RECOMMENDATIONS TO THE SECRETARY OF THE INTERIOR:

INTERIM FLOW RELEASES FROM FRIANT DAM FOR OCTOBER 1 THROUGH NOVEMBER 20, 2009 TO THE UPPER SAN JOAQUIN RIVER

Prepared for:

The Secretary of the Interior
and
The San Joaquin River Restoration Program Manager

Prepared by:

Roderick J. Meade, Jr.
San Joaquin River Restoration Program Restoration Administrator

August 2009

Printed on recycled paper

San Joaquin River Restoration Program
Restoration Administrator

August 21, 2009

Mr. Jason Phillips
Program Manager, SJRRP
Bureau of Reclamation
Mid-Pacific Regional Office
2800 Cottage Way
Sacramento, California 95825-1898

Subject: Restoration Administrator Recommendations for the Fall 2009 Program of Interim Flows (October 1 through November 20, 2009)

Dear Mr. Phillips:

I am pleased to forward the attached Restoration Administrator (RA) recommendations for the Interim Flows that are scheduled to commence October 1 and continue through mid-November, 2009.

These RA recommendations have been prepared consistent with Paragraph 15 of the Settlement Agreement. Accordingly, prior to completing these RA recommendations I consulted closely with and have been advised on technical issues by the Technical Advisory Committee (TAC). I also consulted with outside agency, local government and other interests, as noted in the enclosed Recommendations.

The RA recommendations are largely based on the excellent technical analyses and advice provided by the Technical Advisory Committee (the TAC), including a June 2009 TAC Technical Memorandum addressing the October and November Interim Flows that provided recommended objectives, study priorities, modeling and monitoring protocols, and flow volumes, magnitudes and duration. After discussing these technical recommendations with the TAC and consulting with outside agencies, local officials and other interests, I prepared and am submitting the enclosed RA recommendations to the Secretary.

The enclosed RA recommendations confirm and pass on many of the TAC recommendations as they were submitted to me. However, some TAC recommendations have been modified as part of the RA recommendations in response to comments received during consultation with downstream water users, landowners and other interests. The RA modifications to the June TAC recommendations change the timing and duration of Interim Flow releases and are explained in

1221 Torrey Pines Road La Jolla, California 92037-3725 Tel 858.531.1705 E rjmeade@san.rr.com

the enclosure and, briefly, below.

The RA changes address concerns expressed during consultation with downstream users that focused on potential impacts associated with TAC-recommended 700 cfs Interim Flow releases From Friant Dam that would have continued until November 18 or 19 and continued arriving at the Mendota for the following 5 to 7 days. As explained by the operators of the Mendota Pool, this is a particularly sensitive time of year for Mendota Pool operations and the dewatering of the Pool for required semi-annual Mendota Dam safety inspections is scheduled to commence November 26, 2009. To alleviate these concerns, the RA recommends that timing of 700 cfs releases from Friant Dam occur earlier, with Friant Dam 700 cfs releases commencing October 31 and ending November 13.

I look forward to discussing these recommendations with you, the Program Management Team and other interested parties. Please call or email me with any questions or concerns. Thank you for your consideration.

Best regards,

Roderick J. Meade, Jr.
SJRRP Restoration Administrator

Enclosure: Recommendations to the Secretary of Interior: Interim Flow Releases from Friant Dam for October 1 through November 20, 2009 to the Upper San Joaquin River

cc:

Mr. Monty Schmitt
Natural resources Defense Council
111 Sutter Street, 20th Floor
San Francisco, CA 94104

Mr. William Luce
Friant Water Users Authority
854 North Harvard Avenue
Lindsay, CA 93247

Ms. Paula Landis
Department of Water Resources
3374 East Shields Avenue
Fresno, CA 93726-6913

Dr. Jeff Single
Department of Fish and Game
1234 East Shaw Avenue
Fresno, CA 93710

Mr. Jeff Mclain
U. S. Fish and Wildlife Service
2800 Cottage Way
Sacramento, CA 95825

Ms. Rhonda Reed
National Marine Fisheries Service
650 Capitol Mall, Ste 8-300
Sacramento, CA 95825

1221 Torrey Pines Road La Jolla, California 92037-3725 Tel 858.531.1705 E rjmeade@san.rr.com

TABLE OF CONTENTS

EXECUTIVE SUMMARY.....1

1. INTRODUCTION AND PURPOSE.....3

1.1 SCOPE OF THE RA RECOMMENDATIONS.....3
1.2 CONSISTENCY OF THE RA RECOMMENDATIONS WITH THE REQUIREMENTS OF THE SETTLEMENT.....4
1.3 CONSISTENCY OF THE RECOMMENDATIONS WITH OTHER APPLICABLE REQUIREMENTS.....5
1.4 RA CONSULTATION WITH AGENCIES, PUBLIC OFFICIALS AND LOCAL INTERESTS PRIOR TO PREPARING INTERIM FLOW RECOMMENDATIONS.....6

2 TAC FALL 2009 INTERIM FLOW OBJECTIVES.....7

2.1 SOURCES CONSULTED TO FORMULATE OBJECTIVES.....7
2.2 IDENTIFICATION OF INFORMATION NEEDS.....7
2.3 FIELD MONITORING OBJECTIVES FOR THE OVERALL INTERIM FLOW PROGRAM.....7
2.4 PROCEDURAL AND PROCESS PROTOCOLS.....8
2.5 PRIORITY MONITORING OBJECTIVES FOR THE FALL INTERIM FLOWS.....8

3 TAC RECOMMENDATONS TO THE RA FOR FALL 2009 INTERIM FLOWS.....12

3.1 TAC ASSESSMENT OF OPPORTUNITIES, CONSTRAINTS AND ASSUMPTIONS.....12
3.2 TAC RECOMMENDED INTERIM FLOW RELEASE VOLUMES AND MAGNITUDES.....13
3.3 ANTICIPATED SEEPAGE LOSSES IN REACH 2A.....13
3.4 ANTICIPATED DOWNSTREAM EXTENT OF INTERIM FLOWS.....14
3.5 TAC RECOMMENDED OCTOBER 1-NOVEMBER 20, 2009 INTERIM FLOW RELEASES.....15
3.6 ALTERNATIVE RELEASE REGIMES CONSIDERED BY THE TAC.....15
3.7 TAC INTERIM FLOW RELEASE RECOMMENDATION TO THE RA.....16
3.8 TAC MODELING AND MONITORING RECOMMENDATIONS.....19
Modeling Recommendations.....19
Monitoring Recommendations.....19

4 RESTORATION ADMINISTRATOR RECOMMENDATIONS TO THE SECRETARY 22

4.1 RA CONFIRMATION OF THE TAC'S INTERIM FLOW FALL OBJECTIVES, MODELING AND MONITORING RECOMMENDATIONS 22
4.2 RA RECOMMENDATIONS FOR FALL INTERIM FLOW RELEASES: VOLUMES, MAGNITUDES AND DURATION AND RELEASE SCHEDULE 22
4.3 RA RECOMMENDATIONS FOR THE INTERIM FLOW IMPLEMENTATION PROCESS 25

REFERENCES 26

LIST OF FIGURES

Figure 1. 1998 predictions of seepage-related flow losses in Reach 2A, and potential fall 2009 Interim Flow bench releases based on benches in Exhibit B of Settlement. 13

Figure 2. Conceptual expectation of October 1-November 20 flow release hydrograph propagation downstream through Reach 2A, and definition of steady-state conditions in Reach 2A. As discharge is routed through Reach 2A, a large portion of the flow will perc 16

Figure 3. October 1-November 20, 2009 Alternative 1 and Alternative 2 Interim Flow release hydrographs. Alternative 1 is the hydrograph illustrated in Exhibit B of the Settlement with no alterations. Alternative 2 modifies the Settlement hydrograph to leng.....17

Figure 4. TAC Recommended Release Schedule from Friant Dam to the San Joaquin River for October 1-November 20, 2009, and associated monitoring recommendations for respective benches during the release. 18

Figure 5. Conceptual thermistor placement in a gravel mining pit to document thermal heating caused by gravel pit, to evaluate whether the pits thermally stratify, to evaluate thermal mixing in the pits (laterally and vertically), and to evaluate thermal d.....20

Figure 6. Mendota Dam. 22

Figure 7. RA Recommended Release Schedule from Friant Dam to the San Joaquin River for October 1-November 20, 2009, and associated monitoring recommendations for respective benches during the release. 23

LIST OF TABLES

Table 1 – Summary of Information Needs and Objectives for October 1 - November 20, 2009 Interim Flow Releases.....10

Table 2 – TAC Recommended Interim and Riparian Flow Release Magnitudes and Volumes for October 1 – November 20, 2009.....13

Table 3 – RA Recommended Interim and Riparian Flow Release Magnitudes and Volumes for October 1 – November 20, 2009.....23

EXECUTIVE SUMMARY

The Settlement Agreement states that the Restoration Administrator (RA):

> *". . . in consultation with the Technical Advisory Committee, the Secretary and other appropriate federal, state and local agencies . . . shall develop and recommend to the Secretary implementation of a program of Interim Flows in order to collect relevant data concerning flows, temperatures, fish needs, seepage losses, recirculation, recapture and reuse."* (Settlement, Paragraph 15)

The transmitted RA Recommendations involve only the Fall 2009 Interim Flow releases and cover the period from October 1 through November 20, 2009. A subsequent set of recommendations will be transmitted to the Secretary during September 2009 that will provide recommendations for the February 1 through December 1, 2010 Interim Flow program, also as required by the Settlement.

The Settlement requires that Interim Flows commence no later than October 1, 2009. The Settlement also sets forth terms and requirements with which Interim Flow recommendations must comply. These requirements are discussed in the RA recommendations Other required areas of consistency also are identified in the RA Recommendations.

In preparing these recommendations, the RA has reviewed, considered and discussed with the Technical Advisory Committee (TAC) and federal liaisons the TAC recommendations on the Fall Interim Flows. The RA also discussed the TAC recommendations with federal, state and local interests identified in the enclosed report prior to preparing these RA recommendations. RA recommendations to the Secretary now provide for the Interim Flow magnitudes, schedule and volumes for the period October 1 through November 20, 2009 shown in Table ES1.

Table ES1 – RA Recommended Interim and Riparian Flow Release Magnitudes and Volumes for October 1 – November 20, 2009

Interim Flow Start Date/Duration	Riparian Release	Interim Flow release	Total Release from Friant Dam	Volumes
October 1-October 30, 2009	160 cfs	190 cfs	350 cfs	20,826 ac-ft
October 31-November 13, 2009	130 cfs	570 cfs	700 cfs	19,438 ac-ft
November 14, 2009	120 cfs	210 cfs	330 cfs	654 ac-ft
November 15-20, 2009	120 cfs	0 cfs	120 cfs	1,428 ac-ft
		Total Release Volume:		**42,347 ac-ft**

The Project Management Team, in consultation with other Settling Parties, is currently formulating Restoration Flow Guidelines (RFG) designed to provide a process for implementing both the Interim Flow releases and Restoration Flow releases from Friant Dam. As part of the RFG it will be particularly important to identify the roles of the RA, Reclamation Operator (RO), PMT and other appropriate interests involved in approving, modifying and implementing Interim Flows and Restoration Flows. In addition to identifying the roles of involved entities, the RFG will need to establish the sequence of actions required by each party and the timelines for submittals by the RA, determinations by the RO and involvement of the PMT in decision making.

With these process needs in mind, the RA recommends that the Secretary address the following process issues as part of the finalized RFG:

- Dates for RA submittal of future Interim Flow recommendations to the Secretary starting with the 2011 Water Year;
- A process and timeline for the RO and PMT to review, approve or recommend modifications to the RA recommendations on Interim Flows and provide written notice to the RA;
- Timelines for RA responses to the RO/PMT modifications; and
- A coordinated process for real-time management and monitoring of these flows.

Finally, as noted in the RA modifications to the TAC Interim Flow release schedule, there is a need to formulate an effective process to coordinate implementation of Interim Flows and Restoration Flows with the operators and users of the Mendota Pool and Mendota Dam. PMT staff currently is working on that issue and has involved the RA. Consultation as part of the efforts to formulate an approach to coordinating Interim Flows with operation of the Pool and Dam should continue to minimize potential operational issues and avoid significant adverse impacts to Mendota Pool operations and the Pool and Dam infrastructure.

1. INTRODUCTION AND PURPOSE

The Settlement Agreement states that the Restoration Administrator (RA):

> *". . . in consultation with the Technical Advisory Committee, the Secretary and other appropriate federal, state and local agencies . . . shall develop and recommend to the Secretary implementation of a program of Interim Flows in order to collect relevant data concerning flows, temperatures, fish needs, seepage losses, recirculation, recapture and reuse." (Settlement, Paragraph 15)*

These recommendations involve only the Fall 2009 Interim Flow releases covering the period from October 1 through November 20, 2009. A subsequent set of recommendations will be transmitted to the Secretary during September 2009 that will provide recommendations for the February 1 through December 1, 2010 Interim Flow program, as required by the Settlement (Paragraph 15).

In June 2009 the Technical Advisory Committee (TAC) submitted a technical memorandum to the RA that outlined the TAC's recommendations for Interim Flows for Fall 2009 (October 1-November 20). The TAC recommendations to the RA addressed Interim Flow volumes, magnitudes and a schedule for releases from Friant Dam. As noted below, the RA considered those recommendations and included additional recommendations relating to the need for a process for preparing, reviewing and modifying Interim Flows that would involve the RA (in consultation with the TAC), the Program Management Team and other appropriate agency and local interests.

1.1 SCOPE OF THE RA RECOMMENDATIONS

The TAC transmittal to the RA focused on technical flow recommendations. The RA modified some TAC technical recommendations and expanded the range of TAC recommendation beyond interim flow volumes, magnitudes and duration to address process issues relating to effective implementation of the Interim Flow program. Thus, the RA addresses the need to accomplish the following:

- As part of the process of finalizing the Restoration Flow Guidelines that will be a part of the PEIS/R, the Secretary include a process for addressing potential change to the RA recommendations on Interim Flows and a coordinated process for real-time management and monitoring of these flows; and
- A collaborative process for coordinating management of Interim Flows with the operators and users of the Mendota Pool and Mendota Dam to minimize potential operational issues and avoid significant adverse impacts to future Pool and Dam.

It is important to understand that, while the RA is tasked with preparing and submitting Interim Flow Program recommendations to the Secretary, it is the Secretary who will ultimately determine how Friant Dam will be operated. Thus, the Secretary will evaluate the RA's recommendations and determine whether they are consistent with the Settlement, the San Joaquin River Restoration Act of 2009 and other requirements discussed herein. If the Secretary determines that the RA recommendations are consistent with applicable requirements, it is anticipated that these RA recommendations will be implemented as submitted. However, actual

conditions on and along the San Joaquin River during implementation of the Interim Flows will be closely monitored and managed to assure that material adverse impacts to downstream users and adjacent landowners do not occur. Thus, the actual implementation of Interim Flow releases will continue to be coordinated and collaborative as part of a process involving the RA, the Project Management Team and, as appropriate, other affected parties.

Future RA recommendations will be transmitted to the Secretary in September 2009 to address the February 1 through December 1, 2010, Interim Flow program. In addition, commencing in 2010, the RA will prepare and transmit annual recommendations to the Secretary for implementing the Interim Flow program for Water years 2011 through 2013. No later than January 1, 2014, the Settlement requires that Restoration Flows commence. The RA will prepare and submit Restoration Flow recommendations to the Secretary throughout the ongoing process of implementing the Settlement.

1.2 CONSISTENCY OF THE RA RECOMMENDATIONS WITH THE REQUIREMENTS OF THE SETTLEMENT

Paragraph 15 of the San Joaquin River Restoration Program (SJRRP) Settlement Agreement (Settlement) requires that the Restoration Administrator (RA) prepare recommendations to the Secretary for a program of Interim Flows to address areas of scientific uncertainty (*i.e.*, flows, temperatures, fish needs, seepage losses, recirculation, recapture, and reuse). Information acquired by the study program for Interim Flows will provide the technical foundation for preparing and refining future Restoration Flow recommendations prepared by the TAC and RA.

Paragraph 15 of the Settlement requires that the Interim Flow program shall include releasing flows identified in Exhibit B of the Settlement to the extent that such flows would not:

- Impede or delay completion of measures specified in Paragraph 11(a) of the Settlement; or
- Exceed downstream channel capacities.

The Settlement provides that Interim Flows can be implemented using the “flexible flow period” provisions contained in the Settlement (Exhibit B, Paragraph 4) to provide flexibility to the RA but that Interim Flows are not eligible to take advantage of Settlement provisions that address “buffer flows” or purchases of additional water to address unforeseen seepage losses or other conditions specified in the Settlement.

The following recommendations are formulated to be consistent with all of these Settlement requirements and terms.

1.3 CONSISTENCY OF THE RECOMMENDATIONS WITH OTHER APPLICABLE REQUIREMENTS

In addition to Settlement requirements that are applicable to Interim Flows and related RA recommendations, the Interim Flows also must be consistent with other requirements, including those imposed pursuant to the following:

- The San Joaquin River Restoration Act, which includes a number of requirements applicable to the Interim Flow program, including those which require the Secretary to:
  - identify impacts and measures which shall be implemented to mitigate impacts on adjacent and downstream water users and landowners (Sec. 10004(d));
  - avoid involuntary reductions in contract water allocations to Central Valley Project long-term contractors, other than Friant Division long-term contractors (Sec. 10004(f));
  - prepare a study in compliance with NEPA including at a minimum
    - an analysis of channel conveyance capacities and potential for levee or groundwater seepage
    - a description of the associated seepage monitoring program
    - an evaluation of possible impacts associated with release of Interim Flows and mitigation measures for those impacts
    - a description of the associated flow monitoring program
    - an analysis of the likely federal costs, if any, of any fish screens, fish bypass facilities, fish salvage facilities and related operations on the San Joaquin River south of the confluence with the Merced River

      Sec. 10004(h)(1) and (3)
  - reduce Interim Flows to the extent necessary to address any material adverse impacts to third parties from groundwater seepage caused by such flows
- Future conditions that are a part of other approvals required by agencies including, but not limited to, the State Water Resources Control Board, U. S. Army Corps of Engineers, NOAA Fisheries; and
- Other conditions that may be imposed prior to commencement of Interim Flows, including, for instance, potential flow easements or other agreements.

Accordingly, since some of the above potential agency approvals and agreements are still being sought, the recommendations contained herein may be modified by the Secretary for reasons not currently known in order to be consistent with those future approvals.

1.4 RA CONSULTATION WITH AGENCIES, PUBLIC OFFICIALS AND LOCAL INTERESTS PRIOR TO PREPARING INTERIM FLOW RECOMMENDATIONS

Beginning in late June of 2009, the RA initiated a series of consultations with a variety of agencies, local governments and other local interests to discuss the scheduled commencement of Interim Flow releases as required in the Settlement Agreement. These meetings were intended to inform the various interests of the imminent release of Interim Flows and to broaden the understanding of the RA regarding any concerns or suggestions that the contacted interests might want understood prior to commencing the Fall Interim Flows. The RA consultation meetings included representatives of the Program Management Team and Settling Parties to the extent that the scheduling allowed. Between January 26 and August 5 the RA conducted the meetings involving the following entities and persons:

- Monthly Board Meetings of the SJR Resource Management Coalition Meetings (Third Parties)
  - January 30
  - March 26
  - May 28 (tours of Reach 4B, Eastside By-pass and Mariposa By-pass conducted by RMC)
  - May 29
  - June 26
- Reach 2b and 4b Landowner Meetings convened by the PMT and attended by RMC members and various landowners
  - January 26 – Firebaugh and Dos Palos
  - March 26 – Firebaugh and Dos Palos
- San Joaquin River Partnership Meetings Attended by the RA
  - January 29
  - March 3
- Executive Director of the San Joaquin River Conservancy – June 25
- Directors of the Fresno Business Council and SJR River Parkway and Trust – June 25
- Chair, Fresno County Board of Supervisors, Ms. Susan Anderson – July 23
- Mayor of City of Fresno, Ms. Ashley Swearengin – July 30
- Fresno County Supervisor, Mr. Phil Larson – August 3
- Madera County Supervisor, Mr. Frank Bigelow – August 3
- San Joaquin River Group Authority – August 5

2 TAC FALL 2009 INTERIM FLOW OBJECTIVES

2.1 SOURCES CONSULTED TO FORMULATE OBJECTIVES

TAC discussions of study objectives for the October 1-November 20, 2009 drew from four key sources of information:

- The hydrographs defined in Exhibit B of the Settlement;
- Management objectives for hydrograph components in Exhibit B of the Settlement;
- The Priority Information Needs matrix (7-23-08 version) developed by the TAC; and
- Discussions with technical staff from USBR, CDFG, DWR, Program consultants, and TAC liaisons.

2.2 IDENTIFICATION OF INFORMATION NEEDS

There are many information needs in the upper San Joaquin River, including significant gaps in our understanding of flow-related relationships such as: stage-discharge relationships; flow-water temperature relationships; flow attenuation; flow accretions and depletions; flow-habitat relationships, sediment transport, and others. It is not possible to address all flow-related information needs during the October-November, 2009 Interim Flow releases because of limits on the volume of water available, the need to assess seasonal variation in flow-related relationships, and the complexity involved in implementing many different study components simultaneously. Consequently, the TAC evaluated a range of study objectives before selecting a focused set of objectives to guide the design of the fall 2009 interim flow period. The TAC's overarching goal is to recommend flow releases in a manner that address several information needs within the limits of existing constraints, while simultaneously keeping the releases simple enough so as not to compromise the monitoring and research being conducted in the field.

2.3 FIELD MONITORING OBJECTIVES FOR THE OVERALL INTERIM FLOW PROGRAM

As part of planning for the Interim Flow Program the TAC identified a broad set of priority information needs and questions and corresponding flow release experiments. The TAC recognizes that various constraints on flow releases, routing, seasonal timing, and other factors will affect the ability of the program to test and evaluate many of the information needs at specific times as the Interim Flows are being implemented. The broader list of information needs/objectives serves as a guide for developing the experimental design for each test period. The broader set of information need/objectives includes:

- Gathering water temperature information in Reaches 1 - 5 to calibrate and validate water temperature model predictions;
- Gathering water temperature information in Reach 1 gravel pits to evaluate vertical stratification (early October), lateral diversity and mixing, and longitudinal warming;
- Verifying flow accretions/depletions in Reach 2A, 4A, Eastside Bypass, and Mariposa Bypass assumed by the Settlement as illustrated in Exhibit B during steady releases from Friant Dam, and evaluate how those accretions/depletions change over time;
- Evaluating surface water/groundwater interactions in Reach 2A, 4A and the Eastside Bypass;

- Evaluating flow routing in Reaches 1-5;
- Evaluating fine bedload (sand) transport thresholds and rates in Reach 1; and
- Evaluating flow-habitat relationships in Reach 1.

The water temperature information will improve understanding of how water temperatures change in response to flow releases and meteorological conditions, and this improved understanding will be used to inform and refine flow releases to better achieve fishery restoration goals. Improving understanding of thermal dynamics of gravel pits will allow for evaluating thermal warming caused by the pits, provide insight to potential juvenile salmon predation dynamics by piscivores, and contribute towards an overall evaluation of gravel pit remediation approaches. Evaluating flow accretions/depletions and routing will improve understanding of how Restoration Flows will propagate through the system, and refine estimates of Friant Dam releases needed to achieve reach-specific flow magnitude, duration, timing, and rate of change objectives. Evaluating fine sediment transport thresholds in Reach 1 will identify what flow magnitude begins to transport sand out of the pools and across the riffles, and identifying fine sediment transport rates will help evaluate how the Restoration Flows may affect fine sediment storage. Lastly, gaining a quantitative understanding of the relationship between flow release and salmon spawning/holding/rearing habitat in Reach 1 will enable refinement of releases during various hydrograph components (within the Settlement terms and applicable constraints) to increase salmon habitat availability, which could improve juvenile production and better achieve salmon restoration goals.

2.4 PROCEDURAL AND PROCESS PROTOCOLS

In addition to these scientific field-based objectives, the TAC also defined the following procedural and process objectives:

- Evaluating and refining methods/protocols for 2010 monitoring and assessments;
- Identifying and resolving operational coordination issues and processes for implementing 2010 Interim Flows (February 1-December 1); and
- Providing a framework for interagency collaboration in planning, conducting, monitoring, assessing, and reporting test results.

2.5 PRIORITY MONITORING OBJECTIVES FOR THE FALL INTERIM FLOWS

The TAC then narrowed the list of candidate objectives described in Section 2.3 by considering the short window for implementing the Fall 2009 flow period (October 1 – November 20) and the available volume of water to support the study (approximately 27,550 ac-ft of Interim Flows plus 14,800 ac-ft of riparian releases = 42,350 ac-ft). Using this filtering process, the TAC arrived at the following priority study objectives to guide the design of the fall 2009 flow period:

- Flow accretions/depletions in Reach 2A (primary priority);
- Flow-water temperature relationships in Reach 1 and 2 (primary priority);
- Seepage impacts in Reach 2 (highest priority);
- Flow accretions and depletions;

- Water temperature dynamics in the gravel mining pits, and in the mainstem channel upstream and downstream of gravel mining pits (secondary priority); and
- Fine sediment transport rates in Reach 1A (secondary priority).

The objectives, flow range proposed for testing, and a brief description of each of the study elements included in the October 1-November 20, 2009 Interim Flow tests are briefly described in Table 1.

By developing a better understanding of flow accretions/depletions in Reach 2A, a better estimate of future flow release requirements can be prepared. For example, the 1999 Pilot Project (FWUA and NRDC 2002) estimated that approximately 6,000 ac-ft of water percolated into the channel bed of Reach 2A at the beginning of the 1999 flow release, thereby causing mainstem channel streamflows to decrease through Reach 2A until the shallow groundwater table was largely filled, and Reach 2A streamflows reached a steady-state condition. However, the releases monitored by the 1999 Pilot Project were short-duration (three day benches), so there is a remaining information need on: (1) the actual volume of water required to achieve steady-state flow conditions in Reach 2A, and (2) once steady state flow conditions are achieved, the steady-state flow losses in Reach 2A to the overdrafted local groundwater aquifer. The TAC prioritized Reach 2A over downstream reaches for flow accretion/depletion assessment; therefore, information needs in these downstream reaches should not compromise the experimental flow releases needed to gather flow loss information in Reach 2A.

Water temperature information measured in all reaches over the range of Restoration Flow to be released from Friant Dam is limited. Because water temperature is anticipated to be a significant factor in restoring a self-sustaining population of salmon to the San Joaquin River (Stillwater Sciences 2003), more information is needed to relate downstream water temperatures in the San Joaquin River to Friant Dam releases and variable meteorological conditions. Reclamation has developed a water temperature model for the upper San Joaquin River, but additional flow-water temperature information is needed during a range of flow releases and meteorological conditions to calibrate that model and improve its predictive capability. The fall 2009 Interim Flow period provides an opportunity to gather flow-water temperature information to guide future restoration planning and refinements to the water temperature model. Flow releases for water temperature monitoring objectives should again prioritize upstream reaches (Reach 1 and 2) over downstream reaches. Interim Flow releases from February – May 2010 will be larger in magnitude, occur over a wider range of meteorological conditions, and will have a longer duration, all of which will enable better data to be collected in downstream reaches.

In addition to harboring fish species that prey on juvenile salmon, the large gravel pits in Reach 1 may also impair water temperatures in the mainstem San Joaquin River channel via accentuated thermal heating. It is also possible that an increase in flow releases will change the thermal regime in the gravel pits, which may affect the distribution of piscivorous fishes that would tend to prey on juvenile salmon as they migrate downstream through the gravel pits. Increased magnitude of flow releases should reduce water temperature in the pits, which may redistribute warm-water piscivores and better isolate them from cold-water juvenile salmon. Understanding the thermal dynamics in the gravel pits as a function of increased flows will support a better assessment of the risk they pose to restoring a salmon population.

Table 1 - Summary of information needs and objectives for October 1-November 20, 2009 Interim Flow releases

Information need/objective	Flow Release Range	Description/Discussion
Document flow losses in Reach 2A under various antecedent conditions	350-700 cfs	Expected flow with 350 cfs Friant release is 195 cfs at top of Reach 2A. Recommended release of 350 (195 cfs in Reach 2A) for 30 days should substantially re-charge the shallow groundwater table and reach steady-state conditions in Reach 2A. The 350 cfs release, combined with the subsequent two weeks of 700 cfs release, should contribute two data points towards redefining the flow loss curve in Reach 2A based on a charged system (in contrast to the late 1990's Pilot projects). The Program needs to ensure that the gaging network is up and running (or have an alternative manual measurements), and synoptic flow measurements are recommended in Reach 2A at each bench to document where flow losses occur, and make seepage observations.
Hydraulic model calibration	700 cfs	Collect water surface elevations at 700 cfs for calibrating roughness in 1-D model in Reach 1 and 2, and documenting flow splits in Reach 1 for flow releases between 350 cfs and 700 cfs. This develops relationships on how flow is distributed between the main channel and side channels, which may be important in evaluating flow-habitat relationships in Reach 1. This will also help calibrate the 2-D hydraulic model, and validate how it predicts flow splits.
Flow routing model calibration/validation	700 cfs	Apply flow routing model to existing channel geometry conditions and compare with respect to observed flow routing from gaging network. This will be an important tool for developing future Interim Flow recommendations to satisfy flow constraints in downstream reaches (during construction, infrastructure limitations, etc per the Settlement).
Develop rating curves for new gaging stations, check/refine rating curves for existing gaging stations	350-700 cfs	If needed, these measurements will provide more accurate continuous flow estimates at the gaging stations that can be for other evaluations
Temperature model validation	350-350 cfs	While probably most pertinent for October when a few warmer days may still occur, monitoring temperature and using this data to calibrate/validate the temperature model will help focus on assessing adult fall-run migration temperatures. A better calibrated temperature model will improve assessment of juvenile outmigration and over-summer rearing in the spring and summer.
Document sand transport at 700 cfs in Reach 1	700 cfs	Recommend using hand-held (wading) Helley-Smith samplers at Reach 1 monitoring locations. This information would begin documenting whether sand is moving over the top of spawning riffles at 700 cfs, and if so, how much. This data point would be the first point to develop an empirically-based fine bedload transport rating curve, and when combined with data from higher spring 2010 flows, future high flow releases, and potential flood control releases, would develop a fine bedload transport rating curve upon which fine sediment storage and sources could be compared (i.e., will future flow releases begin reducing fine sediment storage in Reach 1?). This assessment needs to be complemented with a fine sediment storage and source evaluation in Reach 1.

A lower priority objective would be to begin documenting fine bedload (sand) transport thresholds and rates in Reach 1 during flows greater than 700 cfs. Reconnaissance assessments in Reach 1 indicate significant in-channel storage of sand and fine sediments (Stillwater Sciences 2003). Sand that is currently stored in pools and runs may be flushed downstream as the more sustained and higher Restoration Flows are released to the San Joaquin River. Understanding the potential for flows to mobilize and re-deposit sand in Reach 1 will inform potential improvements to pool and run habitat (potential oversummering habitat for yearling juvenile salmon), as well as riffles and pool tails (spawning habitat for adult salmon).

The TAC believes that focusing the Fall 2009 flow period on this list of objectives balances information gain with flow volume and time constraints related to the fall flow period and the need to achieve implementation success during the commencement of restoration efforts on the San Joaquin River. Monitoring information collected by the fall 2009 Interim Flows will be too limited in time and scale to provide conclusive results on the above objectives; more data will be needed with longer duration flows and a wider range of meteorological conditions will be needed to make conclusions. The TAC expects that data from the fall 2009 Interim Flows may result in refining experiments and hypotheses for the spring 2010 Interim Flow releases. The longer time window and wider range of flows identified in Exhibit B of the Settlement will allow a wider range of information needs to be addressed during the February 1-December 1, 2010 period of Interim Flows. The RA will be preparing and transmitting recommendations for the February 1-December 1, 2010 period in September 2009.

3 TAC RECOMMENDATONS TO THE RA FOR FALL 2009 INTERIM FLOWS

3.1 TAC ASSESSMENT OF OPPORTUNITIES, CONSTRAINTS AND ASSUMPTIONS

Potential opportunities and constraints relating to information needs as part of the Fall Interim Flows have been summarized from internal TAC discussions, as well as those summarized by the WY2010 Interim Flows Issue Paper prepared by SJRRP staff on March 20, 2009. The following opportunities and constraints were identified specifically for the October 1 – November 20, 2009 Interim Flow releases. Because Interim Flows during this limited time period are of small magnitude compared to other components of the Settlement hydrograph, the opportunities and constraints listed below are unique to this period, and are not intended to apply to future Interim Flow releases. Some of the potential constraints below may be alleviated prior to initiating Interim Flow releases, while others may not.

Potential Opportunities include:

- Additional flexibility to release flows that may exceed typical ramping rates and timing because there are currently no salmon in the San Joaquin River (keeping in mind other biota that could be potentially affected by Interim Flow releases);
- No SJRRP in-river construction activity will be underway as part of the restoration program, thereby avoiding conflicts with construction schedules (although there could be non-Settlement activities, such as sand/gravel mining, that could be impacted);
- Information collected as part of the Interim Flow releases in October-November 2009 can be used to refine the experimental design and data collection activities implemented as part of the 2010 interim flow release program;
- Monitoring methods can be initiated, tested, and refined in the October-November 2009 period to improve quality of data collection methods, monitoring efficiency, and cost effectiveness in future monitoring efforts;
- Real-time flow management and coordination with Reclamation operations staff can be initiated, tested, and refined in the October-November 2009 period to improve management in future Interim Flow and Restoration Flow releases; and
- Additional flexibility in the precise flow amounts on specific dates released from Friant Dam so long as the total volume of Base Flows allocated during that period is not changed.

Potential Constraints include:

- Access and operational agreements/easements; and
- Potential seepage impacts.

3.2 TAC RECOMMENDED INTERIM FLOW RELEASE VOLUMES AND MAGNITUDES

Water Year 2009 has been classified as a Normal-Dry Water Year. Correspondingly, Exhibit B of the Settlement identifies the following releases for the October 1-November 20 period:

Table 2 – TAC Recommended Interim and Riparian Flow Release Magnitudes and Volumes for October 1 – November 20, 2009

Time window	Riparian Release	Interim Flow Release	Total Friant Dam Release
Oct 1-31	160 cfs	190 cfs	350 cfs
Nov 1-10	130 cfs	570 cfs	700 cfs
Nov 11-20	120 cfs	230 cfs	350 cfs
Total Release Volume:	14,797 ac-ft	27,550 ac-ft	42,347 ac-ft

Because one of the primary objectives of the Interim Flows is to collect data that fills information gaps and reduces scientific uncertainty, it is recommended that there be flexibility in daily average releases from Friant Dam to deviate from the releases in Exhibit B of the Settlement, provided: (a) there is good scientific justification to do so, and (b) total release volume during the October 1-November 20 period does not exceed 42,347 ac-ft.

3.3 ANTICIPATED SEEPAGE LOSSES IN REACH 2A

Groundwater pumping in both the confined and unconfined aquifer along the San Joaquin River has been most pronounced in Reach 2A (Williamson et al. 1989). Recharge of the confined aquifer originates from rain and snowmelt in the foothills, and is largely independent of flows in the river. However, the unconfined, shallow groundwater table is recharged by local precipitation and river flows. Historically, the shallow groundwater table in Reach 2A is estimated to have been at the same elevation as river flows (Williamson et al. 1989). Overdraft of the unconfined, shallow groundwater table over the past 100 years, combined with river flow depletions, has reduced the elevation of the shallow groundwater table. When flows occur in Reach 2A, there is a hydraulic differential between the river flows and shallow groundwater elevation, causing flow losses to occur as water infiltrates from the surface river flow into the shallow groundwater table. The rate of flow loss should be highest as flows are reintroduced to the reach, and is expected to decay to a lower, more stable flow loss rate once the shallow groundwater table is substantially recharged by river flow infiltration and the hydraulic differential is reduced.

Based on review of historic flows measured at Gravelly Ford and below the Chowchilla Bifurcation Structure, a preliminary flow loss curve was developed for Reach 2A (Figure 1, JSA and MEI 2002). However, there is a recognized need to gather more data to evaluate, and if needed, improve the accuracy of this curve, particularly since the flow observations that generated the curve had variable antecedent conditions, and most likely did not reflect steady state conditions where the shallow groundwater table in Reach 2A had been substantially recharged before the flow loss estimate was made. Given the preliminary status of the flow loss

curve and its steepness over the range of low flows (100-500 cfs at Gravelly Ford), validating or refining the curve over this range of flows is important to improve the understanding of how future Restoration Flows will translate to downstream reaches. Therefore, the more data points that can be collected during the fall 2009 and spring 2010 under steady state conditions in Reach 2A will address one of the higher priority data needs, and improve our understanding of how Restoration Flows will route to downstream reaches.

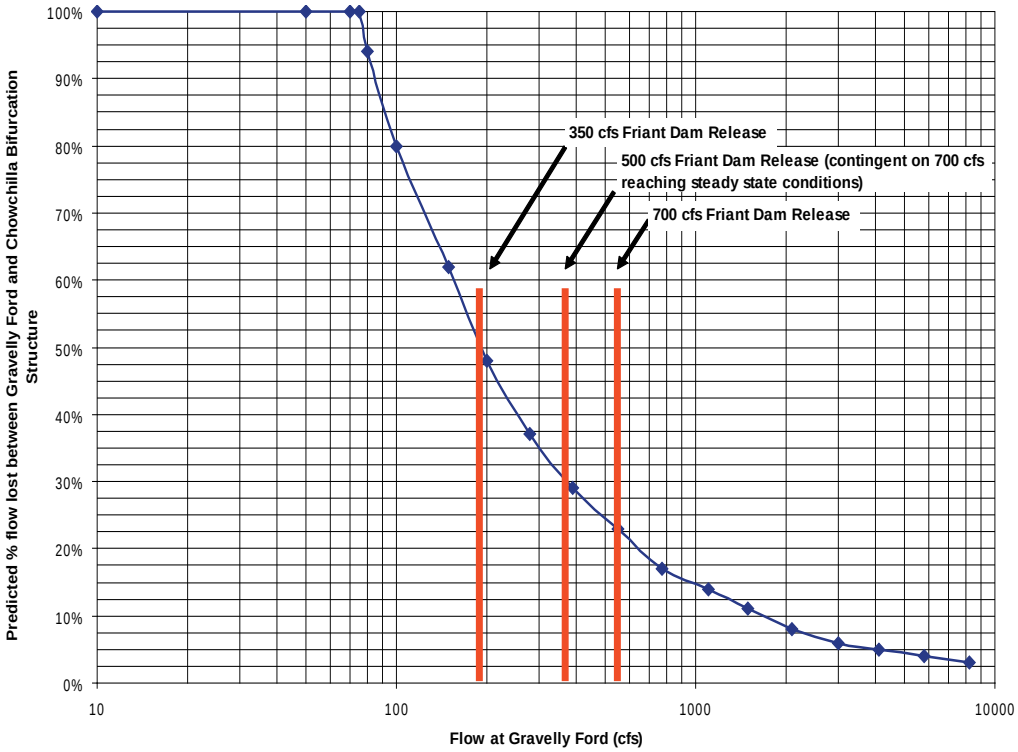

Figure 1. 1998 predictions of seepage-related flow losses in Reach 2A, and potential fall 2009 Interim Flow bench releases based on benches in Exhibit B of Settlement.

3.4 ANTICIPATED DOWNSTREAM EXTENT OF INTERIM FLOWS

Flow losses are expected to be greatest in Reach 2A. Flow accretions and depletions are also expected in downstream reaches, and there is even less data available to estimate the location and magnitude of those possible accretions and depletions. While these accretions and depletions in downstream reaches are expected to be on a much smaller scale than Reach 2A, there is substantial need to gain a better quantitative understanding of the location and scale of those accretions and depletions. Therefore, consistent with the Settlement, the TAC recommends that the fall 2009 Interim Flows be routed downstream past Mendota Dam, past Sack Dam, around the upstream half of Reach 4B through the Eastside and Mariposa bypasses, and into the downstream half of Reach 4B.

3.5 TAC RECOMMENDED OCTOBER 1-NOVEMBER 20, 2009 INTERIM FLOW RELEASES

After discussions with Program staff and review of the 1999 Pilot Project report (Friant and NRDC 1999), the TAC has determined that a long duration flow is needed to: (1) substantially recharge the shallow groundwater table in Reach 2A; and (2) evaluate steady state flow losses in Reach 2A. The 1999 Pilot Project estimates that approximately 6,000 ac-ft of water is required to substantially recharge the shallow groundwater table in Reach 2A when total Friant Dam releases are 800 cfs (approximately 600 cfs entering Reach 2A). Higher flow releases will likely require more than 6,000 ac-ft to substantially recharge the shallow groundwater table, and lower flow releases will likely require less than 6,000 ac-ft. Using the hydrograph release of 350 cfs (with approximately 195 cfs reaching Gravelly Ford), and conservatively assuming that 6,000 ac-ft will be required to substantially recharge the shallow groundwater table, it could take 16 days of a continuous release from Friant Dam of 350 cfs to substantially recharge the shallow groundwater table and approach steady-state conditions at the downstream end of Reach 2A. The TAC defines steady-state conditions as the point where flow losses through Reach 2A become constant (Figure 2).

3.6 ALTERNATIVE RELEASE REGIMES CONSIDERED BY THE TAC

The TAC considered two alternative flow releases, both of which: (1) have a total Friant Dam release volume of 42,350 ac-ft (27,550 ac-ft of Interim Flows plus 14,800 ac-ft of riparian releases), (2) have an initial duration beyond the estimated 16 days required to substantially recharge the shallow groundwater table, and (3) should easily achieve steady state conditions at the downstream end of Reach 2A based on projections from the 1999 Pilot Project report. Alternative 1 is the Settlement Hydrograph and distributes the total Friant Dam release volume of 42,350 ac-ft over the October 1-November 20 period as described in Exhibit B of the Settlement (Figure 3). This release would evaluate two of the estimated Reach 2A flow loss points in Exhibit B of the Settlement: 350 cfs for fall, winter, and summer base releases, and 700 cfs for fall attraction flow releases.

Alternative 2 retains the 10-day 700 cfs bench in the Settlement Hydrograph, but moves it towards the end of the release to extend the initial 350 cfs bench from 31 days up to 41 days (Figure 3). This alternative acknowledges uncertainty in the computed 16-days needed to reach steady-state conditions, and provides up to an additional 10 days of 350 cfs to better ensure that steady-state conditions are achieved in Reach 2A. Real-time flow monitoring in Reach 2A would document when steady-state conditions are achieved, and once those conditions are achieved and necessary monitoring data is collected, flows would be increased to 700 cfs. Ideally, it would take less than 41 days to reach steady-state conditions such that the 700 cfs bench would commence earlier in the fall (warmer meteorological conditions) when reintroduced adult fall-run Chinook salmon would be migrating upstream. Commencement of the 700 cfs Friant Dam release would occur at any time between approximately October 21 and November 10 based on the results of the real-time flow monitoring. The duration of the 700 cfs release would continue until steady state conditions were again reached, or would continue until the 42,347 ac-ft of allocated release volume is exhausted. If steady state conditions were achieved for the 350 cfs and 700 cfs benches earlier than expected, and if some of the 42,347 ac-ft were still available prior to November 10, another 500 cfs bench would be added to obtain another flow loss data point (Figure 1). Applying

this contingency would provide another flow loss data point for no additional water cost, and would facilitate our effort to refine the flow loss curve as rapidly as possible to allow subsequent Interim Flows to address other priority scientific information needs. This release would also evaluate up to three of the estimated Reach 2A flow loss points in Exhibit B of the Settlement: 350 cfs for fall, winter, and summer base releases, 700 cfs for fall attraction flow releases, and as a contingency, 500 cfs for the spring rise prior to the pulse flow.

3.7 TAC INTERIM FLOW RELEASE RECOMMENDATION TO THE RA

The TAC recommends Alternative 2 (Figure 4) for the following reasons:

- The release of 350 cfs for up to 41-days in Alternative 2 is predicted to be long enough to substantially recharge the shallow groundwater table in Reach 2A and achieve approximate steady state conditions at the downstream end of Reach 2A
- The release of 700 cfs for up to 12 days should occur after the shallow groundwater table has been substantially recharged by the 350 cfs bench, and because a new steady state condition should be achieved more rapidly after the 350 cfs bench, the 700 cfs bench will provide verification of Exhibit B flow accretion/depletion assumptions for a second flow bench value.
- The release of 700 cfs for up to 12 days is large enough that it should be able to route to Reach 4A, through the Sand Slough Control Structure to the Eastside Bypass, and through the Mariposa Bypass, enabling some flow accretion/depletion information to be gathered at those locations (provided the flow easement agreements can be obtained). However, the short duration of the 700 cfs flow may not result in achieving steady state conditions in these downstream reaches.
- The release of 700 cfs for up to 12 days may be large enough to evaluate whether seepage is occurring in Reach 2 and/or Reach 4.

While the water volume in the recommended hydrograph is the same as that shown in Exhibit B of the Settlement, the timing and duration of the recommended release deviates slightly from Exhibit B. Because of the uncertainty in estimating the volume of water and duration of flow needed to substantially recharge the shallow groundwater table and achieve steady-state flow in Reach 2A, the TAC recommends that the duration of the benches be of longer duration than that shown in Exhibit B to better ensure that steady-state conditions in Reach 2A are reached, and to increase the chance that steady-state conditions are achieved in downstream reaches if flows are able to route downstream of Mendota Dam. The Restoration Flows in Exhibit B are intended to satisfy the Restoration Goals, yet uncertainty remains in the specific flows needed to satisfy many of those objectives; therefore, it is critically important that flow release flexibility be retained (within volume and conveyance constraints) to fill information gaps and reduce scientific uncertainty, particularly during the Interim Flow period.

Real-time flow management will be integral to future Interim Flow and Restoration Flow releases; therefore, the TAC also recommends real-time flow management be initiated during the fall 2009 Interim Flow release. As a simple initial exercise, the TAC recommends that achieving steady-state flow conditions in Reach 2A be a trigger for commencing the 700 cfs bench release shown in Figure 4. If steady-state conditions is achieved more quickly than is anticipated, then the 700 cfs bench could commence earlier than that shown in Figure 4, and the duration of the 700 cfs bench continue until steady state conditions are again reached or the 42,347 ac-ft of

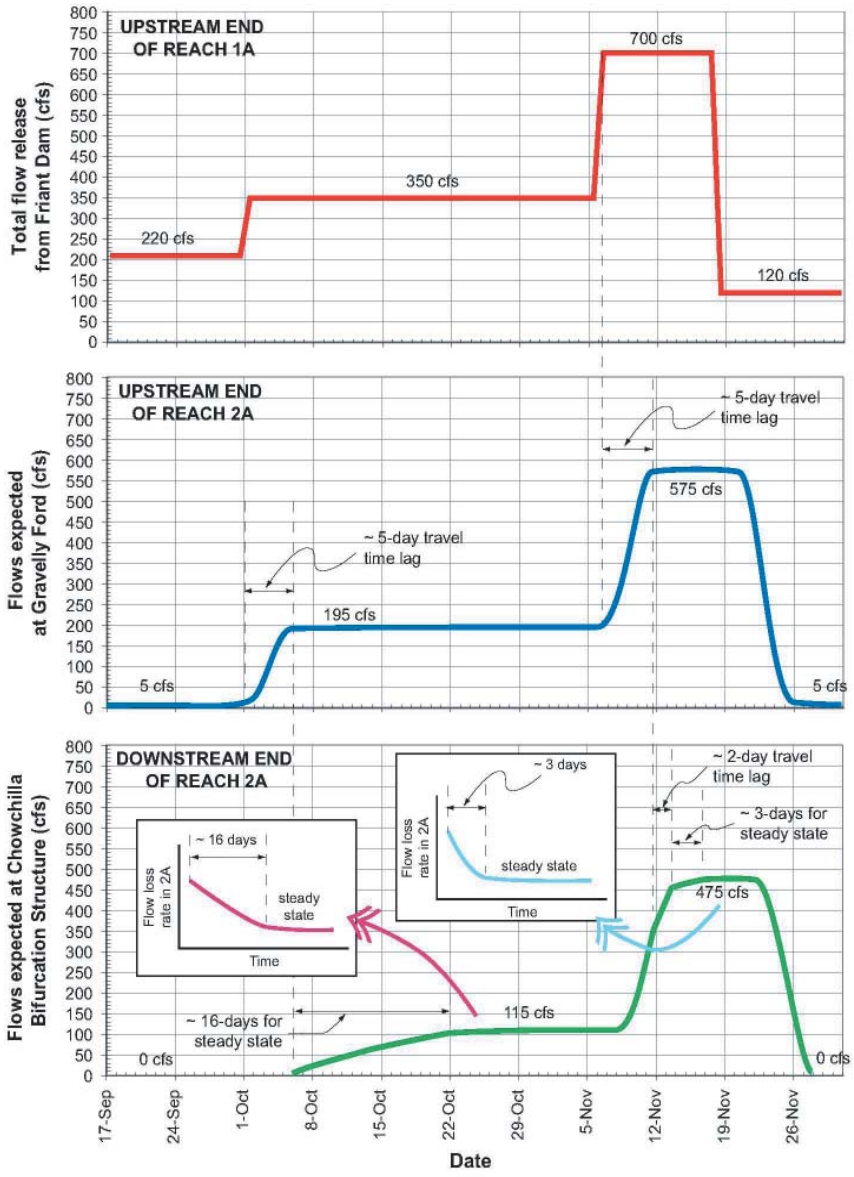

Figure 2. Conceptual expectation of October 1-November 20 flow release hydrograph propagation downstream through Reach 2A, and definition of steady-state conditions in Reach 2A. As discharge is routed through Reach 2A, a large portion of the flow will percolate into the channel bed and substantially recharge the shallow groundwater table, thereby decreasing the volume of flow left in the channel. As the shallow groundwater table is recharged, the volume of flow lost to the channel bed should decrease until a steady-state flow loss rate in Reach 2A is achieved. These conceptual figures illustrate the projected loss of flow to the channel in Reach 2A over time until steady-state flow is achieved. Approximately 6,000 ac-ft of water will be needed to substantially recharge the shallow groundwater table and achieve steady-state flow conditions in Reach 2A.

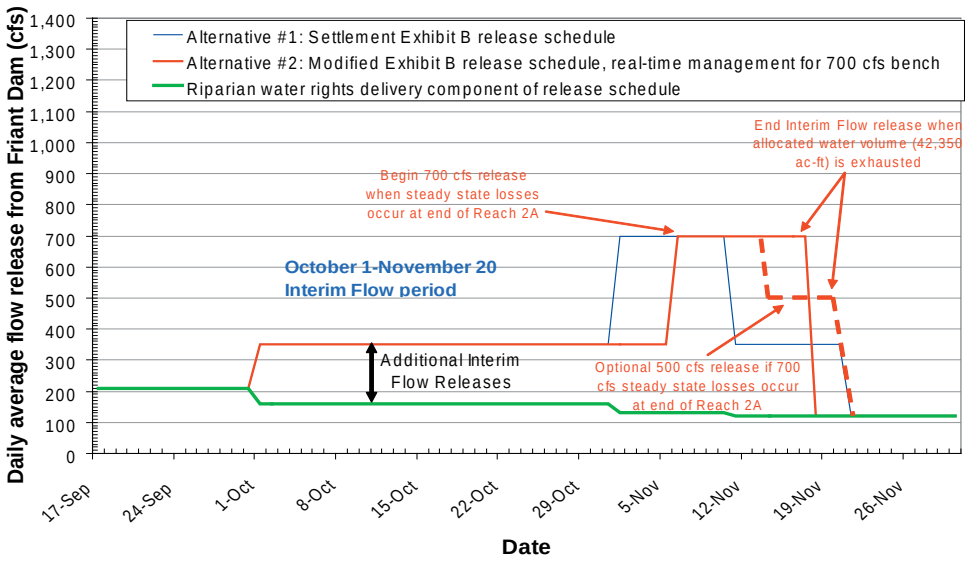

Figure 3. October 1-November 20, 2009 Alternative 1 and Alternative 2 Interim Flow release hydrographs. Alternative 1 is the hydrograph illustrated in Exhibit B of the Settlement with no alterations. Alternative 2 modifies the Settlement hydrograph to lengthen the duration of the benches to ensure steady-state conditions are achieved, and institutes real-time flow management where steady-state flow monitoring in Reach 2A informs the specific timing of the 700 cfs bench, and determines whether a 500 cfs bench will be released after the 700 cfs bench.

water allocated to the October 1-November 20 Interim Flow release period is released. If steady state conditions for the 350 cfs and 700 cfs releases are reached earlier than expected, the TAC recommends that an additional 500 cfs bench be released until the 42,347 ac-ft of allocated water is released.

The TAC recommends that these releases be routed through Reach 1, Reach 2, Reach 3, Reach 4A, Eastside Bypass, Mariposa Bypass, Reach 4B2 and Reach 5. Paragraph 15 of the Settlement requires that the program of Interim Flows also collect relevant data on flow recirculation, recapture, and reuse. The recommended Friant Dam release in Figure 4 may provide recapture and reuse opportunities downstream of Friant Dam, and the TAC assumes that Reclamation will develop and implement a plan to increase recirculation, recapture, and reuse opportunities during this Interim Flow period. As described in Paragraph 16(b) of the Settlement, the TAC assumes this plan will include: locations for recovery or recapture; physical mechanisms of recirculation and reuse; identification and resolution of institutional, legal, conveyance, and infrastructure constraints; and monitoring and accounting for water supply losses and returns as part of the development of the Recovered Water Account. The TAC assumes that this plan will ensure that implementing this plan will have no adverse impact on the Restoration Goal, downstream water quality, or fisheries per Paragraph 16(a)(1).

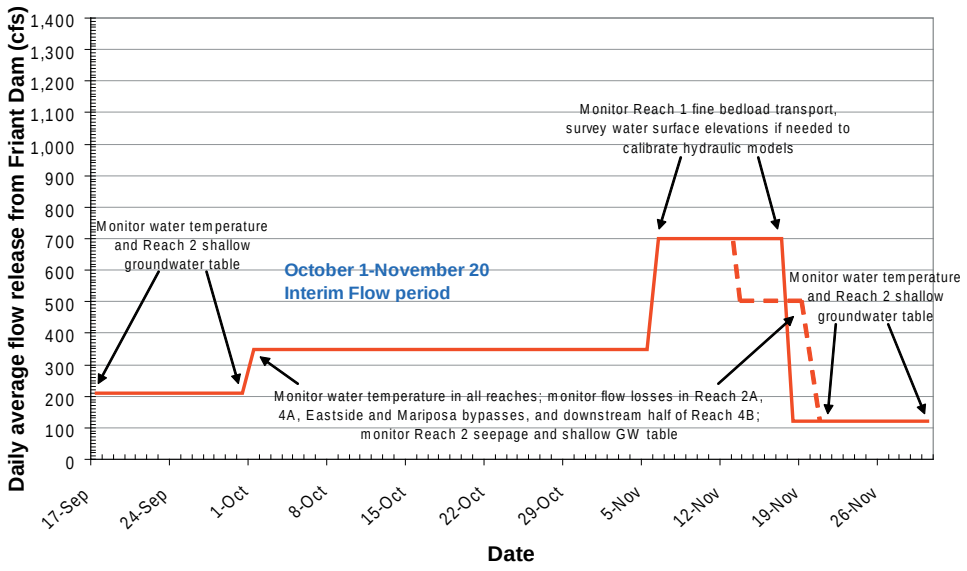

Figure 4. TAC Recommended Release Schedule from Friant Dam to the San Joaquin River for October 1-November 20, 2009, and associated monitoring recommendations for respective benches during the release.

3.8 TAC MODELING AND MONITORING RECOMMENDATIONS

A combination of predictions prior to an experiment and monitoring during and after an experiment are integral components of adaptive management. Program agencies are developing a variety of models for use in the SJRRP, and the Interim Flow releases provides an opportunity to apply, calibrate, and/or validate these models. Therefore, the TAC recommends that modeling efforts be conducted prior to the releases to refine expectations in flow routing (Figure 2) and water temperature response downstream. The TAC also recommends monitoring and assessment be conducted to address the priority study objectives discussed above.

Modeling Recommendations

The TAC recommends that the recently developed SJR5Q temperature model (SJRRP 2008) be run for the recommended Friant Dam release illustrated in Figure 4 under a range possible meteorological conditions that could be expected during the October 1-November 20 period (e.g., hot-dry to cool-moist). The TAC also recommends that a flow routing model be run for the recommended Friant Dam release illustrated in Figure 4 to predict the expected resultant hydrograph at priority nodes downstream (Gravelly Ford, Chowchilla Bifurcation Structure, and downstream nodes if flow are routed downstream of Mendota Pool).

Monitoring Recommendations

Monitoring should be conducted before, during, and after the October 1-November 20 Interim Flow releases to evaluate the priority study objectives discussed above, and to evaluate/validate the flow routing and water temperature model predictions, and as needed, provide calibration information that will improve future model predictions. The TAC recommends that monitoring instrumentation be fully installed by mid-August, checked to verify proper operation by September 1, and if needed, repaired/calibrated/adjusted by September 15 to gather data before commencement of Interim Flows. Specific monitoring recommendations are summarized below.

Streamflow Monitoring

Streamflows should be monitored on a 15-minute interval at the gaging stations listed in SJRRPTAC (2009) using USGS or equivalent protocols (Carter and Davidian 1968, Buchanan and Somers 1968). Flow data from these gaging stations will document flow magnitude, duration, timing, and ramping rates at key locations (e.g., to document whether steady-state conditions are achieved in Reach 2A and to guide real-time flow management for initiating the 700 cfs release bench), as well as enable evaluation of the flow routing model. Also, to get a better understanding of flow losses in Reach 2A over the duration of the Friant Dam releases, the TAC recommends that the change in flow loss over the steady flow release be well documented, both spatially and temporally. The TAC recommends that "synoptic" flow measurements be conducted in Reach 2A (and downstream reaches if flow is able to route past Mendota Dam) to supplement the gaging stations at Gravelly Ford and below the Chowchilla Bifurcation Structure. "Synoptic" measurements are defined as flow measurements collected at many locations simultaneously to compare flows at the same point in time. The synoptic flow measurements should be made by a two-person field crew that starts at the upstream site in the morning, and takes measurements in the downstream direction on the same day as rapidly as possible. The measurements should be done by wading by trained hydrographers, be done at hydraulically simple sites, and follow USGS measurement and computation protocols to enable accurate, comparable measurements (Buchanan and Somers 1969). The TAC recommends that the following 1999 Pilot Project monitoring sites be reoccupied and used for the synoptic flow measurement locations: RM 224.1, RM 222.1, RM 219.5, and RM 217.7. The actual measurement site will depend on landowner access and local site measurement conditions. If the Interim Flows can be routed downstream of Mendota Pool, the TAC recommends adding synoptic flow measurement locations in Reach 4A (2), Eastside Bypass (2), Mariposa Bypass (1), and Reach 4B2 (1) to enable better resolution of flow accretions and depletions in those reaches. Lastly, the TAC recommends that the Reach 1 riparian diversions be estimated at the time of the Interim Flow releases.

Because the TAC hypothesizes that the flow loss rates in Reach 2A (and downstream reaches if flows are routed downstream of Mendota Dam) will be greater at the beginning of the release (as the shallow groundwater table is recharged), the TAC recommends that synoptic flow measurements be done more frequently at the beginning of each bench in the Interim Flow release. Synoptic flow measurements should be done every other day once the pulse arrives at the upstream end of a monitoring reach, and could be extended to every 4 days towards the end of the bench.

Lastly, water surface elevations should be surveyed as needed during the 700 cfs bench of the Interim Flow release, and when combined with the local flow magnitude measurement representative of that water surface elevation, it should be used to calibrate hydraulic models being developed by Reclamation and DWR. The TAC assumes that Reach 1 will be the highest priority because the flow magnitude will decrease in the downstream direction due to riparian diversions, flow depletions in Reach 2A, and recapture/reuse efforts.

Water Temperature Monitoring

Water temperature should be monitored at 1-hr intervals or less (consistent with other monitoring time steps) at the thermistor stations listed in SJRRPTAC (2009). These thermistors should document representative average water temperature in the river at a particular longitudinal location (i.e., not in a stagnant zone that is unrepresentative of the overall river temperature at that location). Meteorological data should continue to be gathered from the following California Irrigation Management Information System (CIMIS) stations along the San Joaquin River; STN 80 (Fresno), STN 92 (Kesterson), and STN 71 (Modesto). The water temperature monitoring data should be compared to the SJR5Q water temperature model predictions for the observed meteorological conditions, and as needed, the model should be calibrated based on the water temperature and meteorological data. In addition, to address thermal dynamics of gravel pits, the TAC recommends that thermistors be installed laterally and vertically in several gravel pits in Reach 1, including locations where predatory piscivores could be displaced/relocated as a function of flow and water temperature management (Figure 5). These thermistors should ideally be placed as soon as possible to document conditions through the summer as well as during the October 1-Novemebr 20 Interim Flow releases.

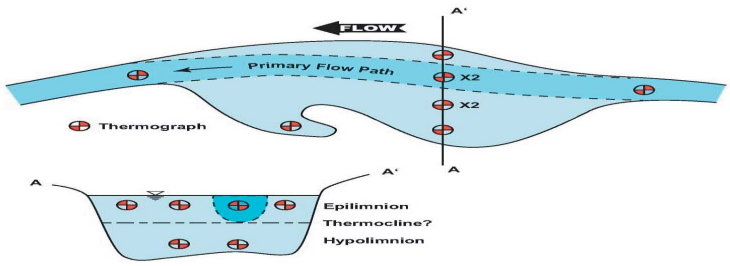

Figure 5. Conceptual thermistor placement in a gravel mining pit to document thermal heating caused by gravel pit, to evaluate whether the pits thermally stratify, to evaluate thermal mixing in the pits (laterally and vertically), and to evaluate thermal differences in backwater areas.

Shallow Groundwater Table and Seepage Monitoring

To better understand the relationship between flow releases, shallow groundwater table response, and seepage impacts to agricultural lands adjacent to the river, the TAC recommends that shallow groundwater elevations and seepage be monitored in Reach 2A. The four monitoring locations used in the 1999 Pilot Project should be reoccupied, as well as new piezometers to be installed by the Program in the coming months. The piezometers within the floodway, as well as wells outside the floodway, should be monitored on the same schedule as the synoptic flow measurements described above.

4 RESTORATION ADMINISTRATOR RECOMMENDATIONS TO THE SECRETARY

The RA has carefully considered the technical recommendations of the TAC and discussed those technical recommendations in follow up conversations with individuals and during meetings of the TAC in June, July and August. The RA also has carefully considered the comments received during the consultations with interested agencies, local officials, landowners and other interests cited in Section 1.4. Based on these discussions and recommendations, the RA is submitting the following to the Secretary in accordance with Paragraph 15 and Exhibit B of the Settlement Agreement.

4.1 RA CONFIRMATION OF THE TAC'S INTERIM FLOW FALL OBJECTIVES, MODELING AND MONITORING RECOMMENDATIONS

The technical findings and recommendations of the TAC as reported in Section 2 as a whole (TAC Fall 2009 Interim Flow Objectives) and sections 3.1, 3.3, 3.4 and 3.8 are confirmed by the RA and recommended to the Secretary for implementation as part of the Interim Flows Program that will implemented by the Program Management Team.

4.2 RA RECOMMENDATIONS FOR FALL INTERIM FLOW RELEASES: VOLUMES, MAGNITUDES AND DURATION AND RELEASE SCHEDULE

These RA recommendations differ from the TAC recommendations submitted to the RA in June and contained in sections 3.2, 3.5 and 3.7 of this Report. In large part, the reasons for modifying the June 2009 TAC flow recommendations are based on comments and concerns expressed by members of the San Joaquin River Resource Management Coalition (RMC) during meetings on June 26 and July 31 when the RA provided briefings about the status of the TAC Interim Flow recommendations. At those June and July RMC meetings the concerns and comments of operators and users involved two aspects of the management/operation the Mendota Pool and Mendota Dam (Figure 6). The first issue focused on maintaining Mendota Pool water elevations within the very narrow range of acceptable elevation during November when flows Interim Flow releases up to 700 cfs from Friant Dam would be reaching the Pool. The second issue focused on the required semi-annual dewatering of the Mendota Pool that is scheduled to commence on November 26. Under the TAC recommended Interim Flow hydrograph, the 700 cfs releases from Friant Dam would continue through November 18 or 19 and would be expected to arrive at the Pool approximately five to seven days later (Figure 2).

Subsequent to the RA briefings with the RMC, the concerns expressed by the Mendota Pool and Dam operators/users were discussed with the TAC. It was decided to modify the June TAC recommendations (see Section 3.5) to provide greater separation between the arrival of the 700 cfs Interim Flows released from Friant Dam to minimize the potential conflict between Interim Flows, the particularly sensitive time-frame identified by the RMC for pool operations, and the scheduled dewatering of the Pool to allow for the required semi-annual safety inspection of the Dam.

Accordingly, the following Table 3 and Figure 7 represent the RA's recommendation to the Secretary for releases of Interim Flows from Friant Dam commencing October 1 and continuing through November 20, 2009.

Figure 6. Mendota Dam.

Table 3 – RA Recommended Interim and Riparian Flow Release Magnitudes and Volumes for October 1 – November 20, 2009

Interim Flow Start Date/Duration	Riparian Release	Interim Flow release	Total Release from Friant Dam	Volumes
October 1-October 30, 2009	160 cfs	190 cfs	350 cfs	20,826 ac-ft
October 31-November 13, 2009	130 cfs	570 cfs	700 cfs	19,438 ac-ft
November 14, 2009	120 cfs	210 cfs	330 cfs	654 ac-ft
November 15-20, 2009	120 cfs	0 cfs	120 cfs	1,428 ac-ft
			Total Release Volume:	**42,347 ac-ft**

As described in Table 3 and Figure 7, a combined Friant Dam release of Riparian and Interim Flows totaling 350 cfs would begin on October 1, 2009 and continue through October 30, 2009. The 30 days of 350 cfs flows would account for a total volume of 20,826 ac. ft. of water from Friant Dam. Following the initial 30 days at 350 cfs, a combined Riparian and Interim Flow release totaling 700 cfs would commence on October 31, 2009 and continue for fourteen (14) days, ending on November 13, 2009. Finally, a brief step down flow of 330 cfs would be conducted on November 14, 2009 to provide a more gentle return to the time when only the scheduled Riparian Flows would be released from Friant Dam. As indicated by Table 3, the total volume of water released by Friant Dam for this period of time is 42,347 ac. ft. This volume of release water is consistent with the total volume of Riparian/Interim Flow water allocated for this period by Exhibit B hydrograph for a Normal-Dry Water Year.

In terms of potential impacts to the operation of the Mendota Pool and Dam, the RA recommendation should serve to reduce the potential for impacts by moving the last day of Interim Flow releases from Friant Dam from November 20 under both the TAC recommendation and the Exhibit B hydrograph to November 14, a gain of six (6) days of separation in terms of the time when Interim Flow releases would likely be entering the Mendota Pool. It also provides about the same increase in spacing between the last day of Interim Flow releases and the scheduled dewatering of the Pool for November 26.

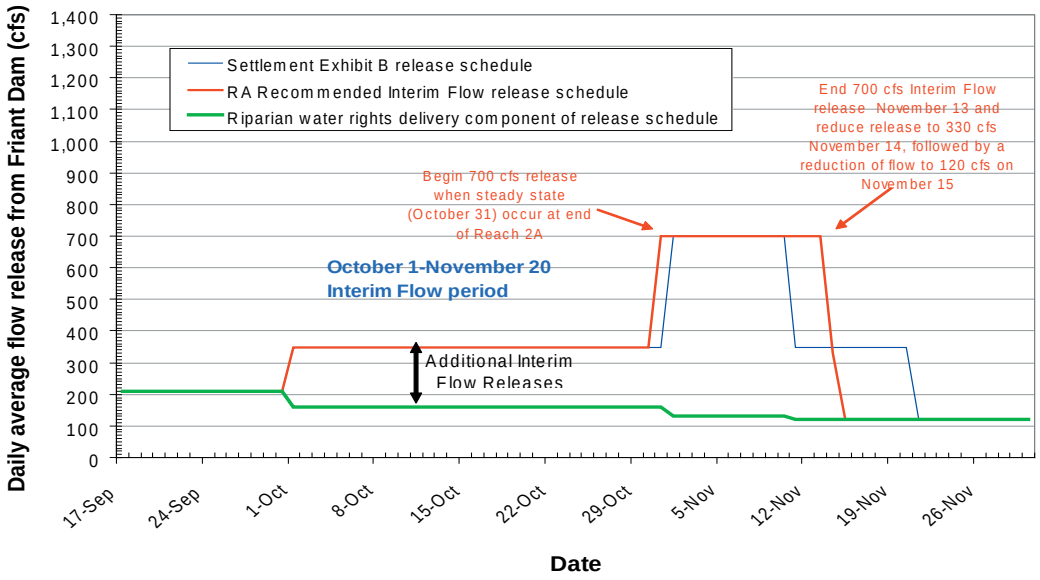

Figure 7. RA Recommended Release Schedule from Friant Dam to the San Joaquin River for October 1-November 20, 2009, and associated monitoring recommendations for respective benches during the release.

4.3 RA RECOMMENDATIONS FOR THE INTERIM FLOW IMPLEMENTATION PROCESS

The Project Management Team is currently formulating Restoration Flow Guidelines (RFG) designed to provide a process for implementing both the Interim Flow releases and Restoration Flow releases from Friant Dam. As part of the RFG it will be particularly important to identify the roles of the RA, Reclamation Operator (RO), PMT and other appropriate interests involved in approving, modifying and implementing Interim Flows and Restoration Flows. In addition to identifying the roles of involved entities, the RFG will need to establish the sequence of actions required by each party and the timelines for submittals by the RA, determinations by the RO and involvement of the PMT in decision making.

With these process needs in mind, the RA recommends that the Secretary address the following process issues as part of the finalized RFG:

- Dates for RA submittal of future Interim Flow recommendations to the Secretary starting with the 2011 Water Year;
- A process and timeline for the RO and PMT to review, approve or recommend modifications to the RA recommendations on Interim Flows and provide written notice to the RA;
- Timelines for RA responses to the RO/PMT modifications; and
- A coordinated process for real-time management and monitoring of these flows.

Finally, as noted in the RA modifications to the TAC Interim Flow release schedule, there is a need to formulate an effective process to coordinate implementation of Interim Flows and Restoration Flows with the operators and users of the Mendota Pool and Mendota Dam. PMT staff currently is working on that issue and has involved the RA. Consultation as part of the efforts to formulate an approach to coordinating Interim Flows with operation of the Pool and Dam should continue to minimize potential operational issues and avoid significant adverse impacts to Mendota Pool operations and the Pool and Dam infrastructure.

REFERENCES

Buchanan, T.J. and W. P. Somers. 1968. *Stage measurements at gaging stations*, Techniques of Water Resource Investigations of the U.S. Geological Survey, Book 3, Chapter A7, 28 p.

Buchanan, T.J. and W. P. Somers. 1969. *Discharge measurements at gaging stations*, Techniques of Water Resource Investigations of the U.S. Geological Survey, Book 3, Chapter A8, 65 p.

Carter, R.W. and J. Davidian. 1968. *General procedure for gaging streams*, Techniques of Water Resource Investigations of the U.S. Geological Survey, Book 3, Chapter A6, 13 p.

Friant Water Users Authority (FWUA) and Natural Resources Defense Council (NRDC), 2002. *1999 San Joaquin River Riparian Flow Release Pilot Project*, Lindsay, CA and San Francisco, CA.

Jones and Stokes (JSA) and Mussetter Engineering Incorporated (MEI) 2002. San Joaquin River Restoration Plan Draft Background Report, Prepared for Friant Water Users Authority and Natural Resources Defense Council, January 2002, Sacramento CA.

San Joaquin River Restoration Program Technical Advisory Committee (SJRRPTAC) 2009. *Technical Memorandum: Technical Recommendations to San Joaquin River Administrator (RA) on October 1 – November 20, 2009 Interim Flow Recommendations*. Prepared for the San Joaquin River Restoration Program Restoration Administrator.

San Joaquin River Restoration Program Technical Advisory Committee (SJRRPTAC) 2009. *Recommendations on Monitoring and Evaluating Interim Flows to the Upper San Joaquin River*. Prepared for the San Joaquin River Restoration Program Restoration Administrator.

San Joaquin River Restoration Program (SJRRP) 2008. *Temperature Model Selection*. Draft Technical Memorandum, Sacramento, CA.

Stillwater Sciences (2003). *Draft Restoration Strategies for the San Joaquin River*. Prepared for the Natural Resources Defense Council and Friant Water Users Authority. Berkeley, CA,

Williamson, A. K., D. E. Prudic, and L. A. Swain, 1989. Ground-water flow in the Central Valley, California, *USGS Professional Paper 1401-D*, Washington, DC.