

Appendix D

Seepage Monitoring and Management Plan for Water Year 2010 Interim Flows

Water Year 2010 Interim Flows Project
Draft Environmental Assessment/Initial Study



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1 **List of Abbreviations and Acronyms**

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3	Act	San Joaquin River Restoration Settlement Act
4	cfs	cubic feet per second
5	EA/IS	Environmental Assessment/Initial Study
6	Secretary	Secretary of the U.S. Department of the Interior
7	SJRRP	San Joaquin River Restoration Program
8	WY	Water Year

1.0 Introduction

This Seepage Monitoring and Management Plan for Water Year (WY) 2010 Interim Flows (Seepage Monitoring and Management Plan) describes management objectives for groundwater and levee seepage, approaches for detecting seepage, monitoring conditions indicating that seepage management objectives have been attained, and potential actions that could be taken to address nonattainment. The guidelines and monitoring approach described in this plan are included in the Proposed Action for the San Joaquin River Restoration Program (SJRRP) – Water Year (WY) 2010 Interim Flows Environmental Assessment/Initial Study (EA/IS).

1.1 Overview

Portions of the Restoration Area have historically experienced groundwater seepage to adjacent lands associated with elevated flows. Groundwater seepage has the potential to cause waterlogging of crops and salt mobilization in the crop root zone. Similarly, some portions of the Restoration Area have experienced levee instability resulting from through-levee and under-levee seepage during periods of elevated flows.

The intention of this plan is to identify direction for seepage monitoring and management, but not to offer details on the design of seepage monitoring activities (e.g., location of groundwater wells, timing and frequency of levee patrols). Table 1-1 summarizes the content discussed in this plan.

Table 1-1.
Components of the Seepage Monitoring and Management Plan
for First Year of Interim Flows

Monitoring and Management Components	Application of Component to the Seepage Monitoring and Management Plan
SJRRP Management Objective for Restoration Flows Within the Restoration Area	Reduce or avoid adverse third-party impacts resulting from groundwater and levee seepage
Associated Physical Condition Monitoring Within the Restoration Area	Monitor groundwater elevations, patrol and visually inspect levees, and establish contact with landowners
Conditions Indicating Attainment of SJRRP Management Objectives	Convey Interim Flows without causing third-party seepage impacts
Potential Actions to Address Nonattainment of Management Objectives	Change releases, redirect flows through bypasses

Key:

SJRRP = San Joaquin River Restoration Program

1.2 Definition of Key Terms

Key terms defined in the Settlement include the following:

- **Infiltration** – Transition of water from surface to subsurface flows.
- **Program Manager** – Authorized representative for the Secretary of the U.S. Department of the Interior (Secretary) overseeing the SJRRP.
- **Restoration Flows** – Collectively, the Base Flows, Buffer Flows, and any additional water acquired by the Secretary from willing sellers to meet the Restoration Goal of the Settlement.
- **Seepage** – Lateral flow of water from the flood channel into adjacent lands.
- **Shallow Groundwater Table** – Elevation of water at or near the surface of surrounding lands.
- **Interim Flows** – Releases of water from Friant Dam consistent with Restoration Flow Schedules specified in the Settlement but subject to channel capacity limitations, commencing no later than October 1, 2009, for the purpose of collecting relevant data concerning flows, temperatures, fish needs, seepage losses, recirculation, recapture, and reuse.
- **Restoration Flows** – Collectively, Base Flows, Buffer Flows, and any additional water acquired by the Secretary from willing sellers to meet the Restoration Goal of the Settlement.
- **Base Flows** – Releases from Friant Dam made in accordance with Exhibit B of the Settlement. Together, the Base Flows, Buffer Flows, and any additional water acquired by the Secretary from willing sellers to meet the Restoration Goal of the Settlement are collectively referred to as the “Restoration Flows.”
- **Buffer Flows** – Releases of up to an additional 10 percent of applicable Base Flows, as provided in Paragraph 18 and Exhibit B of the Settlement. Together, the Base Flows, Buffer Flows, and any additional water acquired by the Secretary from willing sellers to meet the Restoration Goal of the Settlement are collectively referred to as the “Restoration Flows.”
- **Flushing Flows** – A block of water averaging 4,000 cubic feet per second (cfs) from April 16 through 30 in Normal-Wet and Wet years that could be needed to perform geomorphic functions such as flushing spawning gravels, in accordance with Exhibit B of the Settlement.
- **Restoration Year-Type** – Exhibit B of the Settlement identifies six restoration year-types based on October-to-September unimpaired runoff (inflow) at Friant Dam. These are (in order of increasing “wetness”) as follows: Critical-Low, Critical-High, Dry, Normal-Dry, Normal-Wet, and Wet. Except the lowest water

year-type (Critical-Low), water years are defined as falling in a defined range on an exceedence curve of the unimpaired runoff. The Settlement defines year-types based on their occurrence in an 83-year period, from 1922 through 2004, without using a conventional threshold approach. While the associated year-type for each year within the 83-year period is clear, extrapolation of such a restoration year-type definition for years outside this period is not. To be consistent with Exhibit B, a threshold was defined using a practical point, near the average of the unimpaired runoff amounts, of 2 years that bracket the transition. Therefore, classification of restoration year-types was recommended for the SJRRP based on annual October-through-September unimpaired flow below Friant Dam threshold levels, as shown in Table 1-2.

Table 1-2.
Water Year-Types and Associated Threshold Levels
Based on the Settlement

Total Annual Inflow to Millerton Lake	Exceedence Level	Restoration Year-Type
Equal to or greater than 2,500,000 acre-feet	Wettest 20%	Wet
Equal to or greater than 1,450,000 acre-feet	Next 30% (20 to 50%)	Normal-Wet
Equal to or greater than 930,000 acre-feet	Next 30% (50 to 80%)	Normal-Dry
Equal to or greater than 670,000 acre-feet	Next 15% (80 to 95%)	Dry
Equal to or greater than 400,000 acre-feet	Remaining 5% (95 to 100%)	Critical-High
Less than 400,000 acre-feet		Critical-Low

Key:

Settlement = Stipulation of Settlement

- **Hydrographs** – A chronological graphic record of stream discharge or water level (stage) at a given point on a stream (i.e., a graph of discharge or stage versus time). Hydrographs for various reaches of the San Joaquin River for each water year-type are contained in Exhibit B of the Settlement.
- **Settlement** – NRDC, et al., v. Kirk Rodgers, et al.
- **Legislation** – San Joaquin River Restoration Settlement Act (Act) (Public Law 111-11)

2.0 Seepage Management

This section describes the seepage management plan for WY 2010 Interim Flows. This plan includes monitoring of flow and groundwater levels, and management responses with regard to groundwater and levee seepage. This section provides a framework for the monitoring plan, discussed in the following section.

2.1 Pertinent Language from the Legislation

Section 1004, paragraph (h), of the legislation describes requirements for developing a seepage monitoring plan. Some subsections are especially relevant to this plan, and are included in the following:

Line 3, Page 9423, Paragraph (h) INTERIM FLOWS

(1) *STUDY REQUIRED* – Prior to releasing any Interim Flows under the Settlement, the Secretary shall prepare an analysis in compliance with the National Environmental Policy Act of 1969 (42 U.S.C 4321 et seq.), including at a minimum –

(A) *an analysis of [...] potential for levee or groundwater seepage;*

(B) *a description of the associated seepage monitoring program;*

Line 11, Page 943, Paragraph (h) INTERIM FLOWS

(3) *SEEPAGE IMPACTS* – The Secretary shall reduce Interim Flows to the extent necessary to address any material adverse impacts to third parties from groundwater seepage caused by such flows that the Secretary identifies based on the monitoring program of the Secretary.

2.2 Seepage Monitoring Information

Information used for the Seepage Monitoring and Management Plan includes the following kinds of actions, which will be undertaken on an as-needed basis to implementing the plan:

- Groundwater level monitoring
- Flow monitoring
- Patrols for visual observations in collaboration with the Lower San Joaquin Levee District
- Feedback from local landowners through phone and e-mail

2.3 Attainment of Seepage Management Objective

Historically, groundwater seepage associated with flow in the San Joaquin River has resulted in several adverse effects to adjacent lands, including waterlogging of crops; salt mobilization into the root zone; and increased levee instability.

During the first year of Interim Flows, attainment of the seepage management objective would be achieved if adverse seepage impacts to third parties resulting from Interim Flows are either addressed or avoided. Potential conditions that might trigger actions would depend on site-specific concerns, and include the following:

- Groundwater elevations indicating an impending rise of the water table into root zones
- Levee stability problems and lateral seepage, as evidenced by visual observation of boils or piping
- Landowner communication of seepage problems

2.4 Potential Actions to Address Nonattainment

Legislation directs the Secretary to reduce the release of Interim Flows to the point where they no longer cause third-party groundwater seepage impacts. It is inferred that the detection of conditions that would lead to seepage impacts would also trigger a reduction in Interim Flow releases, such that negative impacts are avoided entirely. Potential operational responses to the detection or anticipation of adverse groundwater seepage impacts include the following:

- **Restriction on Ramping Rate** – Limits on incremental increases in flow rates would provide the ability to observe system response while limiting the volume of upstream water requiring management if an impending impact is observed.
- **Reductions of Interim Flow at Friant Dam** – Reductions in the release rate from Friant Dam would limit the amount of water present for seepage impacts. Planned thresholds for reductions at Friant Dam would need to consider travel time and associated delay in response.
- **Redirection of Interim Flows at Chowchilla Bypass Bifurcation Structure** – Directing flow into the bypass system at the Chowchilla Bypass Bifurcation Structure would provide a faster response for downstream reaches. This response requires an agreement for operations, and mitigation for levee district actions.
- **Delivery of Interim Flows to Exchange Contractors at Mendota Pool** – Delivery of water to Mendota Pool would reduce flows in Reach 3. Use of diversion in Mendota Pool to reduce flows would require coordination with Central California Irrigation District and San Luis Delta-Mendota Water Authority.

- 1 • **Delivery of Interim Flows to Exchange Contractors and/or Refuges at Sack**
2 **Dam** – When San Luis Canal Company is not fully diverting, additional water
3 diversions can assist with reducing potential seepage impacts in Reach 4A and
4 downstream. Use of the Sack Dam response will require agreements with San
5 Luis Canal Company.
- 6 • **Redirection of Interim Flows at Sand Slough Control Structure** – During the
7 first year of Interim Flows, water will not be directed into Reach 4B. In
8 subsequent years, water causing impacts in Reach 4B can be diverted into the
9 Eastside Bypass.

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3.0 Interim Flow Monitoring for Seepage

This section describes monitoring pertaining to groundwater and levee seepage in the first year of Interim Flows. This includes monitoring of flow and groundwater levels, and management responses to groundwater and levee seepage. This section provides a framework for the SJRRP Monitoring Program, attached to this document.

Tools identified to support the Seepage Management Program for the first year of Interim Flows include monitoring of flow and groundwater elevations, conducting levee patrols, and contacting landowners. Implementation will require a number of site-specific efforts to identify final monitoring locations, and install groundwater monitoring wells. Coordination with local landowners will provide information to improve the effectiveness of the monitoring program.

3.1 Flow Monitoring

The flow monitoring program will obtain streamflow data. Paragraph 13 and Exhibit B of the Settlement specify Interim Flow measurement on the San Joaquin River at the first six locations listed below. In addition to the six gages identified by the Settlement, a seventh gage is scheduled for installation to monitor potential Interim Flows to the Eastside Bypass.

The following is a complete list of intended flow monitoring locations for the first year of Interim Flows:

- Below Friant Dam
- At Gravelly Ford
- Below Chowchilla Bypass Bifurcation Structure
- Below Sack Dam
- At the head of Reach 4B1
- Above the Merced River confluence
- At the head of the Sand Slough Bypass

3.2 Groundwater Level Monitoring

The groundwater level monitoring program will provide groundwater elevations for transects across, at 8 to 10 mile intervals, the San Joaquin River. All new monitoring wells will be placed at key monitoring locations with high probabilities of groundwater seepage impacts within the Restoration Area. Access limitations and information from monitoring, analysis, and trouble spots identified by local landowners will determine the final location of groundwater transects and wells developed with the specific intent of

- 1 monitoring for groundwater seepage. Information collected as part of the initial phases of
- 2 monitoring may require changing locations, or adding or decommissioning wells in the
- 3 future

4 **3.3 Levee Patrols for Seepage Impacts**

- 5 Levee patrols will be conducted in coordination with the Lower San Joaquin Levee
- 6 District to assist with identifying adverse impacts to third parties from groundwater
- 7 seepage. These patrols would be used to identify the formation of boils, piping, and
- 8 surface water, indicating a realization or potential realization of damages.

9 **3.4 Landowner Contact for Seepage Impacts**

- 10 Outreach to landowners adjacent to the San Joaquin River will be conducted to assist in
- 11 identifying potential adverse impacts to third parties from groundwater seepage.

Attachment

Monitoring Program for Water Year 2010 Interim Flows

**Draft Seepage Management and Monitoring Plan
for Water Year 2010 Interim Flows**



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1 **List of Abbreviations and Acronyms**

2	Act	San Joaquin River Restoration Settlement Act
3	cfs	cubic feet per second
4	Secretary	Secretary of the U.S. Department of the Interior
5	SJRRP	San Joaquin River Restoration Program

1.0 Introduction

An initial set of river transects has been identified for the first phase locations of flow gages and groundwater level monitoring wells. These locations are summarized by reach in Figures 1-1 through 1-6. This initial set of monitoring locations was selected from a much larger monitoring program, currently under development by Reclamation. The monitoring program at large will be designed to collect data on several physical parameters, including flow, water quality, groundwater levels and sediment transport.

These locations were selected from the larger monitoring program based on ease of access and location on public lands.

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2.0 Flow Monitoring Locations

This section describes locations selected for flow monitoring for the first year of SJRRP Interim Flows.

In addition to the six gages identified by the Settlement, a seventh gage is scheduled for installation to monitor potential Interim Flows to the Eastside Bypass. This gage will be located at the head of the Sand Slough Bypass. The locations for flow monitoring identified above are summarized in Table 2-1 and shown in Figure 2-1. Interim Flows will be measured using these seven stream gages.

Table 2-1.
Interim Flow and Restoration Flow Monitoring Locations
Specified in the Settlement

Location	Station Identifier(s) ¹	Responsible Agency	Remarks
Below Friant Dam	MIL	Reclamation	Flows will be measured at Friant Dam outlets and spillway
Gravelly Ford	GRF	Reclamation	Existing gage adequate to measure Interim Flows and Restoration Flows
Below Chowchilla Bypass Bifurcation Structure	CBP, SJB	Reclamation	Existing gages will be retrofitted to measure Interim Flows and Restoration Flows
Below Sack Dam	To be determined	DWR	Gage to be installed, pending landowner agreements
Head of Reach 4B1	To be determined	DWR	Gage to be installed, pending landowner agreements
Head of Sand Slough Bypass	To be determined	DWR	Gage to be installed, pending landowner agreements
Above the Merced River Confluence	To be determined	USGS	Gage to be installed, pending landowner agreements

Note:

¹ California Data Exchange Center identifiers

Key:

CBP = Chowchilla Bypass below Bifurcation Structure

DWR = California Department of Water Resources

GRF = San Joaquin River at Gravelly Ford

MIL = Millerton Lake

Reclamation = U.S. Department of the Interior, Bureau of Reclamation

Settlement = Stipulation of Settlement

SJB = San Joaquin River below Bifurcation Structure

USGS = U.S. Geological Survey

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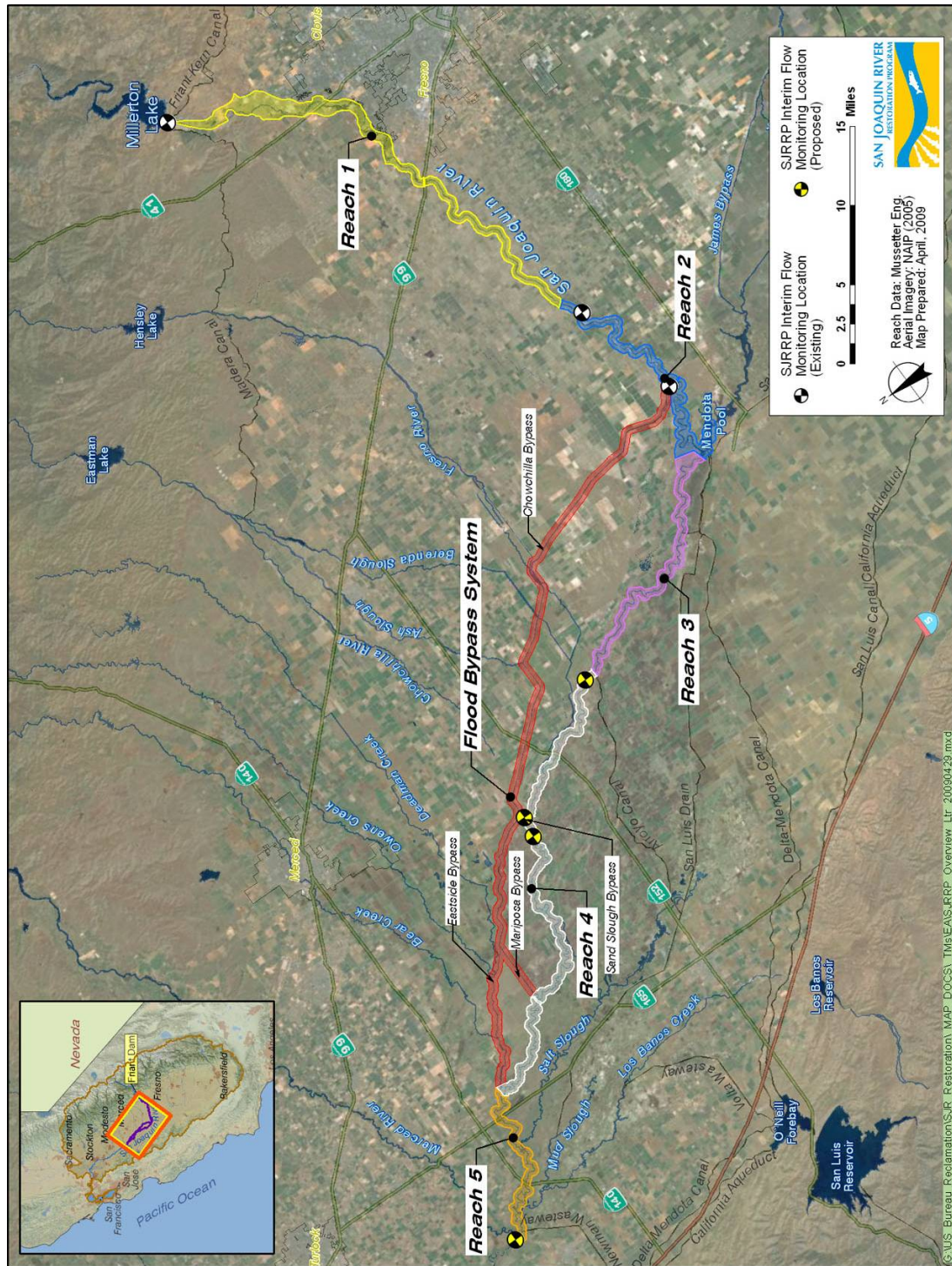


Figure 2-1.
Streamflow Gages Used for Restoration Flow Monitoring

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1 **3.0 Groundwater Level Monitoring**

2 **Locations**

3 This section describes the locations selected for groundwater monitoring for the first year
4 of SJRRP Interim Flows.

5 For the first year of Interim Flows, the groundwater wells used during the pilot program
6 will be made available for monitoring groundwater. Additionally, desirable groundwater
7 transects have been identified on publically accessible lands. These existing wells and
8 identified transects are presented in Figures 3-1 through 3-6.

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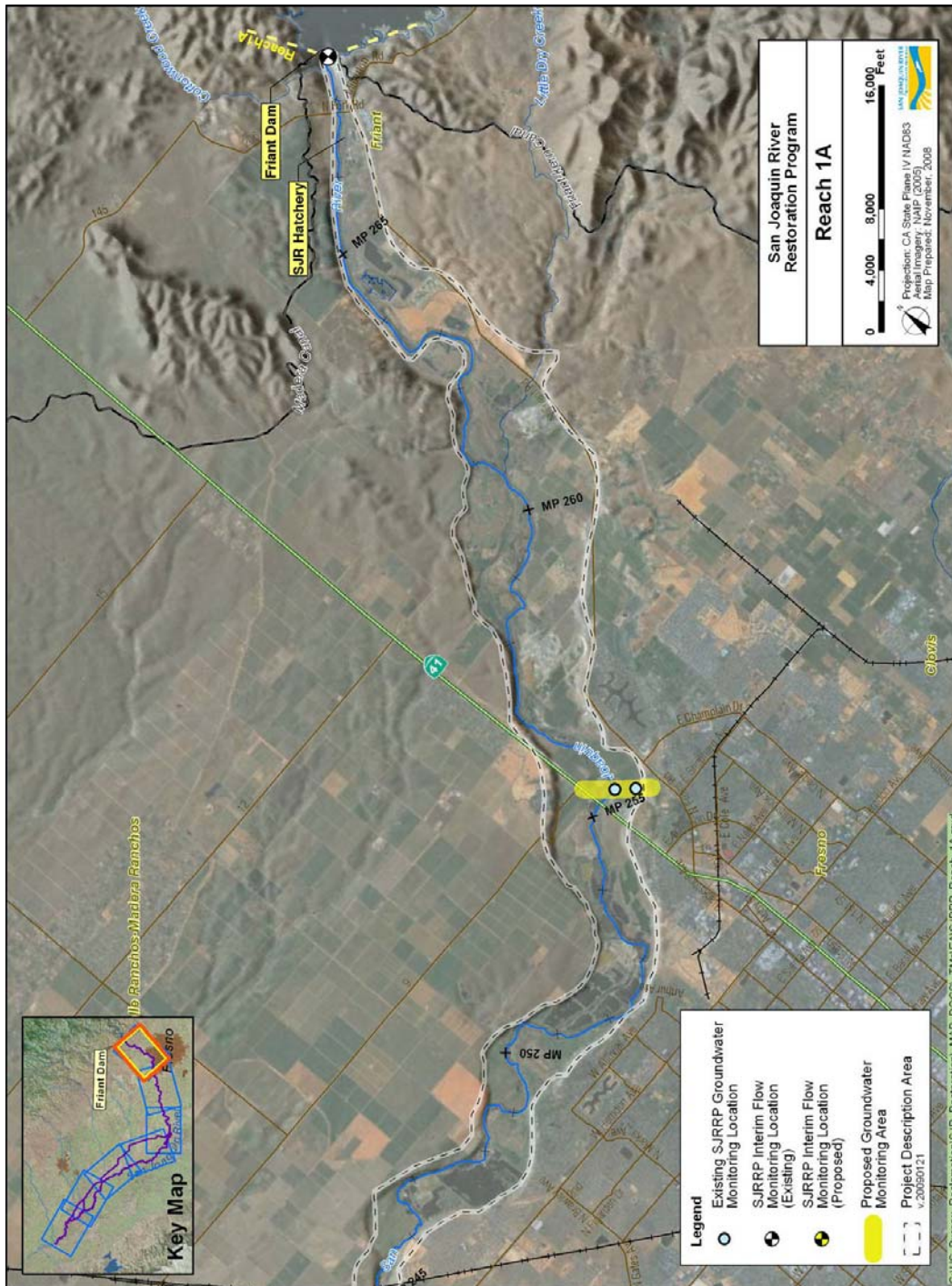


Figure 3-1
Reach 1A – Existing Gages for Flow and Groundwater, and Potential Transects for
Interim Flow Groundwater Monitoring

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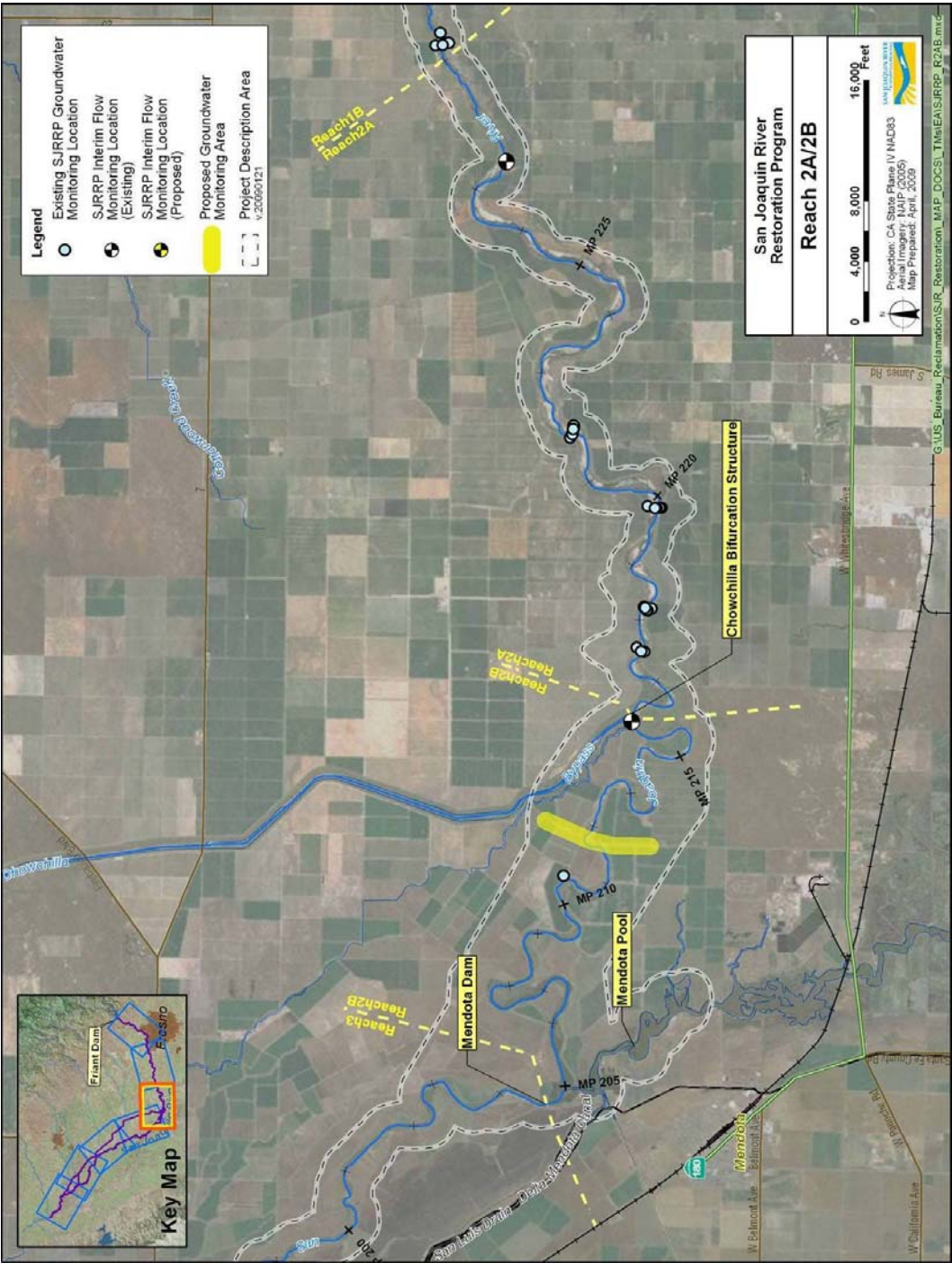


Figure 3-2.
Reaches 2A/2B – Existing Gages for Flow and Groundwater, and Potential Transects for Interim Flow Groundwater Monitoring

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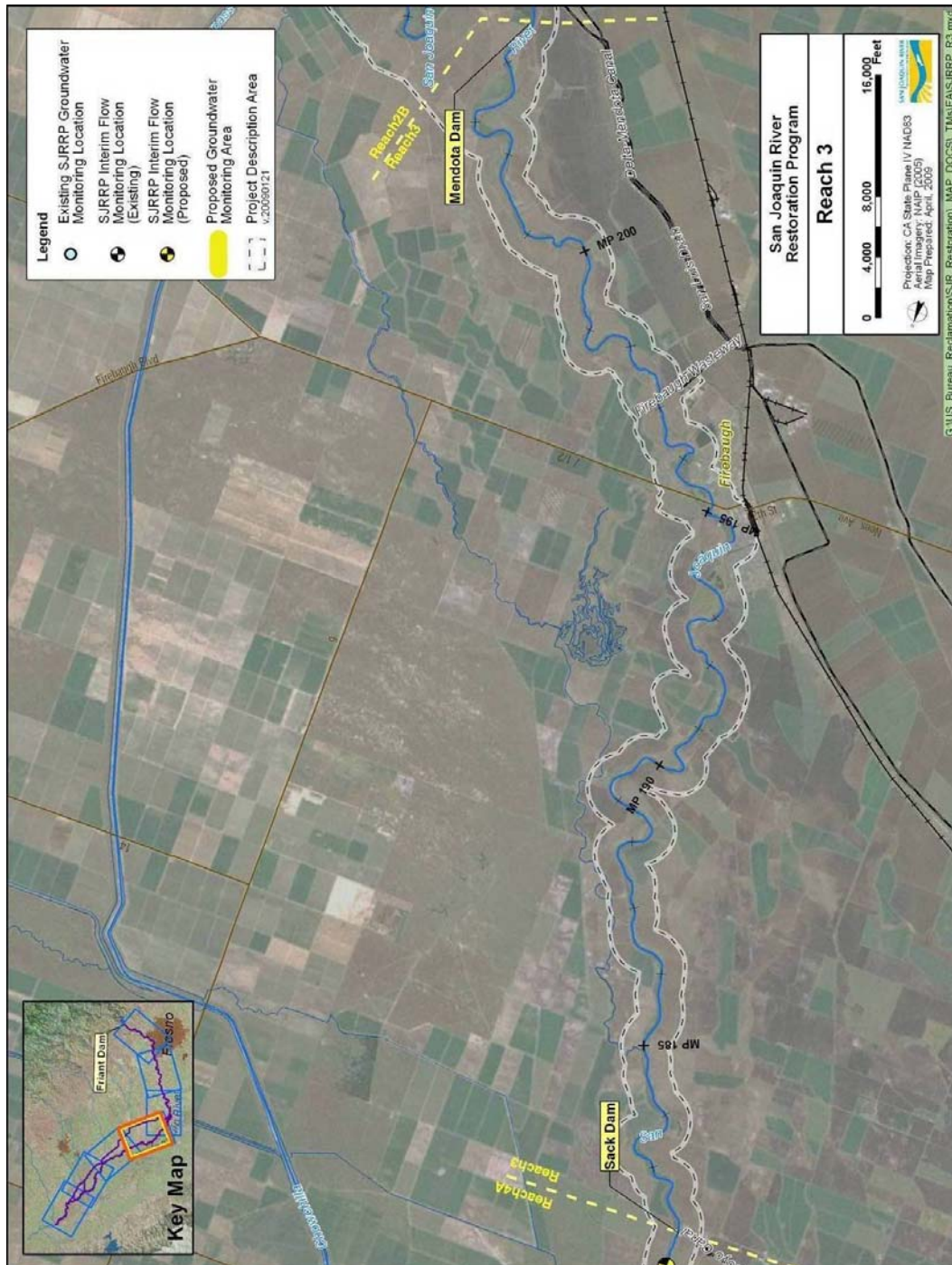


Figure 3-3.
Reach 3 – Existing Gages for Flow and Groundwater, and Potential Transects for
Interim Flow Groundwater Monitoring

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Attachment
Monitoring Program for Water Year 2010 Interim Flows

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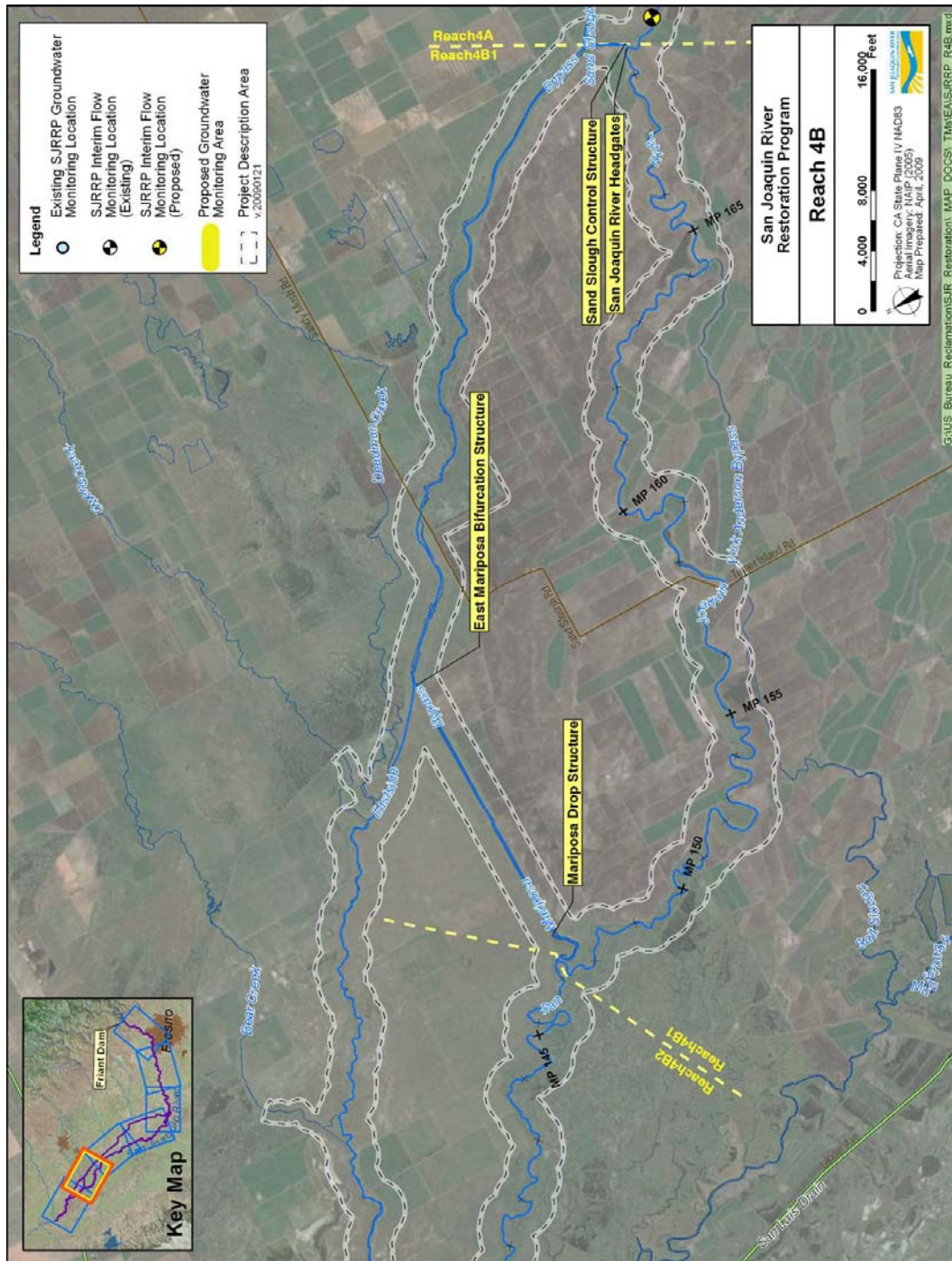


Figure 3-5.
Reach 4B – Existing Gages for Flow and Groundwater, and Potential Transects for
Interim Flow Groundwater Monitoring

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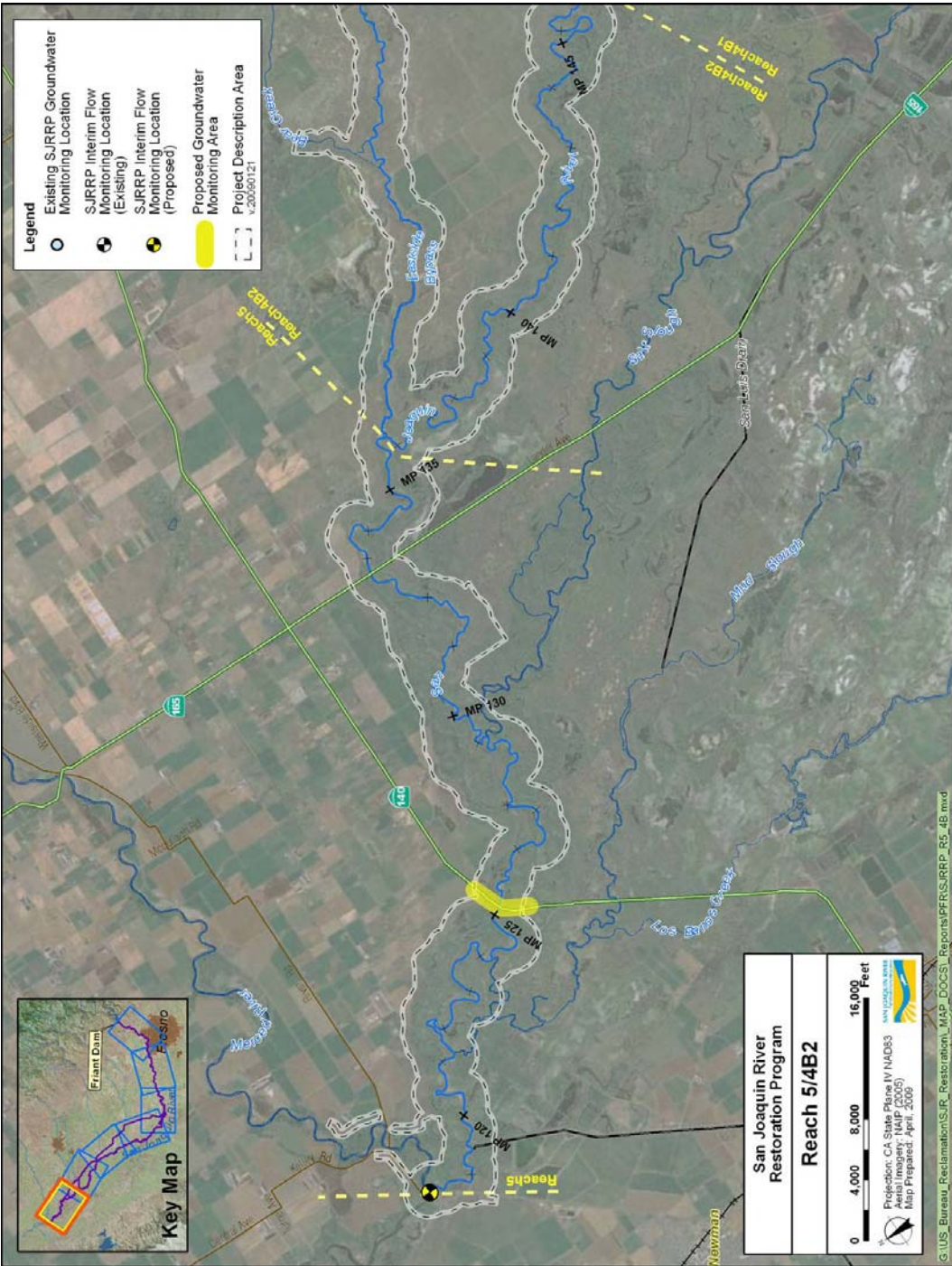


Figure 3-6.
Reaches 5/4B 2 – Existing Gages for Flow and Groundwater, and Potential Transects for Interim Flow Groundwater Monitoring

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