Funding Constrained Framework for Implementation

May 2018

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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List of Abbreviations and Acronyms

2012 Framework	Third Party Working Draft Framework for Implementation, dated June 19, 2012
2015 Revised Framework	Revised Framework for Implementation, dated July 2015
AF	acre-feet
cfs	cubic feet per second
Conservation Facility	Salmon Conservation and Research Facility
CVP	Central Valley Project
DFW	California Department of Fish and Wildlife
DWR	California Department of Water Resources
EIS/R	Environmental Impact Statement/Report
FY	Fiscal Year
Flood Control Project	Lower San Joaquin Flood Control Project
MAP	Monitoring and Analysis Plan
NMFS	National Marine Fisheries Service
PEIS/R	Program Environmental Impact Statement/Report
Program	San Joaquin River Restoration Program
Reclamation	Bureau of Reclamation
ROD	Record of Decision
RWA	Recovered Water Account
USFWS	U.S. Fish and Wildlife Service
Settlement	Stipulation of Settlement in *Natural Resources Defense Council, et al., v. Kirk Rodgers, et al.,*
Settlement Act	San Joaquin River Restoration Settlement Act
SJRR Fund	San Joaquin River Restoration Fund
SJRRP	San Joaquin River Restoration Program
WIIN Act	Water Infrastructure for Improvements to the Nation Act

Executive Summary

This document is a limited and focused assessment of implementation of the San Joaquin River Restoration Program (SJRRP) given a more limited future funding stream than previously anticipated. This document builds upon the *Revised Framework for Implementation*, dated July 2015 (2015 Revised Framework; SJRRP 2015). Specifically, this Funding Constrained Framework assesses the actions that can be accomplished to achieve as much as possible of the Restoration and Water Management goals in the Stipulation of Settlement in *NRDC, et al. v. Kirk Rodgers, et al.* (Settlement), the San Joaquin River Restoration Settlement Act, Title X, Subtitle A, Part I of Public Law 111-11 (Settlement Act), and the "Friant Division Improvements" in Title X, Subtitle A, Part III of Public Law 111-11 (Friant Division Improvements) with a more limited future funding stream and using existing, authorized funding sources (assuming no additional authorization for federal appropriations) and existing authorities.

Building on the development of the 2015 Revised Framework , the Implementing Agencies – the Bureau of Reclamation, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the California Department of Fish and Wildlife, and the California Department of Water Resources (DWR) – the parties to the Settlement, and affected downstream water districts and landowners have held meetings from August 2017 to March 2018 and continue to hold a number of meetings to address various concerns expressed and determine a path forward for the SJRRP including funding challenges facing the SJRRP. These parties collectively prepared a *Foundation for the Funding Constrained Framework for Implementation* (Framework Foundation; SJRRP 2018b).

In the Framework Foundation, the parties collectively came to the understanding that the funding currently identified and authorized in the Settlement Act is not sufficient to complete all of the actions necessary to implement the Settlement and Settlement Act. In order to proceed towards fulfilling the Restoration and Water Management goals, along with the third party protections, the parties identified a multi-staged approach, which is described in this document and in the Framework Foundation. The staged approach is consistent with the Settlement and Settlement Act and will not involve any modifications or amendments to either. In addition, this approach does not in any way amend or alter the Settlement or Settlement Act, or alter the obligation to fully implement the Settlement. Each party commits to working collaboratively and in good faith towards full implementation of the SJRRP through this multi-staged approach.

The first stage (termed Stage 1), which is the focus of this document, has the primary goal of beginning the reestablishment of spring-run and fall-run Chinook salmon in the San Joaquin River between the Merced River and Friant Dam through the establishment of volitional fish passage, sufficient flows to manage temperatures, and provide for the basic habitat needs of the species. To accomplish this goal, Stage 1, which extends from federal fiscal year (FY) 2017 through 2024, consists of a number of major construction activities as identified in Table ES-1. Costs for these activities are provided in Table ES-2.

Table ES-3 shows the summary of funding needed to implement Stage 1 from federal and State sources. Funding needs are escalated into the future and thus provided in various year dollars. Funding sources identified in the Settlement Act at October 2006 or October 2008 price levels have also been escalated into future price levels.

In summary, the federal funding need is estimated to be $540,912,000. Of this amount, $534,776,000 has been identified through existing sources, leaving a deficit of $6,135,000. The funding need designated as a State cost is $102,343,000. The State has identified $93,709,000 in funding, leaving a remaining funding deficit of $8,634,000.

Table ES-1. Key SJRRP Major Construction Actions Schedule for Completion in Stage 1

Stage 1, FY 2017 to FY 2024	
Primary Goal – Begin the reestablishment of spring-run and fall-run Chinook salmon through the establishment of volitional fish passage, sufficient flows to manage temperatures, and provide for the basic habitat needs of the species	
Flow-Related Activities	• Seepage projects up to 2,500 cfs • Levee stability projects up to 2,500 cfs
Restoration Goal Activities	• Mendota Pool Bypass and associated structures • Mendota Pool Fish Screen • Levees in Reach 2B to convey 4,500 cfs through Reach 2B and 2,000 cfs into the Mendota Pool • Fish passage improvements to the San Joaquin River Side of the Chowchilla Bifurcation Structure • Arroyo Canal Fish Screen and Sack Dam Fish Passage • Salmon Conservation and Research Facility • Fish passage actions in the Middle Eastside Bypass
Water Management Goal Activities	• Award remaining funding to non-federal partners to move forward with the construction of the Friant-Kern Canal and Madera Canal Capacity Correction projects
Although not construction actions, Stage 1 will also consist of the operations of the facilities constructed along with a number of minor projects and activities	

Table ES-2. SJRRP Project and Activity Costs to be Undertaken in Stage 1
(values in thousands)

Action	Cost (Various $)[1]
Staffing and Administration	$59,869
Flow Actions	
Conservation Strategy / Mitigation Measures	$10,931
Flows	$6,150
Seepage Projects	$72,204
Levee Stability	$20,319
Channel and Structural Improvements	
Mendota Pool Bypass, Fish Screen and Reach 2B Levees[2]	$336,803
Reach 4B, Eastside Bypass and Mariposa Bypass[3]	$1,387
Arroyo Canal Fish Screen and Sack Dam Fish Passage	$41,645
Salt and Mud Slough Seasonal Barriers	$0
Reach 4B, Eastside Bypass High Flow Routing	$0
Chowchilla Fish Passage	$0
Gravel Pits Filling or Isolation[3]	$2,946
Paragraph 12 Activities[3]	$0
Passage at Key Barriers	$12,161
Fish Reestablishment	$37,565
Water Management Goal & Friant Division Improvements	
Water Management Goal Oversight	$10,464
Friant-Kern and Madera Canal Capacity Restoration	$28,530
Reverse Flow Facilities	$40
Financial Assistance for Friant Division Improvements	$32
Miscellaneous	$2,210
Total	**$643,255**

1. Cost have been escalated into future years.
2. Includes Mendota Pool Bypass, Mendota Pool Fish Screen, and part or all of the Reach 2B Levees. Actual facilities constructed and phasing will be determined in coordination with the Implementing Agencies, Settling Parties, and Third Parties by late spring 2018. Modifications to the San Joaquin River side of the Chowchilla Bifurcation Structure are included in this Funding Constrained Framework as part of the Mendota Pool Bypass, Fish Screen and Reach 2B Levees.
3. DWR may have available funds beyond their commitments in this Funding Constrained Framework. DWR may use their remaining funds to continue to support restoration actions by conducting studies and implementing small projects that continue to improve the success of a naturally-reproducing, self-sustaining salmon fishery.

Table ES-3. SJRRP Funding Needs and Sources to Implement the Actions in Stage 1
(values in thousands)

	Funds in Various Dollars[1]
Federal Funding Needs	
Total Estimated Federal Funding Need	$540,912
Federal Funding Sources Remaining	
SJRR Fund [2]	$303,061
CVP Restoration Fund [3]	$16,000
Federal Appropriations – Section 10009 of PL 111-11	$215,683
Federal Appropriations – Section 10203 of PL 111-11 [4]	$32
Federal Appropriations – WIIN Act	$0
Federal Appropriations – Fish and Wildlife Coordination Act	$0
Total Estimated Remaining Federal Funding Sources	*$534,776*
Federal Funding Remaining / (Shortfall)	($6,135)
State Funding Needs	
Total Estimated State Funding Need	$82,024
Total Estimated State Funding Need with Levee Stability	$102,343
State Funding Sources Remaining	
State Authorized Funding Remaining	$93,709
State Funding Remaining / (Shortfall)	($8,634)

Note:
1. Funding need and sources (as authorized by law) have both been escalated into future year dollars.
2. Estimated funds accumulated in the SJRR Fund through the end of FY 2024. Includes estimated future Unreleased Restoration Flows sales, RWA sales, and Friant surcharge collections.
3. CVP Restoration Fund amounts assume an average of $2,000,000 annually, although this amount can be indexed.
4. Implementation of additional Part III groundwater banking projects is not included in Stage 1. The funding for this line reflects on the amount Reclamation would expend to complete the existing projects. However, it is important to note that there are a few years when Reclamation anticipates not being able to obligate the entire appropriations within the fiscal year. In these years, some or all of these funds could be used to implement additional Part III actions. In addition, this does not preclude Reclamation from pursuing additional appropriations for the Part III groundwater banking projects in Stage 1.

1.0 Introduction

This document is a limited and focused assessment of implementation of the San Joaquin River Restoration Program (SJRRP) given a more limited future funding stream than previously anticipated. This document builds upon the *Revised Framework for Implementation*, dated July 2015 (2015 Revised Framework; SJRRP 2015). Specifically, this Funding Constrained Framework assesses the actions that can be accomplished to achieve as much as possible of the Restoration and Water Management goals in the Stipulation of Settlement in *NRDC, et al. v. Kirk Rodgers, et al.* (Settlement), the San Joaquin River Restoration Settlement Act, Title X, Subtitle A, Part I of Public Law 111-11 (Settlement Act), and the "Friant Division Improvements" in Title X, Subtitle A, Part III of Public Law 111-11 (Friant Division Improvements) with a more limited future funding stream and using existing, authorized funding sources (assuming no additional authorization for federal appropriations) and existing authorities.

For various reasons, the implementation of the Settlement is behind schedule and implementation of the Settlement, Settlement Act, and Friant Division Improvements collectively will cost more than originally anticipated. In 2015, an extensive effort was made to develop a reasonable and effective schedule for implementing the SJRRP given realistic time-frames and financial solvency. Building on the development of the 2015 Revised Framework and to address various concerns expressed and determine a path forward for the SJRRP, the Implementing Agencies – the Bureau of Reclamation (Reclamation), the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the California Department of Fish and Wildlife (DFW), and the California Department of Water Resources (DWR) – the parties to the Settlement (Settling Parties), and affected downstream water districts and landowners (Third Parties) have held a number of meetings from August 2017 to March 2018 and continue to hold meetings to address the funding challenges facing the SJRRP. These parties collectively prepared a *Foundation for the Funding Constrained Framework for Implementation* (Framework Foundation; SJRRP 2018b) that is provided in Appendix A.

In the Framework Foundation, the parties collectively came to the understanding that the funding currently identified and authorized in the Settlement Act is not sufficient to complete all of the actions necessary to implement the Settlement and Settlement Act. In order to proceed towards fulfilling the Restoration and Water Management goals, along with the third party protections, the parties identified a multi-staged approach, which is described in this document and in the Framework Foundation. The staged approach is consistent with the Settlement and Settlement Act and will not involve any modifications or amendments to either. In addition, this approach does not in any way amend or alter the Settlement or Settlement Act, or alter the obligation to fully implement the Settlement. Each party has committed to working collaboratively and in good faith towards full implementation of the SJRRP through this multi-staged approach.

Similar to the 2015 Revised Framework, this Funding Constrained Framework is a "living" document and it is anticipated that updates will be made as additional information is gained and milestones are reached. While this Funding Constrained Framework represents a path forward in compliance with the Settlement and Settlement Act, it does not encompass all of the actions that

are necessary to comply with the Settlement and Settlement Act and also does not encompass all of the actions that may ultimately be taken to implement the SJRRP. The ultimate implementation of the SJRRP will be shaped by decisions made through planning processes that are part of the SJRRP, such as the Fisheries Management Plan, environmental processes, permit requirements, and adaptive management.

1.1 Stage 1: Providing the Conditions Necessary for Reestablishment of Salmon

In the Framework Foundation, the parties identified a staged approach that can be implemented in the near term and within the bounds of currently identified funding. The first stage, termed Stage 1, has the primary goal of beginning the reestablishment of spring-run and fall-run Chinook salmon in the San Joaquin River between the Merced River and Friant Dam through the establishment of volitional fish passage, sufficient flows to manage temperatures in the river, and provide for the basic habitat needs of the species. To accomplish this goal, Stage 1, which extends from federal fiscal year (FY) 2017 through 2024, consists of completion of the following major construction activities:

- Construction of the Mendota Pool Bypass and fish screen;
- Construction of sufficient levees in Reach 2B to provide floodplain habitat and channel capacity of 4,500 cubic feet per second (cfs) through Reach 2B and construction of facilities to allow Reclamation to make deliveries of San Joaquin River water into the Mendota Pool when necessary;
- Completion of seepage and levee stability actions to achieve up to 2,500 cfs flow capacity through Reach 2A, Reach 3, Reach 4A, in the Eastside Bypass from the Sand Slough Connecter north to the confluence with the San Joaquin River;
- Construction of the Arroyo Canal Fish Screen and Sack Dam Fish Passage Project;
- Construction of the Salmon Conservation and Research Facility;
- Construction of fish passage actions in the Eastside Bypass from the Sand Slough Connecter north to the confluence with the San Joaquin River and at the San Joaquin River side of the Chowchilla Bifurcation Structure; and,
- Award remaining funding to non-federal partners to move forward with the construction of the Friant-Kern Canal and Madera Canal Capacity Correction projects.

Although not construction actions, Stage 1 will also consist of the operations of the facilities constructed along with a number of minor projects and activities (see Chapter 3 for a full description of these).

Table 1-1 provides a summary of the major construction action in Stage 1 and Table 1-2 provides costs for all of the Stage 1 actions. Figure 1-1 provides a summary of the costs and benefits of the Stage 1 actions. Figure 1-2 provides a summary of the timing of key channel capacity and fish passage action in Stage 1.

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3. DWR may have available funds beyond their commitments in this Funding Constrained Framework. DWR may use their remaining funds to continue to support restoration actions by conducting studies and implementing small projects that continue to improve the success of a naturally-reproducing, self-sustaining salmon fishery.

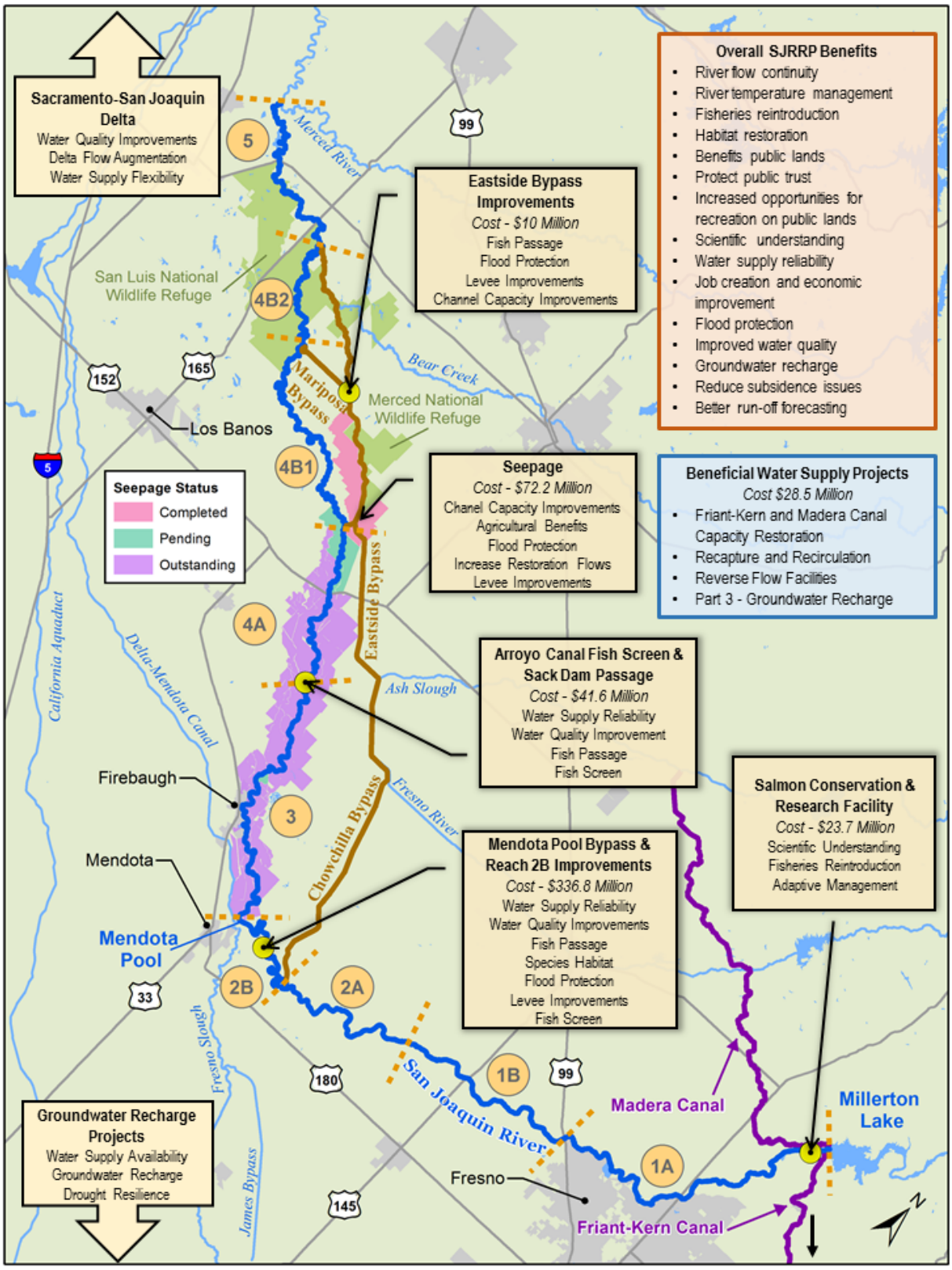
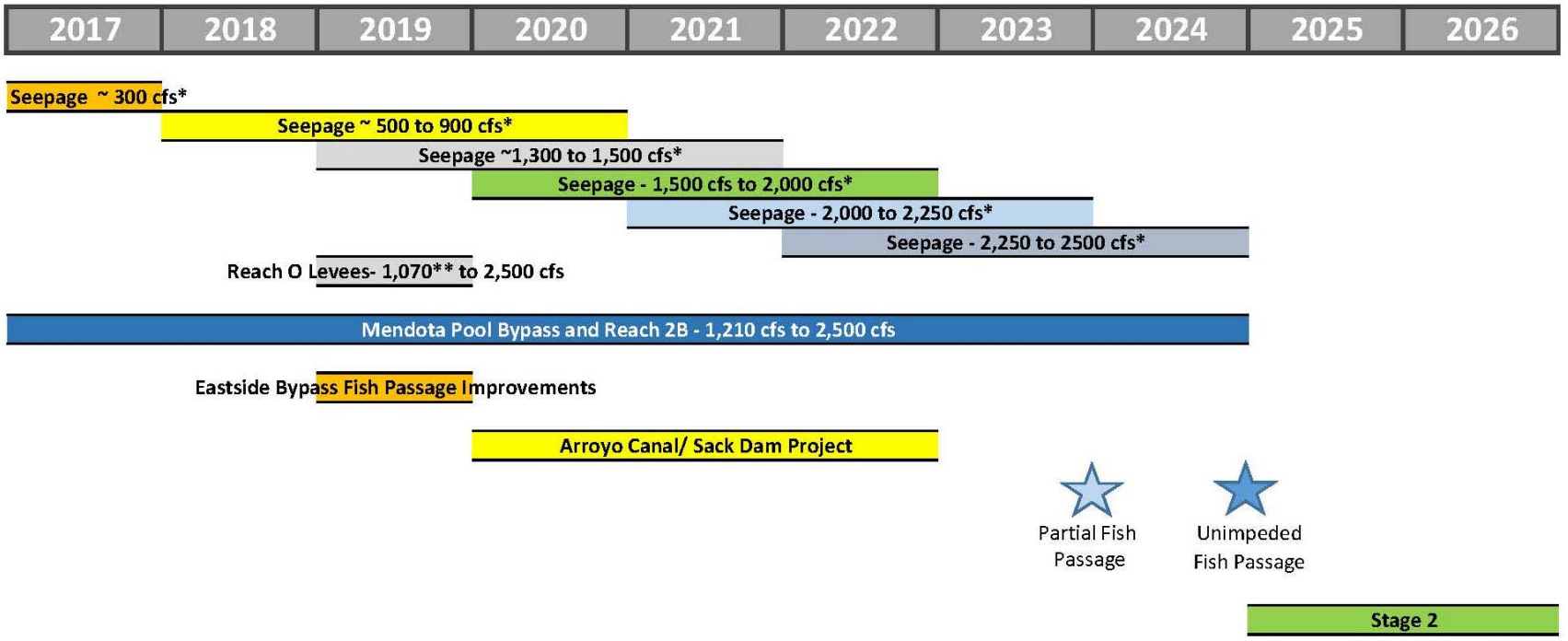


Figure 1-1. Summary of Major Activities and Costs in this Funding Constrained Framework



Estimated Channel Capacity (cfs)

300	500	700	900	1,210	1,210	1,210	2,500	2,500	2,500

Factor Controlling Channel Capacity

Seepage	Seepage	Seepage	Seepage	MPB	MPB	MPB	Seepage	Seepage	Seepage

* The magnitude of flow that is addressed by seepage actions are approximate and subject to change.

**This channel capacity assumes that the weir boards will be removed from the Merced National Wildlife Refuge weirs. With boards in the weirs, capacity is 580 cfs.

Figure 1-2. Summary of Key Timing for Channel Capacity and Fish Passage Actions in Stage 1

1.2 Stage 2 and Beyond: Full Implementation

As previously described, the actions identified in Stage 1 do not fully implement the Settlement, Settlement Act, and Friant Division Improvements. Additional stages will be identified by the parties collectively in the future to fully implement the Settlement, Settlement Act, and Friant Division Improvements. Chapter 4 provides a list of actions that will not be implemented within Stage 1, but will be included in a future stage. Reclamation plans to begin preparation of a Framework document for future stages in 2021. Additional local, state, and federal funding will be necessary after Stage 1 to fully implement the Settlement and Settlement Act, and the non-federal Settling Parties and Third Parties will use good faith efforts to obtain the funding necessary to fund completion of this first and later stages, including collectively supporting Congressional authorization of additional appropriations, in order to fully implement the Settlement and Settlement Act.

1.3 Framework Background

The SJRRP has prepared a number of Framework documents dating back to 2012 that form the basis of the actions in the Framework Foundation and in this Funding Constrained Framework. The development of these documents, which have taken tremendous effort and time over the years, has led to increased fine-tuning of the SJRRP. This has made the SJRRP more efficient and effective with a more collaborative, consensus based effort. The Implementing Agencies, Settling Parties, and Third Parties have been involved in each one of these Framework efforts and provided critical input, which has led to a solid foundation for the major construction actions commencing in Stage 1. These previous Framework efforts and resulting documents are summarized below.

1.3.1 2012 Framework for Implementation

In June 2012, the SJRRP, in coordination with the Implementing Agencies and Settling Parties, prepared and released the *Third Party Working Draft Framework for Implementation* (2012 Framework; SJRRP 2012). The 2012 Framework made use of new information to provide a revised schedule and budget to guide SJRRP activities. The 2012 Framework identified:

1. Conditions necessary to reintroduce Chinook salmon into the San Joaquin River in light of existing and anticipated river conditions, and in a manner consistent with the Settlement and Settlement Act.

2. Implementing Agencies' priorities in achieving the Restoration and Water Management goals.

3. Actions that require additional information, and established the relative benefits and costs before committing resources to those actions.

4. Actions that can be undertaken incrementally, while preserving the flexibility to adjust and adapt as the Implementing Agencies learn more about actions that may benefit the Restoration and Water Management goals.

5. Actions as "core", "secondary", and, "improvement" actions. In addition, the 2012 Framework focused the near-term scope, schedule, and budget of the SJRRP to the "core" actions.

    - "Core": actions considered essential to the success of the SJRRP, where the Implementing Agencies are certain that the action will result in a positive outcome, and where the absence of action would result in program failure.

    - "Secondary": actions where the Implementing Agencies have a high level of confidence in a beneficial outcome, but where the absence would not result in the failure to achieve the goals of the Settlement and Settlement Act. For the Restoration Goal, some of these secondary actions may be required to address the potential cumulative effects of fishery impairments. Information gained through monitoring and analysis may result in secondary actions becoming core or improvement actions.

    - "Improvement": actions with uncertain benefits to the overall SJRRP. These actions are thought to increase the SJRRP's success, but additional study and analysis is needed. Information gained through monitoring and analysis may result in these actions becoming secondary or core actions.

However, the 2012 Framework was limited in that it both continued to assume all projects would move forward at the same time and assumed funds would be available to meet the SJRRP's funding needs.

1.3.2 2015 Revised Framework

In July 2015, the SJRRP, in coordination with the Implementing Agencies, Settling Parties, Third Parties, and interested members of the public, prepared and released the *Revised Framework for Implementation* (2015 Revised Framework; SJRRP 2015). The 2015 Revised Framework updated and revised the 2012 Framework, and established a realistic schedule for the implementation of the SJRRP based upon the best available technical, biological, scheduling, and funding information. Specifically, the 2015 Revised Framework established the following:

- Five year visions to provide clear, realistic, and accomplishable steps towards meeting the Restoration and Water Management goals in the Settlement and the Settlement Act and towards completing the Friant Division Improvements;

- Achievable schedules based upon realistic federal and State of California appropriation levels, improving the Implementing Agencies ability to plan and be transparent on actions; and,

- Roles and responsibilities for each Implementing Agency, increasing each agency's ability to budget, plan, and approve construction actions.

This 2015 Revised Framework provided a more realistic schedule and associated future funding needs for the SJRRP Implementing Agencies to focus on implementation of the Settlement, Settlement Act, and Friant Division Improvements. The 2015 Revised Framework identified the

cost of implementing the SJRRP from FY 2015 to FY 2029 as $1.5 billion and identified insufficient funding authorized to complete the actions in the 2015 Revised Framework.

1.3.3 Fisheries Framework

The 2012 Framework and the 2015 Revised Framework both primarily focused on activities necessary to plan, permit, design, and construct major physical project elements of the SJRRP. In June 2017, the SJRRP, in coordination with the Implementing Agencies and Settling Parties, prepared the *Fisheries Framework: Spring-run and Fall-run Chinook Salmon* (Fisheries Framework; SJRRP 2017). The Fisheries Framework established a realistic schedule for implementation of the fisheries management actions in the Settlement and Settlement Act based upon the best available science and information and provides guidance to the Implementing Agencies to implement the fisheries components of the Settlement and Settlement Act. The Fisheries Framework contains a description of: (1) goals and objectives for establishing spring-run and fall-run Chinook salmon populations in the Restoration Area (the area from Friant Dam to the Merced River confluence); (2) habitat and ecosystem conditions that will support naturally reproducing, self-sustaining salmon populations; (3) the scientific foundation for the planned management actions; and (4) a proposed Adaptive Management process and implementation plan.

The Fisheries Framework is in draft form and is expected to be finalized in 2018.

1.4 Development of this Funding Constrained Framework

This Funding Constrained Framework was developed in coordination with the Implementing Agencies, Settling Parties, and the Third Parties beginning with the Framework Foundation (SJRRP 2018b) that is provided in Appendix A and the *Analysis of Physical Flow Characteristics Supportive of Chinook Salmon to Inform Channel Capacity Selection in the Funding Constrained Framework* provided in Appendix B (Fish Flow Characteristics Report; SJRRP 2018a). Over a dozen one-on-one, small group, and large group meetings and conference calls were held from August 2017 through March 2018 to develop the Framework Foundation and the Fish Flow Characteristics Report. The Framework Foundation then formed the basis of this Funding Constrained Framework. The Fish Flow Characteristics Report informed the Implementing Agencies, Settling Parties, and the Third Parties on key physical flow characteristics for fish provided by different channel capacities. This Fish Flow Characteristics Report provided supporting information for the channel capacities necessary to begin the fish reestablishment actions called for in Stage 1.

1.5 Tracking Implementation of this Funding Constrained Framework

Tracking progress in implementing this Funding Constrained Framework is key to the successful implementation of Stage 1. As part of the development of this Funding Constrained Framework, Reclamation initiated a Cost Containment and Cost Cutting Team consisting of members of the Implementing Agencies, Settling Parties, Restoration Administrator and Technical Advisory

Team, and Third Parties. This team met a number of times throughout the development of this document and was successful in reducing costs substantially.

In tracking implementation of this Funding Constrained Framework, the Cost Containment and Cost Cutting Team will continue to meet on at least a biannual basis to review costs to date, discuss upcoming activities, and continue to seek ways to reduce SJRRP costs. The team may met more frequently if warranted.

1.6 Changes to this Funding Constrained Framework

This Framework is a working document and it is expected that some things will change as more information is developed over time or as funding changes over time. Changes to this Funding Constrained Framework will follow the same process identified in the 2015 Revised Framework.

2.0 Funding Sources and Summary of Costs

A discussion of the SJRRP's funding sources along with the obligations and expenditures through FY 2016 are provided in this chapter. This section provides a summary description of each funding source. See Chapter 3 of the 2015 Revised Framework for a more extensive description of each. See Appendix A for a more detailed accounting of federal obligations and expenditures for the SJRRP through FY 2016.

2.1 Federal Funding Sources

The Settlement Act identifies a series of federal funding sources for implementation of the SJRRP. These sources are described in Section 10009 and Section 10203 of Public Law 111-11 and collectively include the San Joaquin River Restoration (SJRR) Fund, Central Valley Project (CVP) Restoration Fund, and new federal appropriations. A summary of these sources is provided below. In addition to those sources in the Settlement Act, Reclamation also has other authorizations, including the Secure Water Act, the Water Infrastructure for Improvements to the Nation (WIIN) Act, and the Fish and Wildlife Coordination Act. These possible sources are also described below. Table 2-1 provides a summary of the amounts approved (available or authorized and appropriated by Congress) as of the end of FY 2016 from these sources.

2.1.1 San Joaquin River Restoration Fund

Section 10009 of the Settlement Act created the SJRR Fund. Sources of monies deposited into the fund are described in summary below (see Chapter 3 of the 2015 Revised Framework for further information). Table 2-2 identifies collections into the SJRR Fund by source and year. The Settlement Act included the appropriation of $88 million from the SJRR Fund. The remainder must either be appropriated by Congress or becomes available for expenditure, not subject to appropriation after October 1, 2019 (in essence, FY 2020).

Friant Surcharge

The Friant surcharge is the continuation of and the dedication of an environmental fee charged pursuant to the CVP Improvement Act for every acre-foot (AF) of CVP project water delivered to Friant contractors, except for Recovered Water Account water. Reclamation assumes a long-term average sale of 800,000 AF to the Friant Division. However, actual deliveries and therefore, proceeds will vary substantially by year, as shown in Table 2-2. This Funding Constrained Framework assumes that the surcharge would remain at $7 per acre-foot from FY 2020 to FY 2039 and, pursuant to Section 10010(d)(1) of the Settlement Act, Reclamation would reduce the contractors' annual operation and maintenance obligation on a dollar-for-dollar basis.

Table 2-1. Approved Funds Through FY 2016, SJRRP Federal Funding Sources
(values in thousands)

	Prior FYs	FY 10	FY 11	FY 12	FY 13	FY 14	FY 15	FY 16	Total
San Joaquin River Restoration Fund	$0	$88,000	$0	$0	$0	$0	$0	$0	**$88,000**
CVP Restoration Fund	$24,500	$1,000	$1,500	$2,000	$2,000	$2,000	$2,000	$2,000	**$37,000**
Federal Appropriations - Section 10009 of PL 111-11	$0	$5,000	$5,016	$8,892	$5,553	$25,973	$34,944	$33,544	**$118,922**
Federal Appropriations - Section 10203 of PL 111-11	$0	$0	$0	$0	$9,977	$27	$56	$1,456	**$11,516**
Federal Appropriations - Secure Water Act	$0	$0	$0	$0	$0	$0	$2,300	$1,000	**$3,300**
Federal Appropriations - WIIN Act	--	--			--		--		**$0**
Federal Appropriations - Fish and Wildlife Coordination Act	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
CalFed	$1,000	$0	$0	$0	$0	$0	$0	$0	**$1,000**
San Joaquin River Restoration Trust Fund	$2,000	$1,000	$1,500	$0	$0	$0	$0	$0	**$4,500**
Total	**$27,500**	**$95,000**	**$8,016**	**$10,892**	**$17,530**	**$28,000**	**$39,300**	**$38,000**	**$264,238**

Note: Does not include prior year recovery or carryover of funds from year to year.

Table 2-2. Collections into the SJRR Fund Through FY 2016
(values in thousands)

	FY 10	FY 11	FY 12	FY 13	FY 14	FY 15	FY 16	Total
Friant Capital Repayment	$1,219	$192,500	$22,405	$958	$0	$0	$0	**$217,082**
Friant Surcharge	$10,804	$7,952	$6,358	$4,305	$1,435	$653	$3,248	**$34,755**
Water and Land Sales	$0	$1,449	$2,016	$480	$2,780	$585	$7,466	**$14,776**
Non-Federal Funds	$0	$0	$0	$0	$0	$0	$0	**$0**
Total	**$12,023**	**$201,901**	**$30,779**	**$5,743**	**$4,215**	**$1,283**	**$10,714**	**$266,613**

Note: Actual receipts. Only $88M of the Friant Surcharge and the Water and Land Sales funds can be spent without further appropriation until FY 20.

Friant Capital Repayment

The Friant Capital Repayment redirects the capital (construction) component of water rates paid by Friant Division, Hidden Unit, and Buchanan Unit water users to the SJRR Fund. In 2010, Reclamation converted all of the Friant Division, Hidden Unit, and Buchanan Unit long-term water service contracts into repayment contracts, except for four water service contracts. All proceeds from the capital component in this contract conversion were deposited into the SJRR Fund. In addition, the capital component of the water rates paid by the four contractors that did not convert to repayment contracts is also deposited into the SJRR Fund.

Sales of Water and Property

There are three types of revenues in this category as follows:

- Sale of Recovered Water Account (RWA) water – Paragraph 16(b) of the Settlement directs Reclamation to make water available to all of the Friant Division long-term contractors who are impacted by the Settlement's Interim and Restoration flows at a total cost of $10 per acre-foot. Water is to be made available only in wet hydrologic conditions. Proceeds from the sale of RWA water are deposited into the SJRR Fund. This Funding Constrained Framework assumes a long-term average sale of RWA water of 68,000 AF per year, corresponding to long-term average proceeds of $680,000 per year.

- Unreleased Restoration Flows – Under Paragraph 13(i) of the Settlement, and consistent with the conditions of that paragraph, in general, the Secretary of the Interior can sell the amount of Restoration Flows not released into the San Joaquin River in any year. An analysis was completed as part of the development of the 2015 Revised Framework to estimate the potential amount and revenues from the sale of Unreleased Restoration Flows assuming the schedule of projects in this document. Based on this analysis and the increasing channel capacity schedule, this Funding Constrained Framework assumes $13,294,000 per year in FY 2018 and FY 2019 and $5,799,000 per year from FY 2020 through FY 2024.

- Sale of Property and Interests in Property – The proceeds from this source are assumed to be negligible.

Non-Federal Funds

Non-federal funds, including State funds, may be deposited into the SJRR Fund. As most State activities on the SJRRP are anticipated to be implemented by the State on an "in kind service" basis, cash deposits from the State into the SJRR Fund are assumed to be negligible.

2.1.2 CVP Restoration Fund

Section 10009(b)(2) of the Settlement Act authorizes up to $2 million annually, in 2006 price levels, from the CVP Restoration Fund to implement the Settlement. CVP Restoration Funds must be appropriated annually by Congress and are contingent on actual collections from water and power sales.

2.1.3 Federal Appropriations – Section 10009 and 10203 of PL 111-11

Two sources of federal appropriations are provided in Public Law 111-11 as follows:

- Part I, Section 10009(b)(1) of the Settlement Act authorizes federal appropriations up to $250 million, in 2006 price levels, for implementing the Settlement. In June 2017 levels, this is $314,545,000. Additionally, the Settlement Act sets a limit on the rate of expenditure of these funds. Section 10009(b)(1) identifies that the Secretary of the Interior can only expend these funds in an amount equal to the sum of the Friant surcharge, non-federal contributions, in-kind contributions, and other non-federal payments actually committed to implementing the Settlement.

- Part III, Section 10203 of Public Law 111-11 authorizes an additional $50 million, in 2008 price levels, to carry out certain improvements within the Friant Division, and financial assistance to local agencies for groundwater banking projects. In June 2017 levels, this is $60,257,000. No constraints are provided on the rate of expenditure of these funds.

2.1.4 Federal Appropriations – Secure Water Act

Public Law 111-11, Title IX, Subtitle F (Secure Water Act), Section 9504(a)(1)(C) and (D), authorizes the Secretary of the Interior to provide any grants to or agreement with, any eligible applicant to assist in planning, designing, or constructing any improvement to, among other things, enhance water management. Western Drought Response appropriations totaling $3.3 million was provided for the Friant-Kern Canal Reverse Flow Pumpback Project in FY 2015 and FY 2016.

2.1.5 Federal Appropriations – WIIN Act

Public Law 114-322, the Water Infrastructure Improvements for the Nation Act (WIIN Act), Subtitle J – California Water, Section 4007 and 4010(b)(6), provides a few authorities that may be applicable to implementing both the Restoration and Water Management goals. Section 4007 of the WIIN Act provides Reclamation with the authority for the design, study or construction or expansion of any federally owned storage project or the ability to participate in a State-led storage project. For federally owned projects, there is a 50/50 cost share requirement; the cost share for State-led storage projects is no more than 25 percent. Section 4007 may be applicable to the Friant-Kern Canal Capacity Restoration Project or Water Management Goal Investment Strategy projects. Section 4010(b)(6) of the WIIN Act provides Reclamation with the authority to acquire land, water, or interests in lands or water from willing sellers in California to: (1) benefit listed or candidate species under the Federal Endangered Species Act or California Endangered Species Act; (2) to meet requirements of or otherwise provide water quality benefits; (3) for the protection and enhancement of the environment. There is no cost share requirement for this section. Section 4010(b)(6) of the WIIN Act may be applicable to components of the Restoration Goal. The SJRRP has not used these authorities in the past, but could conceivably use them in the future.

2.1.6 Federal Appropriations – Fish and Wildlife Coordination Act

Public Law 85-624, the Fish and Wildlife Coordination Act of 1934, as amended, and Section 7(a) of the Fish and Wildlife Coordination Act (16 USC 742f(a)) establishes a comprehensive national fish, shellfish, and wildlife resources policy with emphasis on the commercial fishing industry but also with a direction to administer the Act with regard to the inherent right of every citizen and resident to fish for pleasure, enjoyment, and betterment and to maintain and increase public opportunities for recreational use of fish and wildlife resources. The FWCA provides

Reclamation with a variety of authorities that may be applicable to the implementation of the Restoration Goal. These include conducting activities for the improvement of fish and wildlife habitat associated with water systems or water supplies affected by Reclamation projects; plan, design, construct, and monitor, including acquiring lands or interest in lands, for instream habitat improvements; acquire or lease water or water rights from willing sellers; and monitor and evaluate the effect of Reclamation actions on fish and wildlife resources. Reclamation can take these actions directly or through the issuance of financial assistance agreements. The SJRRP has not used these authorities in the past, but could conceivably use them in the future.

2.1.7 CalFed

Funds in the amount of $1 million were provided through the CalFed appropriation in FY 2009. The SJRRP does not anticipate additional CalFed funding moving forward.

2.1.8 San Joaquin River Restoration Trust Fund

DWR has provided funds via contract to Reclamation to implement certain SJRRP activities. A total of $4.5 million was provided to Reclamation. These funds were provided prior to the authorization of the SJRR Fund and therefore, they were deposited into a trust fund and not into the SJRR Fund. These funds are used not subject to appropriations.

2.2 State Funding

The State of California has committed to seek multi-benefit projects and funds equaling at least $200 million to support the implementation of the Settlement. State funds are anticipated to come from three different bond sources as described below. Table 2-3 provides a summary of the amounts approved through FY 2016 from these sources.

Table 2-3. Approved State Funds Through FY 2016, SJRRP State Funding Sources
(values in thousands)

	Prior FYs	FY 10	FY 11	FY 12	FY 13	FY 14	FY 15	FY 16	Total
Department of Water Resources									
Proposition 1E	--		--		$4,999	--	--	$1,005	$6,004
Proposition 13	$2,476	$228	$224	$225	--		--	--	$3,153
Proposition 84	$7,131	$6,748	$7,625	$5,159	$3,927	$4,101	$2,137	$3,311	$40,139
Proposition 1	--		--				--		$0
Total DWR	$9,607	$6,976	$7,849	$5,384	$8,926	$4,101	$2,137	$4,316	$49,296
Department of Fish and Wildlife									
Proposition 1	--		--	--	--		--		$0
Proposition 13	$1,688	--	$039	$1,090	$454	$449	--	--	$3,720
Proposition 84	$5,304	$3,001	$3,484	$1,349	$1,072	$1,292	$2,873	$1,402	$19,777
Total DFW	$6,992	$3,001	$3,523	$2,439	$1,526	$1,741	$2,873	$1,402	$23,497
Total State	**$16,599**	**$9,977**	**$11,372**	**$7,823**	**$10,452**	**$5,842**	**$5,010**	**$5,718**	**$72,793**

Note: Amounts approved by the legislature to use from the specific bonds.

- Proposition 1E – The Disaster Preparedness and Flood Protection Bond Act of 2006 (Proposition 1E) authorizes $4.09 billion in to be invested in flood and related water management improvements. The funds are being managed by DWR. Five million dollars of these funds were allocated to assist the SJRRP in investigating the stability of Lower San Joaquin River Flood Control Project (Flood Control Project) levees.

- Proposition 13 – In March 2000, California voters approved Proposition 13 (2000 Water Bond), which authorizes $1.97 billion to support safe drinking, water quality, flood protection, and water reliability projects throughout the State. Approximately $8 million in funds were provided to DWR and DFW to support the Settlement.

- Proposition 84 – In 2006, California voters approved Proposition 84 that included $100 million in funds to the Natural Resources Agency to be provided to DWR and DFW to support the Settlement.

- Proposition 1 – The Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1) authorizes $7.545 billion to fund ecosystems and watershed protection and restoration, water supply infrastructure projects, including surface and groundwater storage, and drinking water protection. Of the funds authorized, $475 million will be available to the Natural Resources Agency to support certain projects of the State of California, one of those projects being the Settlement Agreement to restore the San Joaquin River. Currently, $45 million in funds have been made available to DWR and DFW to support the Settlement.

2.3 Obligations and Expenditures

Table 2-4 provides a summary of the SJRRP obligations and expenditures through FY 2016. Additional information on the federal obligations and expenditures, by funding source and year, is provided in Appendix C. Obligated funds are those that are encumbered for specific activities, such as a contract, plus expended funds. Some obligations can be pulled back or "recovered" if, for example, contracts are cancelled and remaining funds are "deobligated." Expenditures are payments for goods or services, or a charge against available funds. These funds are not recoverable.

Table 2-4. SJRRP Obligations and Expenditures Through FY 2016

Fund	Obligations (FY 07 to FY 16)	Expenditures (FY 07 to FY 16)
Federal Funding Sources[1]		
SJRR Fund	$82,668,859	$74,484,322
CVP Restoration Fund	$36,565,996	$29,386,806
Appropriations – Section 10009 of PL 111-11	$115,814,212	$64,596,338
Appropriations – Section 10203 of PL 111-11	$11,515,352	$1,356,645
Appropriations – Secure Water Act	$3,300,000	$0
Appropriations – WIIN Act	$0	$0
Appropriations – Fish and Wildlife Coordination Act	$0	$0
CalFed Funds	$997,822	$997,820
San Joaquin River Restoration Trust Fund	$4,499,134	$3,226,468
Federal Total	**$255,361,374**	**$174,048,398**
Department of Water Resources		
Proposition 1E	$6,003,251	$6,003,251
Proposition 13	$3,152,564	$3,152,564
Proposition 84	$40,139,745	$39,966,713
Proposition 1	--	--
Department of Fish and Wildlife		
Proposition 1E	--	--
Proposition 13	$3,720,538	$3,720,538
Proposition 84	$19,820,547	$19,776,899
State Total	**$72,836,645**	**$72,619,965**
Total	**$328,198,019**	**$246,668,363**

1. Note, for federal obligations, funds can be obligated more than once. For example, funds can be obligated to a contract, deobligated at a later date, and then re-obligated to a different contract. The obligated balances do not adjust for this.

Federal obligations and expenditures for individual SJRRP projects through FY 2016 are provided in Table 2-5. Table 2-5 is based on a series of assumptions as in the early years of the Program, activities were charged to general cost authority numbers. These are all included in the Administration and Program Management activity in the table. This significantly overstates this activity and under states all others. Given the current state of cost tracking, further breakdown for these prior years is not possible. In addition, until FY 2014, the Flow-Related item was a general cost authority covering all aspects of flows management, seepage management, Monitoring and Analysis Plan activities, and to some extent, fish reintroduction. Given the current state of cost tracking, further breakdown for these prior years is not possible. However, a

conservative general assumption is that 65 percent of the Flow-Related activity was for seepage actions. Reclamation has established an accounting system to track costs on individual projects identified in this Framework. Seepage Management costs continue to be the SJRRP's single largest obligation and expenditure as of the end of FY 2016.

Table 2-5. Federal SJRRP Obligations and Expenditures for Individual SJRRP Projects Through FY 2016 (All Fund Sources)

	Obligated [1] (FY 07 to FY 16)	Expended (FY 07 to FY 16)
Administration & Program Management*	$55,115,996	$45,758,108
Restoration Goal Activities	**$17,608,369**	**$14,528,323**
Mendota Pool Bypass/Reach 2B Improvements	$5,360,173	$5,226,056
Reach 4B/ESB/MB Channel & Structural Improvements	$2,442,805	$1,982,175
Arroyo Canal Fish Screen & Sack Dam Fish Passage	$4,650,917	$4,650,914
Salt & Mud Slough Seasonal Barriers	$98,119	$98,119
Gravel Pit Filing and/or Isolation	$2,062,417	$179,151
Fisheries Reestablishment	$2,993,937	$2,391,909
Flow-Related Activities	**$149,411,203**	**$97,650,844**
Flow-Related Activities (General Cost Authority)	$32,559,179	$28,549,443
Seepage Management	$116,852,024	$69,101,401
Water Management Goal and Friant Division Improvement Activities	**$33,225,805**	**$14,416,749**
Paragraph 16 Activities	$10,013,676	$8,701,502
Friant Division Improvements per Part III		
Friant-Kern & Madera Canal Capacity Restoration	$6,411,463	$4,067,822
Reverse Flow Facilities	$3,590,779	$290,779
Groundwater Banking Projects	$11,515,351	$1,356,645
Other Settlement/Legislation Required Activities [2]	$1,627,703	$1,627,541
Viability Study [3]	$55,222	$55,221
Wolfsen v US	$11,611	$11,611
Total	**$255,361,374**	**$174,048,398**

Notes: This table is based on a series of assumptions as in the early years of the Program, activities were charged to general cost authority numbers. These are all included in the Administration and Program Management activity in the table. This significantly overstates this activity and under states all others. Given the current state of cost tracking, further breakdown for these prior years is not possible. In addition, until FY 2014, the Flow-Related item was a general cost authority covering all aspects of flows management, seepage management, Monitoring and Analysis Plan activities, and to some extent, fish reintroduction. It is not possible to break these items down further at this time. However, a conservative general assumption is that 65 percent of the Flow-Related activity was for seepage actions.
Numbers may not add due to rounding.

1. Funds can be obligated more than once. For example, funds can be obligated to a contract, deobligated at a later date, and then re-obligated to a different contract. The obligated balances adjust for this.
2. Other Settlement Required Activities was generally the last contract for the Program Environmental Impact Statement / Report (PEIS/R), Reclamation's staff time to complete the document and Reclamation's time to modify its water rights at Friant Dam to implement the SJRRP.
3. Viability Study was the Chowchilla Bypass Viability Study.

2.4 Summary of Costs (FY 2017 to FY 2024)

A summary of the estimated costs to implement the SJRRP under this Funding Constrained Framework from FY 2017 to FY 2024 is provided in Table 2-6. A comprehensive cost table is provided in Appendix D. Costs were escalated into the future using an assumed 2.89 percent inflation rate. This rate was based on that average monthly inflation rate from the Engineering News and Review's Building Cost Index from 1991 to 2016.

Table 2-6. SJRRP Project and Activity Costs to be Undertaken in Stage 1
(values in thousands)

Action	Cost (Various $)[1]
Staffing and Administration	$59,869
Flow Actions	
Conservation Strategy / Mitigation Measures	$10,931
Flows	$6,150
Seepage Projects	$72,204
Levee Stability	$20,319
Channel and Structural Improvements	
Mendota Pool Bypass, Fish Screen and Reach 2B Levees[2]	$336,803
Reach 4B, Eastside Bypass and Mariposa Bypass[3]	$1,387
Arroyo Canal Fish Screen and Sack Dam Fish Passage	$41,645
Salt and Mud Slough Seasonal Barriers	$0
Reach 4B, Eastside Bypass High Flow Routing	$0
Chowchilla Fish Passage	$0
Gravel Pits Filling or Isolation[3]	$2,946
Paragraph 12 Activities[3]	$0
Passage at Key Barriers	$12,161
Fish Reestablishment	$37,565
Water Management Goal & Friant Division Improvements	
Water Management Goal Oversight	$10,464
Friant-Kern and Madera Canal Capacity Restoration	$28,530
Reverse Flow Facilities	$40
Financial Assistance for Friant Division Improvements	$32
Miscellaneous	$2,210
Total	**$643,255**

1. Cost have been escalated into future years.
2. Includes Mendota Pool Bypass, Mendota Pool Fish Screen, and part or all of the Reach 2B Levees. Actual facilities constructed and phasing will be determined in coordination with the Implementing Agencies, Settling Parties, and Third Parties by late spring 2018. Modifications to the San Joaquin River side of the Chowchilla Bifurcation Structure are included in this Funding Constrained Framework as part of the Mendota Pool Bypass, Fish Screen and Reach 2B Levees.
3. DWR may have available funds beyond their commitments in this Funding Constrained Framework. DWR may use their remaining funds to continue to support restoration actions by conducting studies and implementing small projects that continue to improve the success of a naturally-reproducing, self-sustaining salmon fishery.

Costs provided in this Funding Constrained Framework are based upon the best available information; however, most costs are based on conceptual or preliminary designs and thus a

significant amount of uncertainty exists in the estimates. For construction actions, costs include contingencies based on standard design cost estimating principles within Reclamation and DWR for the level of detail of design. Additional contingencies were applied to the following projects:

- Seepage Actions – An additional contingency of 20 percent was applied to the annual project costs starting in FY 2018 to reflect the uncertainty in the cost of land and the potential risks of interceptor lines.

- Mendota Pool Bypass, Fish Screen and Reach 2B Levees – An additional contingency of 5 percent was applied to the annual project costs starting in FY 2018 to reflect the uncertainty in land and mitigation costs. Construction costs for the project already include a contingency based on Reclamation's standard design cost estimating principles.

- Arroyo Canal Fish Screen and Sack Dam Fish Passage – An additional contingency of 15 percent was applied to the annual project costs starting in FY 2018 to reflect the uncertainty in the re-design efforts.

For this Funding Constrained Framework, all construction costs have been indexed to June 2017 price levels. Construction costs generally include a five percent mobilization contingency, 15 percent design contingency, and 20 percent construction contingency. Land acquisition costs have been updated based on a 50 percent value – the difference between the high and low values of the range given by county and crop type in the 2016 Agricultural Land Trends report of the California Chapter of the American Society of Farm Managers and Rural Appraisers, times 50 percent plus the low value (ASFMRA 2016). This more closely follows with recent land costs for SJRRP activities. In addition, for seepage projects above 700 cfs, the least cost option to address the challenge was chosen as the basis of the cost in this Funding Constrained Framework.

It is expected that some costs may increase while some costs may decrease. Costs provided in this Funding Constrained Framework are not intended to be final and are not intended for funding purposes. The costs in this Funding Constrained Framework are provided for planning purposes and provide a general sense of magnitude of actions. For the following actions / projects, target reductions were applied and the project costs are expected to stay within these targets:

- Staffing and Administration – A target reduction of 10 percent was applied to all federal staffing and administration costs. This resulted in a total federal staffing and administration cost of $29.040 million.

- Seepage Projects – A target reduction of 25 percent was applied to all seepage actions. This resulted in a total seepage cost of $72.204 million.

- Mendota Pool Bypass, Fish Screen and Reach 2B Levees – A target reduction of 25 percent was applied to the Mendota Pool Bypass, Fish Screen and Reach 2B Levees Project. This resulted in a total project cost of $336.733 million.

- Arroyo Canal Fish Screen and Sack Dam Fish Passage – A target reduction of 25 percent was also applied to this project. This resulted in a total project cost of $41.645 million.

- Water Management Goal Oversight – A target reduction of 10 percent was applied to this project as most of the efforts are federal staffing costs. This resulted in a total project cost of $10.464 million.

2.5 Budget Outlook Summary

Table 2-7 shows the summary of funding needed to implement the SJRRP from federal and State sources. Funding needs are escalated into the future and thus provided in various year dollars. Funding sources identified in the Settlement Act at October 2006 or October 2008 price levels have also been escalated into future price levels.

In summary, the federal funding need is estimated to be $540,912,000. Of this amount, $534,776,000 has been identified through existing sources, leaving a deficit of $6,135,000. The funding need designated as a State cost is $102,343,000. The State has identified $93,709,000 in funding, leaving a remaining funding of $8,634,000.

Table 2-7. SJRRP Funding Needs and Sources to Implement the Actions Identified in Stage 1
(values in thousands)

	Funds in Various Dollars[1]
Federal Funding Needs	
Total Estimated Federal Funding Need	$540,912
Federal Funding Sources Remaining	
SJRR Fund [2]	$303,061
CVP Restoration Fund [3]	$16,000
Federal Appropriations – Section 10009 of PL 111-11	$215,683
Federal Appropriations – Section 10203 of PL 111-11 [4]	$32
Federal Appropriations – WIIN Act	$0
Federal Appropriations – Fish and Wildlife Coordination Act	$0
Total Estimated Remaining Federal Funding Sources	*$534,776*
Federal Funding Remaining / (Shortfall)	($6,135)
State Funding Needs	
Total Estimated State Funding Need	$82,024
Total Estimated State Funding Need with Levee Stability	$102,343
State Funding Sources Remaining	
State Authorized Funding Remaining	$93,709
State Funding Remaining / (Shortfall)	($8,634)

Note:
1. Funding need and sources (as authorized by law) have both been escalated into future year dollars.
2. Estimated funds accumulated in the SJRR Fund through the end of FY 2024. Includes estimated future Unreleased Restoration Flows sales, RWA sales, and Friant surcharge collections.
3. CVP Restoration Fund amounts assume an average of $2,000,000 annually, although this amount can be indexed.
4. Implementation of additional Part III groundwater banking projects is not included in Stage 1. The funding for this line reflects on the amount Reclamation would expend to complete the existing projects. However, it is important to note that there are a few years when Reclamation anticipates not being able to obligate the entire appropriations within the fiscal year. In these years, some or all of these funds could be used to implement additional Part III actions. In addition, this does not preclude Reclamation from pursuing additional appropriations for the Part III groundwater banking projects in Stage 1.

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3.0 Actions Implemented within this Funding Constrained Framework

This chapter describes the SJRRP activities that would be implemented within this Funding Constrained Framework. All of these activities were included in the 2015 Revised Framework. However, not all activities in the 2015 Revised Framework would be implemented in Stage 1 of this more funding constrained scenario. In addition, some activities are delayed and implemented later due to current project schedule delays or to accommodate limited funding in certain years or limited funding from specific sources in certain years.

This chapter provides a description, cost, and estimated schedule for each activity that is anticipated to be implemented. The Visions and the goals of each Vision identified in the 2015 Revised Framework remains the same; although in this Funding Constrained Framework, some of those goals are not met on the schedule in the 2015 Revised Framework.

Specific actions that the Implementing Agencies intend to undertake in this Funding Constrained Framework are listed below and described in more detail in the following sections:

- Program Staffing
  - Continue Program Management and Administration actions for all agencies
- Flow Actions
  - Implement portions of the Conservation Strategy and flow-related mitigation measures and environmental commitments from the Program Environmental Impact Statement / Report (PEIS/R) Record of Decision (ROD)
  - Implement flow management and monitoring
  - Complete seepage and levee stability actions to allow for flows up to 2,500 cfs capacity in the river and Middle and Lower Eastside Bypass
- Channel and Structural Improvements
  - Construct the Mendota Pool Bypass, Mendota Pool Fish Screen, and a portion or all of the Reach 2B Levees, and make improvements to the San Joaquin River side of the Chowchilla Bypass Structure
  - Construct the Arroyo Canal Fish Screen and Sack Dam Fish Passage Project
  - Provide passage for anadromous salmonids at key barriers to migration (now called the Eastside Bypass Improvements Project)
- Fish Reestablishment
  - Complete construction of the Salmon Conservation and Research Facility (Conservation Facility)
  - Continue to operate and maintain the Interim and permanent Conservation Facility
  - Continue annual spring-run donor stock collection and tagging, including the collection of wild stock
  - Continue annual trap and haul of adult Chinook salmon until Mendota Pool Bypass is completed
  - Continue salmon genetics monitoring

    - Complete permit application and issue permit for the use of wild stock
- Water Management Goal and Friant Division Improvements
    - Continue Water Management Goal support actions including recapture and recirculation of Restoration Flows, tracking Recovered Water Account (RWA) balances, and allocating RWA water
    - Complete the Recapture and Recirculation Plan
    - Complete Interim Recapture and Recirculation environmental compliance as necessary until completion of the Recapture and Recirculation Environmental Impact Statement/Report (EIS/R)
    - Complete the Recapture and Recirculation EIS/R
    - Construct the Reverse Flow Pumpback Project
    - Award all remaining funding for the Friant-Kern Canal and Madera Canal Capacity Restoration projects
    - Complete the Part III Groundwater Projects previously awarded and funded

The Implementing Agency responsible for carrying out each activity has not changed from the 2015 Revised Framework.

3.1 Program Staffing and Administration

Program staffing and administration includes a wide range of activities, including funding for Reclamation, USFWS, and NMFS program wide related activities and administration and program-wide public and landowner outreach. Specific activities were described in Section 4.3 of the 2015 Revised Framework. Under this Funding Constrained Framework, federal staffing is ramped down starting in FY 2021 to reflect a lower level of SJRRP activities from there forward. This assumes that the SJRRP would be ramping down in activities as additional funding sources to continue implementation of the construction actions called for in Paragraph 11 of the Settlement have not been identified and secured. This does not account for funding and activities that will occur beyond Stage 1. If additional funding sources have been secured and some or all of these construction actions are planned to move forward, the ramp down in staffing may be delayed or be more gradual.

3.2 Flow-Related Actions

Flow-related actions include management and monitoring of physical and biological processes that are necessary to successfully implement Paragraph 13 of the Settlement. These are described in detail in Section 4.4 of the 2015 Revised Framework. The following flow-related actions would be implemented under this Funding Constrained Framework.

3.2.1 Conservation Strategy and Flow-related Mitigation Measures

The following conservation strategy and flow-related mitigation measures and environmental commitments would be implemented under this Funding Constrained Framework:

- Conservation Strategy

    - Invasive Species Control – Conservation Measure INV-1 in the PEIS/R ROD includes the implementation of the Invasive Vegetation Monitoring and Management Plan for the SJRRP (Appendix L of the Draft PEIS/R), which includes measures to monitor, control, and where possible eradicate, invasive plant infestations. Funds previously awarded in a financial assistance agreement are expected to continue implementation of the conservation measure through FY 2019. Additional funds would be awarded in FY 2020 for actions from FY 2020 through FY 2024.

    - Vegetation Monitoring and Other – Conservation Measure RHSNC-1 in the PEIS/R ROD requires development and implementation of the Riparian Habitat Mitigation and Monitoring Plan. The draft Riparian Habitat Mitigation and Monitoring Plan requires updating of the riparian habitat map every two to five years. This Funding Constrained Framework assumes a frequency of every three years.

    - Re-consultation on Flows – Consistent with the Biological Opinions issued by NMFS and USFWS, Restoration Flow releases of up to 1,660 cfs at Friant Dam and a corresponding flow of up to 1,300 cfs in Reach 5 would not result in adverse impacts to species or their habitats. In preparation for Restoration Flow releases to exceed 1,660 cfs from Friant Dam and/or 1,300 cfs in Reach 5, this Funding Constrained Framework assumes Reclamation would re-consult on flow releases from 1,660 cfs up to the flows necessary to achieve 2,500 cfs in all reaches of the river and bypass system.

    - Implement Conservation Strategy Actions for Flows Above 1,660 cfs Release – It is assumed that there will be no Conservation Strategy actions for Restoration Flow releases between 1,660 cfs and 2,500 cfs.

- Channel Capacity Advisory Group – The PEIS/R ROD included a commitment to establish a Channel Capacity Advisory Group to provide independent review of estimated then-existing channel capacities, monitoring results, and management actions to address vegetation and sediment transport within the system as identified by Reclamation. DWR has been mostly implementing this effort with minor assistance from Reclamation. As a result of the reduced Restoration Flow releases in this Funding Constrained Framework, there is less need to continually update channel capacities and a lower need to complete the erosion monitoring commitment in the PEIS/R ROD. Thus, costs have been reduced for this effort.

- Physical Monitoring and Management Plan – Physical Monitoring and Management Plan actions are now folded into specific project costs (such as the Mendota Pool Bypass costs) and no longer costed out as a separate cost line item.

- Steelhead Monitoring – Environmental Commitment EC-9 of the PEIS/R ROD includes implementation of steelhead monitoring actions. Implementing the Steelhead Monitoring Plan is also a component of a number of commitments Reclamation has made in its Biological Assessments provided to NMFS by Reclamation for SJRRP actions. This

action would be implemented through the end of construction of the Arroyo Canal Fish Screen and Sack Dam Fish Passage Project.

- Cultural Resources – Mitigation Measure CUL-2 in the PEIS/R ROD includes compliance with the Federal National Historic Preservation Act Section 106 process to mitigate any significant, adverse impacts to cultural resources and historic properties to less than significant levels. Implementation actions continue to be unknown, but are assumed to include surveys throughout the Restoration Area and in Millerton Reservoir for cultural resources, identification of impacts of flows to those resources, and evaluation and recovery of resources that may be impacted. This action has been reduced in cost due to the lower flows assumed in this Funding Constrained Framework and moved back to begin in FY 2020 as the coordination with the State Historic Preservation Officer is not yet completed.

3.2.2 Flow Management and Monitoring

The following flow management and monitoring actions would be implemented at the same or generally the same level as envisioned in the 2015 Revised Framework under this Funding Constrained Framework:

- Daily Flow Management and Monitoring
- Stream Gaging
- Unexpected Seepage Losses
- Unreleased Restoration Flows
- Data Management

The following flow management and monitoring actions would be implemented at a lower level than was envisioned in the 2015 Revised Framework under this Funding Constrained Framework:

- Restoration Flow Guidelines – The Guidelines recognized that revisions may be necessary as more information is known over time. The 2015 Revised Framework assumed these revisions would be completed every three years. Reclamation has changed its approach and is implementing a smaller number of revisions on an annual basis. The cost for this activity has been updated to reflect this revised approach.

- Monitoring and Analysis Plan (MAP) – MAP activities would be implemented by DWR and DFW. No funds would be provided by Reclamation for MAP activities. This would represent a substantial reduction in the Program's science program. Some fish monitoring activities would also continue to occur as part of the Fisheries Reestablishment Activities and as part of individual project costs.

- Water Right Compliance and Annual Report – This activity has become more routine, reducing the level of effort. The costs have been reduced to reflect this.

3.2.3 Seepage and Levee Stability

Seepage and levee stability includes the actions necessary to meet the commitments in the PEIS/R ROD to release flows in a way that does not result in material adverse impacts to adjacent agricultural lands from seepage or result in material adverse impacts to levee stability. These actions are described in more detail in the 2015 Revised Framework.

In this Funding Constrained Framework, seepage and levee stability actions would be completed to allow for up to 2,500 cfs capacity in the Restoration Area. The scientific support for this value is provided in the Fish Flow Characteristics Report in Appendix B.

The groundwater seepage projects for the remaining properties potentially impacted at and below 2,500 cfs and estimated costs for seepage projects to address these properties are provided in Table 3-1. For groundwater seepage, cost estimates were developed for interceptor lines, fee-simple acquisition, and seepage easements. It is assumed that interceptor lines cost $488 per linear foot, based on preliminary designs from Reclamation's contractor including construction and operations and maintenance costs into the future. The 50 percent of the range of the 2016 Land Trends of the California Chapter of the American Society of Farm Managers and Rural Appraisers was used to estimate fee-simple acquisition, based on each property's county, crop type, and water supply (ASFMRA, 2016). Seepage easements were estimated at 60 percent of fee-title based on appraisals conducted by Reclamation to date. Environmental compliance ($30,000 each), appraisal ($20,000 each), and cultural resources costs (depending on likelihood, $5,500 per mile to $175,000 for the property) were also included. Seepage costs presented in Table 3-1 are the lower of the interceptor line or easement costs for each parcel group (i.e., for the different options, the lowest cost was chosen for each parcel group). Reclamation has completed seepage projects for landowners potentially impacted at or below 300 cfs and thus, these properties are not included in the table. Of the amount identified in Table 3-1, as of the end of FY 2017, Reclamation has $37.3 million in escrow accounts to address specific seepage easement acquisition actions.

Table 3-1. Groundwater Seepage Projects and Estimated Costs for Remaining Properties Impacted Below 2,500 cfs

Reach	Impacted Area (acres)	Estimated Cost
2A	1,200	$10,356,000
3	4,720	$52,082,950
4A (required for 500 cfs)	6,205	$57,508,600
Eastside Bypass (complete)	0	$0
5	0	$0
Total	**12,125**	**$119,947,550 ***
Funds in Escrow as of the End of FY 2017	--	$37,315,737
Funds in Financial Assistance Agreements	--	$5,000,000
Total Subtracting Amounts Previously Obligated		**$77,631,813**

Notes:
* Total is greater than identified in the summary tables, as some of these funds are already in escrow accounts or previously obligated to a Financial Assistance Agreement with Central California Irrigation District as mentioned above.

The levee remediation projects to address levee stability issues where 2,500 cfs exceeds the U.S. Army Corps of Engineers criteria for levee seepage and stability are shown in Table 3-2. Currently, the Middle Eastside Bypass and Reach 2B are the only reaches where levees will need to be improved to convey 2,500 cfs. The Reach 2B levees would be addressed as part of the Mendota Pool Bypass and Reach 2B Project and costs are included as part of that project. Slurry walls will be constructed in the Middle Eastside Bypass for an approximately 2-mile length of the right levee. The estimated cost of this levee improvement is $10.2 million. However, over time, subsidence in the bypass system may require that additional levees, and in particular, one segment in the Middle Eastside Bypass on the left bank, would need to be improved to convey 2,500 cfs. After completion of the section of the Middle Eastside Bypass identified in Table 3-2, DWR plans to evaluate this additional reach to determine what, if any, improvements may be necessary. No funds have been identified for these additional improvements.

Table 3-2. Levee Remediation to Address Levee Stability Issues at 2,500 cfs

Reach	Impacted Left Levee Length (feet)	Impacted Right Levee Length (feet)	Total Impacted Levee Length (feet)	Total Cost of Remediation with Slurry Walls
2A	0	0	0	0
3	0	0	0	0
4A	0	0	0	0
5 (all)	0	0	0	0
Middle Eastside Bypass	0	10,000	10,000	$10,150,000
Lower Eastside Bypass	0	0	0	0
Total	**0**	**10,000**	**10,000**	**$10,150,000**

In addition to the efforts identified above, DWR may perform additional levee evaluations for flows up to 4,500 cfs in portions of the San Joaquin River channel and bypass system. This effort will help identify areas that would need remediation in the event that flows were to be increased past 2,500 cfs in the future.

3.3 Channel and Structural Improvements

The following are the channel and structural improvements actions anticipated to occur under this Funding Constrained Framework:

- Construct the Mendota Pool Bypass, Mendota Pool Fish Screen, and a portion or all of the Reach 2B Levees
- Construct the Arroyo Canal Fish Screen and Sack Dam Fish Passage Project
- Provide passage for anadromous salmonids and other fish as determined by the SJRRP at the following key barriers to migration: Dan McNamara Road; Merced National Wildlife

Refuge Weir; and Eastside Bypass Control Structure. These improvements are part of the Eastside Bypass Improvements Project.

These actions are described in detail in the 2015 Revised Framework.

3.3.1 Mendota Pool Bypass, Mendota Pool Fish Screen, and a Portion or All of the Reach 2B Levees

In 2016, Reclamation signed the ROD for the Mendota Pool Bypass and Reach 2B Project selecting the Compact Bypass with Consensus-Based Floodplain and Bifurcation Structure as the alternative for implementation. The Mendota Pool Bypass and Mendota Pool Fish Screen component of this project would be constructed within this Funding Constrained Framework. This would allow for unimpeded fish passage around Mendota Dam and Pool and reduce and/or eliminate the future risk of juvenile and adult salmon entrainment and mortality in over 15 diversion facilities in the Mendota Pool. In addition to the Mendota Pool Bypass, a portion or all of the Reach 2B levees would be constructed to provide floodplain habitat and a channel capacity of 4,500 cfs through Reach 2B and channel capacity of up to 2,000 cfs into the Mendota Pool (accounting for head losses due to the fish screen and/or control structure installed for Mendota Pool operations). This project also includes modifications to the San Joaquin River side of the Chowchilla Bifurcation Structure to remove the trash rack and notch the sill and possibly modifications to include a new fish ladder to provide fish passage for a range of species at a range of flows. The Cost Containment and Cost Cutting Team (see Section 1.5) developed a draft sequence for this project with ten large work orders or groups or related construction activities that can be substantially complete by December 2024. This draft sequencing is provided in Appendix E.

The Cost Containment and Cost Cutting Team identified a range of costs for this project between $324 million and $358 million. All reasonable efforts will be made to constrain costs, including convening the Cost Containment and Cost Cutting Team regularly to continue to provide cost oversight. Through these efforts, the SJRRP is anticipated to be able to complete this project at or near $336 million.

3.3.2 Arroyo Canal Fish Screen and Sack Dam Fish Passage Project

Under this Funding Constrained Framework, the final design, any additional environmental compliance as necessary, and all construction actions for the Arroyo Canal Fish Screen and Sack Dam Fish Passage Project would be completed. Costs assume that the facility would be constructed with necessary re-design to address current and potential future subsidence. The project has a target construction start date of FY 2020.

Based on initial analysis conducted in parallel to this Funding Constrained Framework, it is uncertain if the Arroyo Canal Fish Screen and Sack Dam Fish Passage Project will be able to stay within the $41.6 million cost cap. Efforts on this project are being re-initiated and additional analysis, including an analysis of possible cost reduction measures, is planned. If sufficient cost reductions cannot be found, then Stage 1 funds will be managed to construct this project or supplemented from other sources that are not currently defined.

3.3.3 Passage for Anadromous Salmonids at Key Barriers to Migration

Under this Funding Constrained Framework, Reclamation and DWR would work to address passage at the following key barriers: Dan McNamara Road; Upper Merced National Wildlife Refuge Weir; Lower Merced National Wildlife Refuge Weir; and Eastside Bypass Control Structure. This effort would include design, environmental compliance, and construction of facilities.

3.4 Fish Reestablishment

In this Funding Constrained Framework, the SJRRP will focus on the following fish reestablishment actions which are described in more detail in the 2015 Revised Framework:

- Salmon Conservation and Research Facility Construction – DFW will construct the Conservation Facility.

- Operation of the Interim and Conservation Facility – DFW will continue to operate the Interim Conservation Facility and the permanent Conservation Facility, once constructed. Funding is anticipated to be provided by Reclamation for the operations of these facilities through June 30, 2022, subject to federal appropriations and executed funding agreements. After June 30, 2022, DFW would fund the operations and maintenance activities.

- Spring-run Donor Stock Collection – USFWS and DFW will complete annual spring-run donor stock collection and tagging consistent with the Section 10(a)(1)(A) permits issued by NMFS.

- Trap and Haul of Adult Salmon – The SJRRP is currently evaluating the near-term need for fall-run trap and haul and may not fund this action on an annual basis. It is anticipated that spring-run trap and haul will continue until Mendota Pool Bypass is completed.

- Genetics Monitoring – The SJRRP will continue genetic analysis for spring-run and fall-run.

- Segregation Actions – The Implementing Agencies will continue to investigate feasible methods to segregate fall- and spring-run spawners to reduce interbreeding between the two runs.

- Complete Permit Application and Make Permitting Decision for use of Wild Spring-run Stocks – USFWS completed a permit application for the use of wild spring-run stocks and submitted it to NMFS in 2017. NMFS will make a decision on the permit within the next two years.

- Complete Permit Application and Make Permitting Decision for Continuation of Broodstock and Direct Release Efforts – USFWS will complete permit application(s) for

the continuation of the broodstock and direct release efforts and submit these to NMFS. NMFS will also make a decision on these permits.

- Issue Annual Technical Memorandum Consistent with 10(j) and 4(d) Rule Package – NMFS will continue to issue the annual technical memorandum.

- Prepare and Issue Report to Congress under Section 10011(d) – Section 10011(d) of the Settlement Act calls for the Secretary of Commerce to prepare a report to Congress on the progress made on the reintroduction actions in the Settlement and Settlement Act. NMFS will prepare this report on behalf of the Secretary of Commerce. The cost of preparing this report is assumed to be included in NMFS' Program Staffing and Administration costs.

3.5 Water Management Goal and Friant Division Improvements

In this Funding Constrained Framework, the SJRRP will focus on the following Water Management Goal and Friant Division Improvement actions:

- Water Management Goal Oversight – Continue overall support of the Water Management Goal and ensure individual actions are being completed efficiently and effectively.

- Recapture and Recirculation Plan and Implementation – This includes a potential variety of recapture and recirculation actions; however, under this Funding Constrained Framework, no additional funds would be provided to assist in recapture and recirculation opportunities and no additional funds are planned to implement Investment Strategy projects in Stage 1. Additional recapture and recirculation actions may move forward using non-federal funds. Investment Strategy projects may move forward using opportunistic funding requests (such as Secure Water Act or WIIN Funding).

- Friant-Kern and Madera Canals Capacity Restoration Projects – Continued support for these projects including completion of the respective Feasibility Studies and associated environmental compliance activities. In addition, Reclamation anticipates awarding the funds remaining to Friant Contractors and the Friant Water Authority to complete construction actions.

- Friant-Kern Canal Reverse Flow Pump-Back Project – Completion of design, environmental compliance, and construction of this project using funds outside of the identified SJRRP needs.

- Financial Assistance for Groundwater Banking Facilities – Completing environmental compliance as necessary and construction on the projects that were awarded funding in FY 2013.

These activities are described in more detail in the 2015 Revised Framework.

3.6 Miscellaneous and Opportunistic Actions

Over the timeframe of this Funding Constrained Framework it is expected that some project costs may be higher than anticipated, some actions may arise at the last minute that were not included in the Framework, adaptive management actions may be needed that were not originally envisioned, and/or the Restoration Administrator may recommend some actions under Paragraph 12. There may also be opportunities to cost share on projects that mutually benefit the SJRRP and other entities and organizations. DWR would continue to fund these actions, but on a more limited basis. No federal funding is anticipated to be used for these actions in this Funding Constrained Framework.

4.0 Actions Not Implemented within This Funding Constrained Framework

The following actions would be delayed to a future stage (paragraph number references refer to paragraph numbers in the Settlement):

- Flow Actions
  - Re-consultation on Flows for Restoration Flow releases greater than about 2,500 cfs in Reach 2A
  - Acquisition of Unexpected Seepage Loss water
  - Boat Launch Ramps
  - Traffic Detour Planning
  - Seepage and levee stability projects above 2,500 cfs*
- Channel and Structural Improvements
  - Land acquisition, permitting, final design, and construction of the Reach 4B, Eastside Bypass and Mariposa Bypass Channel and Structural Improvements Project*
  - Planning, design, and construction of the Salt and Mud Slough Barriers Project
  - Planning, design, and construction of the following projects: identify the highest priority gravel pits in Reach 1 (Paragraph 11(b)(3))*; modifications to the Chowchilla Bypass Bifurcation Structure to provide fish passage and prevent entrainment (Paragraph 11(b)(2))*; any additional modifications to the San Joaquin River Control Structure to provide fish passage and prevent entrainment beyond those anticipated to be completed in Stage 1*
  - Planning and construction of Paragraph 12 Projects*
- Fish Reestablishment
  - Developing a phasing out strategy for the Conservation Facility and annual spring-run donor stock collection and tagging
  - Phase out Conservation Facility and donor stock collection
- Water Management Goal and Friant Division Improvements
  - Additional recapture and recirculation opportunities
  - Investment Strategy Projects
  - New Financial Assistance for Groundwater Banking projects

DWR may have available funds beyond their commitments up to 2,500 cfs in this Funding Constrained Framework. DWR plans to use any remaining funds to continue to support restoration actions by conducting studies and implementing small projects that continue to improve the success of a naturally-reproducing, self-sustaining salmon fishery. The items with an asterisk above may be continued by the DWR as funds are available.

One or more of these projects could be implemented to the extent that funding is available that does not impede implementation of the agreed upon Stage 1 actions. This may be completed through the use of other funding sources and/or cost savings within the Stage 1 actions.

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5.0 Re-establishment of Salmon Populations

5.1 Introduction

The SJRRP has prepared a number of planning and implementation documents that describe the Program's approach to reestablishing naturally reproducing and self-sustaining populations of spring-run and fall-run Chinook salmon (other native fish are also addressed in some of these documents). The most recent of these is the SJRRP's *Fisheries Framework: Spring-run and Fall-run Chinook Salmon* (Fisheries Framework; SJRRP 2017). This Fisheries Framework establishes a realistic schedule for implementation of the fisheries management actions based upon the best available science and information. Specifically, this Fisheries Framework establishes a structure for the SJRRP Implementing Agencies to implement the fisheries components of the Settlement and Settlement Act. It also establishes specific fisheries and habitat goals and objectives that lead toward achieving the Settlement's Restoration Goal along with an implementation plan for actions that reduce physical, biological, and ecological stressors, primarily within the Restoration Area, that limit fish production. Chapter 1 of the Fisheries Framework includes a description of the SJRRP fisheries documents along with a summary of the SJRRP's accomplishments and remaining actions for reestablishing Chinook salmon in the Restoration Area.

The Funding Constrained Framework does not seek to limit, reduce or otherwise change the actions that can be accomplished to achieve the re-establishment of spring-run and fall-run Chinook salmon populations. It simply seeks to prioritize them into Stage 1 and later stages to fit within a more funding limited Program and assesses overall actions with a more limited future funding stream while using existing authorized funding sources (assuming no additional authorization for Federal appropriations) and existing authorities. Therefore, the Fisheries Framework and prior SJRRP planning and implementation documents describing the Program's approach to reestablishing spring-run and fall-run Chinook salmon (and other native fish) continue to be applicable and relevant under this Funding Constrained Framework. Refer to these prior documents for more information on the SJRRP's approach to reestablishing spring-run and fall-run Chinook salmon along with other native fish.

This Funding Constrained Framework does seek to identify an "interim" channel capacity as the target capacity to be achieved in Stage 1. A multi-faceted analysis was completed to determine the channel capacity recommendations that would make meaningful progress toward the Restoration Goal and provide the tools required to achieve the necessary habitat and water quality for spring-run and fall-run Chinook salmon success and survival. This analysis is summarized below and described more fully in Appendix B.

5.2 Physical Flow Characteristics of Interim Channel Capacities

The SJRRP, in coordination with the Settling Parties, Restoration Administrator, and Third Parties, completed an analysis to determine the channel capacity recommendations that would

make meaningful progress toward the Restoration Goal and provide the tools required to achieve the necessary habitat and water quality for reestablishing spring-run and fall-run Chinook salmon in this Funding Constrained Framework. The analysis addresses two critical factors for fish related to channel capacity:

- Water temperature control in order to remain below the critical and lethal thresholds for both adult and juvenile, spring-run and fall-run Chinook salmon throughout the Restoration Area; and

- Productive rearing habitat for juvenile Chinook salmon to maximize growth and provide refuge prior to migrating out of the Restoration Area.

The Fisheries Framework developed by the Program provides a description of fisheries objectives, including the definition of success, the identification of stressors, and addresses survival across the entire salmon life cycle (SJRRP 2017). Many factors such as genetic diversity, spawning gravel quality and quantity, and volitional passage are critically important to success, yet are not included in the analysis of physical flow characteristics. An inventory of stressors to spring-run and fall-run Chinook salmon in the Restoration Area have previously been identified in the Fisheries Framework. Through the period of 2020 – 2024 and beyond, the most significant stressors are anticipated to be: (1) inadequate flows; (2) high water temperatures; and, (3) predation (SJRRP 2017). Inadequate flows are directly linked to channel capacity and high water temperatures are strongly influenced by channel capacity, among other factors. Predation is only indirectly influenced by channel capacity. Thus, the constraint imposed by channel capacity has a fundamental influence on the ability to meet fisheries objectives. These factors influence the success of both adult migration and juvenile rearing and emigration. Other life stages such as spawning, adult holding (spring-run), egg incubation/emergence, and ocean phase are not directly affected by the range of channel capacities currently being considered. For example, although water temperature is a factor for adult holding, the existing channel capacity is already adequate to control summer water temperatures in Reach 1A. The extent of instream temperature that are adequate for salmon life stages below Friant Dam can be influenced by flow rates (presuming adequate release temperatures from Friant Dam), and rearing habitat is strongly influenced by floodplain inundation (flooded acres that are the appropriate depth and velocity to provide fish cover and food) (Appendix B). Additionally, the potential to minimize the impact of stressors for juveniles via channel capacity are linked in that improved bioenergetic conditions on floodplains can increase the threshold for temperature tolerance in juveniles (Sommer et al. 2001, Poletto et al. 2017).

5.2.1 Assumptions, Aspects of Channel Capacity Analyzed and Flow Scenarios Used

In order to inform the selection of a suitable channel capacity target in this Funding Constrained Framework, an interrelated suite of analyses were synthesized. This included five aspects of channel capacity for consideration:

1. Water temperature-flow relationships;

2. Juvenile rearing habitat-flow relationships;

3. Riparian vegetation recruitment potential by channel capacity;

4. Available volume of Restoration Flows dictated by the Restoration Allocation; and,

5. Likelihood of flood flows, which may accomplish restoration objectives without the limitations prescribed by channel capacity constraints and preempt Restoration Flows.

Because of the finite volume of water available to the Restoration Program, which varies by water year type, there is a limited ability to release high magnitude flows during the critical spring period. If, for example, there was ample channel capacity to release flows up to 4,500 cfs, that flow rate of water would only be available for a short duration of time because of limits in the total Restoration Allocation volume. The drier the water year type, the smaller the Restoration Allocation and consequently the shorter duration a 4,500 cfs flow would be sustained. When the biological objectives identified in the Fisheries Framework are considered alongside other realistic constraints on Restoration Flows, a channel capacity less than 4,500 cfs is likely to achieve a holistic flow release strategy. Although, the capacity goal of the Program will remain at 4,500 cfs throughout the Restoration Area and implemented in later phases in accordance with the Settlement.

To synthesize this somewhat disparate data within the constraints of the volume of water available to the Program, six discrete flow scenarios were developed with input from fisheries experts among the Implementing Agencies, Restoration Administrator and Technical Advisory Committee. These flow scenarios, labeled A through F (Appendix B), articulate Restoration Flow schedules, each of which have their own resultant water temperature and rearing habitat. These flow scenarios were developed with the goal of optimizing adult spring-run upstream migration and juvenile spring-run and fall-run emigration, yet each taking different strategic approaches to achieving fishery objectives. Two scenarios, A and C, use shorter duration high flows to maximize the extent of floodplain inundation, while their counterparts, B and D, use longer duration flows of lower magnitude to maximize the duration of floodplain inundation. Flow Scenarios A and B release the majority of the spring allocation volume early in the spring, while C and D release the majority of their volume late in the spring. Flow Scenario E is one blended approach which applies an inundation flow of intermediate duration and timing. Flow Scenario F applies two short duration inundation flows, one early and the other late. Combined, this suite of flow scenarios covers the likely range of flow release actions and therefore serves as a good benchmark for understanding the influence of channel capacity upon fisheries objectives. The migration of fall-run Chinook salmon adults expected to occur October through December was not analyzed as the available flows during that period will not be constrained by future channel capacities.

The six flow scenarios encompass a range of likely flow strategies, avoid unrealistic or unproductive flow schedules, and are assembled by various flow components (e.g., pulse flow, inundation flow, ramp-down, base flow, and similar). They are not to be taken as encyclopedic and exact, instead, the scenarios capture the range of flow release strategies likely to be used over the next 10+ years. If all scenarios are viable under a particular channel capacity, then there is reasonable assurance that a wide range of tools are available to the SJRRP unhindered by channel capacity. The application of these flow scenarios across different hydrologies yield a suitable range of channel capacities. Selection of a channel capacity above this range is likely to

result in higher costs (associated with easements, levee improvements, structure design) and a diminishing benefit with higher incremental costs incurred for fisheries. Selection of a channel capacity below this range is unlikely to provide adequate tools for restoring a successful fishery in Stage 1.

The analysis examines the physical characteristics of rearing habitat in Reaches 1B, 2A, 2B and 3 and examines water temperature at the head of Reach 4A (i.e., Sack Dam) and at the head of Reach 5. Assumptions include that all Restoration Flows are routed through the Middle and Lower Eastside Bypasses instead of whole or part through Reach 4B. The analysis does not conclude whether or not meaningful progress on fisheries re-establishment can be made at a given channel capacity; instead it determines whether the tools (e.g. flow volume, flow timing, temperature control, inundation opportunities) are available at a given channel capacity to facilitate a fisheries re-establishment under Stage 1 actions.

5.2.2 Results

The analysis identified at the low range of channel capacities being discussed (1,800 cfs) there is minimal flexibility in flow scheduling to address both temperature and rearing habitat objectives and only at the cusp of Normal-Dry and Normal-Wet water type years (i.e. median hydrologic conditions). Channel capacities below 1,800 cfs do not provide the necessary flexibility to address rearing habitat and water temperature except during drier year types (i.e. drier than median hydrologic conditions). Channel capacity increments above 3,300 cfs appear to provide diminishing benefit with higher incremental costs incurred for rearing habitat, while increments above 3,800 cfs appear to provide diminishing benefit with higher incremental costs incurred for temperature control. Flows above these values do provide modest benefit for riparian vegetation recruitment and other geomorphic objectives. Under wetter hydrological conditions, an 1,800 cfs channel capacity is very limiting. When channel capacities are increased to 2,200 cfs, there is moderate flexibility to address both temperature control and rearing habitat simultaneously during a typical Normal-Wet year type. At 3,300 cfs channel capacity, there is a wide range of flow options available to address temperature control and rearing habitat needs across all water year types. Focusing on the mid-point of the Normal-Wet year type (Table 6-1b, Appendix B) due to its reduced overlap with flood flows and its overall greater frequency of occurrence, there are two scenarios viable at 2,000 cfs channel capacity (including Scenario D favored by fisheries experts; Figure 5-4, Appendix B), three at 2,100 cfs, four at 2,200 cfs, and six at 3,100 cfs. The highest floodplain habitat acre-days for rearing juveniles, a metric combining inundation area and duration, is available at 2,000 cfs channel capacity (Scenario D) as well as an intermediate temperature control date. To attain the best temperature control date and extend the temperature window to its maximum practical extent, a full 3,100 cfs is required (Scenario C; Figure 5-3, Appendix B).

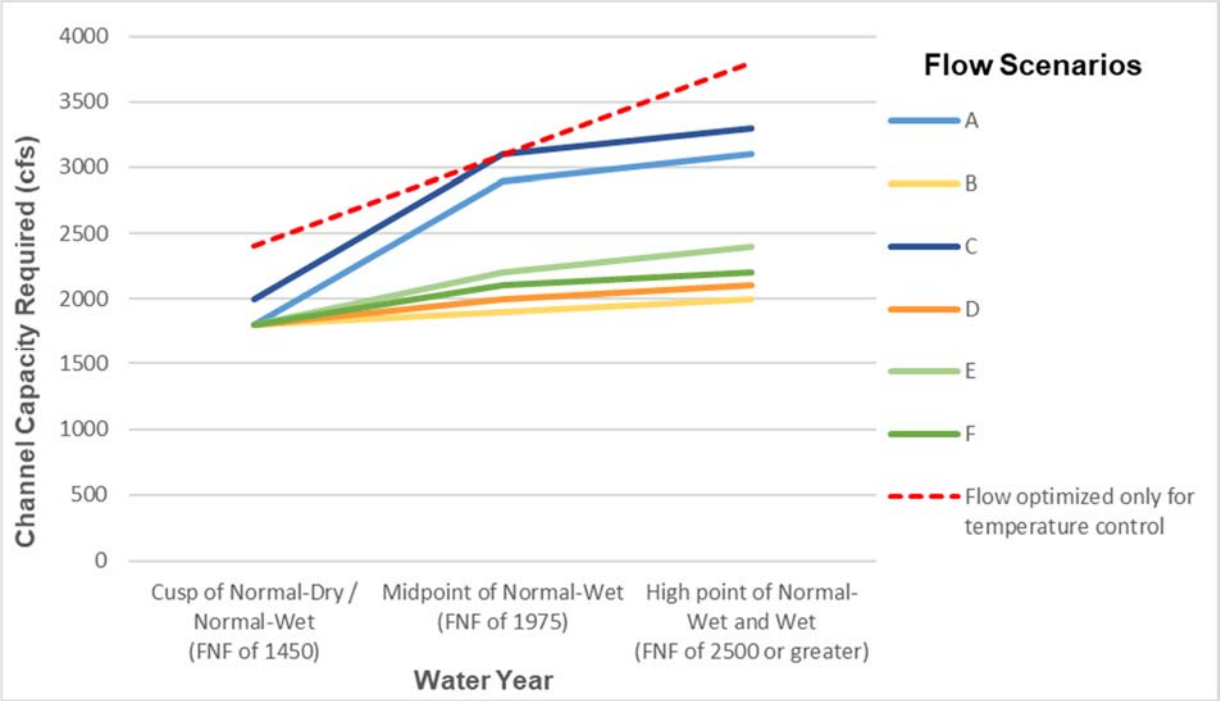

Figure 5-1. Required Channel Capacity for Each Flow Scenario. A hypothetical flow strategy solely addressing temperature control, foregoing other fisheries objectives, is plotted as a reference

Channel Capacity at Gravelly Ford (cfs)												
1,400	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000	3,200	3,400	3,600	3,800
Water Temperature												
	Limited temperature control in normal (median) and drier hydrologic conditions		Limited temperature control in wetter hydrologic conditions, Moderate temperature control in normal and drier conditions		Moderate temperature control in wetter conditions; Maximum temperature control in normal and drier conditions							Max-imum temp control in all cond-itions
Rearing Habitat												
Inade-quate flexibility in normal (median) and drier conditions	Marginal flexibility in normal (median) and drier condition s	Adequate flexibility in normal (median) and drier year types; Inadequate flexibility in wetter conditions		Marginal flexibility in wetter cond-itions	Excellent flexibility in normal (median) and drier year types; Adequate flexibility in wetter conditions					Excellent flexibility in all conditions		
Riparian Vegetation Recruitment												
10%		**20%**		**30%**	**40%**	**50%**		**60%**		**70%**		**80%**

Figure 5-2. Summary Graphic for Informing the Selection of Suitable Channel Capacity for Stage 1

The results of the five aspects of channel capacity that were analyzed and synthesized are provided in more detail below. It is important to acknowledge that the six flow scenarios were developed based on our current knowledge of fishery needs and ecological function in the river. They were intended to respond to Stage 1 Program needs. It is possible that further in the future we may identify other objectives that require higher channel capacities.

Temperature-Flow Relationships

Results of the physical flow characteristics analysis indicate adequate springtime water temperatures are constrained most by Reach 5, the lowermost section of the Restoration Area. The lethal threshold for adult Chinook salmon of 68 °F during their upstream migration is expected to be more of a constraint than the lethal threshold for juvenile Chinook salmon of 75 °F during the emigration downstream. There is a fair amount of uncertainty in the accuracy of the temperature model, however the model is still valuable for comparing different flow scenarios and understanding the relationship between flow and water temperature. The six flow scenarios vary by 20 days in reaching the adult threshold, and 3 days in reaching the juvenile threshold in Wet years, and 19 days and 2 days respectively at the mid-point of Normal-Wet years. Flow Scenario C (Figure 5-3, Appendix B) performs the best for extending adequate water temperatures latest in the year, however Flow Scenario C also requires the highest channel capacity of 3,300 cfs in a Wet year type and 3,100 cfs at the mid-point of Normal-Wet year type. Thus, up to approximately 3,300 cfs, there is an increasing ability to control water temperatures, with lower channel capacities resulting in a shorter migration window for adult salmon, and having a smaller impact upon the out-migration window duration for juvenile salmon.

Rearing Habitat-Flow Relationships

The findings from the juvenile rearing habitat analysis, calculated using a simplified Habitat Suitability Index, suggest rearing habitat is present in all the reaches analyzed at flows as low as 1,000 cfs. However, at such low flow rates, rearing habitat is limited to channel margins; floodplains and side channels are not inundated until flows in excess of roughly 1,000 cfs. The relationship between flow and suitable habitat is not linear, and varies by reach due to the diversity of floodplain configurations found along the San Joaquin River. Additionally, as flow rate increases, the stage of the river rises and inundates more floodplain, and the in-channel and channel margin habitat becomes unsuitable due to increasing water depth and velocity. Thus there is not a demarcation in the data where suitable habitat increases sharply with increasing flow, and there is a variety of rearing habitat available at flow rates far lower than the maximum 4,000 cfs inundation flows envisioned in the Settlement. Flow Scenarios B and D (Figures 5-2 and 5-4, Appendix B) provide the greatest floodplain habitat acre-days, an index that is the product of suitable habitat and duration of floodplain inundation. At 2,200 – 2,400 cfs channel capacity, the majority of flow scenarios are supported in the wetter year types. All flow scenarios are supported at 3,300 cfs channel capacity in all year types, while below 1,500 – 1,600 cfs, none of the six flow scenarios are supported during Normal-Wet and Wet year types (i.e. only supported during drier year types).

Riparian Vegetation Recruitment Potential by Channel Capacity

Natural riparian vegetation recruitment through the use of gradual flow ramp-downs is more likely to be effective with higher channel capacities. At 1,800 cfs channel capacity, one-quarter (index of 0.25) of the potential riparian vegetation recruitment is available with Restoration Flows compared to full 4,500 cfs channel capacity. At 2,500 cfs, over half (index of 0.51) of the

potential is available, and at 3,300 cfs, three-quarters (index of 0.75) of the potential is available. Riparian vegetation recruitment is also possible with flood flows, which are forecast to exceed 4,000 cfs an estimated 7% of all years during the suitable time for riparian vegetation recruitment.

Available Volume of Restoration Flows and Likelihood of Flood Flows

Wet year types are the most demanding of channel capacity to convey the higher Restoration Flow volumes that are available, however the likelihood of flood flows occurring during Wet year types (and the upper range of Normal-Wet year types) is also substantially higher. Flood flows of at least 15 days are nearly certain (100 percent) in May and June of Wet year types, though only about one-third (35 percent) of these exceed 4,000 cfs for a period of 15 days during those same months. Flood frequencies for March and April of Wet year types are slightly lower (75 percent and 94 percent respectively), yet are more likely to exceed 4,000 cfs. These flood flows preempt Restoration Flows, and may also accomplish some or most restoration objectives without the need for a robust channel capacity provided by the Program. Because of this probability, indicated channel capacities during wetter hydrologic conditions should be somewhat deemphasized because of the role that flood flows play. The probability of flood flows drops substantially at and below the mid-point of the Normal-Wet year type.

5.3 Conclusion

In conclusion, the analysis suggests that Stage 1 can accomplish much of the Restoration Goal with far lower channel capacities, in the range of 1,800 – 3,300 cfs, instead of needing to initially attain 4,500 cfs channel capacity that is called for in the Settlement or the 4,000 cfs maximum flow depicted in Exhibit B of the Settlement. The six flow scenarios vetted by the SJRRP fisheries agencies all require less channel capacity than the 4,500 cfs. Outside of periods of Restoration Flows, flood flows are likely to assist with fishery management objectives and riparian vegetation recruitment objectives during Wet and some Normal-Wet year types. Although this analysis was limited due to the timeframe to prepare this Funding Constrained Framework, the SJRRP Implementing Agencies believe there is a reasonable expectation for a meaningful progress toward conditions that will support successful re-establishment of spring-run and fall-run Chinook salmon within a proposed “interim” channel capacity of 2,200 – 2,400 cfs during Stage 1. Such a channel capacity should yield adequate flexibility to control temperature and provide juvenile rearing habitat across two-thirds of water year types (mid-point of Normal-Wet and drier), with somewhat limited flexibility during the wetter one-third of year types with the potential of flood flows accomplishing some of the restoration objectives.

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