United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish and Wildlife Office
650 Capitol Mall, Suite 8-300
Sacramento, California 95814

MAY 24 2016

In reply refer to:
08FBDT00-2016-CPA-0036

Memorandum

To: Manager, San Joaquin River Restoration Program, Mid-Pacific Regional Office, Bureau of Reclamation, Sacramento, California

From: Field Supervisor, San Francisco Bay-Delta Fish and Wildlife Office, Sacramento, California

Subject: Fish and Wildlife Coordination Act Report for the U.S. Bureau of Reclamation's San Joaquin River Restoration Program Mendota Pool Bypass and Reach 2B Improvements Project

In accordance with 48 Stat. 401, as amended; 16 U.S.C. 661 et seq., this document constitutes the U. S. Fish and Wildlife Service's (Service) Fish and Wildlife Coordination Act (FWCA) report to the U. S. Bureau of Reclamation (Reclamation) for the San Joaquin River Restoration Program (SJRRP) Mendota Pool Bypass and Reach 2B Improvements Project (Project). The FWCA requires Federal agencies proposing water resource development projects or involved in issuance of related permits or licenses to consult with the Service and provide equal consideration to the conservation, rehabilitation, and enhancement of fish and wildlife resources with other project purposes. The findings of this report are based on information provided in the *SJRRP Mendota Pool Bypass and Reach 2B Improvements Project Draft Environmental Impact Statement/Report*, dated June 2015, additional available data, field investigations, and information and comments provided by other State and Federal Agencies. Our report addresses the proposed project-related beneficial and adverse impacts on fish, wildlife, and botanical resources and provides recommendations if the proposed project were to be implemented in the future. Details of the project's effects on federally listed species, pursuant to Section 7 of the Endangered Species Act of 1973, as amended, will be addressed separately. As an Implementing Agency in the SJRRP, the Service has been working closely with Reclamation since early 2008 on project planning and development of avoidance and minimization measures for federally-listed species and migratory birds.

BACKGROUND

Originating high in the Sierra Nevada Mountains, the San Joaquin River carries snowmelt from mountain meadows to the valley floor before turning north and becoming the backbone of tributaries draining into the San Joaquin Valley. The San Joaquin River is California's second

reintroduction of Chinook salmon. Restoration Flows are specific volumes of water to be released from Friant Dam during different water year types, according to Exhibit B of the Settlement and began on January 1, 2014; Interim Flows were experimental flows that began in 2009 and continued until Restoration Flows were initiated, with the purpose of collecting relevant data concerning flows, temperatures, fish needs, seepage losses, recirculation, recapture, and reuse.

To achieve the Water Management Goal, the Settlement calls for recirculation, recapture, reuse, exchange or transfer of the Interim and Restoration flows to reduce or avoid impacts to water deliveries to all of the Friant Division long-term contractors caused by the Interim and Restoration flows. In addition, the Settlement establishes a Recovered Water Account (RWA) and program to make water available to all of the Friant Division long-term contractors who provide water to meet Interim or Restoration flows to reduce or avoid the impact of the Interim and Restoration flows on such contractors.

The Settlement and the Act authorize and direct specific physical and operational actions that could potentially directly or indirectly affect environmental conditions in the Central Valley. Areas potentially affected by Settlement actions include the San Joaquin River and associated flood bypass system, tributaries to the San Joaquin River, the Delta, and water service areas of the CVP and State Water Project (SWP), including the Friant Division. Settlement Paragraphs 11 through 16 describe physical and operational actions (see Table 1).

Table 1. Restoration and Water Management Framework in Key Settlement Paragraphs

Settlement Paragraph	Description of Constraint or Assumption
11	Identifies specific channel and structural improvements considered necessary to achieve the Restoration Goal. Includes a reach-by-reach list of improvements.
12	Acknowledges that additional channel or structural improvements not identified in Paragraph 11 may be needed to achieve the Restoration Goal.
13	Identifies specific volumes of water to be released from Friant Dam during different year-types (Restoration Flows), and provisional water supplies to meet the Restoration Flow targets as provided in Exhibit B of the Settlement. Stipulates the release of Restoration Flows no later than January 1, 2014, subject to then-existing channel capacities.
14	Stipulates that spring-run and fall-run Chinook salmon be reintroduced to the San Joaquin River between Friant Dam and the confluence of the San Joaquin River with the Merced River no later than December 31, 2012, consistent with all applicable law and after commencement of sufficient flows and the issuance of all necessary permits. Assigns priority to wild spring-run Chinook salmon over fall-run Chinook salmon.
15	Specifies that Interim Flows begin no later than October 1, 2009, and continue until Restoration Flows can begin, to collect relevant data concerning flows, temperatures, fish needs, seepage losses, recirculation, recapture, and reuse.
16	Requires that the Secretary of the Interior develop and implement a plan for recirculation, recapture, reuse, exchange, or transfer of the Interim and Restoration flows to reduce or avoid impacts to water deliveries for all Friant Division long-term contractors. This paragraph also calls for establishment of an RWA and program to make water available to the Friant Division long-term contractors who provide water to meet Interim or Restoration flows.

Key:
CEQA = California Environmental Quality Act
NEPA = National Environmental Policy Act
PEIS/R = Program Environmental Impact Statement/Environmental Impact Report
RWA = Recovered Water Account

(2) Modifications in channel capacity (incorporating new floodplain and related riparian habitat) to ensure conveyance of at least 4,500 cfs in Reach 2B between the Chowchilla Bifurcation Structure and the new Mendota Pool bypass channel.

Because the functions of these channels may be inter-related, the design, environmental compliance, and construction of the two are being addressed as one project. The Project would be implemented consistent with the Settlement and the Act, with implementation dates clarified by the Implementation Framework (SJRRP 2015).

The Mendota Pool Bypass would include conveyance of at least 4,500 cfs around Mendota Pool (or the Pool) from Reach 2B to Reach 3 and a fish barrier, if appropriate, to direct upmigrating adult salmon into the bypass. The bypass could be accomplished by constructing a new channel around Mendota Pool or by limiting Mendota Pool to areas outside of the San Joaquin River. This action would include the ability to divert 2,500 cfs to the Pool if water deliveries are required for the San Joaquin River Exchange Contractors (Exchange Contractors) and may consist of a bifurcation structure in Reach 2B. The bifurcation structure would include a fish passage facility to enable up-migrating salmon to pass the structure and a fish screen, if appropriate, to direct out-migrating fish into the bypass channel and minimize or avoid fish entrainment to the Pool.

Improvements to Reach 2B would include modifications to the San Joaquin River channel from the Chowchilla Bifurcation Structure to the new Mendota Pool Bypass to provide a capacity of at least 4,500 cfs with integrated floodplain habitat. The options under consideration include potential levee setbacks along Reach 2B to increase the channel and floodplain capacity and provide for floodplain habitat. Floodplain habitat is included along the Reach 2B portion of the Project as required by the Settlement; floodplain habitat is being considered along the Mendota Pool Bypass channel because Central Valley floodplains have been shown to be of value to rearing juvenile salmon as they migrate downstream (Jeffres 2008, Grosholz 2006, Sommer et al 2001, Sommer et al 2004). In addition, the SJRRP *Fisheries Management Plan* (SJRRP 2010a) and *Minimum Floodplain Habitat Area for Spring and Fall-Run Chinook Salmon* report (SJRRP 2012) describe that sufficient floodplain habitat is an important feature for meeting salmon population targets.

Improvements included in the project could potentially be implemented in a phased approach to facilitate scheduling and funding.

PROJECT AREA

The Project area includes areas that may be affected directly or indirectly by the Project alternatives. The Project footprint (township 13S, range 15E), shown in Figure 2, has two major components: Reach 2B and the Mendota Pool Bypass. Reach 2B generally includes the area from the San Joaquin River Control Structure near the Chowchilla Bypass downstream to Mendota Dam. Potential Project improvements in Reach 2B, which vary by alternative, extend from the Chowchilla Bifurcation Structure on the upstream end to the head of the potential Mendota Pool Bypass channel or to Mendota Dam on the downstream end. However, Reach 2B improvements may also include areas just upstream of the Chowchilla Bifurcation Structure and may continue downstream of the head of the Mendota Pool Bypass or Mendota Dam, including the Pool area, as necessary to meet Project goals and objectives. The lateral extent of potential Project Reach 2B improvements, which varies by alternative, includes lands to the north and south of the San Joaquin River in Reach 2B.

The Mendota Pool Bypass element of the Project alternatives generally includes the area from the downstream end of the Reach 2B improvements to a tie-in location in Reach 3. Improvements for the Mendota Pool Bypass, which vary by alternative, extend from the area south of Mowry Bridge over Fresno Slough to the area north of Mendota Dam where the Bypass ties into Reach 3. The Mendota Pool Bypass element of the Project alternatives also includes areas adjacent to and on the west side of Mendota Pool and Fresno Slough and areas to the south of the potential Project Reach 2B improvements. Areas indirectly affected by this Project include portions of Reach 3 downstream and Reach 2A upstream that are outside the direct Project footprint.

PROJECT DESCRIPTION

No-Action Alternative

The No-Action Alternative is required for the analysis of environmental effects according to NEPA. Under this alternative, the Project would not be implemented. The No-Action Alternative is not consistent with the Settlement.

No-Action Conditions

If the Project were not implemented, the components described in the Action Alternatives would not be implemented; however, the No Action Alternative assumes that other components of the SJRRP, as described in the 2012 Record of Decision, and other reasonably foreseeable actions consistent with current management direction expected to occur in the Project area, would be implemented.

The No-Action Alternative generally assumes no channel or structural improvements would be made in Reach 2B, and Restoration Flows would be reduced to not exceed the existing Reach 2B capacity. It is assumed for the No-Action condition that agriculture would continue and cropland would be the dominant cover type, consistent with the existing condition. The following assumptions about No-Action have been evaluated in the resource sections of the Project EIS/R.

Fisheries

In the No-Action Alternative, the maximum channel conveyance would be limited to the existing capacity. Fish passage improvements would not be provided at structures (Chowchilla Bifurcation Structure, San Mateo Avenue, and Mendota Dam). However, the remainder of the SJRRP would proceed, and salmon would be reintroduced into the San Joaquin River.

Habitat

Under the No-Action Alternative, habitat conditions will remain mostly unchanged. Some new vegetation may recruit as a result of Restoration Flows.

Seepage

The No-Action Alternative would maintain the existing levee alignments and heights and maximum conveyance would continue to be limited to the existing capacity.

Land Use, Agriculture, Economics & Socioeconomics

Under the No-Action conditions future lands use in the area is unlikely to change.

The Action Alternatives also include provision of fish passage at structures for salmonids and other native fish. These structures vary by alternative but overall include fish screens, fish passage facilities, grade control structures, and bifurcation structures (under certain flows). The designs for structures with fish passage components would be based on criteria in *Anadromous Salmonid Passage Facility Design* (NMFS 2008) and *Guidelines for Salmonid Passage at Stream Crossings* (NMFS 2001). Specifically, the Action Alternatives would provide suitable hydraulic conditions for passage of up-migrating adult salmonids, out-migrating juvenile salmonids, and inter-reach migration of other native fish between Reach 2A and Reach 3. Suitable hydraulic conditions include those conditions which the species is physically capable of passing and do not cause undue stress on the animal. The passage features would be designed to cause no physical harm to fish. The design criteria are structured around the life stages of the target anadromous species and the timing of the runs for upstream movement of adult fall and spring run Chinook and winter steelhead and the downstream movement of juvenile life stages spawned from these runs. Recommended criteria are based on a combination of swimming ability of the fish species as reported in scientific papers and criteria in agency design guidelines. Recommended design criteria to provide for successful fish passage (depth of flow, suitable velocity ranges and jump height) are provided in Table 2. The design criteria for a particular species would be met over the associated flow range (minimum flow to maximum flow).

Table 2. Fish Passage Design Criteria

Species	Life-stage	Migration Timeframe	Frequency	Minimum Flow	Maximum Flow	Maximum Velocity [1]	Minimum Water Depth [2]	Maximum Jump Height [3]	Minimum Pool Depth
			years	cfs	cfs	fps	feet	feet	feet
Chinook salmon	Adult	Spring and fall pulse	All years except CL	115 [4]	4,500	4.0	1.2	1.0	[5]
	Juvenile (downstream)	Nov-May	All years except CL	85 [7]	n/a	n/a	1.0	n/a	[5]
Steelhead	Adult	Spring and fall pulse	All years except CL	115 [4]	4,500	4.0	1.2	1.0	[5]
	Juvenile (downstream)	Nov-May	All years except CL	85 [7]	n/a	n/a	1.0	n/a	[5]
Sturgeon	Adult	Spring pulse	W and NW years	1,138 [8]	4,500	6.6	3.3	None – swim through	n/a
Lamprey	Adult	Spring pulse	All years except CL	125 [6]	4,500	[9]	[9]	[9]	n/a
Other native fish	Adult	Spring pulse	W, NW, and ND years	543 [10]	4,500	2.5	1.0	None – swim through	n/a

W = wet; NW = normal wet; ND = normal dry; CL = critical low

[1] Recommended maximum velocities shown are for grade control structures or structures with short longitudinal lengths based on *Anadromous Salmonid Passage Facility Design* (NMFS 2008) and *Guidelines for Salmonid Passage at Stream*

Levees would be required along the Project area to contain Restoration Flows. While the height and footprint of the levees vary according to their location along the channel and the ground elevation, the capacity, freeboard, and cross-section would be consistent. Localized backwater and redirection effects at Project structures would be considered during design of levee heights. Levees would be designed to maintain at least 3 feet of freeboard on the levees at 4,500 cfs. Levee design would be based on the U.S. Army Corps of Engineers (Corps) *Engineer Manual 1110-2-1913-Design and Construction of Levees* guidelines (Corps 2000a) and *Engineer Manual 1110-2-301 Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, & Embankment Dams* (Corps 2000b). The design includes seepage control measures, inspection trenches, maintenances roads, and drainage trenches to direct off-site drainage. Levee alignments maintain a 300-foot buffer zone, where appropriate, between the levee and river channel to avoid impact to levees over time due to potential channel migration. In areas where a minimum 300-foot buffer zone between the main river channel and levee cannot be maintained, bank revetment would be incorporated in the design.
New levees would be designed to have sideslopes of 3 horizontal to 1 vertical (3H to 1V) on the waterside and landside. A maintenance road and surface drainage ditch would also be included. Surface drainage ditches would only be intended to capture and direct runoff; they are not intended to address groundwater seepage or through-levee seepage. By following the Corps standards, all levees would have an inspection trench. Additional data collection and analysis would be required to verify the groundwater conductivity rates of the *in situ* and borrow soils and to finalize the design of seepage control measures.

The levee alignments shown on the plan views of the Action Alternatives may be adjusted during final design. Adjustments may be made for several reasons, including to improve flow conditions on the floodplain, to improve habitat conditions on the floodplain, to reduce potential erosion, to accommodate adverse soil conditions, and to avoid existing infrastructure among others. The final levee alignments will be within the impact areas evaluated in this document.

Seepage Control Measures

Seepage of river water through or under levees is a concern for levee integrity and adjacent land uses. Through-seepage, water that seeps laterally through the levee section, would be addressed through proper levee design and construction (e.g., selection of low porosity materials and proper compaction). Under-seepage, water that seeps laterally by travelling under the levee section, is primarily controlled by the native soils beneath the levee and seepage control measures would be included where native soils do not provide sufficient control. Seepage control measures would be included, as necessary, in the Project in areas where under-seepage is likely to affect adjacent land uses. Seepage control measures could include: cut-off walls, interceptor drains or ditches, seepage wells, seepage berms, land acquisition (fee title or seepage easements) and other measures that can be implemented within the Project area. A cut-off wall is a construction technique to reinforce areas of soft earth that are near open water or a high groundwater table with a mixture of soil, bentonite, and cement. Interceptor drains are buried perforated pipes and interceptor ditches are surface ditches, both of which intercept groundwater and redirect it to a discharge point. Because the drains and ditches have lower resistance to flow, the groundwater table can be kept artificially low in areas near the pipe or ditch. The discharge point could include a lift pump to move drained water over the levees, or it could be discharged directly to a

Removal of Existing Levees

Removal of portions of the existing levees is included and designed to expand the inundation area of the floodplain out to the proposed levees and improve connectivity between the river channel and proposed floodplain. The locations of existing levee removal would be based upon the hydraulic performance of the channel and floodplain. In certain locations, however, highly desirable existing vegetation (native and sensitive vegetation communities that can serve as seed banks for future vegetation communities) can be found on the existing levees. Where hydraulic performance and connectivity of the floodplain would not be negatively affected, portions of the existing levees with highly desirable vegetation would remain in place. Materials that are removed from the existing levees would likely be reused within the Project area.

Floodplain and Channel Grading

Floodplain and channel grading would be included with the Action Alternatives. Floodplain and channel grading would include any or all of the following at locations to be determined during design:

- Creating high-flow channels through the floodplain to increase the inundation extent at lower flows.
- Connecting low-lying areas on the floodplain to the river to prevent stranding.
- Removing high areas where flow connectivity would be impeded (e.g., farm road grades).
- Excavating floodplain benches adjacent to the river channel to increase the frequency of inundation.
- Creating greater inundation depth diversity on the floodplain.
- Excavating channels in portions of the Project area to tie into existing elevations upstream and downstream of the Project or to create desirable sediment transport conditions.

Floodplain and channel grading can provide benefits to salmon and other native fish by allowing inundation to occur at lower flows, by distributing suitable rearing habitats further into the floodplain, by connecting rearing habitat to primary production areas (shallow water habitat), by providing escape routes during receding flows, and by confining flows to a deeper, narrower channel to limit temperature increases.

Figure 3. provides an example of how various floodplain grading approaches can be used to expand inundation on the floodplain. The Existing Channel graphic shows an example of how inundation would occur without floodplain grading. The Lowered Floodplain example shows an example of how floodplain benches, lowered areas to either side of the channel, could be used to inundate floodplain areas at lesser flows. This graphic also shows how lowered floodplains could affect inundation at moderate flows. The High Flow Channels graphic shows an example of how high flow channels, side channels that initiate at larger flows than the main channel, could be used to expand floodplain inundation.

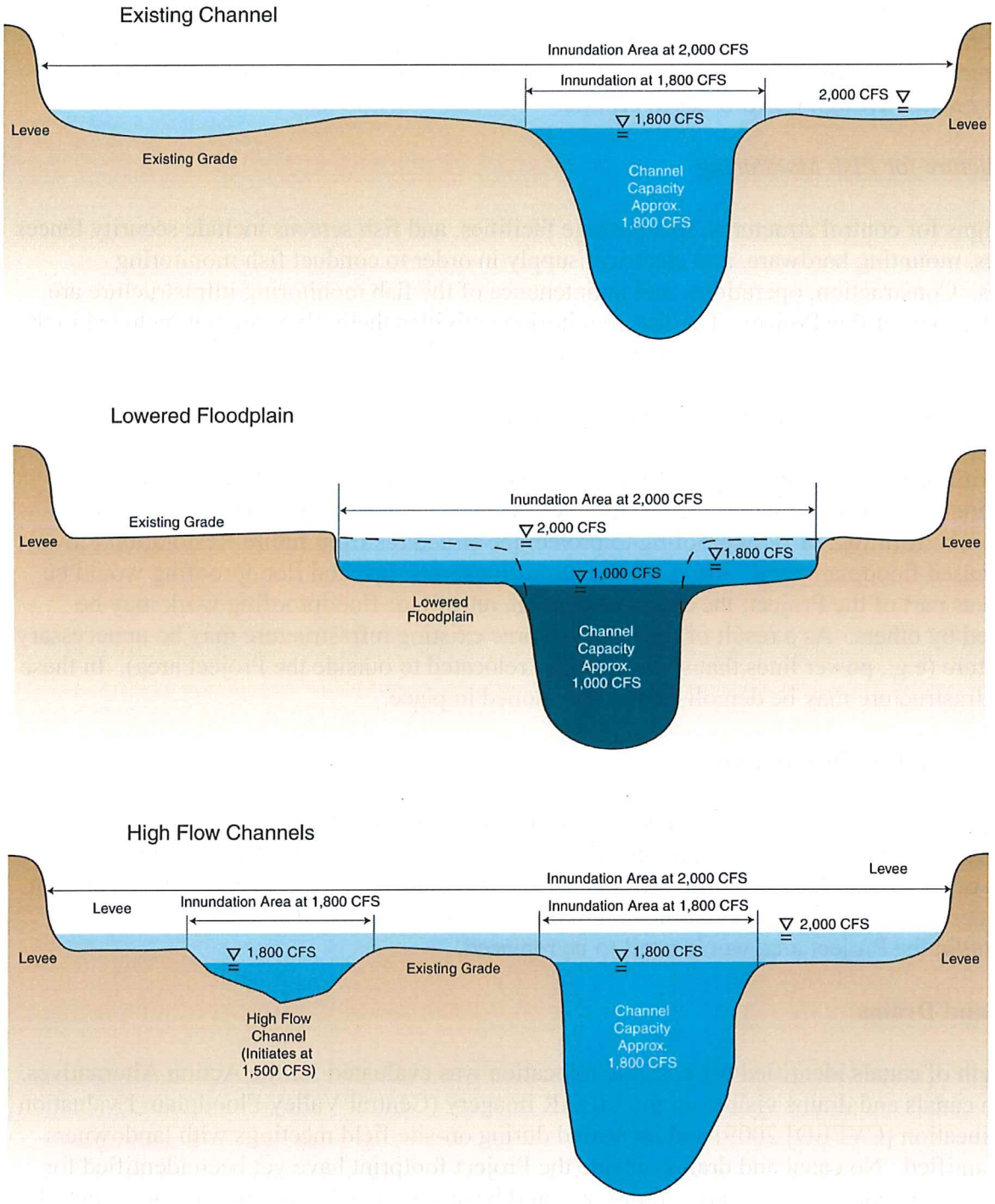

Figure 3.
Example Floodplain Grading Approaches

Passage Assessment Database (CalFish 2014) were assumed to require relocation to new facilities on the edge of the proposed levees. A pilot channel dug from the low flow river channel to the intake of the relocated pumps was also assumed. Locations in the CalFish Passage Assessment database were confirmed using the LiDAR imagery when possible.

crucial conversations

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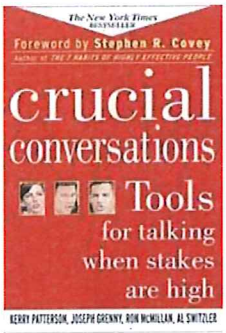

Instructions

Before you start, read through the following points:

- **Relationship**. Before you get started, think about the relationship you want to improve—with your boss, coworker, direct report, friend, or family member—and keep this relationship in mind.
- **Circumstance**. Next, think of a tough situation—one that you might have handled poorly or avoided altogether.
- **Apply**. Now, with that situation in mind, respond to the following statements as either true or false.

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☑T	☐F	21. When others get defensive because they misunderstand me, I immediately get us back on track by clarifying what I do and don't mean.
☐T	☑F	22. There are some people I'm rough on because, to be honest, they need or deserve what I give them.
☐T	☑F	23. I sometimes make absolute statements like "The fact is…" or "It's obvious that…" to be sure my point gets across.
☑T	☐F	24. If others hesitate to share their views, I sincerely invite them to say what's on their minds, no matter what it is.
☑T	☐F	25. At times I argue hard for my view hoping to keep others from bringing up opinions that would be a waste of energy to discuss anyway.
☑T	☐F	26. Even when things get tense, I adapt quickly to how others are responding to me and try a new strategy.
☑T	☐F	27. When I find that I'm at cross purposes with someone, I often keep trying to win my way rather than looking for common ground.
☑T	☐F	28. When things don't go well, I'm more inclined to see the mistakes others made than notice my own role.
☑T	☐F	29. After I share strong opinions, I go out of my way to invite others to share their views, particularly opposing ones.
☑T	☐F	30. When others hesitate to share their views, I do whatever I can to make it safe for them to speak honestly.
☐T	☑F	31. Sometimes I have to discuss things I thought had been settled because I don't keep track of what was discussed before.
☐T	☑F	32. I find myself in situations where people get their feelings hurt because they thought they would have more of a say in final decisions than they end up having.
☑T	☐F	33. I get frustrated sometimes at how long it takes some groups to make decisions because too many people are involved.

Scoring

Fill out the score sheet on the next page. Each domain contains two to three questions. Next to the question number is either a (T) or (F). For example, under "Masking," question 5, you'll find a (T). If you answered question 5 true, check the box. With question 13, on the other hand, you'll find an (F). Only check that box if you answered the question false—and so on.

Your Style Under Stress score will show you which forms of silence or violence you turn to most often. Your Crucial Conversation Skills score is organized by concept and chapter from the book *Crucial Conversations: Tools for Talking When Stakes are High* (McGraw-Hill 2002) so that you can decide which chapters will benefit you the most. Again, a self-scoring version of this test is available at www.crucialconversations.com. This test is also duplicated on pages 56-60 of *Crucial Conversations: Tools for Talking When Stakes Are High.*

Style Under Stress

Your silence and violence scores give you a measure of how frequently you fall into these less-than-perfect strategies. It's actually possible to score high in both. A high score (one or two checked boxes

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
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In Reply Refer to:
08FBDT00-2016-F-0049

Memorandum

To: Manager, San Joaquin River Restoration Program, Mid-Pacific Regional Office, Bureau of Reclamation, Sacramento, California

From: Assistant Field Supervisor, San Francisco Bay-Delta Fish and Wildlife Office, Sacramento, California

Subject: Informal Consultation Under Section 7(a)(2) of the Endangered Species Act on the San Joaquin River Restoration Program's Mendota Pool Bypass and Reach 2B Improvements Project.

This memorandum is in response to the U.S. Bureau of Reclamation's (Reclamation) February 24, 2016, request for formal consultation with the U.S. Fish & Wildlife Service (Service) pursuant to section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act), for the proposed San Joaquin River Restoration Program's (SJRRP) Mendota Pool Bypass and Reach 2B Improvements Project (proposed project).

Reclamation's request for consultation was received by the Service on February 24, 2016. At issue are the effects of the proposed project on the federally-listed as threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), giant garter snake (*Thamnophis gigas*), and the federally-listed as endangered San Joaquin kit fox (*Vulpes macrotis mutica*), Fresno kangaroo rat (*Dipodomys nitratoides exilis*), blunt-nosed leopard lizard (*Gambelia sila*), least Bell's vireo (*Vireo bellii pusillus*), palmate-bracted bird's beak (*Cordylanthus palmatus*), California jewelflower (*Caulanthus californicus*), and San Joaquin woolly threads (*Monolopia* (=*Lembertia*) *congdonii*).

In 2015, the Service determined that the population of elderberry longhorn beetle south of the Merced County border is part of the California elderberry longhorn beetle (*Desmocerus californicus californicus*) subspecies and not the listed subspecies valley elderberry longhorn beetle. The proposed project is no longer considered to be within the range of the listed valley elderberry longhorn beetle, and so this biological opinion will not consider the effects of the proposed project to the valley elderberry longhorn beetle.

Reclamation has requested the Service's concurrence with a determination that the proposed project is not likely to adversely affect the San Joaquin kit fox, Fresno kangaroo rat, blunt-nosed

January 14, 2015	Reclamation and the Service conducted meetings regarding consultation on the proposed project on January 14, 2015, January 27, 2015, March 17, 2015, a site visit on May 28, 2015, and September 29, 2015.
December 11, 2015	Reclamation provided a draft Reach 2B BA to the Service for review.
January 13, 2015	The Service provided Reclamation with comments on the draft BA and met with Reclamation to discuss the comments.
February 10, 2016	The Service received a letter of initiation and the BA for the proposed project from Reclamation.

BIOLOGICAL OPINION

Background

In 1988, a coalition of environmental groups, led by the Natural Resources Defense Council (NRDC) filed a lawsuit, entitled *NRDC, et al., v. Kirk Rodgers, et al.*, challenging the renewal of long-term water service contracts between the United States and the Friant Contractors. On September 13, 2006, after more than 18 years of litigation, the Settling Parties, including NRDC, Friant Water Users Authority, and the U.S. Departments of the Interior and Commerce, agreed on the terms and conditions of the Stipulation of Settlement in *NRDC, et al., v. Kirk Rodgers, et al.*, (Settlement) subsequently approved by the U.S. District Court for the Eastern District of California on October 23, 2006. Public Law 111-11 authorizes and directs the Secretary of the Interior to implement the Settlement. The Settlement establishes two primary goals:

> **Restoration Goal** – To restore and maintain fish populations in "good condition" in the main stem San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish.
>
> **Water Management Goal** – To reduce or avoid adverse water supply impacts on all of the Friant Division long-term contractors that may result from the Interim and Restoration flows provided for in the Settlement.

In accordance with the Settlement, the SJRRP is being implemented by Reclamation, the Service, National Marine Fisheries Service (NMFS), the State of California Department of Water Resources (DWR), and the State of California Department of Fish and Wildlife (CDFW). The SJRRP Implementing Agencies completed the SJRRP Programmatic Environmental Impact Statement/Report and related documents, including the San Joaquin River Restoration Program Biological Opinions, in 2012.

The Mendota Pool bypass and Reach 2B improvements defined in the Settlement are (Settlement Paragraph 11[a]):

Improvements to Reach 2B will include modifications to the San Joaquin River channel from the Chowchilla Bifurcation Structure to the Compact Bypass structures to provide a capacity of at least 4,500 cfs, with integrated floodplain habitat. New levees will be constructed along Reach 2B to increase the channel capacity while allowing for new floodplain habitat. The existing crossing at San Mateo Avenue will be removed.

Implementation of the proposed project will be phased. Construction of the Compact Bypass portion of the proposed project will occur first from approximately 2017 to 2020 and will be followed by construction of the Reach 2B channel improvements from approximately 2020 to 2025. For these reasons, the Project Description is divided into separate sections, one describing the Compact Bypass, and one describing the Reach 2B channel improvements.

Compact Bypass Channel

The bypass channel will convey 4,500 cfs around the Mendota Pool by constructing a channel just southwest of the existing Columbia Canal alignment. Once constructed, the bypass channel will become the new river channel. The proposed project includes excavating the bypass channel, constructing setback levees and in-channel structures, breaching existing levees (leaving some segments that provide valuable habitat and seed source in place), relocating or modifying existing infrastructure, and acquiring land. The in-channel structures include the Compact Bypass control structure, Mendota Pool control structure, grade control structures, fish screen, fish passage facility at the Compact Bypass control structure, Columbia Canal siphon and pumping plant, as well as the Drive 10 ½ realignment. The bypass channel and associated structures provide downstream passage of juvenile Chinook salmon and upstream passage of adult Chinook salmon, as well as passage for other native fishes, while isolating Mendota Pool from Restoration Flows.

The bypass channel will connect to Reach 3 about 0.6 mile downstream from Mendota Dam (near River Mile [RM] 204), bypass the Mendota Pool to the north, and connect to Reach 2B about 0.9 mile upstream from Mendota Dam (near RM 205.5). The bypass channel will have a total length of about 0.8 mile. A siphon under the bypass channel will be constructed to connect the Columbia Canal to the Mendota Pool.

The bypass channel will be a multi-stage channel designed to facilitate fish passage at low flows, channel stability at moderate flows, and contain high flows. The low flow channel is about 70 feet wide and has an average depth of about 3 feet deep. It is designed to contain about 200 cfs, and is sinuous. The overbank slopes toward the low flow channel. The bank slope of 67 feet horizontal to 1 foot vertical (67H:1V) and a flow of 1,200 cfs is designed to have about 1 foot of depth in the overbank. The overbank slope increases to 20H:1V at a distance of 135 feet from the center of the channel. The floodplain is intended to produce a range of channel depths regardless of the flow.

The elevation of the Compact Bypass control structure is set at 141 feet in order to promote sediment stability throughout Reaches 2 and 3 and minimize the need for grade control in the Compact Bypass channel. Because the entrance to the bypass is located about 7 feet below the current thalweg of Reach 2B, a pilot channel will be constructed to create a smoother transition

Compact Bypass Structures

Two control structures will be constructed at the upstream end of the Compact Bypass: one across the path of Restoration Flows (Compact Bypass), also known as the Compact Bypass control structure, and one across the path of water deliveries to Mendota Pool (San Joaquin River), also known as the Mendota Pool control structure. The Compact Bypass control structure includes a fish passage facility on the side of the structure (i.e., the Compact Bypass Fish Passage Facility) and the Mendota Pool control structure may include a fish screen upstream of the structure (i.e., the Mendota Pool Fish Screen), if appropriate. Each control structure will be placed in the middle of the channel and has earthen embankments, which are designed as dams as they may have water on both sides, connecting the structure to the proposed levees. A 16-foot-wide roadway and 20-foot-wide maintenance/operations platform will be provided over each control structure.

Compact Bypass Control Structure
The Compact Bypass control structure will be designed to accommodate up to 4,500 cfs and will consist of eight 14-foot-wide bays. Conditions in this control structure will be designed based on the *Guidelines for Salmonid Passage at Stream Crossings* (NMFS 2001) and *Anadromous Salmonid Passage Facility Design* (NMFS 2008) fish passage criteria. The bays will be outfitted with radial gates. About 95 percent of the time, fish and Restoration Flow will pass through this structure and all gates will be open.

When deliveries are occurring, most of the gates of the Compact Bypass control structure will be shut nearly all the way. The water surface elevation will increase by several feet on the upstream side of the structure. The gates of the Mendota Pool control structure will open and water will be delivered to Mendota Pool. In the delivery situation, fish and Restoration Flows will pass primarily through the fish passage facility, described below. Water that passes through the Compact Bypass control structure will be forced through a small opening, and a hydraulic jump will form downstream of the structure. A stilling basin will be located on the downstream side of the Compact Bypass control structure to contain the hydraulic jump that will form when deliveries are occurring to Mendota Pool.

Mendota Pool Control Structure
The control structure across the San Joaquin River (the path of the water deliveries) will be designed to accommodate up to 2,500 cfs. The structure will have twelve bays that are 10 feet wide, and will contain slide gates to control the flow of water rather than radial gates, since Mendota Pool will be impounded on the downstream side of the structure at all times. Guides for stop logs will be provided in all bays to allow for maintenance. A 5-foot barrier wall may be added to the upstream side of the structure in several decades, to allow continued operation with subsidence.

Compact Bypass Fish Passage Facility

The Compact Bypass control structure (across the Restoration Flow path) includes a fish passage facility. The fish passage facility will be necessary to provide passage during water deliveries. The design of the fish passage facility is a vertical slot ladder with a sloped bottom, with about

appropriate. The fish screen would keep or return out-migrating juvenile salmon to the Compact Bypass (the path of Restoration Flows) during water deliveries. The Compact Bypass structures are only operated for Exchange Contractor diversions in summer months in highly infrequent dry years or during flood flow deliveries, when flows split several times before entering Mendota Pool and fish survival through the bypasses is high.

The screen would be designed to pass flow up to 2,500 cfs. The type of fish screen could be a fixed flat plate in "V" configuration, vertical flat plate, inclined flat plate, cone, or cylindrical screens. Depending on the design type, the fish screen facility may include trash racks, stainless steel wedge wire fish screens, flow control baffle systems behind the screens, screen cleaning systems for the trash racks and screens; bypass flow control weirs, fish-friendly pumps, and/or fish bypass pressure pipelines. The trash racks would be installed at the entrance to the screen structures to protect screens from trash, logs, and other large debris.

Approach, sweeping, and bypass entrance velocities would be kept within established fish screen criteria (NMFS 2008). Flow through the fish screens may be controlled by baffles behind the fish screens. Cleaning of the screens would be accomplished using an automated brush system. Electric power would be needed for fish friendly pumps, if included, and screen cleaning systems. Operation of the fish screens would include methods to reduce predation of juvenile fish (e.g., noise systems to scatter predators, netting, and periodic draining of the screen return pipes).

Floodplain and Riparian Habitat

The proposed project includes a mixture of active and passive riparian and floodplain habitat restoration and floodplain compatible agricultural activities. Active restoration planting of native riparian species will occur along both banks of the low flow channel of the river up to 450 feet from the bank, and will be irrigated with a planting density of approximately 545 plants per acre. In accordance with the Rearing Habitat Design Objectives, it will include native species that will provide shade and reduce air temperatures to help minimize water temperatures, provide large woody debris and organic matter needed to provide habitat and food, and help stabilize the low-flow channel. The irrigated area will include 16-foot spacing between irrigation lines for equipment access and 5-foot spacing along irrigation lines to maximize density. Forbs and grasses will be planted as plugs or transplants in between irrigation lines in order to encourage structural diversity. Some areas may be passively revegetated by creating riparian establishment areas that provide a riparian seed bank of native species. The remaining areas will be seeded with native grasses and forbs to minimize erosion and to help control invasive species. These upland areas will be broadcast seeded or drilled with incorporation as necessary. Active revegetation activities will include a combination of seeding, transplanting, and pole/live stake plantings. Plantings may be designed as either clusters of trees and shrubs with larger areas of seeded grasses and forbs or as dense forests. Spacing and alignment of plantings will take into account species growth patterns, potential equipment access needs for monitoring and maintenance, and desired future stand development. Passive restoration will occur in areas that rely on Restoration Flows for additional vegetation recruitment. Natural riparian recruitment (passive restoration) will promote continual habitat succession, particularly in areas where sediment is deposited or vegetation is removed by natural processes. Emergent wetlands and

Temporary Irrigation System and Water Supply
Proposed plantings that are wetland species or borderline wetland species will need regular aboveground irrigation (typically April through October) during their establishment period (typically 3 to 5 years depending on rainfall conditions and the plants' growth rates and vigor). The amount of water needed is estimated to be about 2.4 acre feet per year. An extensive temporary aboveground irrigation system, such as aerial spray, will provide water for the plants several times a week during the hot months of the year. If an aerial spray irrigation system is installed, the irrigation distribution piping would be installed aboveground and anchored to the ground so that it would not be damaged during high flows inundating the floodplain. If an aerial spray system is used, sprinkler heads would likely be installed on braced standpipes so that their irrigation stream would not be blocked or diverted by growing vegetation. The irrigation system would be disassembled and removed at the end of the establishment period.

The Program will pursue options for irrigation water supply, including groundwater wells or water pumped from the river with portable, skid-mounted, diesel- or gas-powered pumps and stored in tanks. Additionally, purchases from willing sellers may be required to withdraw water from the river or other nearby water sources (e.g., Mendota Pool). If water is pumped from the river, the amount of water diverted would be controlled so that river water temperatures do not increase and passage for salmonids is not impaired. The diversion from the river would also be screened if necessary to prevent entraining juvenile salmonids.

Maintenance and Monitoring
Maintenance and monitoring will be conducted following revegetation for 10 years, yearly for the first 3 years, every other year until year 7, and a final assessment at year 10. Monitoring activities include monitoring of the installed plants for drought stress and overwatering, identification of competitive, invasive, non-native species for removal, identification of diseased, dead and washed-out plants, irrigation system function, and identification of trash and debris for removal. Maintenance activities will include controlling invasive plant species, mitigating animal damage, irrigation, replacement of diseased, dead, or washed-out plants, irrigation system maintenance, and removal of trash and debris. Animal damage to newly planted or germinated vegetation may be alleviated with screens, aquatic-safe chemical deterrents, or other exclusion methods.

Temporary irrigation of wetland and riparian areas during establishment, especially if precipitation is below normal, will facilitate root system development into the alluvium groundwater. Irrigation infrastructure will need to be installed and remain in place for at least 3 years. The irrigation system will be used each year on a biweekly to daily basis during the hot part of the growing season. The landscape contractor will be required to regularly check the integrity of the system and make sure that system is not clogged or damaged. Upland areas will be seeded in the fall before the winter precipitation season, and it is likely that these areas will become established to an acceptable level after one season of normal precipitation (there may be more than one active revegetation effort required to establish a dense riparian corridor necessary to naturally stabilize the Compact Bypass channel). Removal of trash and debris from the restoration areas on both sides of the river will be performed on an as-needed basis for the

Levees

Set-back levees will be required within the proposed project limits to contain Restoration Flows. While the height and footprint of the levees vary according to their location along the channel and the ground elevation, the capacity, freeboard, and cross-section will be consistent. Localized backwater and redirection effects at proposed project structures will be considered during design of levee heights. Levees will be designed to maintain at least 3 feet of freeboard on the levees at 4,500 cfs. Levee design will be based on the U.S. Army Corps of Engineers (Corps) *Engineer Manual 1110-2-1913 Design and Construction of Levees guidelines* (Corps 2000) and *Engineer Technical Letter 1110-2-583 Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams and Appurtenant Structures* (Corps 2014). The design includes seepage control measures, maintenance roads, and inspection and drainage trenches to direct off-site drainage where required.

Levee alignments maintain a 300-foot buffer zone, where appropriate, between the levee and river channel to avoid impact to levees over time due to potential channel migration. In areas where a minimum 300-foot buffer zone between the main river channel and levee cannot be maintained, bank revetment will be incorporated in the design.

New levees will be designed to have sideslopes of 3 horizontal to 1 vertical (3H:1V) on the waterside and landside. A maintenance road and surface drainage ditch will also be included. Surface drainage ditches will only be intended to capture and direct runoff; they are not intended to address groundwater seepage or through-levee seepage. By following the Corps standards, all levees will have an inspection trench or include a cut-off wall. Additional data collection and analysis will be required to verify the groundwater conductivity rates of the *in situ* and borrow soils and to finalize the design of seepage control measures.

The levee alignments may be adjusted during final design. Adjustments may be made for several reasons, including: to improve flow conditions on the floodplain; to improve habitat conditions on the floodplain; to reduce potential erosion; to accommodate adverse soil conditions; and to avoid existing infrastructure. The final levee alignments will be within the impact areas described in the project description of the BA (SJRRP 2016).

Levee and Structure Protection

The proposed project will generally provide a minimum 300-foot buffer between the existing channel and the proposed levee. For locations where the 300-foot buffer is not included, erosion protection for the levee in the form of revetment will be included. The revetment will be riprap material covered by soil and then planted to provide a vegetated surface. However, softer approaches, such as bioengineering or dense planting, may be considered during design depending on velocities and scour potential. Locations that require revetment include areas where the 300-foot buffer is not included due to the proximity of existing infrastructure, near proposed structures, and along river bends less than 300 feet from the levee in areas that have the potential to erode.

project, the actual relocation, retrofit, or floodproofing work may be performed by others. As a result of the proposed project, some existing infrastructure may be unnecessary in the future (e.g., power lines that service pumps relocated to outside the proposed project limits). In these cases, infrastructure may be demolished or abandoned in place.

Specific plans for relocations, where known, are identified below:

- Natural gas pipelines will be buried lower in the soil column to avoid interference with construction activities.
- Water pipelines will be either buried lower in the soil column or relocated outside of levees but within the Action Area.
- City of Mendota's three groundwater wells will remain in place. Two of them are outside of the levee alignments and will remain unaffected. The third well is immediately adjacent to the San Joaquin River and will be floodproofed, with the adjacent levee extending to protect the well.
- The Mowry Bridge, which holds the city of Mendota's water pipeline, will be replaced for construction access and the water pipeline will be replaced across the new bridge.

Electrical and Gas Distribution

Approximately 48,500 feet of electrical distribution lines and 11,000 feet of gas distribution lines have been identified for possible relocation. Information from Pacific Gas and Electric Company is available for portions of the area in Geographic Information System (GIS) shapefile format and was supplemented by field data. At the current level of design, it is assumed that a portion of the existing electrical and gas distribution lines found within the Action Area will need to be replaced and/or excavated and buried lower in the soil column. Three gas pipelines are buried under the San Joaquin River in this reach. They will need to be re-buried deeper or floodproofed. This may involve trenching and excavation along the pipeline length, within and outside of the future floodplain area to re-bury it deeper in the soil column below any potential impacts from floodplain grading within the Action Area.

Canals and Drains

Approximately 31,500 feet of canals have been identified for possible relocation. On-farm canals and drains are visible on the light detection and ranging (LiDAR) imagery (CVFED 2009) and/or identified during on-site field meetings with landowners have been quantified. No canals or drains outside the proposed project footprint have been identified for redesign. Some portions of canals and drains could be discontinued in the future; the extent of discontinued and replaced canals will be considered during landowner negotiations. No subsurface drains were able to be quantified; however, some are believed to exist within the area.

Lift Pumps

Ten lift pumps have been identified for possible relocation. Lift pumps visible on the LiDAR imagery (CVFED 2009) or noted in the CalFish Passage Assessment Database (CalFish 2014) are assumed to require relocation to new facilities on the edge of the proposed levees. A pilot channel dug from the low flow river channel to the intake of the relocated pumps is also assumed. Locations in the CalFish Passage Assessment database have been confirmed using the LiDAR imagery when possible.

- Chowchilla Canal Road/Road 13 – Approximately 0.3 mile of road starting at Eastside Drive will likely require some overlaying and the implementation of dust control measures.
- San Mateo Avenue – Approximately 0.5 mile of gravel and 1.5 miles of oil-dirt road starting at the existing San Joaquin River levees will likely require some overlying and the implementation of dust control measures.
- Bass Avenue Canal Crossings – These crossings may need additional bracing and shoring to ensure that they will be able to support the load of the construction equipment and activities. All the construction equipment on Bass Avenue will be within the legal loads. This crossing is on the Fresno County replacement list.
- Delta-Mendota Canal Crossing – This crossing may need additional bracing and supports to ensure that it will be able to support the load of the construction equipment activities.
- Mowry Bridge – This bridge will need replacement as it is currently condemned due to beaver activity. It would provide convenient access to the site of the Mendota Pool control structure.

Dust control measures for non-paved roads may include the use of water trucks or dust palliative for dust control or gravel placement where necessary. Legal loads would be used on all roads, and once construction is completed, the roads would be returned to the same condition as they were prior to the Project.

Revegetation of Temporary Disturbance Areas
Areas temporarily disturbed during construction will be restored to their previous contours, if feasible, and then seeded with a native vegetation seed mixture to prevent soil erosion. Some areas, such as borrow areas, may not be feasible to restore previous contours, but these areas will be smoothed and seeded. Staging and borrow areas will occur on annual cropland or land purchased for the proposed project and not on permanent cropland outside of the proposed project levees.

Structure Design and Subsidence

All design work will be completed in general accordance with Reclamation Design Standards, applicable design codes, and commonly accepted industry standards. Where design criteria are missing for a specific project element, either Reclamation will be consulted for design specifications or standard engineering practice methods will be employed.
In addition, ground subsidence effects are anticipated to be experienced in the Action Area. Based on subsidence data collected from December 2011 to July of 2015, Reclamation is designing the proposed project for 5 feet of subsidence, which is equal to the current rate for 25 years. In 2042 (25 years from the start of construction of this Project) the Sustainable Groundwater Management Act requires Groundwater Sustainability Agencies to have reached sustainable levels of withdrawal in all State groundwater basins, presumably meaning subsidence will have stopped. Methods to mitigate this anticipated ground subsidence included are

Cofferdams include two rows of braced sheet piling filled with dirt for stability and seepage control. The total height of the cofferdam is assumed to be 24 feet of which 12 feet will be above the channel bed.

Stone slope protection (riprap) will be provided on the upstream and downstream slopes of the control structure embankment including some portions of the side slopes of the channel itself to prevent scouring. Riprap will be placed on bedding over geotextile fabric. Riprap will be filled with soil and planted with native vegetation.

Construction of the fish screen, which is located in the San Joaquin River, will require removable cofferdams in two phases to facilitate the construction without blocking the flow. The exception to this is the return/bypass fish pipes and outlet, which will take place in the dry period using conventional construction methods.

For construction of the control structures and fish passage facilities, it will be necessary to maintain a minimum flow during construction during fish migration periods; the amount or range of flows during construction has not yet been identified. The construction of the Compact Bypass channel will be undertaken the dry period. The levee between the Compact Bypass and the Mendota Pool will be one of the first components constructed, as it includes a cement-bentonite wall that will assist in dewatering the rest of the site. The cement-bentonite wall will extend around the site of the Compact Bypass control structure on existing land, providing dewatering for the construction of the Compact Bypass control structure as well. Soil will remain in the location of the Compact Bypass control structure until the entire bypass is graded, levees are constructed, and the bypass is revegetated, at which time the Compact Bypass control structure will be constructed. The pilot channel will be excavated when the Mendota Pool control structure is complete and flows will start passing through the Compact Bypass.

Operations and Maintenance

The Project includes long-term operations and maintenance of the proposed facilities and features as described below.

Maintenance
Levees will require maintenance for vegetation management, access roads, levee inspections, levee restoration, rodent control, minor structures, encroachment removal, levee patrolling during flood events, and equipment. Levee vegetation management includes equipment to drag or mow the levee banks or aquatic-safe herbicide applications. Maintenance of access roads includes replacing gravel or scraping and filling of ruts to keep the roads in good condition. Levee restoration includes restoring areas with erosion or settlement problems or adding armor. Rodent control includes setting traps with bait and periodically checking the traps. Minor structures maintenance includes repair or replacement of gates, locks or fences. Encroachment removal involves removing illegally dumped materials.

between spring and fall and will depend on the plant species that are being treated. Typically the herbicide will be administered prior to the plant going to seed and may need to be sprayed more than once. Disking for vegetation management usually occurs twice within the year; once in early spring after the wet season and then again in late summer prior to plants going to seed. Access road and levee restoration work will be done in the summer. Rodent control will be done by a pest control advisor and will be done in the spring through fall and not during the wet season.

Timing of the maintenance of structures within the waterways will depend on the flow hydrograph and forecasted flows, but can be expected in the summer/fall after high spring flows have receded. Cleaning of the in-channel structures will occur when flows are low enough to allow crews and equipment to enter the river safely to access the structures. San Mateo Avenue may be cleared earlier for access as soon as flows recede and are not likely to increase for the remainder of the water year. If earlier, this work will only be for road access and will not be located in the channel itself.

Debris that collects on trash racks, screens, ladders, or other fish passage structures will be periodically removed but will be scheduled based on the operation permits for these structures. Annual maintenance cleaning will be after the fish migration, but will be timed when flows have receded.

Lubing and annual gate maintenance will be in the late summer or early fall prior to winter and spring flows to be sure the structures are operating properly and to provide time for repairs and ordering parts if needed.

Operations
There are no operations for levees, floodplains, or levee and structure protection, for details refer to the proposed project BA (SJRRP 2016).

Monitoring Activities
Monitoring activities will include physical and nonphysical activities within the Action Area, for details refer to the proposed project BA (SJRRP 2016).

Construction of the Reach 2B Channel Improvements

Structures

Fish Passage Facility Control Structure at the Chowchilla Bifurcation Structure
The size and geometry of the fish passage facility would be dictated by the flow requirements for juvenile and adult fish.

San Joaquin River Control Structure at the Chowchilla Bifurcation Structure Modifications
The San Joaquin River control structure at the Chowchilla Bifurcation Structure will be modified to improve fish passage through the control structure itself or to improve operations of the passage facility.

measures address all potentially affected federally-listed and/or State-listed species, and all other species identified by the Service, NMFS or CDFW as candidates, sensitive, or special-status in local or regional plans, policies, or regulations. The applicable, feasible measures will guide development of action-specific conservation strategies.

Giant garter snake

1. For work that will occur during the active season for giant garter snakes (between May 1 and October 1), preconstruction surveys will be completed by a qualified biologist approved by the Service and CDFW within a 24-hour period before any ground disturbance of potential giant garter snake habitat. If ground-disturbing activities stop on the project site for a period of 2 weeks or more, a new giant garter snake survey will be completed no more than 24 hours before the restart of ground-disturbing activities. Avoidance of suitable giant garter snake habitat, as defined by the Service (USFWS 1999a) and CDFW will occur, where feasible, by demarcating and maintaining a 300-foot-wide buffer around these areas.

2. To the extent feasible, all activity involving disturbance of potential giant garter snake habitat will be restricted to the active season for giant garter snakes (between May 1 and October 1). For project activities that cannot feasibly occur within this window, a cofferdam will be constructed in coordination with the Service and work will be conducted in the dried area. If cofferdam construction is infeasible, work will be conducted during one active season (May 1 to October 1) and the following inactive season. Exclusion fencing and increased monitoring of wintering sites will occur in coordination with the Service during this inactive period construction. Construction will be minimized within 200 feet of banks of habitat, especially during the inactive period (Oct 2 to April 30) and movement of heavy equipment will be confined to existing roadways, to the extent feasible. Stockpiles and staging areas will be established more than 200 feet from the bank/edge of aquatic habitat.

3. Clearing will be confined to the contractor use area which should be considered the minimal area necessary to facilitate construction activities. Giant garter snake habitat within or adjacent to the proposed project will be flagged, staked, or fenced and designated as an Environmentally Sensitive Area. No activity will occur within this area, to the extent feasible, and Service-approved worker awareness training and biological monitoring will be conducted to ensure that avoidance measures are being implemented.

4. Vegetation will be hand-cleared in areas where suitable giant garter snake habitat is documented to occur, based on mapping provided in the BA or future, Service-approved mapping. Exclusionary fencing with one-way exit funnels will be installed at least 1 month before activities to allow the species to passively leave the area and to prevent reentry into work zones, per Service and/or CDFW guidance.

5. If a giant garter snake is found during construction activities, the Service, CDFW, and the proposed project's biological monitor will immediately be notified. The biological monitor, or his/her assignee, will stop construction in the vicinity of the find and allow

13. Compensatory mitigation will include:

    a. A new turn-key mitigation site, or sites, in Fresno Slough and/or

    b. A new turn-key mitigation site or purchase of credits at a mitigation bank near the Volta Wildlife Area

14. In addition to the above up to 3.5:1 acreage compensation, installation of a groundwater well at Volta Wildlife Area, construction of ridges for burrows in an existing area of habitat, or creating additional wetland habitat at the existing Volta Wildlife Area may be pursued to provide benefits to the existing population (Table 1).

Table 1. Giant Garter Snake – Extent of Potential Impacts and Estimated Mitigation Acreages

Anticipated GGS Impacts	Potential Impacts (acres)	Mitigation Target (acres)
Aquatic	142	423
Upland	221	848
TOTAL	363	1,271[1]

[1] = Amount may vary based on habitat availability and mitigation opportunities

Least Bell's Vireo

1. Prior to ground disturbance, a qualified biologist will conduct surveys for least Bell's vireo in all riparian habitats within 500 feet of ground-disturbing activities at the start of the spring nesting season adhering to guidance offered in Least Bell's Vireo Survey Guidelines (USFWS 2001).

2. If full protocol surveys cannot be implemented prior to initiation of ground-disturbing activities, the monitoring Service-approved biologist will be present for all activities within 500 feet of potentially suitable habitat. The monitoring biologist will perform a minimum of three focused surveys on three separate days prior to ground disturbance to determine the presence of least Bell's vireo, nest building, egg incubation, or brood rearing activities within 500 feet of the proposed project footprint. The surveys will begin a maximum of 7 days prior to construction and one survey will be conducted the day before ground disturbance. If any least Bell's vireo are detected, Reclamation will postpone work within 500 feet of the location and contact the Service within 24 hours. Upon notification, the Service will discuss the best approach to avoid/minimize impacts to nesting least Bell's vireo and a nest monitoring program acceptable to the Service. Subsequent to these discussions, work may be initiated subject to implementation of the agreed upon avoidance/minimization approach and nest monitoring program. In addition, if least Bell's vireo are detected in the Action Area, RNB-2 (Compensate for Loss of Habitat or Species) from the *Formal Consultation and Conference Report Under Section 7(a)(2) of the Endangered Species Act for the San Joaquin River Restoration Program* (08ESMF00-2012-F-0125) will be implemented.

Consultation and Conference Report Under Section 7(a)(2) of the Endangered Species Act for the San Joaquin River Restoration Program (08ESMF00-2012-F-0125) will be implemented.

San Joaquin kit fox

1. A qualified biologist will conduct preconstruction surveys in the Action Area no less than 14 days and no more than 30 days before the commencement of ground-disturbing activities to identify potential dens more than 5 inches in diameter. Reclamation will implement the Service's *Standardized Recommendations for Protection of San Joaquin Kit Fox Prior to or During Ground Disturbance* (USFWS 1999b). Reclamation will notify the Service and CDFW in writing of the results of the preconstruction survey within 30 days after these activities are completed.

2. If San Joaquin kit fox are detected within or adjacent to the Action Area, additional avoidance and minimization measures, including measures that will avoid direct take of this species, will be developed in coordination with the Service and CDFW and implemented before initiation of ground-disturbing activities. If dens are located within the proposed work area, and cannot be avoided during construction activities, a Service-approved biologist will determine if the dens are occupied. Reclamation will present the results of pre-activity den searches within 5 days after these activities are completed and before the start of ground-disturbing activities in the Action Area. Reclamation will notify the Service and CDFW immediately if a natal or pupping den is found in the survey area.

3. If occupied San Joaquin kit fox dens are present within the proposed work area, their disturbance and destruction will be avoided, to the fullest extent possible. Exclusion zones will be implemented following the latest Service procedures, and construction activities in occupied San Joaquin kit fox habitat will be conducted when they are least likely to affect the species (i.e., after the normal breeding season of December to April [Ahlborn 2000]). This timing will be coordinated with the Service and CDFW. In addition, if San Joaquin kit fox are detected within or adjacent to the Action Area, SJKF-2 (Compensate for Loss of Habitat or Species) from the *Formal Consultation and Conference Report Under Section 7(a)(2) of the Endangered Species Act for the San Joaquin River Restoration Program* (08ESMF00-2012-F-0125) will be implemented.

Federally Listed Plants

1. Within 1 year before the commencement of ground-disturbing activities, protocol-level surveys for the special-status plants that are applicable to Reach 2B, will be conducted in grassland, elderberry savannah, fresh emergent wetland, and wet herbaceous habitats by a qualified botanist, in accordance with *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (CDFW 2009). If detected, locations of special-status plant populations that can be avoided will be clearly identified in the field by staking, flagging, or fencing a minimum 100-foot-wide buffer

The jeopardy analysis in this Biological Opinion places an emphasis on consideration of the range-wide survival and recovery needs of the giant garter snake and the role of the action area in the survival and recovery of the species as the context for evaluating the significance of the effects on the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Adverse Modification Determination

No Federally designated critical habitat for any listed species is within the proposed project Action Area.

Status of the Species

Giant Garter Snake

See the Service's most recent Five-year Review for this species.

Environmental Baseline

Giant Garter Snake

The giant garter snake is known to occur in suitable habitat in the San Luis NWR Complex, in the Mendota Wildlife Area, at Mendota Pool (Dickert 2005), and south of the San Joaquin River in Fresno Slough (USFWS 2007). Although no sightings of giant garter snakes south of the Mendota Wildlife Area have occurred since the time of listing (Hansen 2008), the species is expected to occur in suitable habitat at other locations in the Restoration Area and, although it generally avoids large, wide rivers, giant garter snakes may occur in portions of the river channel that would be inundated by the release of Interim and Restoration flows. This species also may occur in suitable habitat in other locations in the Action Area that cannot be assessed because of private property constraints.

Effects of the Action

Construction activities in the Compact Bypass and Reach 2B channel improvements portion of the proposed project will result in the permanent loss of suitable upland and aquatic habitat for giant garter snake. Project construction activities have the potential to harm, harass, or kill giant garter snake through the degradation of habitat quality, and production of high levels of noise, vibration, and other disturbances during construction. Some suitable habitat will be eliminated due to conversion of portions of Mendota Pool to riverine habitat, and associated conversion of lentic to lotic aquatic habitat. Conservation Measure will be implemented to avoid and minimize effects and the risk of take associated with construction activities.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future

The measures described below are non-discretionary, and must be implemented by Reclamation so that they become binding conditions of any action associated with the proposed project, as appropriate, in order for the exemption in section 7(o)(2) to apply. Reclamation has a continuing duty to regulate the activity covered by this incidental take statement. If Reclamation (1) fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

Amount or Extent of Take

Incidental take of the giant garter snake is covered by this incidental take statement. The Service anticipates incidental take of giant garter snake will be difficult to detect or quantify. The cryptic nature of the species and its highly aquatic nature make the finding of an injured or dead specimen unlikely. The species occurs in habitats that make it difficult to detect. Due to the difficulty in quantifying the number of giant garter snakes that will be taken as a result of the proposed project, the Service is quantifying take incidental to the project as death, injury, harassment, and harm of all giant garter snakes inhabiting or otherwise utilizing 142.3 acres of aquatic habitat and 220.7 acres of upland habitat.

Effect of the Take

The Service has determined that this level of anticipated take is not likely to result in jeopardy to the listed wildlife species in this opinion or result in destruction or adverse modification of critical habitat.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the impact of taking giant garter snakes:

1. Minimize take in the form of harassment and/or harm of the giant garter snake during project construction activities and during project implementation.

2. The permanent and temporary loss and degradation of giant garter snake habitat shall be confined to the proposed project site, and minimized and restored to the greatest extent practicable.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, Reclamation must ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary:

1. Reclamation personnel, and all agents and contractors representing Reclamation, will implement all the described conservation measures included in this biological opinion.

REINITIATION NOTICE

This concludes formal consultation on the proposed project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if; (1) the amount or extent of incidental take is exceeded, (2) new information reveal effects of the proposed action may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat is designated that may be affected by the proposed action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Any questions or comments regarding these comments should be directed to Janet Whitlock, Assistant Field Supervisor, or Rocky Montgomery, Senior Biologist, San Joaquin River Restoration Program/Watershed Planning Branch at (916) 414-6733.

cc:
Mr. William Guthrie, US Army Corps of Engineers, Sacramento, California
Ms. Maria Rea, National Marine Fisheries Service, Sacramento, California
Mr. Gerald Hatler, California Department of Fish and Wildlife, Fresno, California
Mr. Kevin Faulkenberry, Department of Water Resources, South Central Region Office, Fresno, California

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish and Wildlife Office
650 Capitol Mall, Suite 8-300
Sacramento, California 95814

In reply refer to:
08FBDT00-2016-CPA-0036

Memorandum

To: Manager, San Joaquin River Restoration Program, Mid-Pacific Regional Office, Bureau of Reclamation, Sacramento, California

From: Field Supervisor, San Francisco Bay-Delta Fish and Wildlife Office, Sacramento, California

Subject: Fish and Wildlife Coordination Act Report for the U.S. Bureau of Reclamation's San Joaquin River Restoration Program Mendota Pool Bypass and Reach 2B Improvements Project

In accordance with 48 Stat. 401, as amended; 16 U.S.C. 661 et seq., this document constitutes the U. S. Fish and Wildlife Service's (Service) Draft Fish and Wildlife Coordination Act (FWCA) report to the U. S. Bureau of Reclamation (Reclamation) for the San Joaquin River Restoration Program (SJRRP) Mendota Pool Bypass and Reach 2B Improvements Project (Project). The FWCA requires Federal agencies proposing water resource development projects or involved in issuance of related permits or licenses to consult with the Service and provide equal consideration to the conservation, rehabilitation, and enhancement of fish and wildlife resources with other project purposes. The findings of this report are based on information provided in the *SJRRP Mendota Pool Bypass and Reach 2B Improvements Project Draft Environmental Impact Statement/Report*, dated June 2015, additional available data, field investigations, and information and comments provided by other State and Federal Agencies. Our report addresses the proposed project-related beneficial and adverse impacts on fish, wildlife, and botanical resources and provides recommendations if the proposed project were to be implemented in the future. Details of the project's effects on federally listed species, pursuant to Section 7 of the Endangered Species Act of 1973, as amended, will be addressed separately. As an Implementing Agency in the SJRRP, the Service has been working closely with Reclamation since early 2008 on project planning and development of avoidance and minimization measures for federally-listed species and migratory birds.

BACKGROUND

Originating high in the Sierra Nevada Mountains, the San Joaquin River carries snowmelt from mountain meadows to the valley floor before turning north and becoming the backbone of tributaries draining into the San Joaquin Valley. The San Joaquin River is California's second

reintroduction of Chinook salmon. Restoration Flows are specific volumes of water to be released from Friant Dam during different water year types, according to Exhibit B of the Settlement and began on January 1, 2014; Interim Flows were experimental flows that began in 2009 and continued until Restoration Flows were initiated, with the purpose of collecting relevant data concerning flows, temperatures, fish needs, seepage losses, recirculation, recapture, and reuse.

To achieve the Water Management Goal, the Settlement calls for recirculation, recapture, reuse, exchange or transfer of the Interim and Restoration flows to reduce or avoid impacts to water deliveries to all of the Friant Division long-term contractors caused by the Interim and Restoration flows. In addition, the Settlement establishes a Recovered Water Account (RWA) and program to make water available to all of the Friant Division long-term contractors who provide water to meet Interim or Restoration flows to reduce or avoid the impact of the Interim and Restoration flows on such contractors.

The Settlement and the Act authorize and direct specific physical and operational actions that could potentially directly or indirectly affect environmental conditions in the Central Valley. Areas potentially affected by Settlement actions include the San Joaquin River and associated flood bypass system, tributaries to the San Joaquin River, the Delta, and water service areas of the CVP and State Water Project (SWP), including the Friant Division. Settlement Paragraphs 11 through 16 describe physical and operational actions (see Table 1).

Table 1. Restoration and Water Management Framework in Key Settlement Paragraphs

Settlement Paragraph	Description of Constraint or Assumption
11	Identifies specific channel and structural improvements considered necessary to achieve the Restoration Goal. Includes a reach-by-reach list of improvements.
12	Acknowledges that additional channel or structural improvements not identified in Paragraph 11 may be needed to achieve the Restoration Goal.
13	Identifies specific volumes of water to be released from Friant Dam during different year-types (Restoration Flows), and provisional water supplies to meet the Restoration Flow targets as provided in Exhibit B of the Settlement. Stipulates the release of Restoration Flows no later than January 1, 2014, subject to then-existing channel capacities.
14	Stipulates that spring-run and fall-run Chinook salmon be reintroduced to the San Joaquin River between Friant Dam and the confluence of the San Joaquin River with the Merced River no later than December 31, 2012, consistent with all applicable law and after commencement of sufficient flows and the issuance of all necessary permits. Assigns priority to wild spring-run Chinook salmon over fall-run Chinook salmon.
15	Specifies that Interim Flows begin no later than October 1, 2009, and continue until Restoration Flows can begin, to collect relevant data concerning flows, temperatures, fish needs, seepage losses, recirculation, recapture, and reuse.
16	Requires that the Secretary of the Interior develop and implement a plan for recirculation, recapture, reuse, exchange, or transfer of the Interim and Restoration flows to reduce or avoid impacts to water deliveries for all Friant Division long-term contractors. This paragraph also calls for establishment of an RWA and program to make water available to the Friant Division long-term contractors who provide water to meet Interim or Restoration flows.

Key:
CEQA = California Environmental Quality Act
NEPA = National Environmental Policy Act
PEIS/R = Program Environmental Impact Statement/Environmental Impact Report
RWA = Recovered Water Account

(2) Modifications in channel capacity (incorporating new floodplain and related riparian habitat) to ensure conveyance of at least 4,500 cfs in Reach 2B between the Chowchilla Bifurcation Structure and the new Mendota Pool bypass channel.

Because the functions of these channels may be inter-related, the design, environmental compliance, and construction of the two are being addressed as one project. The Project would be implemented consistent with the Settlement and the Act, with implementation dates clarified by the Implementation Framework (SJRRP 2015).

The Mendota Pool Bypass would include conveyance of at least 4,500 cfs around Mendota Pool (or the Pool) from Reach 2B to Reach 3 and a fish barrier, if appropriate, to direct upmigrating adult salmon into the bypass. The bypass could be accomplished by constructing a new channel around Mendota Pool or by limiting Mendota Pool to areas outside of the San Joaquin River. This action would include the ability to divert 2,500 cfs to the Pool if water deliveries are required for the San Joaquin River Exchange Contractors (Exchange Contractors) and may consist of a bifurcation structure in Reach 2B. The bifurcation structure would include a fish passage facility to enable up-migrating salmon to pass the structure and a fish screen, if appropriate, to direct out-migrating fish into the bypass channel and minimize or avoid fish entrainment to the Pool.

Improvements to Reach 2B would include modifications to the San Joaquin River channel from the Chowchilla Bifurcation Structure to the new Mendota Pool Bypass to provide a capacity of at least 4,500 cfs with integrated floodplain habitat. The options under consideration include potential levee setbacks along Reach 2B to increase the channel and floodplain capacity and provide for floodplain habitat. Floodplain habitat is included along the Reach 2B portion of the Project as required by the Settlement; floodplain habitat is being considered along the Mendota Pool Bypass channel because Central Valley floodplains have been shown to be of value to rearing juvenile salmon as they migrate downstream (Jeffres 2008, Grosholz 2006, Sommer et al 2001, Sommer et al 2004). In addition, the SJRRP *Fisheries Management Plan* (SJRRP 2010a) and *Minimum Floodplain Habitat Area for Spring and Fall-Run Chinook Salmon* report (SJRRP 2012) describe that sufficient floodplain habitat is an important feature for meeting salmon population targets.

Improvements included in the project could potentially be implemented in a phased approach to facilitate scheduling and funding.

PROJECT AREA

The Project area includes areas that may be affected directly or indirectly by the Project alternatives. The Project footprint (township 13S, range 15E), shown in Figure 2, has two major components: Reach 2B and the Mendota Pool Bypass. Reach 2B generally includes the area from the San Joaquin River Control Structure near the Chowchilla Bypass downstream to Mendota Dam. Potential Project improvements in Reach 2B, which vary by alternative, extend from the Chowchilla Bifurcation Structure on the upstream end to the head of the potential Mendota Pool Bypass channel or to Mendota Dam on the downstream end. However, Reach 2B improvements may also include areas just upstream of the Chowchilla Bifurcation Structure and may continue downstream of the head of the Mendota Pool Bypass or Mendota Dam, including the Pool area, as necessary to meet Project goals and objectives. The lateral extent of potential Project Reach 2B improvements, which varies by alternative, includes lands to the north and south of the San Joaquin River in Reach 2B.

The Mendota Pool Bypass element of the Project alternatives generally includes the area from the downstream end of the Reach 2B improvements to a tie-in location in Reach 3. Improvements for the Mendota Pool Bypass, which vary by alternative, extend from the area south of Mowry Bridge over Fresno Slough to the area north of Mendota Dam where the Bypass ties into Reach 3. The Mendota Pool Bypass element of the Project alternatives also includes areas adjacent to and on the west side of Mendota Pool and Fresno Slough and areas to the south of the potential Project Reach 2B improvements. Areas indirectly affected by this Project include portions of Reach 3 downstream and Reach 2A upstream that are outside the direct Project footprint.

PROJECT DESCRIPTION

No-Action Alternative

The No-Action Alternative is required for the analysis of environmental effects according to NEPA. Under this alternative, the Project would not be implemented. The No-Action Alternative is not consistent with the Settlement.

No-Action Conditions

If the Project were not implemented, the components described in the Action Alternatives would not be implemented; however, the No Action Alternative assumes that other components of the SJRRP, as described in the 2012 Record of Decision, and other reasonably foreseeable actions consistent with current management direction expected to occur in the Project area, would be implemented.

The No-Action Alternative generally assumes no channel or structural improvements would be made in Reach 2B, and Restoration Flows would be reduced to not exceed the existing Reach 2B capacity. It is assumed for the No-Action condition that agriculture would continue and cropland would be the dominant cover type, consistent with the existing condition. The following assumptions about No-Action have been evaluated in the resource sections of the Project EIS/R.

Fisheries

In the No-Action Alternative, the maximum channel conveyance would be limited to the existing capacity. Fish passage improvements would not be provided at structures (Chowchilla Bifurcation Structure, San Mateo Avenue, and Mendota Dam). However, the remainder of the SJRRP would proceed, and salmon would be reintroduced into the San Joaquin River.

Habitat

Under the No-Action Alternative, habitat conditions will remain mostly unchanged. Some new vegetation may recruit as a result of Restoration Flows.

Seepage

The No-Action Alternative would maintain the existing levee alignments and heights and maximum conveyance would continue to be limited to the existing capacity.

Land Use, Agriculture, Economics & Socioeconomics

Under the No-Action conditions future lands use in the area is unlikely to change.

The Action Alternatives also include provision of fish passage at structures for salmonids and other native fish. These structures vary by alternative but overall include fish screens, fish passage facilities, grade control structures, and bifurcation structures (under certain flows). The designs for structures with fish passage components would be based on criteria in *Anadromous Salmonid Passage Facility Design* (NMFS 2008) and *Guidelines for Salmonid Passage at Stream Crossings* (NMFS 2001). Specifically, the Action Alternatives would provide suitable hydraulic conditions for passage of up-migrating adult salmonids, out-migrating juvenile salmonids, and inter-reach migration of other native fish between Reach 2A and Reach 3. Suitable hydraulic conditions include those conditions which the species is physically capable of passing and do not cause undue stress on the animal. The passage features would be designed to cause no physical harm to fish. The design criteria are structured around the life stages of the target anadromous species and the timing of the runs for upstream movement of adult fall and spring run Chinook and winter steelhead and the downstream movement of juvenile life stages spawned from these runs. Recommended criteria are based on a combination of swimming ability of the fish species as reported in scientific papers and criteria in agency design guidelines. Recommended design criteria to provide for successful fish passage (depth of flow, suitable velocity ranges and jump height) are provided in Table 2. The design criteria for a particular species would be met over the associated flow range (minimum flow to maximum flow).

Table 2. Fish Passage Design Criteria

Species	Life-stage	Migration Timeframe	Frequency	Minimum Flow	Maximum Flow	Maximum Velocity [1]	Minimum Water Depth [2]	Maximum Jump Height [3]	Minimum Pool Depth
			years	cfs	cfs	fps	feet	feet	feet
Chinook salmon	Adult	Spring and fall pulse	All years except CL	115 [4]	4,500	4.0	1.2	1.0	[5]
	Juvenile (downstream)	Nov-May	All years except CL	85 [7]	n/a	n/a	1.0	n/a	[5]
Steelhead	Adult	Spring and fall pulse	All years except CL	115 [4]	4,500	4.0	1.2	1.0	[5]
	Juvenile (downstream)	Nov-May	All years except CL	85 [7]	n/a	n/a	1.0	n/a	[5]
Sturgeon	Adult	Spring pulse	W and NW years	1,138 [8]	4,500	6.6	3.3	None – swim through	n/a
Lamprey	Adult	Spring pulse	All years except CL	125 [6]	4,500	[9]	[9]	[9]	n/a
Other native fish	Adult	Spring pulse	W, NW, and ND years	543 [10]	4,500	2.5	1.0	None – swim through	n/a

W = wet; NW = normal wet; ND = normal dry; CL = critical low

[1] Recommended maximum velocities shown are for grade control structures or structures with short longitudinal lengths based on *Anadromous Salmonid Passage Facility Design* (NMFS 2008) and *Guidelines for Salmonid Passage at Stream*

Levees would be required along the Project area to contain Restoration Flows. While the height and footprint of the levees vary according to their location along the channel and the ground elevation, the capacity, freeboard, and cross-section would be consistent. Localized backwater and redirection effects at Project structures would be considered during design of levee heights. Levees would be designed to maintain at least 3 feet of freeboard on the levees at 4,500 cfs. Levee design would be based on the U.S. Army Corps of Engineers (Corps) *Engineer Manual 1110-2-1913-Design and Construction of Levees* guidelines (Corps 2000a) and *Engineer Manual 1110-2-301 Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, & Embankment Dams* (Corps 2000b). The design includes seepage control measures, inspection trenches, maintenances roads, and drainage trenches to direct off-site drainage. Levee alignments maintain a 300-foot buffer zone, where appropriate, between the levee and river channel to avoid impact to levees over time due to potential channel migration. In areas where a minimum 300-foot buffer zone between the main river channel and levee cannot be maintained, bank revetment would be incorporated in the design.
New levees would be designed to have sideslopes of 3 horizontal to 1 vertical (3H to 1V) on the waterside and landside. A maintenance road and surface drainage ditch would also be included. Surface drainage ditches would only be intended to capture and direct runoff; they are not intended to address groundwater seepage or through-levee seepage. By following the Corps standards, all levees would have an inspection trench. Additional data collection and analysis would be required to verify the groundwater conductivity rates of the *in situ* and borrow soils and to finalize the design of seepage control measures.

The levee alignments shown on the plan views of the Action Alternatives may be adjusted during final design. Adjustments may be made for several reasons, including to improve flow conditions on the floodplain, to improve habitat conditions on the floodplain, to reduce potential erosion, to accommodate adverse soil conditions, and to avoid existing infrastructure among others. The final levee alignments will be within the impact areas evaluated in this document.

Seepage Control Measures

Seepage of river water through or under levees is a concern for levee integrity and adjacent land uses. Through-seepage, water that seeps laterally through the levee section, would be addressed through proper levee design and construction (e.g., selection of low porosity materials and proper compaction). Under-seepage, water that seeps laterally by travelling under the levee section, is primarily controlled by the native soils beneath the levee and seepage control measures would be included where native soils do not provide sufficient control. Seepage control measures would be included, as necessary, in the Project in areas where under-seepage is likely to affect adjacent land uses. Seepage control measures could include: cut-off walls, interceptor drains or ditches, seepage wells, seepage berms, land acquisition (fee title or seepage easements) and other measures that can be implemented within the Project area. A cut-off wall is a construction technique to reinforce areas of soft earth that are near open water or a high groundwater table with a mixture of soil, bentonite, and cement. Interceptor drains are buried perforated pipes and interceptor ditches are surface ditches, both of which intercept groundwater and redirect it to a discharge point. Because the drains and ditches have lower resistance to flow, the groundwater table can be kept artificially low in areas near the pipe or ditch. The discharge point could include a lift pump to move drained water over the levees, or it could be discharged directly to a

Removal of Existing Levees

Removal of portions of the existing levees is included and designed to expand the inundation area of the floodplain out to the proposed levees and improve connectivity between the river channel and proposed floodplain. The locations of existing levee removal would be based upon the hydraulic performance of the channel and floodplain. In certain locations, however, highly desirable existing vegetation (native and sensitive vegetation communities that can serve as seed banks for future vegetation communities) can be found on the existing levees. Where hydraulic performance and connectivity of the floodplain would not be negatively affected, portions of the existing levees with highly desirable vegetation would remain in place. Materials that are removed from the existing levees would likely be reused within the Project area.

Floodplain and Channel Grading

Floodplain and channel grading would be included with the Action Alternatives. Floodplain and channel grading would include any or all of the following at locations to be determined during design:

- Creating high-flow channels through the floodplain to increase the inundation extent at lower flows.
- Connecting low-lying areas on the floodplain to the river to prevent stranding.
- Removing high areas where flow connectivity would be impeded (e.g., farm road grades).
- Excavating floodplain benches adjacent to the river channel to increase the frequency of inundation.
- Creating greater inundation depth diversity on the floodplain.
- Excavating channels in portions of the Project area to tie into existing elevations upstream and downstream of the Project or to create desirable sediment transport conditions.

Floodplain and channel grading can provide benefits to salmon and other native fish by allowing inundation to occur at lower flows, by distributing suitable rearing habitats further into the floodplain, by connecting rearing habitat to primary production areas (shallow water habitat), by providing escape routes during receding flows, and by confining flows to a deeper, narrower channel to limit temperature increases.

Figure 3. provides an example of how various floodplain grading approaches can be used to expand inundation on the floodplain. The Existing Channel graphic shows an example of how inundation would occur without floodplain grading. The Lowered Floodplain example shows an example of how floodplain benches, lowered areas to either side of the channel, could be used to inundate floodplain areas at lesser flows. This graphic also shows how lowered floodplains could affect inundation at moderate flows. The High Flow Channels graphic shows an example of how high flow channels, side channels that initiate at larger flows than the main channel, could be used to expand floodplain inundation.

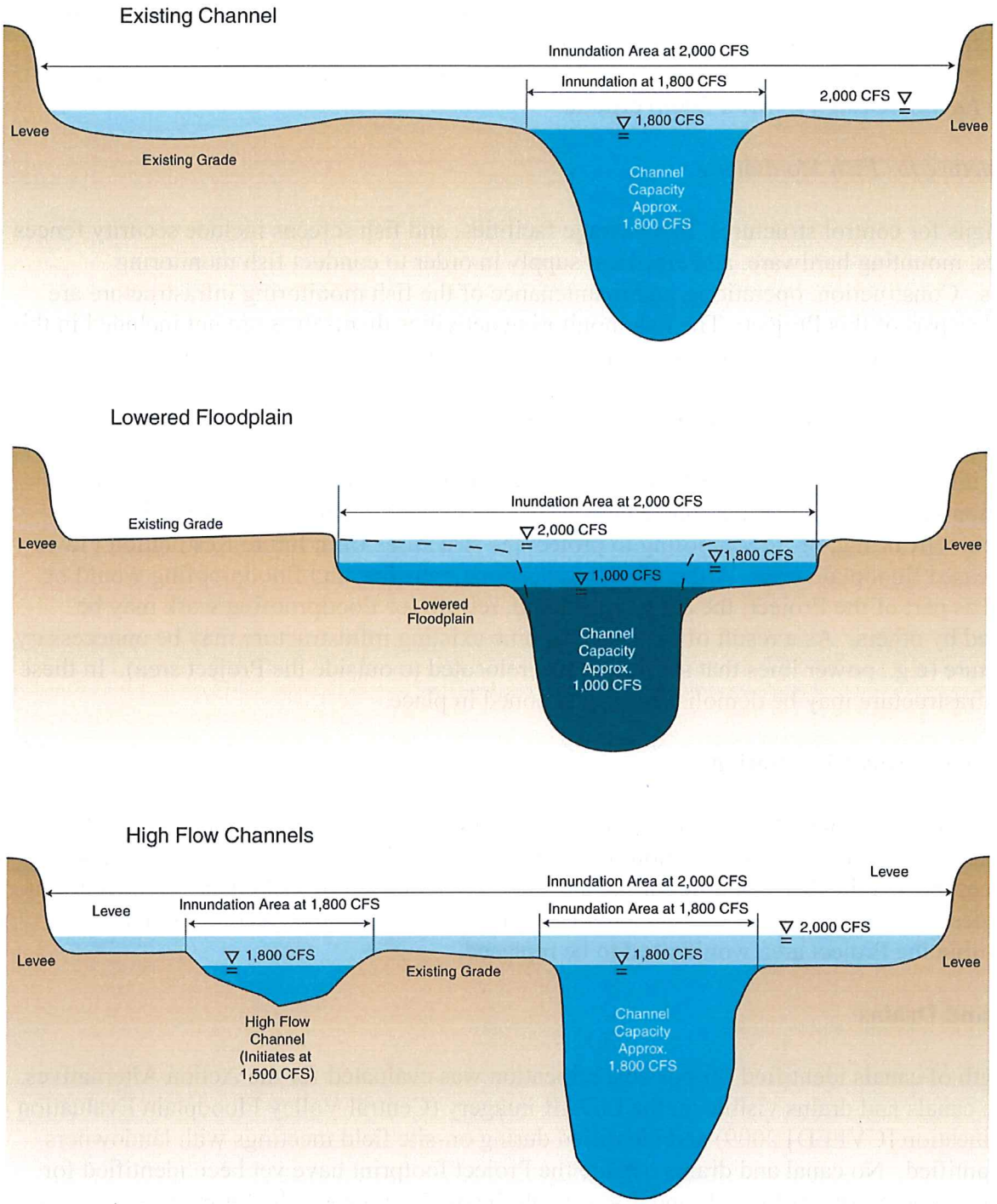

Figure 3.
Example Floodplain Grading Approaches

Passage Assessment Database (CalFish 2014) were assumed to require relocation to new facilities on the edge of the proposed levees. A pilot channel dug from the low flow river channel to the intake of the relocated pumps was also assumed. Locations in the CalFish Passage Assessment database were confirmed using the LiDAR imagery when possible.

Groundwater Wells

The number of existing wells identified for possible floodproofing or relocation, including the city of Mendota groundwater wells, was evaluated for the Action Alternatives. Wells were identified within the area using aerial photography. During design, the DWR wells database would be consulted for an estimate of abandoned wells that have not been destroyed, so that these old wells would not be conduits for flood waters to the groundwater. A formal well canvas would also be conducted. Floodproofed wells would be provided with year-round vehicular access via a raised roadbed across the floodplain. The roadbed could include multiple culverts to support floodplain connectivity, depending on the length of the access road and its effect on floodplain flows. Wells relocated by the Project would provide equal utility. Wells taken out of service by the Project would be abandoned in accordance with U.S. Environmental Protection Agency (EPA), DWR and/or local regulations.

Regulating Reservoirs

The number of irrigation regulating reservoirs identified for possible relocation was evaluated for the Action Alternatives. Reservoirs were assumed to be a typical size, contain one lift pump, and half of the reservoir located below the surrounding grade and half above the surrounding grade.

Oil and Gas Wells

Two closed or active oil and gas wells have been identified within the Project area for potential closure, relocation, or buyout. If active oil and gas wells cannot be avoided, the destruction or closure of those wells would be conducted in accordance with the California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR) regulations.

Other Utilities

Other infrastructure was identified within the impacted areas. Other facilities include: high voltage transmission lines, gas lines, and water pipelines. High voltage transmission lines are assumed to be high enough to not be impacted. Gas lines are typically attached to bridges or buried below the river when crossing the river and were assumed not to require relocation. Water pipelines were quantified from existing maps and discussions with landowners. Water pipelines may be relocated or abandoned depending on their future use requirements. Service line crossings (e.g., gas, water, electrical) would be considered during levee design.

Construction Access

Access for vehicles carrying materials, equipment, and personnel to and from the construction area would be provided via several existing roadways in the Project vicinity (Figure 5). Improvements may be required to upgrade roadways, pavements, and crossings for anticipated construction traffic and loads, provide adequate turning radii and site distances, and to control dust on non-paved roads. Anticipated improvements include:

- Eastside Drive – Approximately 0.6 mile of dirt road starting at Road 10 ½ will likely require overlaying, and the implementation of dust control measures.
- Chowchilla Canal Road/Road 13 – Approximately 0.3 mile of road starting at Eastside Drive will likely require some overlaying and the implementation of dust control measures.
- San Mateo Avenue – Approximately 0.5 mile of gravel and 1.5 miles of oil-dirt road starting at the existing San Joaquin River levees will likely require some overlying and the implementation of dust control measures.
- Bass Avenue Canal Crossings – These crossings may need additional bracing and shoring to ensure that they will be able to support the load of the construction equipment and activities. All the construction equipment on Bass Avenue will be within the legal loads (see note below). This crossing is on the Fresno County replacement list.
- Delta-Mendota Canal Crossing – This crossing may need additional bracing and supports to ensure that it will be able to support the load of the construction equipment activities.

Dust control measures for non-paved roads could include the use of water trucks or dust palliative for dust control or gravel placement where necessary. Legal loads would be used on all roads, and once construction is completed, the roads would be returned to the same condition as they were prior to the Project.

Revegetation of Temporary Disturbance Areas

Areas temporarily disturbed during construction would be restored to their previous contours, if feasible, and then seeded with a native vegetation seed mixture to prevent soil erosion. Some areas, such as borrow areas, may not be feasible to restore previous contours, but these areas would be smoothed and seeded.

Operations and Maintenance

The Project includes long-term operations and maintenance of the proposed facilities and features as described below.

Maintenance

Levees will require maintenance for vegetation management, access roads, levee inspections, levee restoration, rodent control, minor structures, encroachment removal, levee patrolling during flood events, and equipment. Levee vegetation management includes equipment to drag or mow the levee banks or aquatic-safe herbicide applications. Maintenance of access roads includes replacing gravel or scraping and filling of ruts to keep the roads in good condition. Levee restoration includes restoring areas with erosion or settlement problems or adding armor. Rodent control includes setting traps with bait and periodically checking the traps. Minor structures maintenance includes repair or replacement of gates, locks or fences. Encroachment removal involves removing illegally dumped materials.

Levee and structure protection maintenance includes repair restoration of protection measures due to erosion or degradation and vegetation management.

Water diversion canal maintenance includes sediment removal and channel re-shaping.

Mendota Dam maintenance includes periodic minor upstream sediment removal in order to operate the Short Canal only.

Maintenance Schedule

All maintenance activities, when possible, would be timed to minimize the impacts to fish. Access and safety concerns are the main driver for timing of the maintenance activities, but can be scheduled around fish migration. Ultimately, the schedule may be impacted by compliance with the clearance to conduct the work and timing of flows.

Maintenance of levees and floodplains with aquatic-safe herbicide treatment would occur sometime between spring and fall and would depend on the plant species that are being treated. Typically the herbicide would be administered prior to the plant going to seed and may need to be sprayed more than once. Disking for vegetation management usually occurs twice within the year; once in early spring after the rainfall season and then again in late summer prior to plants going to seed. Access road and levee restoration work would likely be done in the summer after the rainfall season, and timing and projects would be dependent on environmental clearance for small mammals, nesting birds or burrowing owls, and other wildlife species. Rodent control would likely be done by a pest control advisor and would likely be done in the spring through fall and not during the rainfall season. All levee and floodplain work can be impacted by the presence of nesting birds, so in some areas work may not begin until the nesting birds have fledged or if there is some other biological reason to believe that the maintenance activities would not impact the nesting birds.

Timing of the maintenance of structures within the waterways would depend on the flow hydrograph and forecasted flows, but can typically be expected in the summer/fall after high spring flows have receded. Cleaning of the in-channel structures would typically occur when flows are low enough to allow crews and equipment to enter the river safely to access the structures. San Mateo Avenue may be cleared or repaired earlier for access as soon as flows recede and are not likely to increase for the remainder of the water year. If earlier, this work would only be for road access and would not be located in the channel itself.

Debris that collects on trash racks, screens, ladders, or other fish passage structures will need to be periodically removed but will likely be scheduled based on the operation permits for these structures. Annual maintenance cleaning would be expected after the fish migration, but will need to be timed when flows have receded.

Lubing and annual gate maintenance would likely be in the late summer or early fall prior to winter and spring flows to make sure the structures are operating properly and to provide time for repairs and ordering parts if needed.

Monitoring Activities

Monitoring activities would include physical and nonphysical activities within the Project area. Several monitoring components would be covered by the Program's *Physical Monitoring and Management Plan* (PEIS/R pages 2-49 to 2-52, and Appendix D.1, SJRRP 2011), which provides guidelines for observing conditions as well as adjusting to changes in physical conditions within the Project area. The Program's *Physical Monitoring and Management Plan* consists of multiple component plans, addressing physical conditions such as flow, groundwater seepage, channel capacity, and propagation of native vegetation. Each component plan identifies objectives for the physical conditions within the Project area, and provides guidelines for the monitoring and management of those conditions. The component plans identify potential actions that could be taken to further enhance the achievement of the objectives. Finally, the Plan includes a description of monitoring activities which apply to one or more of the component plans. The component plans include the following monitoring objectives, all of which are identified in the Program's *Physical Monitoring and Management Plan*:

- **Flow** – To ensure compliance with the hydrograph releases in Exhibit B of the Settlement and any other applicable flow releases (e.g., buffer flows) (detail is provided in the Program's *Restoration Flow Guidelines*).
- **Seepage** – To reduce or avoid adverse or undesirable seepage impacts (detail is provided in the Program's *Seepage Management Plan*).
- **Channel capacity** – To maintain flood conveyance capacity (detail is provided in the Program's *Channel Capacity Report*).
- **Native vegetation** – To establish and maintain native riparian habitat.

Project specific components of the monitoring will include addressing effectiveness monitoring of fish screens and fish passage at structures within the Project area. The monitoring objective is the following:

- **Passage and screening effectiveness** – To maintain effective fish passage and fish screening at structures and diversions.

Monitoring activities, as they are described in the Program's *Physical Monitoring and Management Plan*, are guidelines for monitoring and could change during Project implementation. Monitoring activities in Reach 2B could include the following Program-level activities:

- **Flow monitoring** – Flow, cross sections, and surface water stage at gaging stations, and at additional locations during high-flow events.
- **Groundwater level monitoring** – Groundwater elevation in monitoring wells (detail is provided in the Program's *Seepage Management Plan*).
- **Aerial and topographic surveys** – True color aerial photographs and topographic surveys to assess river stage, hydraulic roughness, river width, bed elevation, and vegetation conditions.

with the individuals and groups listed above, U.S. Department of the Interior, Bureau of Reclamation (Reclamation) and California State Lands Commission (CSLC) identified a preferred alternative based on the input received on the action alternatives. Alternative B was selected as the preferred alternative and therefore is the only one discussed in this report.

Alternative B (Compact Bypass with Consensus-Based Floodplain and Bifurcation Structure), the Preferred Alternative

Alternative B (Compact Bypass with Consensus-Based Floodplain and Bifurcation Structure) includes:

- Building levees capable of conveying flows up to 4,500 cfs with 3 feet of freeboard.
- Restoring floodplain habitat an average of approximately 4,200 feet wide to provide benefit to salmonids and other native fishes.
- Constructing a channel and structures capable of conveying up to 4,500 cfs of Restoration Flows around the Mendota Pool.
- Constructing structures capable of conveying up to 2,500 cfs from Reach 2B to Mendota Pool.
- Providing upstream and downstream fish passage for adult salmonids and other native fishes, and downstream fish passage for juvenile salmonids, between Reach 2A and Reach 3.

This alternative would construct a channel between Reach 2B and Reach 3, the Compact Bypass channel, in order to bypass the Mendota Pool. Restoration Flows would enter Reach 2B at the Chowchilla Bifurcation Structure, flow through Reach 2B, then downstream to Reach 3 via the Compact Bypass channel. The existing Chowchilla Bifurcation Structure would continue to divert San Joaquin River flows into the Chowchilla Bypass during flood operations, and a fish passage facility and control structure modifications would be included at the San Joaquin River control structure at the Chowchilla Bifurcation Structure. A bifurcation structure would be built at the head of the Compact Bypass channel to control diversions into Mendota Pool. Fish passage facilities would be built at the Compact Bypass bifurcation structure to provide passage around the structure. The existing crossing at the San Mateo Avenue would be removed. These features are described in further detail in the sections below. See Figure 6 and 7 for a plan view of the alternative's features. Elements that are common to all alternatives would be implemented under Alternative B.

Compact Bypass Channel

The bypass channel would convey 4,500 cfs around the Mendota Pool by constructing a channel just southwest of the existing Columbia Canal alignment. Once constructed, the bypass channel would become the new river channel. This alternative includes excavating the bypass channel, constructing levees and in-channel structures, removing existing levees, relocating or modifying existing infrastructure, and acquiring land. The in-channel structures include the bifurcation control structure, grade control structures, fish screen, fish passage facility, Columbia Canal Siphon, as well as the Drive 10 ½ realignment and are discussed under Structures. The bypass

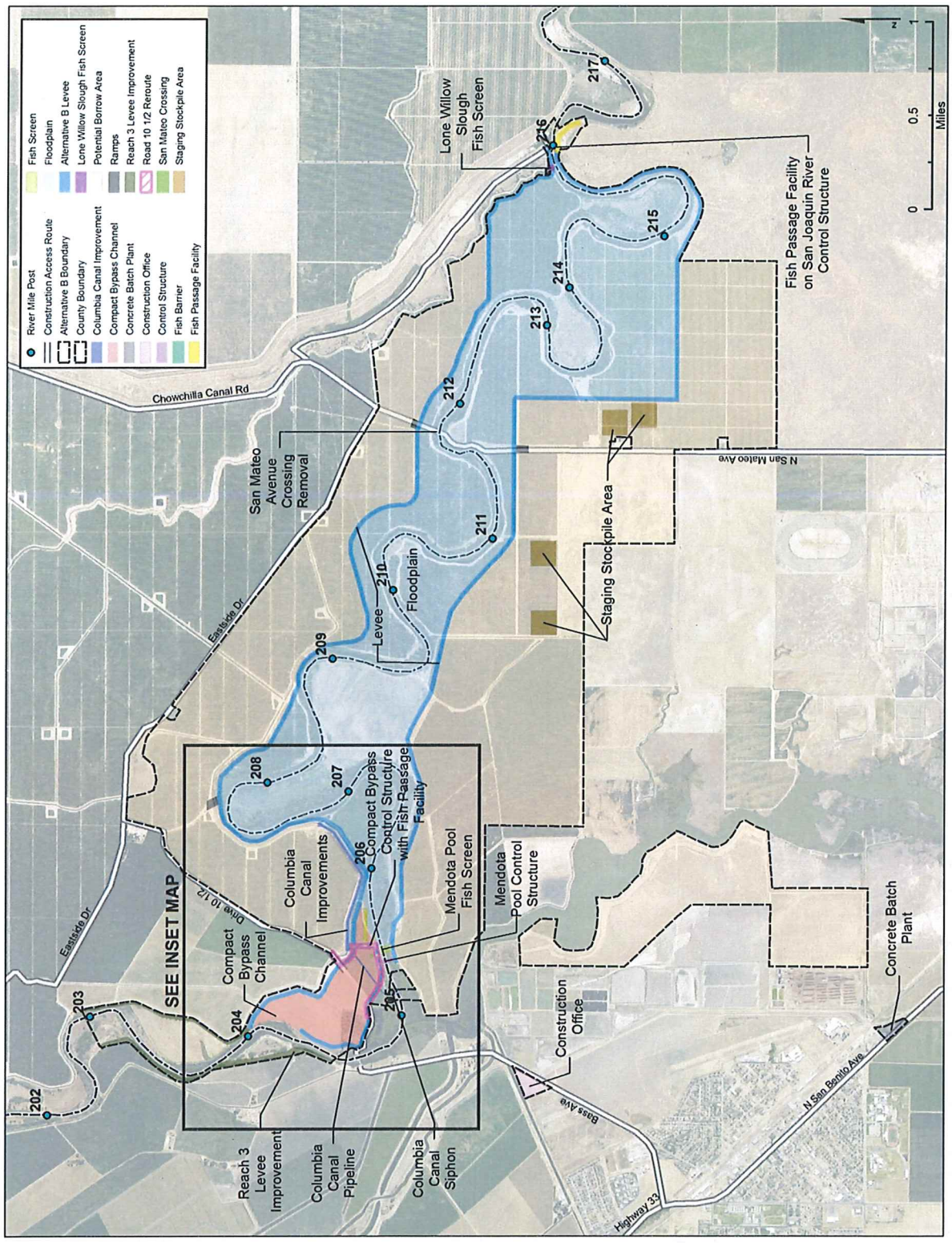

Figure 1.
Plan View of Alternative B (Compact Bypass with Consensus-Based Floodplain and Bifurcation Structure)

The bypass channel would connect to Reach 3 approximately 0.6 mile downstream from Mendota Dam (approximately RM 204), bypass the Mendota Pool to the north, and connect to Reach 2B approximately 0.9 mile upstream from Mendota Dam (approximately RM 205.5). The bypass channel would have a total length of approximately 0.9 mile. A siphon under the bypass channel would be constructed to connect the Columbia Canal to the Mendota Pool.

The bypass channel would be a multi-stage channel designed to facilitate fish passage at low flows, channel stability at moderate flows, and contain high flows. The low-flow channel would be designed for a capacity of around 75 cfs and would have a topwidth of approximately 50 feet and a depth of approximately 1 to 2 feet. The base flow channel would be designed for a capacity of around 200 cfs and would have a topwidth of approximately 70 feet and a depth of approximately 3 feet. The main channel would be designed for a capacity of around 1,500 cfs and would have an average topwidth of approximately 190 feet and total depth of approximately 5 feet. The floodplain bench would be approximately 150 feet wide on average on both sides of the main channel and designed with a shallow cross-slope (approximately 1 percent slope) to allow variable floodplain depths at flows between 1,500 cfs and 4,500 cfs.

The channel, designed as an unlined earthen channel, would be approximately 5,300 feet long with an average total corridor width of approximately 1,150 feet. The total elevation drop would be approximately 3 to 7 feet including grade control structures. A series of grade-control structures would be included to achieve the necessary elevation change (see Grade Control Structures). Channel complexity will be incorporated as appropriate per the Rearing Habitat Design Objectives.

Structures

The structures described below would be required to provide the operational flexibility to divert water to the Mendota Pool, provide fish passage, allow maintenance access to Mendota Dam, prevent fish entrainment and straying, and provide controlled elevation drop between Reach 2B and Reach 3.

Fish Passage Facility on the San Joaquin River Control Structure at the Chowchilla Bifurcation Structure

The existing San Joaquin River control structure at the Chowchilla Bifurcation Structure would not be passable by up-migrating salmon and native fish for all flows and flow splits between the river and the Chowchilla Bypass. The undershot gates, sill across the downstream side of the structure, and trash rack on the upstream side contribute to upstream passage difficulties at high, low, and all flows, respectively. A fish passage facility would be required for upmigrating salmon and other native fish to swim into Reach 2A from Reach 2B under most conditions.

Passage Facility Design

The design of the fish passage facility would be based on criteria in *Anadromous Salmonid Passage Facility Design* (NMFS 2008). The size and geometry of the fish passage facility would be dictated by the flow requirements for juvenile and adult fish. Several types of fish passage

San Mateo Avenue Crossing Removal

The San Mateo Avenue crossing is an existing river crossing located within a public right-of-way in Madera County and on private land in Fresno County at approximately RM 211.8. The crossing transitions from public right-of-way to private land at the center of the river. The crossing consists of a low flow or dip crossing with a single culvert. As part of this alternative, the culvert and road embankments would be demolished, and no river crossing would be provided at this location.

Compact Bypass Bifurcation Structure

A bifurcation structure would be constructed at the upstream end of the Compact Bypass. The bifurcation structure consists of two control structures: one across the path of Restoration Flows (Compact Bypass) and one across the path of water deliveries to Mendota Pool (San Joaquin River). Since this structure will be retaining the Pool, it would likely be regulated by DSOD if owned by a State or local entity.

The control structure across the Compact Bypass would be designed to accommodate up to 4,500 cfs and consists of six 20-foot-wide bays for a structure length of approximately 140 feet. Conditions in this control structure would be designed based on NMFS 2001 and NMFS 2008 fish passage criteria. The control structure across the San Joaquin River (the path of the water deliveries) would be designed to accommodate up to 2,500 cfs and consists of four 20-foot-wide bays for a structure length of approximately 100 feet. Flow through each bay would be controlled by a gate (e.g., radial [Tainter] or inflatable Obermeyer). In the final design, the number and size of the gates may be modified. The size of the gates would be determined by the design maximum flow.

The Compact Bypass control structure includes a fish passage facility on the side of the structure (i.e., the Compact Bypass Fish Passage Facility), and the San Joaquin River (water deliveries flow path) control structure includes a fish screen upstream of the structure (i.e., the Mendota Pool Fish Screen), if appropriate. Each control structure would be placed in the middle of the channel and has earthen embankments connecting the structure to the proposed levees. The connector embankments may include culverts, gates, weirs, inflatable bladder dams, or other features to improve flow and fish passage on the floodplain when water deliveries are not occurring. A 16-foot-wide roadway and 20-foot-wide maintenance/operations platform would be provided over each control structure.

Compact Bypass Fish Passage Facility

The Compact Bypass control structure (across the Restoration Flow path) includes a fish passage facility. The fish passage facility would be necessary to provide passage during water deliveries and for Restoration Flows where passage conditions in the control structure may not be ideal. The design of the fish passage facility is the same as that presented above for the fish passage facility at San Joaquin River control structure at the Chowchilla Bifurcation Structure.

Rock riffles have benefits for native fish migration, but they present construction challenges in the sandy substrate of the Reach 2B and Reach 3 area. The flow over constructed rock riffles may reduce the disorienting effects on juveniles from rapidly changing hydraulics otherwise created at weir structures, and they are more favorable to sturgeon, which do not jump.

Constructed rock riffles may be less favorable to predators which can hold in the quiescent pools below weir structures. However, placing rock in sandy substrate requires engineered foundation materials (layers of rock in gradually decreasing sizes) to prevent undermining the structure. Further analysis during design will determine the rock sizes and riffle slopes.

Sheet piles would be installed on the upstream side of each rock riffle. Caps on the sheet piles would be used to avoid injuring fish and can be surfaced with natural materials (i.e., grouted rock) to emulate natural conditions which fish may be exposed to in non-manmade portions of the San Joaquin River.

Each grade control structure would extend across the main channel and key into the overbanks to protect against flanking, resulting in a total structure width of about 220 feet.

Bank protection measures would be incorporated into the bypass. Bank protection measures could include: vegetated revetment, rock vanes, large woody material structures, bioengineering techniques, and riparian vegetation. Bank protection could be included in the channel, along one channel bank, or along both channel banks. It is assumed that the vegetated revetment would consist of buried riprap covered with topsoil, erosion control fabric, and native woody vegetation, so that fish would experience natural channel banks. Rock vanes would be constructed to only interact with the flow if erosion occurs (i.e., the top of the vane will be level with the constructed overbank surface). Large woody material structures are assumed to be anchored engineered logjams or other similar anchored wood structures that are built into the channel banks. Bioengineering techniques could include vegetated geogrids, fabric encapsulated soil banks, brush mattresses, and root wads. Native woody vegetation directly upstream, downstream, and adjacent to the grade control structures would provide shading and opportunities for juveniles to hide from predators.

Fish Habitat and Passage

The purpose of the floodplain would be to provide riparian and floodplain habitat and support the migration and seasonal rearing of salmonids and other native fishes in Reach 2B. Floodplains would be developed in accordance with the Rearing Habitat Design Objectives. The floodplain has an average width of approximately 4,200 feet and an inundated area of approximately 1,000 acres at 2,500 cfs.

This alternative provides floodplain habitat resulting in approximately 440 acres of shallow water habitat for primary production as well as approximately 560 acres of habitat that supports direct rearing at 2,500 cfs. Approximately 44 percent of the floodplain in this alternative would inundate less than 1 foot deep at 2,500 cfs. This alternative also retains approximately 650 acres of shallow water habitat at flows of 4,500 cfs. Figure 8 below presents conceptual inundation

Each structure would be designed to perform according to the fish passage design criteria (see Section 2.2.4). In addition, the channel and floodplain incorporate riparian plantings to provide cover, woody material, and velocity variability, while the design footprint allows sufficient space to incorporate channel structure variability during detailed design, all of which may help to reduce stress and predation.

This alternative does not include a fish barrier at the downstream end of the Compact Bypass to keep fish from migrating upstream of the Compact Bypass in Reach 3 toward the base of Mendota Dam.

Floodplain and Riparian Habitat

This alternative includes a mixture of active and passive riparian and floodplain habitat restoration (in contrast to the passive restoration included in Alternative A) and compatible agricultural activities in the floodplain. Active restoration planting of native riparian species would occur along both banks of the low flow channel of the river up to 450 feet from the bank.

In accordance with the Rearing Habitat Design Objectives, it would include native species that would provide shade and reduce air temperatures to help minimize water temperatures, provide large woody debris and organic matter needed to provide habitat and food, and help stabilize the low-flow channel. Some areas may be passively revegetated by creating riparian establishment areas that provide a riparian seed bank of native species. The remaining areas would be seeded with native grasses and forbs to minimize erosion and to help control invasive species. Active revegetation activities would likely include a combination of seeding, transplanting, and pole/live stake plantings. Plantings may be designed as either clusters of trees and shrubs with larger areas of seeded grasses and forbs or as dense forests. Spacing and alignment of plantings would take into account species growth patterns, potential equipment access needs for monitoring and maintenance, and desired future stand development. Passive restoration would occur in areas that rely on Restoration Flows for additional vegetation recruitment. Natural riparian recruitment (passive restoration) would promote continual habitat succession, particularly in areas where sediment is deposited or vegetation is removed by natural processes.

Table 3 lists the species that are likely to be planted or seeded during active restoration, and is draft and subject to change. Emergent wetlands and water tolerant woody species of riparian scrub would be selected for development within the main channel, woody shrubs and trees with an herbaceous understory would be selected for development along the main river channel banks, and bands of other habitat types (e.g., grasses) would be selected for development at higher elevations along the channel corridor. Active vegetation restoration would occur following construction and these areas would be irrigated and managed as necessary during the establishment period. Phased implementation of active vegetation restoration at strategic locations could occur concurrently with phased implementation of construction and physical infrastructure.

Agricultural practices (e.g., annual crops, pasture, or floodplain-compatible permanent crops) could occur on the floodplain in previous agricultural areas outside of State-owned and public trust lands. Growers would be required to leave cover on the ground and would be required to

equipment or material within these areas during construction. Existing vegetation would be left in place or only minimally trimmed to facilitate access and work at the site. The existing soil is an ideal growing medium for all the desired native plants. In order to maximize plant growth and planting success, existing soil and topsoil would be preserved unless the soil contains invasive non-native seed or fragmented stems and rhizomes, in which case it should not be preserved, and disturbance during construction would be minimized to the maximum practicable extent.

Invasive Species Control

Invasive, non-native species would be removed from the Project area during the installation, plant establishment and maintenance periods. Invasive species management would consist of removal of the most invasive non-native species within the reach such as giant reed grass (*Arundo donax*), perennial pepperweed (*Lepidium latifolium*) and poison hemlock (*Conium maculatum*). Invasive species management would also include removal of other invasive species that are currently found in upstream reaches and may eventually colonize in the Project area such as red sesbania (*Sesbania punicea*), salt cedar (*Tamarix species*), and Chinese tallow (*Sapium sebiferum*). Invasive plant removal techniques may include mechanical removal, root excavation, hand pulling, mowing, disking, controlled burning, grazing, aquatic-safe herbicides, or a combination of techniques as appropriate.

Temporary Irrigation System and Water Supply

Proposed plantings that are wetland species or borderline wetland species would need regular aboveground irrigation (typically April through October) during their establishment period (typically 3 to 5 years depending on rainfall conditions and the plants' growth rates and vigor). The amount of water needed is estimated to be approximately 2.4 acre feet per year. An extensive temporary aboveground irrigation system, such as aerial spray or drip irrigation, would provide water for the plants several times a week during the hot months of the year. If an aerial spray irrigation system is installed, the irrigation distribution piping would be installed aboveground and anchored to the ground so that it would not be damaged during high flows inundating the floodplain. If an aerial spray system is used, sprinkler heads would likely be installed on braced standpipes so that their irrigation stream would not be blocked or diverted by growing vegetation. The irrigation system would be disassembled and removed at the end of the establishment period.

The Program would pursue options for irrigation water supply, including groundwater wells or water pumped from the river with portable, skid-mounted, diesel- or gas-powered pumps and stored in tanks. Additionally, purchases from willing sellers may be required to withdraw water from the river or other nearby water sources (e.g., Mendota Pool). If water is pumped from the river, the amount of water diverted will be controlled so that river water temperatures do not increase and passage for salmonids is not impaired. The diversion from the river would also be screened if necessary to prevent entraining juvenile salmonids.

drainage-feature repair, and other maintenance activities necessary to maintain the riparian and floodplain habitat quality.

Water Deliveries

This alternative includes a diversion at the head of the Compact Bypass for making up to 2,500 cfs in water deliveries from the San Joaquin River to Mendota Pool. This diversion would directly deliver water from the river to Mendota Pool without the need for a canal. Water deliveries to the Pool would include diversion of Friant Dam releases that are meant to satisfy the Exchange Contract as well as diversion of San Joaquin River flood flows up to 2,500 cfs if there is demand in Mendota Pool.

When water deliveries occur, the gates at the Compact Bypass bifurcation structure would be manipulated to control flows into the Compact Bypass and allow flows into Mendota Pool. Since the Mendota Pool operating elevation is several feet higher than the bottom of the Compact Bypass channel, operation of the gates would include backwatering a portion of the San Joaquin River upstream of the Compact Bypass bifurcation structure. The extent of the backwater is anticipated to be similar to the extent of the Mendota Pool backwater under existing conditions (i.e., upstream to approximately the existing San Mateo Avenue crossing). Up-migrating fish passage from the Compact Bypass into Reach 2B would occur through the Compact Bypass fish passage facility during water deliveries. The Mendota Pool fish screen would capture out-migrating fish entering the diversion and return them to the Compact Bypass. Sufficient flow to support adult and juvenile fish passage through the Compact Bypass would be maintained during water delivery operations during fish migration periods.

Construction Considerations

The total construction timeline for this alternative is currently estimated to range approximately from 106 to 157 months (9 to 13 years); opportunities to shorten the overall schedule through construction efficiencies will be studied during the detailed design process.

Soil improvements for possible liquefiable soils may be required to protect proposed structures from damage or failure during an earthquake. All proposed structures would be designed to account for potential liquefaction. Soil improvements could include removing and replacing soils with adequate materials, injecting soil-cement slurry, vibrofloatation, dynamic compaction, structural foundation piles (stone or reinforced concrete), and other techniques. Vibrofloatation uses a vibrating probe that penetrates the soil and causes the grain structure to collapse and increase the density of the soil. Dynamic compaction involves dropping a heavy weight onto soil to compact it.

Flow in the San Joaquin River, operations at the existing Mendota Dam, operations at the Chowchilla Bifurcation Structure, and operation of the existing Columbia Canal must be maintained during construction. The majority of the Compact Bypass channel would likely be constructed without interruption to the San Joaquin River flow or the Columbia Canal. The construction of the Mendota Pool control structure across the existing river channel would require removable cofferdams in three phases to facilitate the construction without blocking the

Table 2.
Alternative B (Compact Bypass with Consensus-Based Floodplain and Bifurcation Structure)
Levees, Relocations, and Land Acquisition

	Left Levee	Right Levee
Levee Length	8.1 miles	6.8 miles
Average Levee Height	5.6 feet	4.7 feet
Fill Volume	328,600 cubic yards	226,900 cubic yards

Relocations			
Electrical Distribution	48,500 feet	Barn/Shed	1
Gas Transmission	11,000 feet	Facility	1
Water Pipeline	41,000 feet	Groundwater Well	32
Canal	31,500 feet	Lift Pump	10
Culvert	1	Power Pole	162
Diversion	3	Dwelling	2

Land Acquisition and Construction Schedule	
Land Acquisition[1]	2,900 acres
Time to Build[2]	157 months

[1] Total acreage includes areas that are sovereign and public trust lands.

[2] Construction timeline does not include the time that would also be needed to complete the NEPA and CEQA documentation process, obtain permits, appraise and acquire land, and perform pre-construction surveys.

Environmental Commitments

Conservation Strategy

As part of Program implementation, a comprehensive strategy for the conservation of listed and sensitive species and habitats has been prepared, and would be implemented in coordination with the Service, NMFS, and DFW. The strategy's purpose is to serve as a tool built into the project description to minimize and avoid potential impacts to sensitive species and habitats. This Conservation Strategy guides development and implementation of specific conservation measures for project-level actions. The Conservation Strategy includes conservation goals and measures for species and communities (such as avoidance, minimization, monitoring, and management measures) consistent with adopted recovery plans, as described below. If avoidance and minimization measures are impractical or infeasible, then further consultation actions and mitigation measures would be pursued and developed in coordination with the appropriate regulatory agency.

To achieve the Restoration Goal, a number of actions that are proposed to be implemented may substantially alter not only the aquatic ecosystem of the San Joaquin River, but also the river's riparian and wetland ecosystems, and some adjacent upland ecosystems. Riparian, wetland, and upland ecosystems of the Central Valley, such as those along the San Joaquin River, provide habitat for a large number of species, including several Federally-listed and State-listed species. Therefore, the Action Alternatives include this Conservation Strategy, which would be

Table 3.
Conservation Measures for Biological Resources That May Be Affected by Project Actions

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Regulatory Agency
VELB	**Valley Elderberry Longhorn Beetle**	
VELB-1. Avoid and Minimize Effects to Species	If elderberry shrubs and valley elderberry longhorn beetle are anticipated within the project area, within 1 year before the commencement of ground-disturbing activities, a qualified biologist shall identify any elderberry shrubs in the project footprint. Qualified biologist(s) will survey potentially affected shrubs for valley elderberry longhorn beetle exit holes in stems greater than 1 inch in diameter. If elderberry shrubs are found on or adjacent to the construction project site, if feasible, a 100-foot-wide avoidance buffer – measured from the dripline of the plant – will be established around elderberry shrubs with stems greater than 1 inch in diameter at ground level and will be clearly identified in the field by staking, flagging, or fencing. No activities will occur within the buffer areas and worker awareness training and biological monitoring will be conducted to ensure that avoidance measures are being implemented.	USFWS
VELB -2. Compensate for Temporary or Permanent Loss of Habitat	The project proponent will consult with USFWS to determine appropriate compensation ratios. Compensatory mitigation measures will be consistent with the *Conservation Guidelines for Valley Elderberry Longhorn Beetle* (USFWS 1999a), or current guidance. Compensatory mitigation for adverse effects may include transplanting elderberry shrubs during the dormant season (November 1 to February 15), if feasible, to an area protected in perpetuity, as well as required additional elderberry and associated native plantings approved by USFWS. If off-site compensation includes dedication of conservation easements, purchase of mitigation credits, or other off-site conservation measures, the details of these measures will be included in the mitigation plan and must occur with full endowments for management in perpetuity. The plan will include information on responsible parties for long-term management, holders of conservations easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations.	USFWS
BNLL	**Blunt-Nosed Leopard Lizard**	
BNLL-1. Avoid and Minimize Effects to Species	Three areas have been identified as having potential blunt-nosed leopard lizard habitat based on aerial maps. These areas include approximately 2,460 acres along the southwest side of the San Joaquin River in Reach 2, approximately 490 acres in a portion of the Eastside Bypass and adjacent lands near Reach 4A of the San Joaquin River, and approximately 2,938 acres encompassing the northern side of the Mariposa Bypass and parcels north of the Mariposa Bypass and west of the Eastside Bypass. Within 1 year before the commencement of the proposed project, focused site visits and habitat assessment will be conducted on these lands. Based on focused assessment, and discussions with the USFWS and DFW, protocol-level surveys may be conducted. If blunt-nosed leopard lizard are detected within or adjacent to the project site, measures that will avoid direct take of this species will be developed in cooperation with USFWS and DFW and implemented before ground disturbing activities.	USFWS DFW

Table 3.
Conservation Measures for Biological Resources That May Be Affected by Project Actions

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Regulatory Agency
	monitoring will be conducted to ensure that avoidance measures are being implemented. Construction activities shall be minimized within 200 feet of the banks of giant garter snake habitat. Movement of heavy equipment will be confined to existing roadways to minimize habitat disturbance. Vegetation shall be hand-cleared in areas where giant garter snakes are suspected to occur. Exclusionary fencing with one-way exit funnels shall be installed at least 1 month before activities to allow the species to passively leave the area and to prevent reentry into work zones, per USFWS and/or DFW guidance. If a giant garter snake is found during construction activities, USFWS, DFW, and the project's biological monitor will immediately be notified. The biological monitor, or his/her assignee, will stop construction in the vicinity of the find and allow the snake to leave on its own. The monitor will remain in the area for the remainder of the work day to ensure the snake is not harmed. Escape routes for giant garter snake should be determined in advance of construction and snakes will be allowed to leave on their own. If a giant garter snake does not leave on its own within 1 working day, USFWS and DFW will be consulted. All construction-related holes shall be covered to prevent entrapment of individuals. Where applicable, construction areas shall be dewatered 2 weeks before the start of activities to allow giant garter snakes and their prey to move out of the area before any disturbance.	
GGS-2. Compensate for Temporary or Permanent Loss of Habitat	Temporarily affected giant garter snake aquatic habitat will be restored in accordance with criteria listed in the USFWS Mitigation Criteria for Restoration and/or Replacement of Giant Garter Snake Habitat (Appendix A to *Programmatic Formal Consultation for U.S. Army Corps of Engineers 404 Permitted Projects with Relatively Small Effects on the Giant Garter Snake Within Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, and Yolo Counties, California* (USFWS 1997)), or the most current criteria from USFWS or DFW. Permanent loss of giant garter snake habitat will be compensated at a ratio and in a manner consulted on with USFWS and DFW. Compensation may include preservation and enhancement of existing populations, restoration or creation of suitable habitat, or purchase of credits at a regulatory-agency-approved mitigation bank in sufficient quantity to compensate for the effect. Credit purchases, land preservation, or land enhancement to minimize effects to giant garter snakes should occur geographically close to the impact area. If off-site compensation is chosen, it shall include dedication of conservation easements, purchase of mitigation credits, or other off-site conservation measures, and the details of these measures will be included in the mitigation plan and must occur with full endowments for management in perpetuity. The plan will include information on responsible parties for long-term management, holders of conservations easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations.	USFWS DFW

Table 3.
Conservation Measures for Biological Resources That May Be Affected by Project Actions

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Regulatory Agency
Habitat	If potential nesting trees are to be removed during construction activities, removal will take place outside of Swainson's hawk nesting season, and the project proponent will develop a plan to replace known Swainson's hawk nest trees with a number of equivalent native trees that were previously determined to be impacts through consultation with DFW. Compensation shall include dedication of conservation easements, purchase of mitigation credits, or other off-site conservation measures, and the details of these measures will be included in the mitigation plan and must occur with full endowments for management in perpetuity. The plan will include information on responsible parties for long-term management, holders of conservations easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations.	
RAPTOR	**Other Nesting Raptors**	
RAPTOR-1. Avoid and Minimize Loss of Individual Raptors	Construction activity, including vegetation removal, will only occur outside the typical breeding season for raptors (September 16 to December 31), if raptors are determined to be present. Preconstruction surveys will be conducted by a qualified biologist in areas of suitable habitat to identify active nests in the project footprint. If active nests are located in the project footprint, a no-disturbance buffer will be established until a qualified biologist determines that the nest is no longer active. The size of the buffer shall be established by a qualified biologist in coordination with DFW based on the sensitivity of the resource, the type of disturbance activity, and nesting stage. No activity shall occur within the buffer area, and worker awareness training and biological monitoring will be conducted to ensure that avoidance measures are being implemented.	DFW
RAPTOR-2. Compensate for Loss of Nest Trees	Native trees removed during project activities will be replaced with an appropriate number of native trees, in coordination with DFW.	DFW
RNB	**Riparian Nesting Birds: Least Bell's Vireo**	
RNB-1. Avoid Effects to Species	If least Bell's vireo is anticipated within a project area, a qualified biologist shall make an initial site visit to determine if suitable habitat for the species may exist within the project footprint. Where suitable habitat may be present, reconnaissance-level surveys would be conducted by biologists adhering to guidance offered in *Least Bell's Vireo Survey Guidelines*, USFWS, January 19, 2001.	USFWS DFW
RNB-2. Avoid, Minimize, and Compensate for Effects to Species	If least Bell's vireo is detected or suspected to be present in the project footprint, information would be collected according to the guidelines stated in RNB-1. USFWS and DFW would be contacted to determine the approach for avoidance, minimization, or compensation.	USFWS DFW
MBTA	**Other Birds Protected by the Migratory Bird Treaty Act**	
MBTA-1. Avoid and Minimize Effects to	Native nesting birds will be avoided by not conducting project activity, including vegetation removal, during the typical breeding season (February 1 to September 1), if species covered under the Migratory	USFWS DFW

Table 3.
Conservation Measures for Biological Resources That May Be Affected by Project Actions

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Regulatory Agency
	the potential roosting habitat and may include visual surveys or use of acoustic detectors. Visual surveys may consist of a daytime pedestrian survey for evidence of bat use (e.g., guano) and/or an evening emergence survey for the presence or absence of bats and will include trees within ¼-mile of project construction activities. The type of survey will depend on the condition of the potential roosting habitat. If no bat roosts are found, then no further study is required. If evidence of bat use is observed, the number and species of bats using the roost will be determined. Bat detectors may be used to supplement survey efforts. If roosts are determined to be present and must be removed, the bats will be excluded from the roosting site before the facility is removed. A mitigation program addressing compensation, exclusion methods, and roost removal procedures will be developed in consultation with DFW before implementation. Exclusion methods may include use of one-way doors at roost entrances (bats may leave, but not reenter), or sealing roost entrances when a site can be confirmed to contain no bats. Exclusion efforts may be restricted during periods of sensitive activity (e.g., during hibernation or while females in maternity colonies are nursing young).	
BAT-2. Compensate for Loss of Habitat	The loss of each roost will be replaced, in consultation with DFW, and may include construction and installation of bat boxes suitable to the bat species and colony size excluded from the original roosting site. Roost replacement will be implemented before bats are excluded from the original roost sites. Once the replacement roosts are constructed and it is confirmed that bats are not present in the original roost sites, the structure may be removed.	DFW
FKR	**Fresno Kangaroo Rat**	
FKR-1. Avoid and Minimize Effects to Species	Preconstruction surveys will be conducted by a qualified biologist per USFWS and DFW survey methodology to determine if potential burrows for Fresno kangaroo rat are present in the project footprint. Surveys will be conducted within 30 days before ground-disturbing activities. The biologist will conduct burrow searches by systematically walking transects, which shall be adjusted based on vegetation height and topography, and in coordination with USFWS and DFW. Transects shall be used to identify the presence of kangaroo rat burrows. When burrows are found within 100 feet of the Project footprint, focused live trapping surveys shall be conducted by a qualified and permitted biologist, following a methodology approved in advance by USFWS and DFW. Additional conservation measures may be developed pending the results of surveys, and in consultation with USFWS and DFW. Construction activities shall be conducted when they are least likely to affect the species (i.e., after the normal breeding season of December through September (Ahlborn 1999)). This timing shall be coordinated with USFWS and DFW.	USFWS DFW
FKR-3. Compensate for Temporary or Permanent	Compensation for impacts to the species, if needed, will be determined in coordination with DFW and USFWS, as appropriate.	USFWS DFW

Table 3.
Conservation Measures for Biological Resources That May Be Affected by Project Actions

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Regulatory Agency
Other Sensitive Natural Communities	Construction activities will be avoided in areas containing sensitive natural communities, as appropriate.	
RHSNC-2. Compensate for Loss of Riparian Habitat and Other Sensitive Natural Communities	The Riparian Habitat Mitigation and Monitoring Plan for the SJRRP will be developed and implemented in coordination with DFW. Credits for increased acreage or improved ecological function or riparian and wetland habitats resulting from the implementation of SJRRP actions will be applied as compensatory mitigation before additional compensatory measures are required. If losses of other sensitive natural communities (e.g., recognized as sensitive by CNDDB, but not protected under other regulations or policies) would not be offset by the benefits of the SJRRP, then additional compensation will be provided through creating, restoring, or preserving in perpetuity in-kind communities at a sufficient ratio for no net loss of habitat function or acreage. The appropriate ratio will be determined in consultation with USFWS or DFW, depending on agency jurisdiction.	DFW
WUS	**Waters of the United States/Waters of the State**	
WUS-1. Identify and Quantify Wetlands and Other Waters of the United States	Before SJRRP actions that may affect waters of the United States or waters of the State, Reclamation will map the distribution of wetlands (including vernal pools and other seasonal wetlands) in the Eastside and Mariposa bypasses. The project proponent will determine, based on the mapped distribution of these wetlands and hydraulic modeling and field observation, the acreage of effects, if any, on waters of the United States. If it is determined that vernal pools or other seasonal wetlands will be affected by the SJRRP, the project proponent will conduct a delineation of waters of the United States, and submit the delineation to the Corps for verification. The delineation will be conducted according to methods established in the Corps *Wetlands Delineation Manual* and *Arid West Supplement* (Corps Environmental Laboratory 1987, 2008). Construction and modification of road crossings, control structures, fish barriers, fish passages, and other structures will be designed to minimize effects on waters of the United States and waters of the State, and will employ BMPs to avoid indirect effects on water quality.	Corps
WUS-2. Obtain Permits and Compensate for Any Loss of Wetlands and Other Waters of the United States/Waters of the State	The project proponent, in coordination with the Corps, will determine the acreage of effects on waters of the United States and waters of the State that will result from implementation of the SJRRP. The project proponent will adhere to a "no net loss" basis for the acreage of wetlands and other waters of the United States and waters of the State that will be removed and/or degraded. Wetland habitat will be restored, enhanced, and/or replaced at acreages and locations and by methods agreed on by the Corps and the Central Valley RWQCB, and DFW, as appropriate, depending on agency jurisdiction. The project proponent will obtain Section 404 and Section 401 permits and comply with all permit terms. The acreage, location, and methods for compensation will be determined during the Section 401 and Section 404 permitting processes.	Corps

Table 3.
Conservation Measures for Biological Resources That May Be Affected by Project Actions

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Regulatory Agency
	Maintenance of conservation measures will be conducted to the extent necessary to ensure that the overall long-term habitat effects of the project are positive. Before implementation of site-specific actions, the action agency shall conduct an education program for all agency and contracted employees relative to the Federally listed species that may be encountered within the study area of the action, and required practices for their avoidance and protection. A NMFS-appointed representative shall be identified to employees and contractors to ensure that questions regarding avoidance and protection measures are addressed in a timely manner. Disturbance of riparian vegetation will be avoided to the greatest extent practicable. A spill prevention plan will be prepared describing measures to be taken to minimize the risk of fluids or other materials used during construction (e.g., oils, transmission and hydraulic fluids, cement, fuel) from entering the San Joaquin River or contaminating riparian areas adjacent to the river itself. In addition to a spill prevention plan, a cleanup protocol will be developed before construction begins and shall be implemented in case of a spill. Stockpiling of materials, including portable equipment, vehicles and supplies, such as chemicals, shall be restricted to the designated construction staging areas, exclusive of any riparian and wetland areas. A qualified biological monitor will be present during all construction activities, including clearing, grubbing, pruning, and trimming of vegetation at each job site during construction initiation, midway through construction, and at the close of construction, to monitor implementation of conservation measures and water quality. The San Joaquin River channel shall be designed to decrease or eliminate predator holding habitat, in coordination with NMFS.	
CVS-2. Minimize Loss of Habitat and Risk of Take of Species	In-channel construction activities that could affect designated critical habitat for Central Valley steelhead will be limited to the low-flow period between June 1 and October 1 to minimize potential for adversely affecting Federally listed anadromous salmonids during their emigration period. In-channel construction activities that could affect designated critical habitat for Central Valley steelhead will be limited to daylight hours during weekdays, leaving a nighttime and weekend period of passage for Federally listed fish species. Construction BMPs for off-channel staging, and storage of equipment and vehicles, will be implemented to minimize the risk of contaminating the waters of the San Joaquin River by spilled materials. BMPs will also include minimization of erosion and stormwater runoff, as appropriate. Riparian vegetation removed or damaged will be replaced at a ratio, coordinated with NMFS, within the immediate area of the disturbance to maintain habitat quality. If individuals of listed species are observed present within a project area, NMFS must be notified. NMFS personnel shall have access to construction sites during construction, and following completion, to evaluate species presence and condition and/or habitat conditions. If bank stabilization activities should be necessary, then such	NMFS

Table 3.
Conservation Measures for Biological Resources That May Be Affected by Project Actions

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Regulatory Agency
	activities, including clearing, grubbing, pruning, and trimming of vegetation at each job site during construction initiation, midway through construction, and at the close of construction to monitor implementation of conservation measures and water quality. The bottom topography of the San Joaquin River channel will be designed to decrease or eliminate predator holding habitat.	
EFH-2. Minimize Loss of Habitat and Risk of Take from Implementation of Construction Activities	In-channel construction activities that could affect habitat for Pacific Salmonids will be limited to the low-flow period between June 1 and October 1 to minimize potential for adversely affecting Federally listed anadromous salmonids during their emigration period. In-channel construction activities that could affect habitat for Pacific salmonids will be limited to daylight hours during weekdays, leaving a nighttime and weekend period of passage for Federally listed fish species. Construction BMPs for off-channel staging and storage of equipment and vehicles will be implemented to minimize the risk of contaminating the waters of the San Joaquin River by spilled materials. BMPs will also include minimization of erosion and stormwater runoff, as appropriate. Riparian vegetation removed or damaged will be replaced, as applicable, in accordance with the Riparian Habitat Monitoring Management and Mitigation Plan, and will be coordinated with the USFWS and NMFS and/or other agencies as appropriate. If individuals of listed species are observed present within a project area, NMFS must be notified. NMFS personnel shall have access to construction sites during construction and following completion to evaluate species presence and condition and/or habitat conditions. If bank stabilization activities should be necessary, then such stabilization shall be constructed to minimize predator habitat, minimize erosion potential, and contain material suitable for supporting riparian vegetation.	NMFS

Acronyms:

°C = degrees Celsius
°F = degrees Fahrenheit
BMP = best management practice
BO = Biological Opinion
CFR = Code of Federal Regulations
cfs = cubic feet per second
CNDDB = California Natural Diversity Database
Corps = U.S. Army Corps of Engineers
CVP = Central Valley Project
DFW = California Department of Fish and Wildlife
DWR = California Department of Water Resources
EPA = Federal Environmental Protection Agency
NMFS = National Marine Fisheries Service
PEIS/R = Program Environmental Impacts Statement/Report
Reclamation = U.S. Department of the Interior, Bureau of Reclamation
RWQCB = Regional Water Quality Control Board
Settlement = Stipulation of Settlement in *NRDC, et al., v. Kirk Rodgers, et al.*
SJRRP = San Joaquin River Restoration Program
State = State of California
SWP = State Water Project
USFWS = U.S. Fish and Wildlife Service

haliaetus), bald eagle (*Haliaeetus leucocephalus*), long-eared owl (*Asio otus*), black phoebe, black-headed grosbeak (*Pheucticus melanocephalus*), common yellowthroat (*Geothlypis trichas*), song sparrow (*Melospiza melodia*), Swainson's thrush (*Catharus ustulatus*), tree swallow (*Tachycineta bicolor*), tri-colored blackbird (*Agelaius tricolor*), yellow warbler (*Dendroica petechia*), pallid bat (*Antrozous pallidus*), Townsend's big-eared bat (*Corynorhinus townsendii*), small-footed myotis bat (*Myotis leibii*), long-eared myotis bat (*Myotis septentrionalis*), fringed myotis bat (*Myotis thysanodes*), long-legged myotis bat (*Myotis volans*), and Yuma myotis bat (*Myotis yumanensis*) (CALFED 2000; CDFG 2008; Service 1993b; and Riparian Habitat Joint Venture [RHJV] 2004).

Elderberry Savannah

As described by Holland (1986), elderberry savannah habitat is characterized by a winter-deciduous shrub savannah dominated by blue elderberry (*Sambucus mexicana*) and an understory of nonnative grasses. The habitat is generally associated with alluvial soil and areas of floodplains. In natural stands this habitat typically succeeds into riparian vegetation. Typical understory species present in the Project area include tarweed (*Hemizonia* species), mustard (*Brassica* species), California wild rose (*Rosa californica*), and annual grasses. 23 acres of elderberry savannah habitat would be impacted within the Reach 2B project area.

Riparian Scrub

As described in Moise and Hendrickson (2002), riparian scrub habitat is characterized by a mix of semishrubby perennials and woody vines. In the project area, some areas also include a layer of shrub-like trees, including tobacco tree (*Nicotiana glauca*), blue elderberry (*Sambucus mexicana*), buttonbrush (*Cephalanthus occidentalis*), sandbar willow (*Salix exigua*), and Goodding's black willow (*Salix gooddingii*). Common understory species include California wild rose (*Rosa californica*), mugwort (*Artemisia douglasiana*), jimson weed (*Datura* species), cocklebur (*Xanthium strumarium*), nettle (*Urtica dioica*), sunflower (*Helianthus annuus*), tarweed (*Hemizonia* species), mustard (*Brassica* species) and lupin (*Lupinus* species). Riparian scrub is distinguished from willow scrub habitat, described below, by the fact that riparian scrub is dominated by multiple species (i.e., willow and non-willow riparian species), whereas willow scrub is dominated by stands of willow species. In the project area, much of the riparian scrub occurs along highly channelized portions of the river or areas that are subject to frequent disturbance. 99 acres of riparian scrub habitat would be impacted within the Reach 2B project area.

Willow Scrub

As described by Moise and Hendrickson (2002), willow scrub habitat is characterized by winter deciduous, shrubby, streamside willow thickets that are generally associated with areas subject to flooding or disturbance. Typical dominant species present in the Project area include Goodding's black willow (*Salix gooddingii*) and sandbar willow (*Salix exigua*). Typical understory species include wild rose (*Rosa californica*). In the Project area, much of the willow scrub occurs along sand and gravel bars and in small patches along the banks of the San Joaquin River. 122 acres of willow scrub habitat would be impacted within the Reach 2B project area.

californica) and on more alkali sites, saltgrass (*Distichlis spicata*). Common species on more saturated sites include common cattail (*Typha latifolia*) and tule bulrush (*Scirpus acutus* var. *occidentalis*). Fresh emergent wetland habitat, in the Project area, primarily occurs along the margins of and sometimes as small "islands" within lacustrine habitats, including portions of the San Joaquin River, Fresno Slough, and Little San Joaquin Slough. This habitat type may blend into the wet herbaceous habitat type, described below. 65 acres of fresh emergent wetland habitat would be impacted within the Reach 2B project area.

Pasture

As described by WHR (2010), pasture habitat is characterized by irrigated and grazed habitat that consists of a mix of perennial grasses and legumes that provide 100 percent canopy closure planted on flat and gently rolling terrain. Species occurring in this habitat type include Bermuda grass (*Cynodon dactylon*), white melilot (*Melilotus albus*), and ryegrasses (*Lolium* species). Various annual grasses are also present. This habitat type is present south of Little San Joaquin Slough. 8 acres of pasture habitat would be impacted within the Reach 2B project area.

Riverwash

As described by Moise and Hendrickson (2002), riverwash habitat is characterized by scoured banks and bars within or adjacent to the active river channel, without significant vegetative cover. In the project area, this habitat type is present at a few locations along the San Joaquin River totaling 8 acres.

Wet Herbaceous

Wet herbaceous habitat is characterized by annual and perennial herbaceous vegetation growing in areas with a high water table or subject to frequent flooding. These areas are typically wetter than annual grassland but not wet enough to be classified as fresh emergent wetland. Vegetation is lower-growing than in riparian scrub or valley foothill riparian habitats. Common species occurring in this habitat type include white melilot, Indian dogbane (*Apocynum cannabinum*), Bermuda grass, ryegrasses, tarweed, and cocklebur. 69 acres of wet herbaceous habitat would be impacted in the Reach 2B project area.

Lacustrine

As described by WHR (2010), lacustrine habitat is characterized by inland depressions or dammed riverine channels containing standing water. Due to the presence of Mendota Dam, large portions of aquatic habitat in the Project area hold water throughout the summer. 249 acres of lacustrine habitat would be impacted within the Reach 2B project area.

Waterfowl species that forage, overwinter, rear their brood, or otherwise rely on aquatic habitats provided by lacustrine habitat at some time in the year include Canada goose (*Branta canadensis*), wood duck (*Aix sponsa*), gadwall (*Anas strepera*), American wigeon (*Anas americana*), mallard, northern shoveler (*Anas clypeata*), northern pintail (*Anas acuta*), green-winged teal (*Anas carolinensis*), canvasback (*Aythya valisineria*), redhead (*Aythya americana*),

below. The more general cropland habitat type was used when a more specific habitat type could not be assigned, such as where agricultural fields were temporarily fallow (this category may include temporary land fallowing/crop idling acreage) or had recently been tilled in preparation for planting a new crop at the time of the habitat assessment surveys. Fallow fields may be regularly tilled or planted with cover crops, which differentiates them from barren habitat (described below). Croplands occur in the Project area both north and south of the river. 896 acres of cropland would be impacted within the Reach 2B project area.

Croplands within the project area are closely situated to grassland habitats and freshwater permanent emergent habitat. Thus, many of the wildlife species associated with these habitats also forage in croplands (Reclamation and CCWD 2008). Common species occurring in cropland include small mammals such as voles and mice, and birds such as mourning dove, pheasant, and several blackbird species. Croplands are important foraging habitat for numerous raptors including the Swainson's hawk, red-tailed hawk, northern harrier, white-tailed kite, and western burrowing owl (*Athene cunicularia*). Other species found in cropland include sandhill crane, Canada goose, long-billed curlew, mountain plover (*Charadrius montanus*), horned lark, and California ground squirrel.

Irrigated Hayfield

Irrigated hayfield habitat is characterized by alfalfa fields and grass hayfields where plowing may occur annually but often is less frequent. Alfalfa is typically planted as a monoculture and usually exists unplowed for approximately 3 years or more. Grass hayfields are characterized by irrigated, intensively mowed and managed grass crops with nearly 100 percent cover. In addition, occasionally "native" hayfields are irrigated to enhance their productivity. Native hayfields may include introduced grasses and forbs, but they are managed less intensively and contain a variety of naturally occurring species as well. Irrigated hayfields are found in the western portion of the Project area and near Little San Joaquin Slough. 80 acres of irrigated hayfields would be impacted within the Reach 2B project area.

Irrigated Row and Field Crops

Irrigated row and field crop habitat is characterized by annual or perennial green vegetable crops such as asparagus, broccoli, lettuce, cucumbers, fruits from strawberries to melons, and root vegetables such as carrots, potatoes, and beets. Cotton is also grown as an irrigated row crop. Most of these crops are grown in rows and canopy cover varies from 100 percent to crops with significant bare areas. These crops are also managed in a crop rotation system. Irrigated row and field crops occur near the Mendota Dam area. 10 acres of irrigated row and field crops would be impacted within the Reach 2B project area.

Deciduous Orchard

Deciduous orchard habitat is characterized by deciduous trees that produce almonds, apples, apricots, cherries, figs, nectarines, peaches, pears, pecans, pistachios, plums, pomegranates, prunes, and walnuts. Deciduous orchards typically consist of a single species of deciduous trees planted in linear, uniformly spaced rows where the crowns typically touch. Orchards in the

Habitat Associated with Project Structures

Bridges
Mowry Bridge over Fresno Slough could support a nesting colony of cliff swallows. Cliff swallows nest on rocky cliffs, but they also take advantage of the availability of suitable habitat found in bridges, culverts, and buildings, which may serve as surrogates for cliffs (Brown and Brown 1995). Barn and Cliff swallows prefer vertical surfaces with overhangs for nest attachment, an open area for foraging, and a close source for mud to build nests. This bridge within the project area provides habitat suitable for those two species as well as roosting habitat for bats.

Special Status Species

Giant garter snake, San Joaquin kit fox, blunt-nosed leopard lizard, Fresno Kangaroo rat, vernal pool tadpole shrimp, vernal pool fairy shrimp, least Bell's vireo, California jewelflower (*Caulanthus californicus*), Palmate-bracted bird's beak (*Cordylanthus palmatus*), and San Joaquin woolly threads (*Monolopia* (=*Lembertia*) *congdonii*) may be present near the project footprint. Elderberry shrubs, the host plant for the valley elderberry longhorn beetle, have also been documented within the Reach 2B project area and may be within 100 feet of project area service roads. Consultation pursuant to section 7(a) of the Endangered Species Act will address potential impacts to these species in a separate document.

FUTURE CONDITIONS WITHOUT PROJECT

If the Project were not implemented no channel or structural improvements would be made in Reach 2B, and Restoration Flows would be reduced to not exceed the existing Reach 2B capacity. It is assumed that agriculture would continue and cropland would be the dominant cover type, consistent with the existing condition.

Fisheries

The maximum channel conveyance would be limited to the existing capacity. Fish passage improvements would not be provided at structures (Chowchilla Bifurcation Structure, San Mateo Avenue, and Mendota Dam). However, the remainder of the SJRRP would proceed, and salmon would be reintroduced into the San Joaquin River. Each spring during their outmigration, downstream migrating juveniles would be entrained in diversions from Mendota Pool and succumb to high rates of predation by non-native fish present in Mendota Pool. Adult salmon would be blocked on their upstream migration at Mendota Dam in all years except wet year types. Blocked adult salmon would be exposed to poaching in the river below Mendota Dam and poor water quality later in the year. There is no spawning substrate in Reach 3, downstream of the dam, so blocked adult fish would require alternative efforts (e.g., trap and haul) to reach spawning grounds or would not spawn successfully.

and 1.3 percent in Fresno and Madera Counties, respectively, between 2010 and 2060 (California Department of Finance 2014). Most of that growth would likely occur in areas near the main cities in each of the counties. While population and economic projection data for specific unincorporated subareas of the counties are unavailable, neither agricultural nor non-agricultural activity is likely to expand substantially in the Mendota area.

If the Reach 2B Project is not implemented, future socioeconomic conditions in the pertinent Fresno and Madera County areas relative to conditions in other areas in the two counties would be expected to be similar. It is expected that the Reach 2B area would remain in agriculture and that most of the working population in the area would remain employed in agriculture and related industries.

Under No-Action conditions, future land use in the area is unlikely to change. Reach 2B is in the unincorporated areas of both Fresno and Madera Counties. The nearest incorporated cities are Firebaugh and Mendota, both in Fresno County. The population is expected to increase annually, compounded, by 1.1 percent and 1.3 percent in Fresno and Madera Counties, respectively, between 2010 and 2060 (California Department of Finance 2014). Most of that growth would likely occur in areas near the main cities in each of the counties. While population and economic projection data for specific unincorporated subareas of the counties are unavailable, neither agricultural nor non-agricultural activity is likely to expand substantially in the Mendota area.

If the Reach 2B Project is not implemented, future socioeconomic conditions in the pertinent Fresno and Madera County areas relative to conditions in other areas in the two counties would be expected to be similar. It is expected that the Reach 2B area would remain in agriculture and that most of the working population in the area would remain employed in agriculture and related industries.

Geomorphology

The existing levee alignments and heights would be maintained and maximum conveyance would continue to be limited to the existing capacity. If Restoration Flows enter the existing Reach 2B, sand transport would likely increase; however, recent sediment continuity studies have predicted that sand inputs from Reach 2A under Restoration Flows will likely result in net deposition in the upper segment of Reach 2B and potentially down to the Mendota Pool. There would not likely be a change to the existing geomorphic conditions in Reach 2B.

If Restoration Flows enter the existing Reach 2B, sand transport would likely increase; however, recent sediment continuity studies have predicted that sand inputs from Reach 2A under Restoration Flows will likely result in net deposition in the upper segment of Reach 2B and potentially down to the Mendota Pool. The No-Action Alternative would not likely change the existing geomorphic conditions in Reach 2B.

potentially causing the loss of respiratory function; a clogging and abrasion of gill filaments; increased stress levels; and reduced tolerance to disease and toxicants (Waters 1995).

Also, high suspended sediment levels would cause the movement and redistribution of fish populations and can affect physical habitat. Once the suspended sediment is deposited, it can reduce water depths in pools, decreasing the water's physical carrying capacity for juvenile and adult fish (Waters 1995). Increased sediment loading can also degrade food-producing habitat downstream of the project area. Sediment loading can interfere with photosynthesis of aquatic flora and result in the displacement of aquatic fauna. Many fish, including juvenile salmonids, are sight feeders. Turbid waters reduce the fish's efficiency in locating and feeding on prey. Some fish, particularly juveniles, can get disoriented and leave areas where their main food sources are located, which can result in reduced growth rates. Avoidance is the most common response by fish species as a result of increases in turbidity and sedimentation. Fish will not occupy areas that are not suitable for survival, unless they have no other option. Some fish, such as bluegill and bass species, will not spawn in excessively turbid water (Bell 1991). Therefore, habitat can become limiting in systems where high turbidity precludes a species from occupying habitat required for specific life stages.

Water Quality

The potential exists for contaminants to spill into the waterway during construction leading to a short-term degradation of water quality and fish habitat. Various contaminants, such as fuel oils, grease, and other petroleum products used in construction activities, could be introduced accidentally into the water system, either directly or through surface runoff. These contaminants may be toxic to fish or cause altered oxygen diffusion rates and acute and chronic toxicity to aquatic organisms, thereby reducing growth and survival.

MITIGATION

The recommendations provided herein for the protection of fish and wildlife resources are in accordance with the Service's Mitigation Policy as published in the Federal Register (46:15; January 23, 1981).

The Mitigation Policy provides Service personnel with guidance in making recommendations to protect or conserve fish and wildlife resources. The policy helps ensure consistent and effective Service recommendations, while allowing agencies and developers to anticipate Service recommendations and plan early for mitigation needs. The intent of the policy is to ensure protection and conservation of the most important and valuable fish and wildlife resources, while allowing reasonable and balanced use of the Nation's natural resources.

Under the Mitigation Policy, resources are assigned to one of four distinct Resource Categories, each having a mitigation planning goal which is consistent with the fish and wildlife values involved. The Resource Categories cover a range of habitat values from those considered to be unique and irreplaceable to those believed to be much more common and of relatively lesser value to fish and wildlife. The Mitigation Policy does not apply to threatened and endangered species, Service recommendations for completed Federal projects or projects permitted or

In recommending mitigation for adverse impacts to any of these habitats, the Service uses the same sequential mitigation steps recommended in the Council on Environmental Quality's regulations. These mitigation steps (in order of preference) are: avoidance, minimization, rectification, reduction or elimination of impacts over time, and compensation.

Mitigation Planning Goals for Affected Habitat

Fish and/or wildlife habitats were identified in the Reach 2B project study area which had potential for impacts from the Project. These habitats, and their corresponding evaluation species, designated Resource Categories and associated mitigation planning goals are discussed below, and summarized in Table 7.

Table 7. Resource Categories, Evaluation Species, and Acres of Impacts of Action Alternatives in the Reach 2B Project Area.

Cover-Type	Evaluation Species	Resource Category	Impacts (acres)
Valley/Foothill Riparian	yellow warbler, yellow-breasted chat, and black-headed grosbeak	2	153
Elderberry Savannah	neotropical migrant birds	2	23
Riparian Scrub	yellow warbler, yellow-breasted chat, and black-headed grosbeak	2	99
Willow Scrub	yellow warbler, yellow-breasted chat, and black-headed grosbeak	2	122
Annual grassland	burrowing owl, San Joaquin whipsnake (coachwhip), and American badger	2	361
Fresh Emergent Wetland	common yellowthroat, western pond turtle, and yellow-headed blackbird	2	65
Pasture	Aleutian Canada goose, pheasant, and deer	3	8
Riverwash*			8
Wet Herbaceaous	common yellowthroat, western pond turtle, and yellow-headed blackbird	2	69
Lacustrine	osprey, wood duck, and long-eared myotis bat	2	249
Seasonal Wetland	red-winged blackbird, killdeer, and the California vole	2	1
Riverine	Chinook salmon and	2	97

(e.g. bird watching); and (3) the Service's responsibilities for these species protection and management under the Migratory Bird Treaty Act. We chose the San Joaquin whipsnake as an evaluation species because they are an important predator species, and may also be a prey species, for a variety of wildlife species. San Joaquin whipsnake prey species include small mammals, lizards and eggs, snakes (including rattlesnakes), birds and eggs, young turtles, insects, and carrion (CDFG 2008). Raptors prey on San Joaquin whipsnake, and roadrunners may feed on young snakes (CDFG 2008). We chose the American badger as an evaluation species because badgers are highly specialized and play an important role in small mammal population ecology (CDFG 2008). The main portion of the badger diet includes rats, mice, chipmunks, ground squirrels and pocket gophers (CDFG 2008). Badgers will also eat some reptiles, insects, earthworms, eggs, birds, and carrion (CDFG 2008).

Native grassland habitats have become rare in the Central Valley due to competition with non-native species, fire suppression, grazing, and land conversion. Grassland habitats in the proposed project area were designated as Resource Category 2, based on the open habitat characteristics and foraging areas provided by this habitat for native species, and also for the quantity of native plant species they contain. Our associated mitigation planning goal for these areas is "no net loss of in-kind habitat value."

Seasonal Wetland Habitat

The evaluation species selected for seasonal wetland habitat in the project study area are the red-winged blackbird, killdeer, and the California vole. We chose the red-winged blackbird and killdeer as evaluation species because: (1) they have important human non-consumptive benefits (e.g. bird watching); (2) and the Service's responsibilities for these species protection and management under the MBTA. We chose the California vole as an evaluation species because they are important prey species for a variety of wildlife species, including certain raptor and wading bird species, predatory mammal species, and reptile species. Due to the importance of seasonal wetland habitat for migratory birds and for many other native wildlife species in the area, the Service has designated this habitat as Resource Category 2. Our associated mitigation planning goal for these areas is "no net loss of in-kind habitat value."

Nontidal Freshwater Permanent Emergent (including Fresh Emergent Wetlands and Wet Herbaceaous)

The evaluation species selected for nontidal freshwater permanent emergent cover-type that would be impacted are common yellowthroat, western pond turtle, and yellow-headed blackbird. The presence of sedges and native grasses, as well as emergent wetlands and associated uplands, have a positive influence on the abundance of common yellowthroat (RHJV 2004).

Additionally, the Service has responsibility for the protection and management of this bird species under the Migratory Bird Treaty Act. Western pond turtle was selected due to its dependence on creek and emergent wetland habitat throughout the proposed project area and its status as a CALFED MSCS species. Yellow-headed blackbird was selected because of its status as a California Species of Special Concern and because of its strong association with fresh emergent wetlands with dense vegetation.

The evaluation species selected for deciduous orchard cover-type that would be impacted are western red bat (*Lasiurus blossevillii*), Brewer's blackbird (*Euphagus cyanocephalus*), and California ground squirrel. The western red bat was selected because of its status as a California Species of Special Concern and because the bat species is known to utilize fruit and nut orchards in the Central Valley. Brewer's blackbird was selected to represent migratory birds that forage in the deciduous orchards of the project area and because of the Service's responsibility for the bird's protection and management under MBTA. California ground squirrel was selected to represent common small mammals that forage in deciduous orchards in the project area.

The evaluation species selected for dryland grain crops cover-type that would be impacted are tricolored blackbird and Swainson's hawk. The tricolored blackbird is a California Species of Special Concern that is known to nest in dryland grain crops in large colonies. Swainson's hawk is a California threatened species that is known to forage in grain crop habitat within the study area as well as nest in trees along this reach. Both bird species are CALFED MSCS species. The Service also has a responsibility for the protection and management of these birds under the Migratory Bird Treaty Act.

Raptors were selected as the evaluation species for impacts to the irrigated row crops cover-type. Raptors guild was selected to represent the special-status raptors that forage for small mammals and amphibians in this habitat type.

The evaluation species selected for pasture cover-type that would be impacted are Aleutian Canada goose, pheasant, and deer. Aleutian Canada goose was selected because of its status as a CALFED MSCS and to represent waterfowl that utilize pastures in the proposed project area for foraging and/or nesting (D. Woolington, Service, pers. comm. 2009). Pheasant was selected to represent game bird species that utilize pastures in the proposed project area for foraging and nesting. Deer was selected to represent game mammal species that forage in this habitat type.

Overall, pasture, grain and hay, idled fields, and other agricultural habitats were designated as Resource Category 4, based on the open space values that they provide in an area of increasing human development, as well as for the foraging habitat provided for a variety of wildlife species. Our associated mitigation planning goal for these areas is "Minimize loss of habitat value."

Barren Habitat

Evaluation species were not chosen because use by wildlife is so minimal. In view of the extremely low habitat value for most wildlife species provided by these areas in the project footprint, the Service finds that any highly disturbed habitats meeting the Barren/Riprap habitat definition that would be impacted by the project should have a mitigation planning goal of "minimize loss of habitat value" (Resource Category 4).

Mitigation Ratios

The CALFED MSCS (in CALFED 2000) recommends the following mitigation ratios for impacts to these habitat-types:

CONCLUSION

All of the action alternatives will have similar environmental impacts, and Alternative B (Compact Bypass with Consensus-Based Floodplain and Bifurcation Structure, the Preferred Alternative) is the Least Environmentally Damaging Practicable Alternative. The Service supports the selected Preferred Alternative if implemented along with the proposed conservation measures and the Recommendations described below.

RECOMMENDATIONS

The proposed Reach 2B Project could have effects on fish and wildlife and their habitat. If Reclamation proceeds with the project as described, the Service recommends that Reclamation:

- Minimize impacts to ruderal and annual grassland habitat that is temporarily disturbed during construction by reseeding with native grasses and forbs after the construction is complete.

- Implement all appropriate proposed conservation measures for affected species and their habitats as described in the EIS/R for the Project.

- On July 11, 2012, the Service was petitioned by the Center for Biological Diversity to list 53 amphibian and reptile species across the United States. The western pond turtle was one of the species petitioned for listing. Currently the Service is reviewing the status of this species. Minimize impacts to Western Pond Turtle by implementing the conservation measure WPT-1 from Table 5.

- Where appropriate, minimize impacts to Tricolored Blackbirds by following the CDFW Guidance document Staff Guidance Regarding Avoidance of Impacts to Tricolored Blackbird Breeding Colonies on Agricultural Fields in 2015 (California Department of Fish and Wildlife, 2015).

- Minimize impacts to cliff swallow nesting colonies under bridges by developing an exclusion plan in coordination with the Service prior to bridge construction.

- Mitigate for habitat impacts of the project based on the mitigation ratios in Table 8 of this Report.

- Rodenticide should not be used within the project area.

- Implement an Erosion Control Plan and Stormwater Prevention Plan that minimizes erosion and sedimentation during construction by using erosion control devices, such as straw waddles.

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