	270	0	0	24,774
Dec 23	220	50	11,806	270	0	270	0	0	24,774
Dec 24	220	50	11,905	270	0	270	0	0	24,774
Dec 25	220	50	12,004	270	0	270	0	0	24,774
Dec 26	220	50	12,103	270	0	270	0	0	24,774
Dec 27	220	50	12,202	270	0	270	0	0	24,774
Dec 28	220	50	12,301	270	0	270	0	0	24,774
Dec 29	220	50	12,401	270	0	270	0	0	24,774
Dec 30	220	25	12,450	245	0	245	0	0	24,774
Dec 31	220	25	12,500	245	0	245	0	0	24,774

	Oct	Nov	Dec	Total
SJRA Transfer Water (TAF):	7.58	0.00	4.92	12.50
Fall 2000 Transfer Water (TAF):	14.31	10.69	0	25.00

SJRA AND FALL 2000 WATER TRANSFER MONITORING (THROUGH DECEMBER 20)

(OCTOBER 1–NOVEMBER 16) · TRANSFER SCHEDULE REVISED NOVEMBER 3

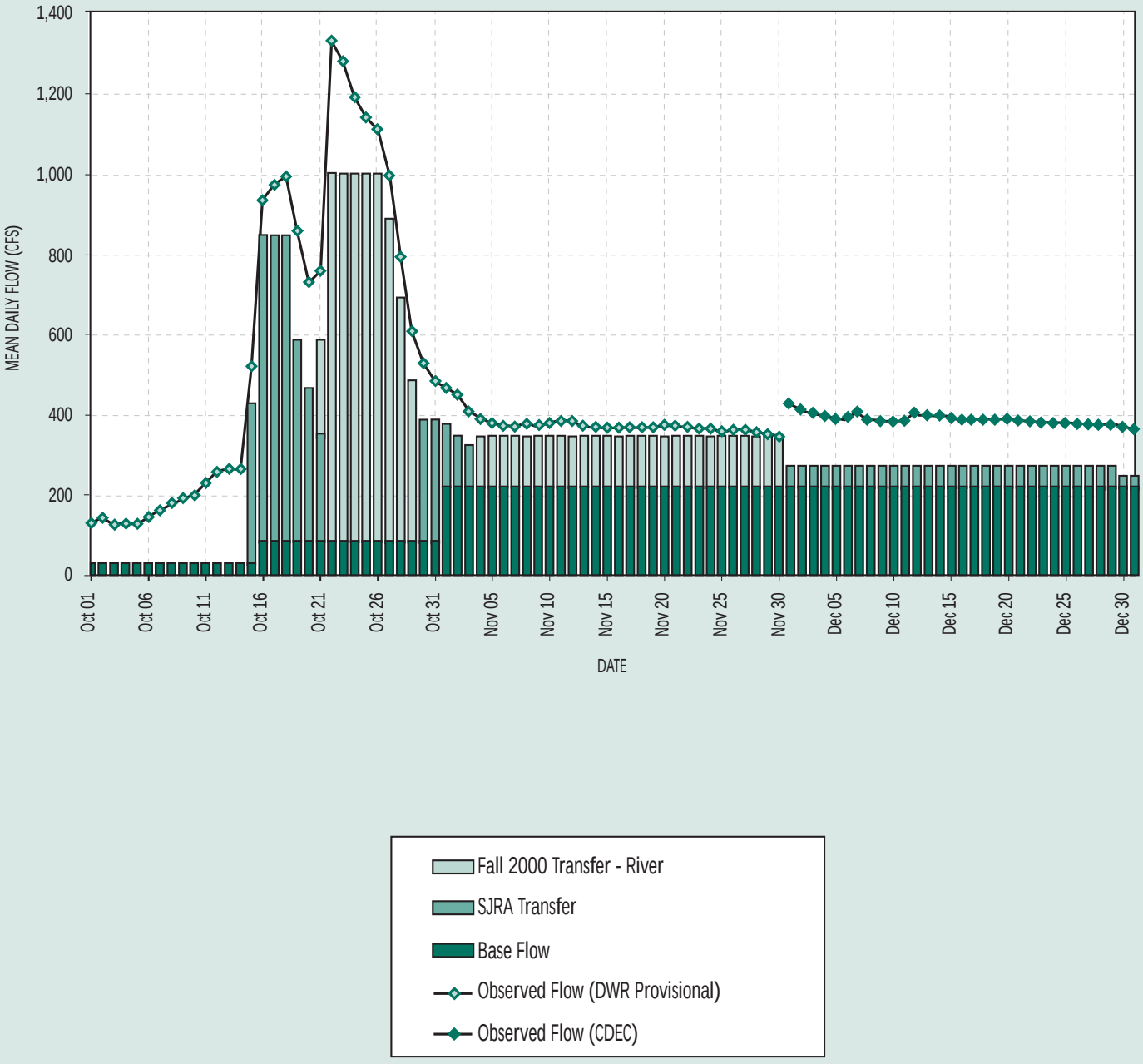
			SJRA Transfer Water			Fall 2000 Transfer Water					
	Shaffer Br/Cressey Base FLow for SJRA Transfer Water	Observed Flow at Cressey	Scheduled SJRA Transfer Water	Observed SJRA Transfer Water	SJRA Transfer Water Cumulative Volume	Scheduled Fall 2000 Transfer Water	Observed Fall 2000 Transfer Water	Scheduled Fall 2000 Transfer Water	Observed Livingston Spill	Observed Fall 2000 Transfer Water	Fall 2000 Transfer Balance
		DWR/CDEC				RIVER		BYPASS			
	cfs	cfs	cfs	cfs	ac-ft	cfs	cfs	cfs	cfs	cfs	acre-ft
Oct 01	30	132	0	0	0	0	0	0		0	0
Oct 02	30	145	0	0	0	0	0	0		0	0
Oct 03	30	130	0	0	0	0	0	0		0	0
Oct 04	30	132	0	0	0	0	0	0		0	0
Oct 05	30	131	0	0	0	0	0	0		0	0
Oct 06	30	149	0	0	0	0	0	0		0	0
Oct 07	30	165	0	0	0	0	0	0		0	0
Oct 08	30	182	0	0	0	0	0	0		0	0
Oct 09	30	195	0	0	0	0	0	0		0	0
Oct 10	30	201	0	0	0	0	0	0		0	0
Oct 11	30	232	0	0	0	0	0	0		0	0
Oct 12	30	257	0	0	0	0	0	0		0	0
Oct 13	30	267	0	0	0	0	0	0		0	0
Oct 14	30	266	0	0	0	0	0	0		0	0
Oct 15	30	521	397	397	787	0	0	0		0	0
Oct 16	85	934	760	760	2,295	0	0	0		0	0
Oct 17	85	972	760	760	3,802	0	0	0		0	0
Oct 18	85	993	760	760	5,310	0	0	0		0	0
Oct 19	85	859	500	500	6,301	0	0	0		0	0
Oct 20	85	731	380	380	7,055	0	0	0		0	0
Oct 21	85	759	265	265	7,581	235	235	0		0	466
Oct 22	85	1,330	0	0	7,581	915	915	0		0	2,281
Oct 23	85	1,280	0	0	7,581	915	915	0		0	4,096
Oct 24	85	1,190	0	0	7,581	915	915	0		0	5,911
Oct 25	85	1,140	0	0	7,581	915	915	0		0	7,726
Oct 26	85	1,110	0	0	7,581	915	915	0		0	9,540
Oct 27	85	995	0	0	7,581	800	800	0		0	11,127
Oct 28	85	793	0	0	7,581	605	605	0		0	12,327
Oct 29	85	609	0	0	7,581	400	400	0		0	13,121
Oct 30	85	529	300	300	8,176	0	0	0		0	13,121
Oct 31	85	485	300	300	8,771	0	0	0		0	13,121
Nov 01	220	462	155	155	9,078	0	0	0	51	0	13,121
Nov 02	220	451	125	125	9,326	0	0	0	34	0	13,121
Nov 03	220	408	100	100	9,525	0	0	0	10	0	13,121
Nov 04	220	393	0	0	9,525	125	125	0	6	0	13,369
Nov 05	220	383	0	0	9,525	125	125	0	73	0	13,617
Nov 06	220	379	0	0	9,525	125	125	100	94	94	14,051
Nov 07	220	376	0	0	9,525	125	125	100	123	100	14,497
Nov 08	220	382	0	0	9,525	125	125	100	122	100	14,943
Nov 09	220	383	0	0	9,525	125	125	100	115	100	15,390
Nov 10	220	385	0	0	9,525	125	125	100	113	100	15,836
Nov 11	220	392	0	0	9,525	125	125	100	114	100	16,282
Nov 12	220	394	0	0	9,525	125	125	100	113	100	16,729
Nov 13	220	380	0	0	9,525	125	125	100	111	100	17,175
Nov 14	220	368	0	0	9,525	125	125	100	111	100	17,621
Nov 15	220	363	0	0	9,525	125	125	100	110	100	18,067
Nov 16	220	363	0	0	9,525	125	125	100	111	100	18,514

SJRA AND FALL 2000 WATER TRANSFER MONITORING (THROUGH DECEMBER 20)

(NOVEMBER 17–DECEMBER 31) · TRANSFER SCHEDULE REVISED NOVEMBER 3

			SJRA Transfer Water			Fall 2000 Transfer Water					
	Shaffer Br/Cressey Base Flow for SJRA Transfer Water	Observed Flow at Cressey	Scheduled SJRA Transfer Water	Observed SJRA Transfer Water	SJRA Transfer Water Cumulative Volume	Scheduled Fall 2000 Transfer Water	Observed Fall 2000 Transfer Water	Scheduled Fall 2000 Transfer Water	Observed Livingston Spill	Observed Fall 2000 Transfer Water	Fall 2000 Transfer Balance
		DWR/CDEC				RIVER		BYPASS			
	cfs	cfs	cfs	cfs	ac-ft	cfs	cfs	cfs	cfs	cfs	acre-ft
Nov 17	220	363	0	0	9,525	125	125	100	112	100	18,960
Nov 18	220	360	0	0	9,525	125	125	100	110	100	19,406
Nov 19	220	360	0	0	9,525	125	125	100	111	100	19,853
Nov 20	220	365	0	0	9,525	125	125	100	111	100	20,299
Nov 21	220	363	0	0	9,525	125	125	100	111	100	20,745
Nov 22	220	360	0	0	9,525	125	125	100	111	100	21,191
Nov 23	220	363	0	0	9,525	125	125	100	111	100	21,638
Nov 24	220	362	0	0	9,525	125	125	100	111	100	22,084
Nov 25	220	354	0	0	9,525	125	125	100	113	100	22,530
Nov 26	220	358	0	0	9,525	125	125	100	114	100	22,977
Nov 27	220	356	0	0	9,525	125	125	100	111	100	23,423
Nov 28	220	349	0	0	9,525	125	125	100	111	100	23,869
Nov 29	220	346	0	0	9,525	125	125	100	112	100	24,315
Nov 30	220	338	0	0	9,525	125	118	100	112	100	24,748
Dec 01	220	416	50	50	9,624						
Dec 02	220	400	50	50	9,723						
Dec 03	220	393	50	50	9,822						
Dec 04	220	389	50	50	9,921						
Dec 05	220	382	50	50	10,020						
Dec 06	220	383	50	50	10,120						
Dec 07	220	408	50	50	10,219						
Dec 08	220	394	50	50	10,318						
Dec 09	220	387	50	50	10,417						
Dec 10	220	380	50	50	10,516						
Dec 11	220	381	50	50	10,616						
Dec 12	220	400	50	50	10,715						
Dec 13	220	393	50	50	10,814						
Dec 14	220	398	50	50	10,913						
Dec 15	220	390	50	50	11,012						
Dec 16	220	382	50	50	11,111						
Dec 17	220	380	50	50	11,211						
Dec 18	220	380	50	50	11,310						
Dec 19	220	381	50	50	11,409						
Dec 20	220	377	50	50	11,508						
Dec 21	220	372	50								
Dec 22	220	371	50								
Dec 23	220	370	50								
Dec 24	220	370	50								
Dec 25	220	370	50								
Dec 26	220	367	50								
Dec 27	220	369	50								
Dec 28	220	369	50								
Dec 29	220	370	50								
Dec 30	220	359	25								
Dec 31	220	351	25								

SJRA AND FALL 2000
WATER TRANSFER MONITORING (THROUGH NOVEMBER 30)
MERCED RIVER AT CRESSEY



APPENDIX C

CHINOOK SALMON SURVIVAL INVESTIGATIONS

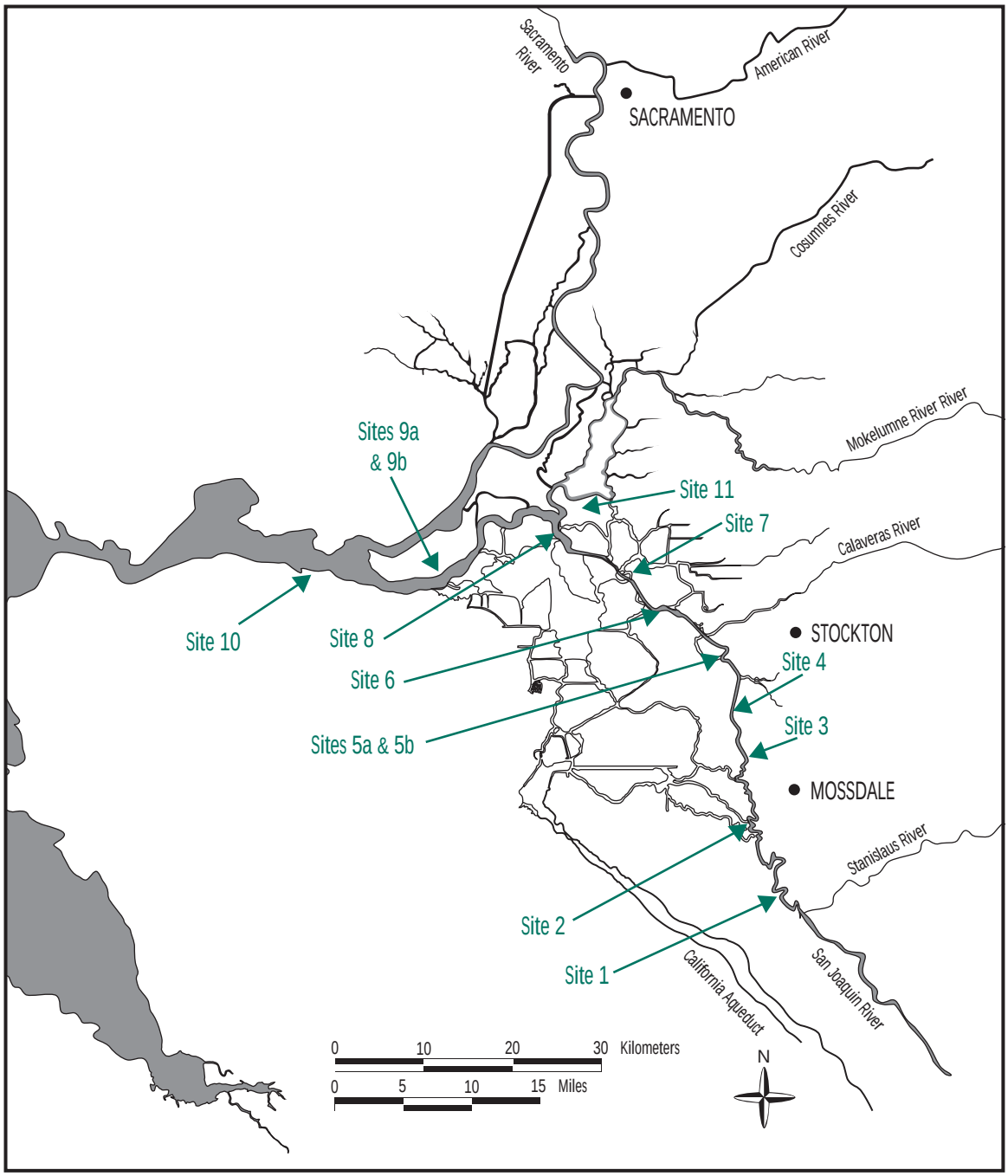


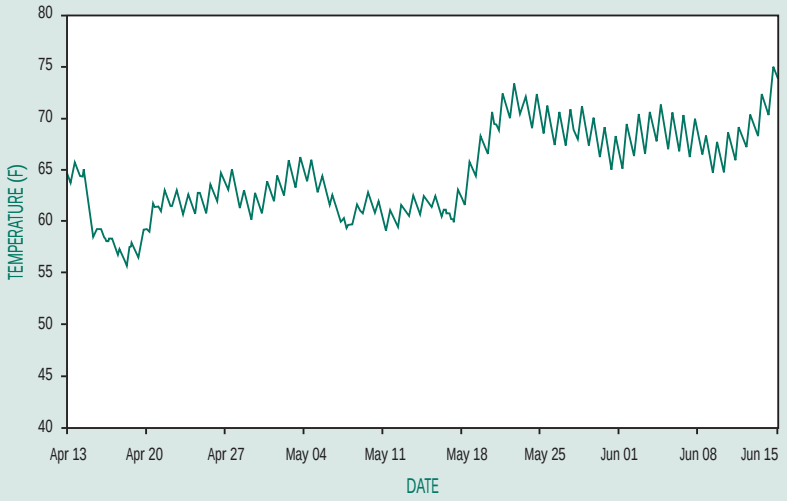
Figure C-1. Water temperature monitoring locations during the VAMP 2000 experiment.

VAMP 2000 WATER TEMPERATURE MONITORING

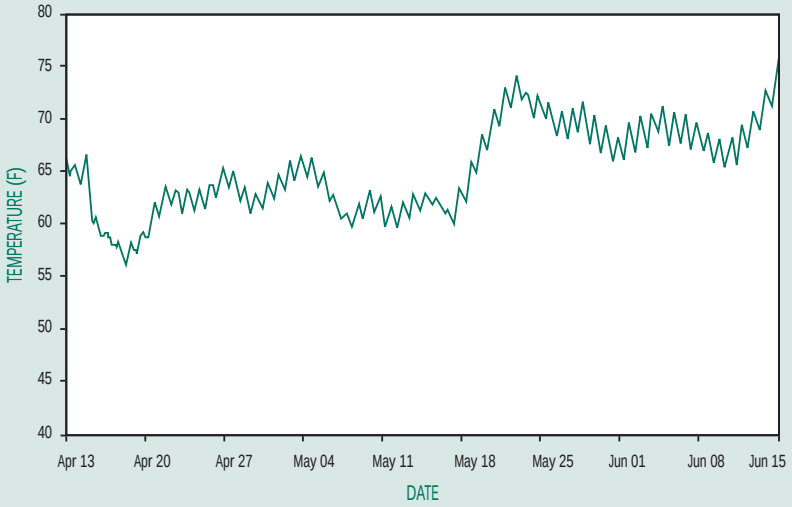
Site no.	Monitoring Location	Latitude	Longitude	Distance from Durham Ferry (mi)	Date Deployed	Date Retrieved	Notes
	Mokelumne River Hatchery			n/a	March 18	April 23	In river Apr 21
	Merced River Hatchery			n/a	March 25	April 19	In river Apr 17
1	Durham Ferry	N 37 41.381	W 121 15657	n/a	April 12	June 22	In 3' of water, casing was filled with mud
2	Mossdale	N 37 47.180	W 121 18.425	11.2	April 12	August 5	Recorder dewatered
3	Dos Reis	N 37 49.808	W 121 18.665	16.4	April 12		Recorder lost
4	DWR Monitoring Station	N 37 51.869	W 121 19.376	19.4	April 12	August 5	In 2½' of water
5a	Confluence – Top	N 37 56.818	W 121 20.285	26.5	April 12	August 5	In 2' of water
5b	Confluence – Bottom	N 37 56.818	W 121 20.285	26.5	April 12	August 5	On bottom in 4½' of water in mud
6	Downstream of Channel Marker 30	N 37 59.611	W 121 25.805	33.3	April 12	August 5	In 3' of water
7	½ mile Upstream of Channel Marker 13	N 38 01.940	W 121 28.769	37.3	April 12	August 5	Retrieved
8	Downstream of Channel Marker 36	N 38 04.522	W 121 34.413	44.7	April 12	August 5	In 4' of water
9a	Jersey Point USGS Gauging Station - top	N 38 03.172	W121 41.637	56.0	April 12	August 5	Retrieved, recorder not operating-data lost
9b	Jersey Point USGS Gauging Station – bottom	N 38 03.172	W121 41.637	56.0	April 12		Recorder lost – stuck & unable to dislodge
10	Chipps Island	N 38 03.084	W 121 55.463	71.5	April 17	September 16	
11	Lighthouse Restaurant Pier	N 38 06.332	W 121 34.209	47.0	April 12	August 5	Under pier in 3' of water

WATER TEMPERATURE MONITORING

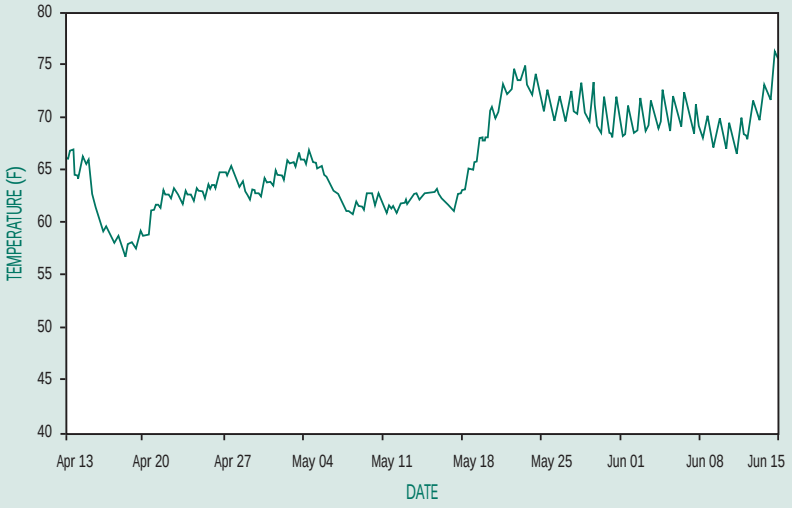
Station 1 · Durham Ferry



Station 2 · Mossdale

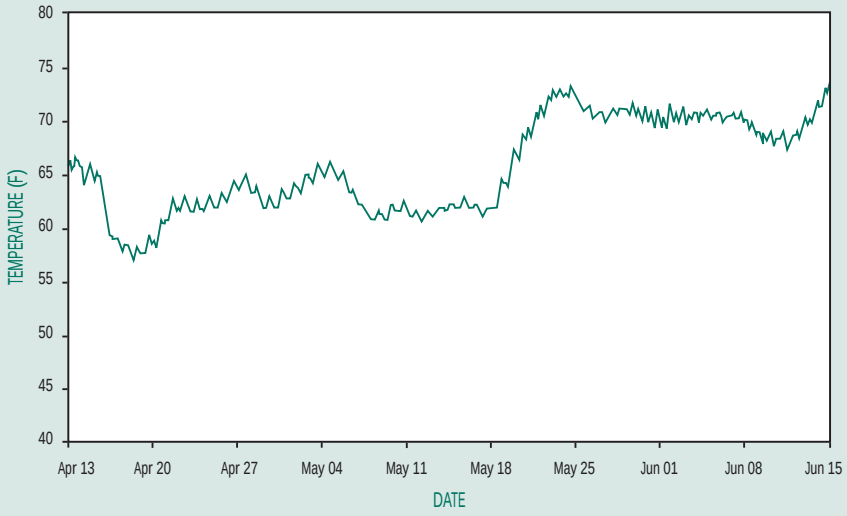


Station 4 · DWR Gauge

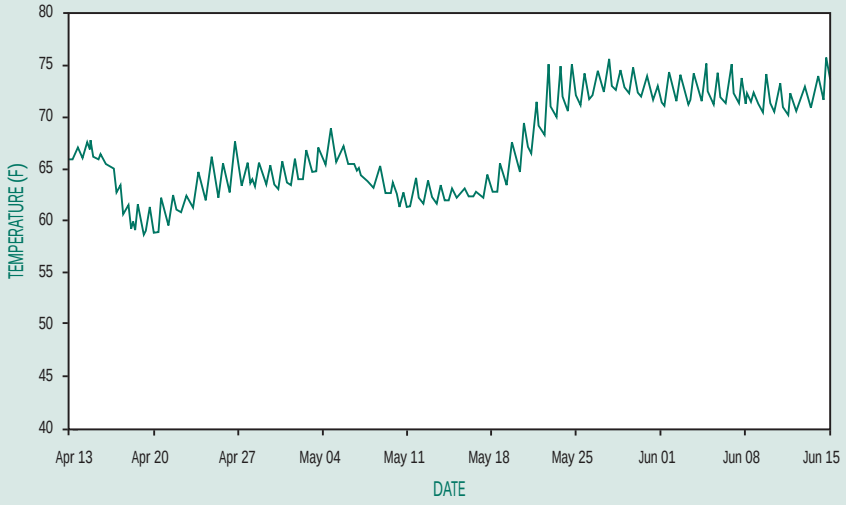


WATER TEMPERATURE MONITORING

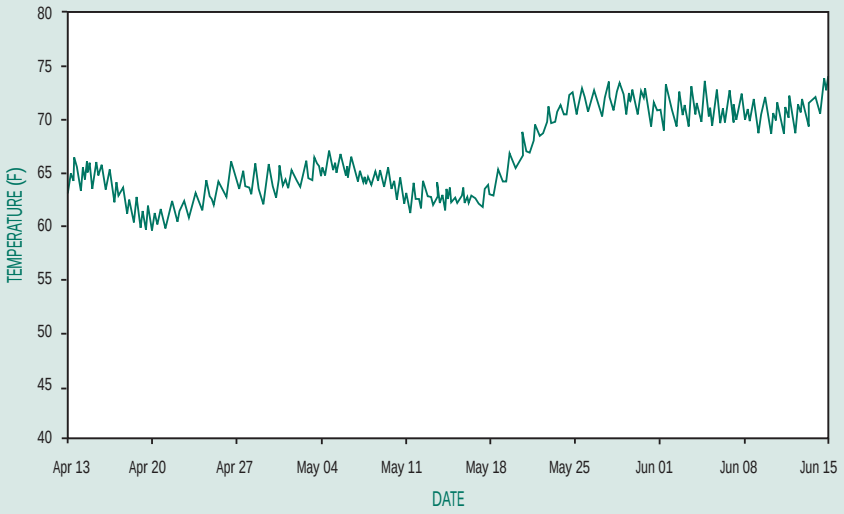
Station 5b · Bottom of Confluence



Station 6 · Downstream of Marker 30

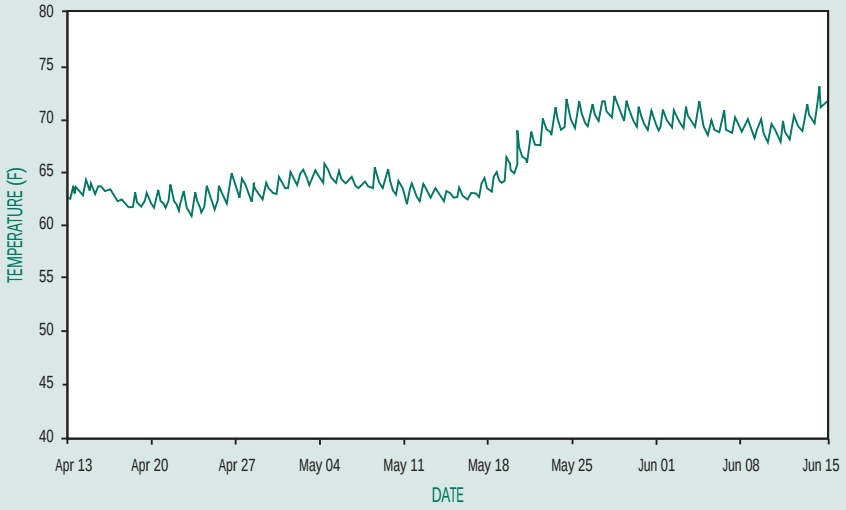


Station 7 · Upstream of Marker 13

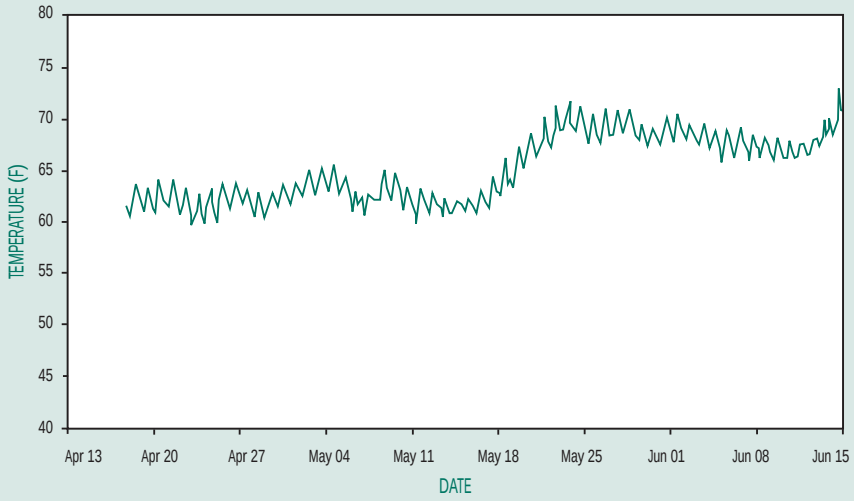


WATER TEMPERATURE MONITORING

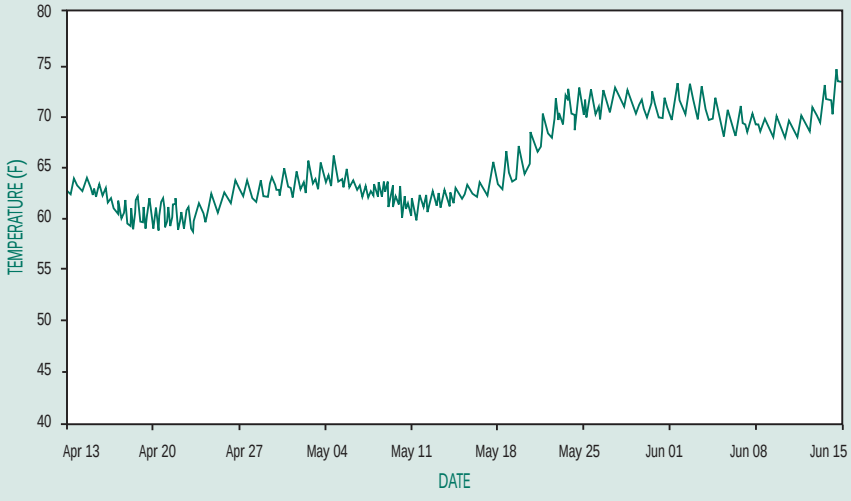
Station 8 · Downstream of Channel Marker 36



Station 10 · Chipps Island

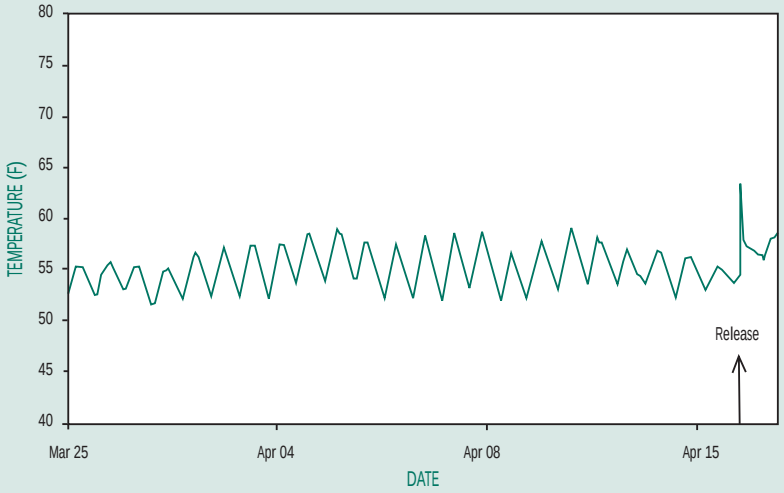


Station 11 · Mokelumne River

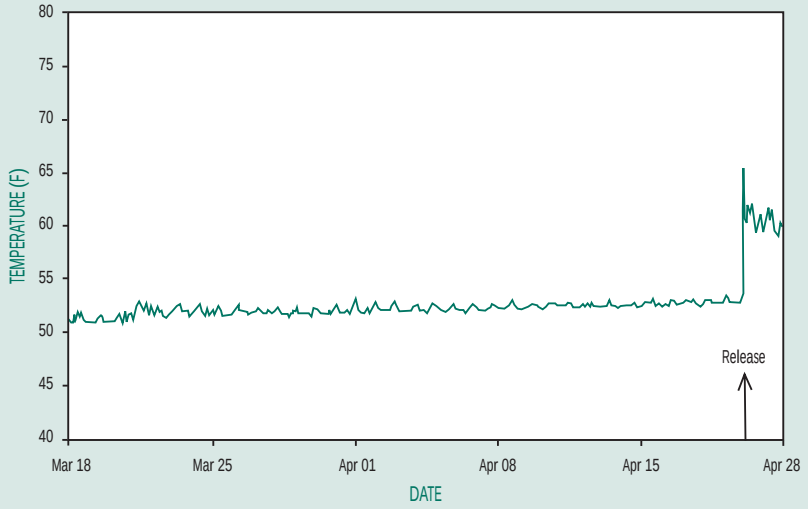


WATER TEMPERATURE MONITORING

Merced River Hatchery



Mokelumne River Hatchery



RESULTS OF NET PEN SAMPLING CONDUCTED IMMEDIATELY AFTER RELEASE AS PART OF THE VAMP STUDIES IN 2000.

Release location, release date, tag code, number in sample	Mean fork length (and range) in millimeters	Mean weight (and range) in grams	Mean percent (and range) of scale loss	Color	Fin hemorrhaging	Eyes	Gill color	Ad clips, comments
Durham Ferry Apr 17 06-04-02, 24 at release	82.9 (73-92)	6.4 (4.6-9.4)	8 (3-15)	Normal	1 with fin	Normal hemorrhaging	Normal	All with ad clip/ 1 with deformed caudal fin; 1 with smashed eye
Durham Ferry, Apr 17 06-04-01, 25 at release	82.6 (69-91)	6.4 (2.6-9.1)	5 (2-13)	Normal	None	Normal	Normal	All with ad clip/ 2 with pink on pelvic and anal fin; 1 with top of caudal gone
Durham Ferry, Apr 17 06-45-63, 25 at release	80.3 (72-87)	5.8 (3.6-7.5)	7 (3-15)	Normal	None	Normal color	1 with faded gill	All with ad clip/1 with deformed caudal fin
Mossdale, Apr 18 06-44-01, 25 at release	82.6 (72-91)	6.6 (4.5-8.8)	6 (1-13)	Normal	None	Normal	Normal	All with ad clip
Mossdale, Apr 18 06-44-02, 26 at release	82.1 (60-92)	6.4 (2.0-11.1)	5 (2-9)	1 with dark color	None	1 with bugged eyes	Normal	1 with no clip
Jersey Point, Apr 20 06-44-04, 25 at release	83.4 (75-90)	6.6 (4.2-8.1)	4 (1-10)	Normal	None	Normal	Normal	2 with poor ad clip
Jersey Point, Apr 20 06-44-03, 25 at release	82.3 (74-90)	6.5 (4.4 –10.0)	4 (1-10)	Normal	None	Normal	Normal	1 with no ad clip
Durham Ferry, Apr 28 06-01-0-6-09-15, 25 at release	77.2 (67-92)	5.1 (3.3- 8.2)	2 (0-5)	Normal	None	Normal	Normal	1 bad ad clip
Durham Ferry, Apr 28 06-01-11-08-14, 25 at release	75.7 (65-86)	4.8 (3.1-7.4)	3 (1-6)	Normal	None	Normal	Normal	1 not clipped, 1 with deformed operculum
Durham Ferry, Apr 28 06-01-11-09-14, 25 at release	78.2 (66-87)	5.2 (3.2 –9.4)	4 (1-20)	Normal	None	Normal	Normal	1 poor clip, 1 with large patch of scales missing
Jersey Point, May 1 06-01-06-10-02, 25 at release	82.9 (74-97)	6.6 (5.5 – 10.4)	2 (0-5)	Normal	None	Normal	Normal	All ad clipped
Jersey Point, May 1 06-01-06-10-01, 25 at release	78.5 (69-94)	5.7 (3.7 – 10.3)	2 (0-4)	Normal	None	Normal	Normal	All ad clipped

RESULTS OF NET PEN SAMPLING AFTER FISH WERE HELD FOR 48 HOURS, CONDUCTED AS PART OF THE VAMP STUDIES IN 2000.

Release location, release date, tag code, number processed	Mean Fork Length (and range) in millimeters	Mean Weight (and range) in grams	Mean (and range) of percent scale loss	Color	Fin Hemorrhaging	Eyes	Gill color	Ad Clips/Comments
Durham Ferry Apr 17 06-04-02								Fish escaped. No data available
Durham Ferry Apr 17 06-04-01								Fish escaped. No data available
Durham Ferry Apr 17 06-45-63								Fish escaped. No data available
Mossdale Apr 18, 06-44-01, 55 processed	82.4 (72-94)	6.0 (3.7-8.1)	1 (0-4)	Normal	None	Normal	Normal	2 with poor ad clip
Mossdale Apr 18, 06-44-02, 55 processed	84.1 (72-92)	6.4 (4.0-8.6)	2 (0-4)	Normal	None	Normal	Normal	3 with poor ad clip
Jersey Point Apr 20, 06-44-04, 86 processed	83.8 (72-94)	6.6 (3.6-8.4)	3 (1-8)	Normal	None	Normal	Normal	All ad clipped
Jersey Point Apr 20, 06-44-03, 123 processed	84.1 (76-94)	6.2 (4.1 –8.2)	2 (1-6)	Normal	None	Normal	Normal	1 with no ad clip
Durham Ferry Apr 28, 06-01-06-09-15, 89 processed	76 (64-90)	4.7 (2.8- 7.7)	2 (0-3)	Normal	None	Normal	Normal	2 with no ad clip
Durham Ferry Apr 28, 06-01-11-08-14, 149 processed	75.4 (59-91)	4.6 (2.3-8.2)	2 (0-5)	Normal	None	Normal	Normal	7 poor ad clipped, 1 with no clip, 4 with partial operculum, 1 dead
Durham Ferry Apr 28, 06-01-11-09-14, 101 processed	78.1 (65-89)	5.0 (2.7 –7.4)	2 (0-5)	Normal	None	Normal	Normal	7 poor clip, 2 with no clip, 1 with deformed caudal, 1escapee
Jersey Point May 1 06-01-06-10-02 200 processed	82.6 (70-97)	6.1 (3.4 – 9.8)	1 (0-3)	Normal	None	Normal	Normal	All ad clipped
Jersey Point May 1, 06-01-06-10-01, 125 processed	77.2 (63-95)	5.7 (2.7 – 10.2)	3 (0-8)	Normal	None	Normal	Normal	1 not clipped

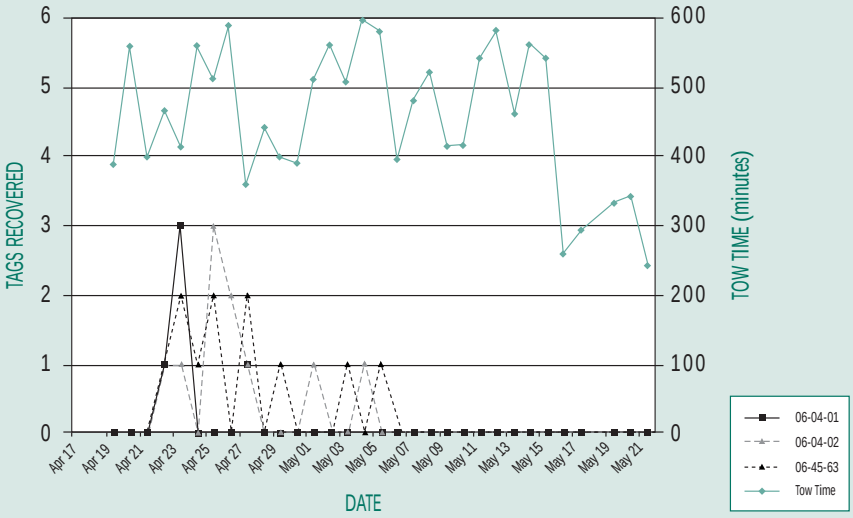
2000 CODED WIRE TAG RECOVERY INFORMATION

AT ANTIOCH AND CHIPPS ISLAND FOR MARKED FISH RELEASE AS PART OF THE VERNALIS ADAPTIVE MANAGEMENT PROGRAM

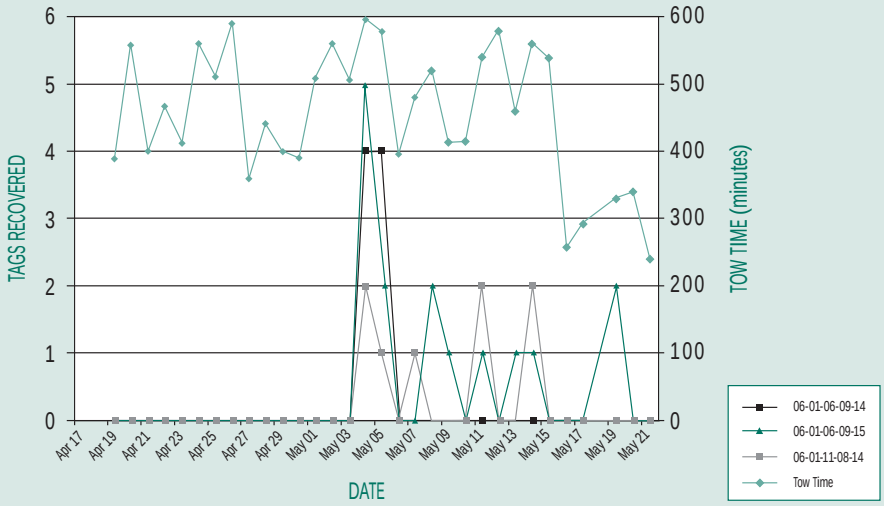
Tag Code	Release Site/Stock	Date	First Day Recovered	Last Day Recovered	Number Recovered	Minutes Fished	Survival Index	Group Survival	First Day Recovered	Last Day Recovered	Number Recovered	Minutes Fished	Survival Index	Group Survival
		Antioch Recovery Information							Chipps Island Recovery Information					
06-04-01	Durham Ferry (MRFF)		Apr 22	May 04	6	6,310	0.054		Apr 22	Apr 29	7	3,000	0.149	
06-04-02	Durham Ferry (MRFF)		Apr 22	May 04	10	6,310	0.088		Apr 23	May 19	10	10,135	0.206	
06-45-63	Durham Ferry (MRFF)		Apr 22	May 05	11	6,890	0.095		Apr 24	May 05	11	4,480	0.226	
	Total	Apr 17	Apr 22	May 05	27	6,890		0.079	Apr 22	May 19	28	10,535		0.193
06-01-06-09-14	Durham Ferry (MRFF)		May 04	May 05	8	1,177	0.059		May 04	May 14	7	4,055	0.150	
06-01-06-09-15	Durham Ferry (MRFF)		May 04	May 19	15	7,219	0.129		May 03	May 12	5	3,655	0.096	
06-01-11-08-14	Durham Ferry (MRFF)		May 04	May 14	8	5,540	0.069		May 04	May 21	10	6,855	0.206	
	Total	Apr 28	May 04	May 19	31	7,219		0.096	May 03	May 21	22	7,155		0.147
06-44-03	Jersey Point (MRFF)		Apr 21	Apr 28	50	3,746	0.434		Apr 22	May 02	24	4,180	0.463	
06-44-04	Jersey Point (MRFF)		Apr 21	May 03	47	6,113	0.401		Apr 22	May 02	41	4,180	0.782	
	Total	Apr 20	Apr 22	May 03	97	6,113		0.416	Apr 22	May 02	65	4,180		0.623
06-01-06-10-01	Jersey Point (MRFF)		May 02	May 14	76	6,607	0.606		May 03	May 17	48	5,555	0.949	
06-01-06-10-02	Jersey Point (MRFF)		May 02	May 20	76	8,626	0.704		May 02	May 14	30	4,755	0.623	
	Total	May 01	May 02	May 20	152	8,626		0.692	May 02	May 17	78	5,955		0.782
06-02-53	Jersey Point (MOK)		May 2	May 15	106	7,147	0.427		May 03	May 14	95	4,355	0.971	
06-02-54	Jersey Point (MOK)		May 2	May 14	110	6,607	0.439		May 02	May 12	74	4,055	0.734	
	Total	May 01	May 2	May 15	216	7,147		0.431	May 02	May 14	169	4,755		0.851
06-44-01	Mossdale (MRFF)		Apr 22	Apr 28	14	3,346	0.129		Apr 23	May 04	9	4,480	0.192	
06-44-02	Mossdale (MRFF)		Apr 23	May 14	16	10,785	0.149		Apr 23	Apr 29	9	2,600	0.199	
	Total	Apr 18	Apr 22	May 14	30	11,253		0.137	Apr 23	May 04	18	4,480		0.195
06-44-05	Mossdale (MRFF)	Apr 19 May 03	Apr 25	May 12	9	8,790	0.082		Apr 29	May 11	7	4,835	0.151	

MRFF denotes Merced River Fish Hatchery

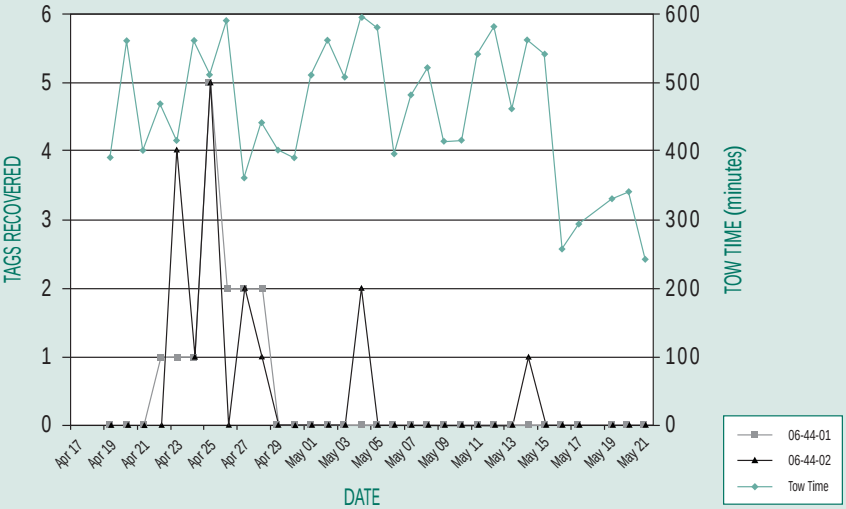
April 17th Durham Ferry Release Recovered at Antioch



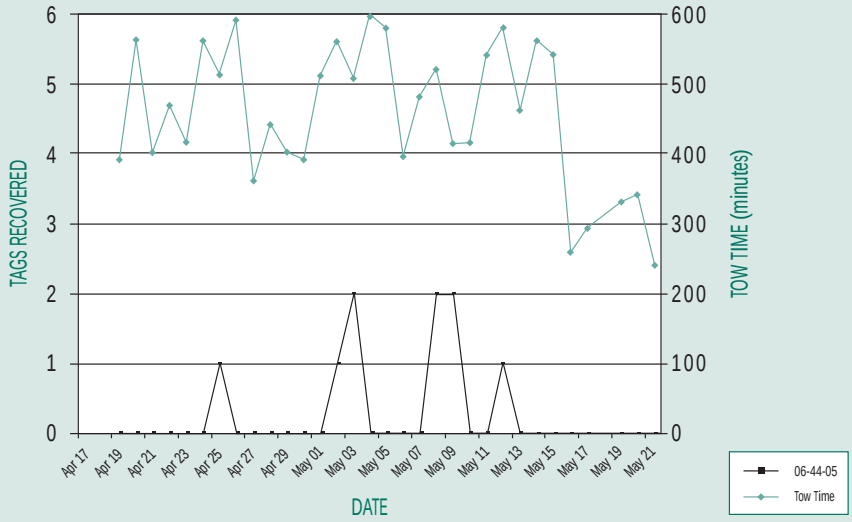
April 28th Durham Ferry Release Recovered at Antioch



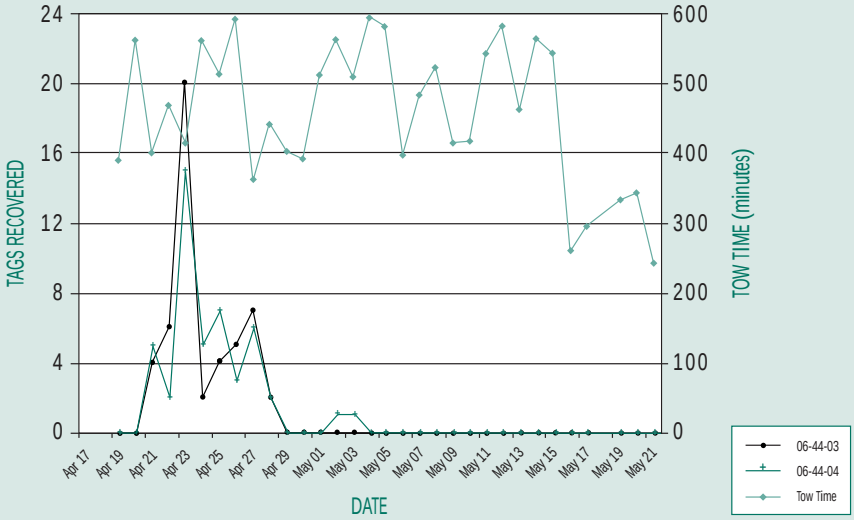
April 18th Mossdale Release Recovered at Antioch



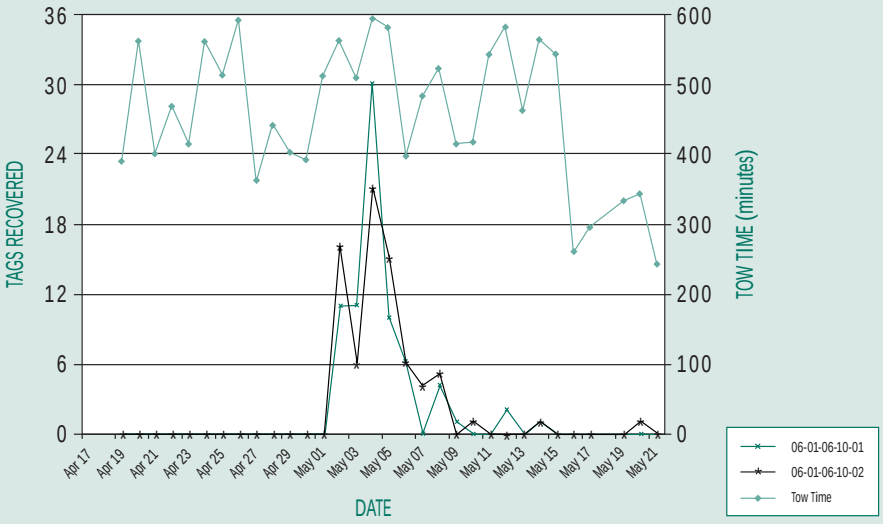
April 19th through May 3rd Mossdale Release Recovered at Antioch



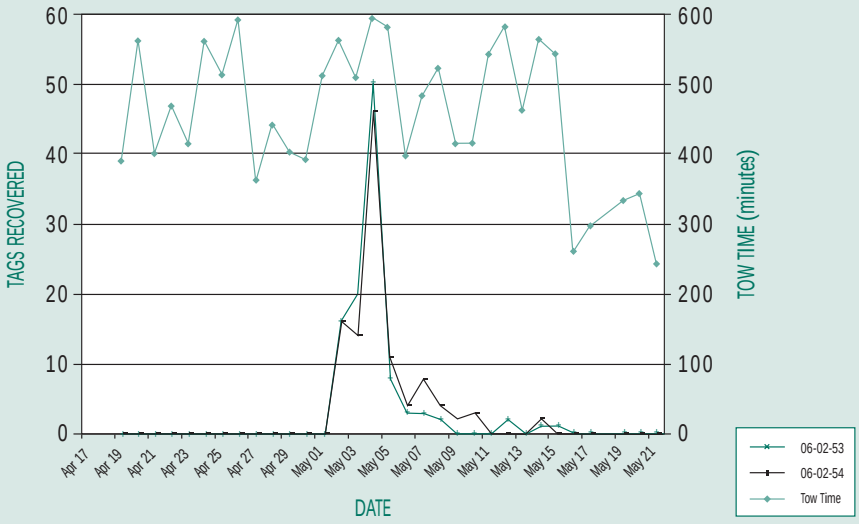
April 20th Jersey Point Release Recovered at Antioch



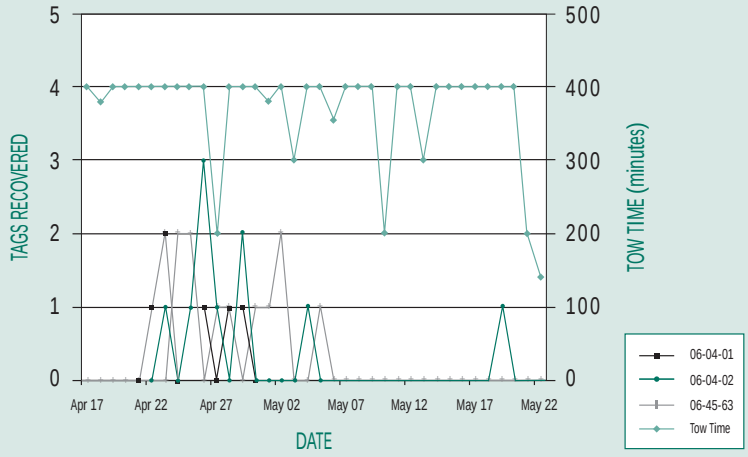
May 1st Jersey Point Release Recovered at Antioch



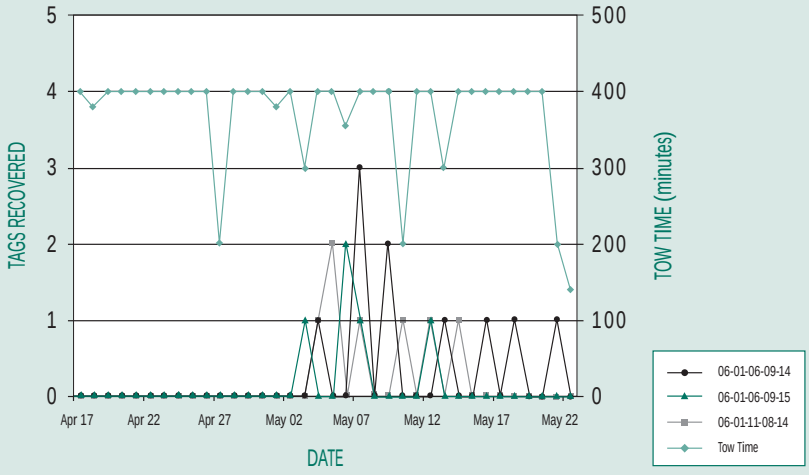
May 1st Jersey Point Release (Mokelumne Stock) Recovered at Antioch



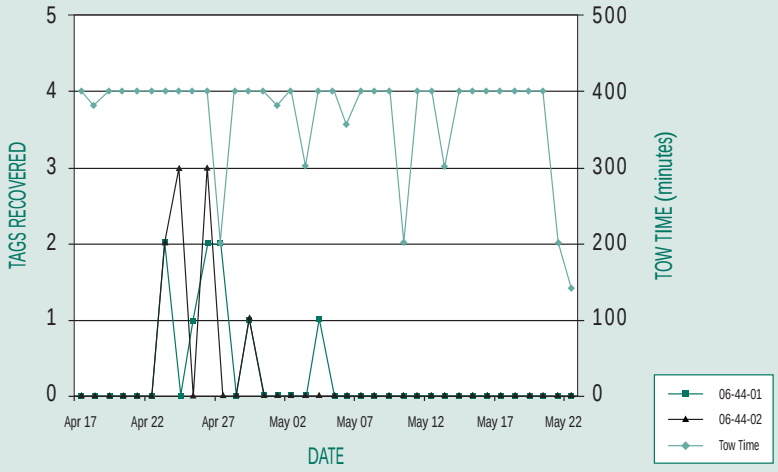
April 17th Durham Ferry Release Recovered at Chipps Island



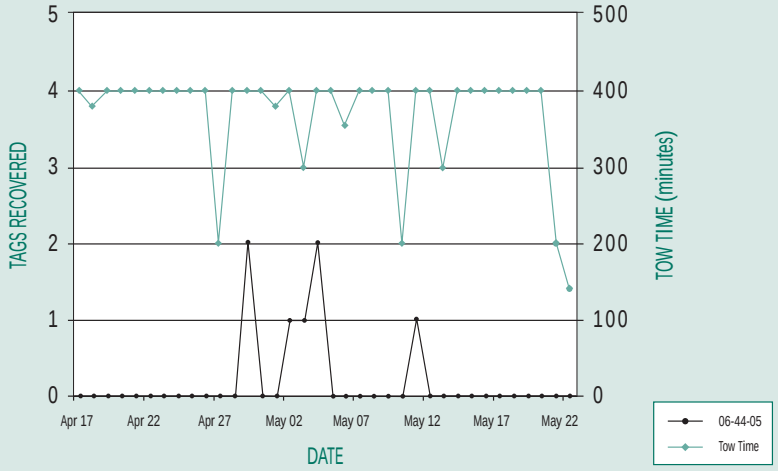
April 28th Durham Ferry Release Recovered at Chipps Island



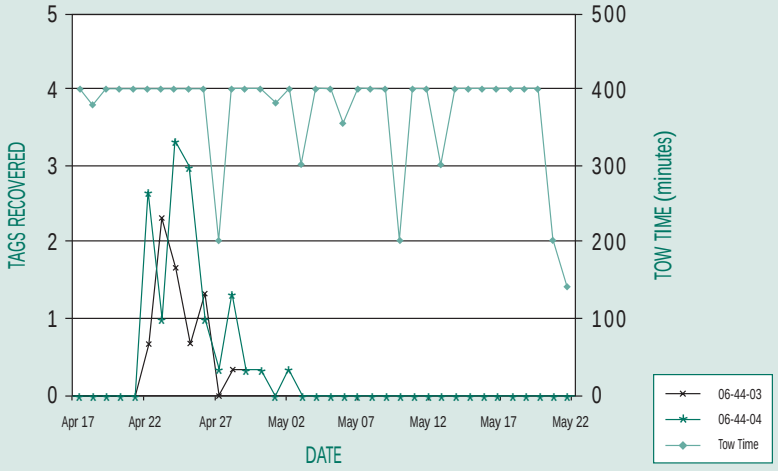
April 18th Mossdale Release Recovered at Chipps Island



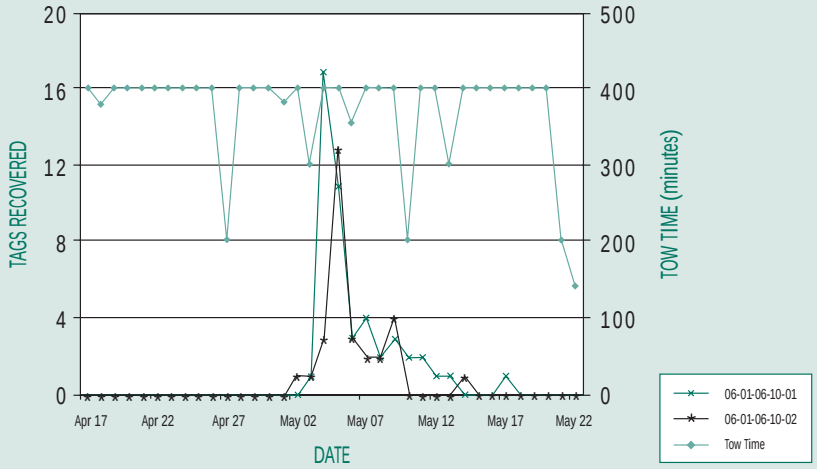
April 19th through May 3rd Mossdale Release Recovered at Chipps Island



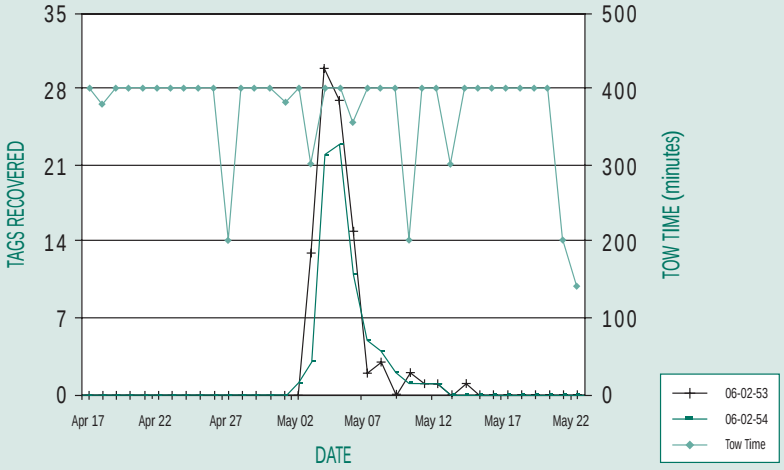
April 20th Jersey Point Release Recovered at Chipps Island



May 1st Jersey Point Release Recovered at Chipps Island



May 1st Jersey Point Release (Mokelumne Stock) Recovered at Chipps Island



2000 CODED WIRE TAG RELEASE

AND ANTIOCH, CHIPPS ISLAND, CENTRAL VALEY PROJECT (CVP) AND STATE WATER PROJECT (SWP)

FISH FACILITY RECOVERY INFORMATION FOR SAN JOAQUIN TRIBUTARY RELEASES

Tag Code	Release Site/Stock	Date	Truck Temp	Release Temp	No. Released	Average Size (mm)	No. Recovered at Antioch	Percent Sampled at Antioch	Survival Index at Antioch	Group Survival at Antioch	No. Recovered at Chipps	Percent Sampled at Chipps	Survival Index at Chipps	Group Survival at Chipps	Expanded Salvage CVP	Expanded Salvage SWP
06-45-39	Upper Merced @ MRFF				25,313	78	2	0.33	0.017		5	0.261	0.098		0	20
06-45-40	Upper Merced @ MRFF				25,507	78	9	0.331	0.077		3	0.243	0.063		0	51
06-45-41	Upper Merced @ MRFF				25,318	78	2	0.383	0.015		4	0.278	0.074		12	41
06-45-42	Upper Merced @ MRFF				25,395	78	2	0.344	0.016		5	0.258	0.099		12	47
Total		Apr 12			101,533		15	0.325		0.033	17	0.262		0.083		
06-45-43	Hatfield State Park (MRFF)		12.2	20	24,525	76	8	0.336	0.07		5	0.258	0.103		12	146
06-45-44	Hatfield State Park (MRFF)		12.2	20	24,490	76	9	0.329	0.08		6	0.278	0.115		0	128
06-45-45	Hatfield State Park (MRFF)		12.2	20	24,432	76	8	0.322	0.07		2	0.278	0.038		12	127
Total		Apr 13			73,447		25	0.329		0.074	13	0.26		0.088		
06-45-49	Upper Merced @ MRFF				25,433	76	3	0.414	0.02		5	0.261	0.098		0	9
06-45-50	Upper Merced @ MRFF				27,042	76	2	0.414	0.013		6	0.263	0.11		36	12
06-45-51	Upper Merced @ MRFF				24,378	76	8	0.346	0.068		1	0.278	0.019		0	24
06-45-52	Upper Merced @ MRFF				25,293	76	7	0.346	0.058		4	0.264	0.078		12	0
Total		Apr 24			102,146		20	0.346	0.041	0.041	16	0.264		0.077		
06-45-53	Hatfield State Park (MRFF)				25,794	81	13	0.338	0.107		5	0.253	0.099		0	57
06-45-54	Hatfield State Park (MRFF)				26,189	81	5	0.35	0.039		4	0.243	0.082		12	90
06-45-55	Hatfield State Park (MRFF)				25,444	81	10	0.334	0.085		6	0.256	0.12		24	78
Total		Apr 27			77,427		28	0.341		0.076	15	0.256		0.098		
Tuolumne River																
06-45-56	La Grange (MRFF)	Apr 13	13.3	11.1	23,603	74	5	0.329	0.046		6	0.261	0.127		12	59
06-45-57	La Grange (MRFF)		13.3	11.1	22,096	74	2	0.336	0.019		1	0.278	0.021		24	22
06-45-58	La Grange (MRFF)		12.2	10.6	21,952	80	3	0.342	0.028		5	0.262	0.113		0	59
Total		Apr 15			44,048		5			0.024	6	0.262		0.067		
Mainstem San Joaquin																
06-45-60	Old Fisherman's Club (MRFF)	Apr 14	12.2	15.6	21,698	75	10	0.344	0.096		5	0.25	0.12		12	95
06-45-59	Old Fisherman's Club (MRFF)	Apr 16	12.2	13.3	23,071	73	12	0.32	0.117		4	0.261	0.086		12	116
Stanislaus River																
06-44-08	Knights Ferry (MRFF)		13.3	12.2	25,786	84	0				1	0.139	0.036		144	144
06-44-09	Knights Ferry (MRFF)		12.8	11.4	26,140	84	0				0				156	117
Total		May 18			51,926		0				1	0.139		0.018		
06-44-07	Knights Ferry (MRFF)	May 19	12.8	12.2	25,511	83	0				3	0.119	0.129		204	99
06-44-10	Two Rivers (MRFF)		14.4	20.6	25,712	85	0				4	0.164	0.123		276	471
06-44-11	Two Rivers (MRFF)		17.8	20.6	24,835	84	0				0				144	219
Total		May 20			50,547		0				4	0.164		0.063		

MRFF denotes Merced River Fish Hatchery

SMOLT SURVIVAL DATA

FOR SMOLTS RELEASED AT MOSSDALE, DURHAM FERRY (DF) AND JERSEY POINT BETWEEN 1994 AND 2000.

Year	Survival Index	No. of Fish Recovered	Release Temp	Size at Release	Survival Index	No. of Fish Recovered	Release Temp	Size at Release	Hatchery Stock	Ratio	Flow at Stockton	Flow at Vernalis	CVP & SWP Exports	Barrier Status
	Mossdale				Jersey Point									
1994	0	0	63	74	0.18	10	64	72	FRH	0.00	437	1387	1268	no barrier
1994	0.04	2	60	77	0.28	16	63	78	FRH	0.13	2468	2468	1671	barrier
1995	0.19	20	57	70	0.48	26	60	70	FRH	0.40	7363	18450	3666	no barrier
1996	0.02	2	59.5	78	0.5	25	62	78	FRH	0.04	2631	6673	1651	no barrier
1996	0.01	1	64	81	0.45	24	64	87	FRH	0.02	2475	6269	1517	no barrier
1997	0.19	10	60	100	1.03	55	63	99	FRH	0.18	5605	5905	2302	barrier (with 2 culverts)
1998	0.1	7	66	84	0.63	40	66	78	FRH	0.16	7692	18850	2004	no barrier
1998	0.56	88	57	86	1.84	187	62	89	MRFF	0.30	9140	22220	1616	no barrier
1999	0.28	36	62	79	0.73	59	63	81	MRFF	0.38	3161	6762	3161	no barrier
2000	0.19	18	56	79	0.62	65	64	82	MRFF	0.31	5936	6196	2332	barrier (with 2 open culverts)
2000	0.19 (DF)	28	57	80	0.62	65	64	82	MRFF	0.31	6077	6339	2335	barrier (with 2 open culverts)
2000	0.15(DF)	22	62	77	0.78	78	63	77	MRFF	0.19	4959	5702	1964	barrier (with 4 open culverts)

FRH denotes Feather River Hatchery

2000 CODED WIRE TAG RECOVERY INFORMATION

AT ANTIOCH AND CHIPPS ISLAND FOR MARKED FISH RELEASE AS PART OF THE VERNALIS ADAPTIVE MANAGEMENT PROGRAM

Tag Code	Release Site/Stock	Date	First Day Recovered	Last Day Recovered	Number Recovered	Minutes Fished	Survival Index	Group Survival	First Day Recovered	Last Day Recovered	Number Recovered	Minutes Fished	Survival Index	Group Survival
			Antioch Recovery Information						Chipps Island Recovery Information					
Merced River														
06-45-39	Upper Merced @ MRFF		Apr 26	Apr 27	2	950	0.017		Apr 25	May 09	5	5,635	0.098	
06-45-40	Upper Merced @ MRFF		Apr 24	Apr 29	9	2,863	0.077		Apr 25	Apr 28	3	1,400	0.063	
06-45-41	Upper Merced @ MRFF		Apr 25	Apr 26	2	1,103	0.015		Apr 24	Apr 26	4	1,200	0.074	
06-45-42	Upper Merced @ MRFF		Apr 23	Apr 25	2	1,488	0.016		Apr 25	May 07	5	4,835	0.099	
	Total	Apr 12	Apr 23	Apr 29	15	3,278		0.033	Apr 24	May 09	17	6,035		0.083
06-45-43	Hatfield State Park (MRFF)		Apr 22	Apr 27	8	2,906	0.070		Apr 22	Apr 28	5	2,600	0.103	
06-45-44	Hatfield State Park (MRFF)		Apr 23	May 02	9	4,738	0.080		Apr 21	Apr 26	6	2,400	0.115	
06-45-45	Hatfield State Park (MRFF)		Apr 20	Apr 30	8	5,096	0.073		Apr 23	Apr 24	2	800	0.038	
	Total	Apr 13	Apr 20	May 02	25	6,166		0.074	Apr 21	Apr 28	13	3,000		0.088
06-45-49	Upper Merced @ MRFF		May 04	May 04	3	597	0.020		May 06	May 19	5	5,255	0.098	
06-45-50	Upper Merced @ MRFF		May 04	May 04	2	597	0.013		May 04	May 19	6	6,055	0.110	
06-45-51	Upper Merced @ MRFF		May 04	May 13	8	4,980	0.068		May 05	May 05	1	400	0.019	
06-45-52	Upper Merced @ MRFF		May 04	May 13	7	4,980	0.058		May 04	May 20	4	6,455	0.078	
	Total	Apr 24	May 04	May 13	20	4,980		0.041	May 04	May 20	16	6,455		0.077
06-45-53	Hatfield State Park (MRFF)		Apr 25	May 13	13	9,250	0.107		May 06	May 12	5	2,555	0.099	
06-45-54	Hatfield State Park (MRFF)		May 04	May 14	5	5,540	0.039		May 08	May 11	4	1,400	0.082	
06-45-55	Hatfield State Park (MRFF)		Apr 27	May 12	10	7,687	0.085		May 05	May 15	6	4,055	0.120	
	Total	Apr 27	Apr 25	May 14	28	9,810		0.076	May 05	May 15	15	4,055		0.098
Tuolumne River														
06-45-56	La Grange (MRFF)	Apr 13	Apr 23	May 02	5	4,738	0.046		Apr 29	May 17	6	7,135	0.127	
06-45-57	La Grange (MRFF)		Apr 23	May 09	2	8,230	0.019		Apr 28	Apr 28	1	400	0.021	
06-45-58	La Grange (MRFF)		Apr 24	May 04	3	5,427	0.029		Apr 24	May 23	5	11,335	0.113	
	Total	Apr 15	Apr 23	May 09	5	8,230		0.024	Apr 24	May 23	6	11,335		0.067
Mainstem San Joaquin River														
06-45-60	Old Fisherman's Club (MRFF)	Apr 14	Apr 25	May 02	10	5,447	0.096		Apr 26	Apr 30	5	1,800	0.120	
06-45-59	Old Fisherman's Club (MRFF)	Apr 16	Apr 23	May 19	12	12,464	0.117		Apr 23	May 01	4	3,380	0.086	
Stanislaus River														
06-44-08	Knights Ferry (MRFF)				0				May 31	May 31	1	200	0.036	
06-44-09	Knights Ferry (MRFF)				0						0			
	Total	May 18							May 31	May 31	1	200		0.018
06-44-07	Knights Ferry (MRFF)	May 19			0				May 29	June 06	3	1,540	0.129	
06-44-10	Two Rivers (MRFF)				0				May 24	May 28	4	1,180	0.123	
06-44-11	Two Rivers (MRFF)				0						0		0.000	
	Total	May 20							May 24	May 28	4	1,180		0.063

MRFF denotes Merced River Fish Hatchery