United States Department of the Interior

FISH AND WILDLIFE SERVICE
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In Reply Refer To
08ESMF00-2012-F-0125

AUG 21 2012

Memorandum

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

From: for Field Supervisor, Sacramento Fish and Wildlife Office
Sacramento, California

Subject: Formal Consultation and Conference Report Under Section 7(a)(2) of the Endangered Species Act for the San Joaquin River Restoration Program

This memorandum is in response to the U.S. Bureau of Reclamation's (Reclamation) November 30, 2011, request for formal consultation with the U.S. Fish and Wildlife Service (Service) on the proposed San Joaquin River Restoration Program (SJRRP) in Fresno, Madera, Merced, Stanislaus and San Joaquin Counties, California (Figure 1).

On September 13, 2006, a Settlement Agreement was entered into by NRDC, Friant Water Users Authority, and the U.S. Departments of the Interior and Commerce. The parties agreed on terms and conditions which were subsequently approved by the U.S. Eastern District Court of California on October 23, 2006. The Settlement establishes two primary goals:

> Restoration Goal- To restore and maintain fish populations in "good condition" in the mainstem San Joaquin River below Friant Dam to the confluence with 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 to all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the Settlement.

The Settlement also establishes a framework for accomplishing the Restoration and Water Management goals that will require National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) compliance for the project design, construction, and monitoring over the multi-year period. On March 30, 2009, President Obama signed the San

Joaquin River Restoration Settlement Act giving the U.S. Department of the Interior full authority to implement the Settlement.

Reclamation's request for consultation and conference was received by the Service on November 30, 2011. At issue are the effects of the SJRRP on the Federally-listed as threatened Delta smelt (*Hypomesus transpacificus*), succulent owl's clover (*Castilleja campestris* ssp. *succulent*), Hoover's spurge (*Chamaesyce hooveri*), Colusa grass (*Neostapfia colusana*), San Joaquin Valley Orcutt grass (*Orcuttia inaequalis*), vernal pool fairy shrimp (*Branchinecta lynchi*), valley elderberry longhorn beetle (*Desmocerus californicus dimorphus)*, the central California distinct population segment of California tiger salamander (central California tiger salamander) (*Ambystoma californiese*), giant garter snake (*Thamnophis gigas*), and the Federally-listed as endangered palmate-bracted bird's-beak (*Cordylanthus palmatus*), hairy Orcutt grass (Orcuttia pilosa), Greene's tuctoria (*Tuctoria greenei*), Conservancy fairy shrimp (*Branchinecta conservatio*), longhorn fairy shrimp (*Branchinecta longiantenna*), vernal pool tadpole shrimp (*Lepardurus pachardi*), blunt-nosed leopard lizard (*Gambelia sila*), Least Bell's Vireo (*Vireo bellii pusillus*), Fresno kangaroo rat (*Dipodomys nitratoides exilis*), San Joaquin woodrat (*Neotoma fuscipes riparia*), riparian brush rabbit (*Sylvilagus bachmani riparius*), San Joaquin kit fox (*Vulpes macritis mutica*), and the candidate for Federal listing western yellow-billed cuckoo (*Coccyzus americanus occidentalis*). The SJRRP is within designated critical habitat for Delta smelt, succulent owl's-clover, Hoover's spurge, Colusa grass, San Joaquin Valley Orcutt grass, hairy Orcutt grass, Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, and central California tiger salamander. This document is issued under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA).

The Service has reviewed: 1) the memorandum requesting consultation dated November 30, 2011; 2) the *San Joaquin River Restoration Program; Programmatic Biological Assessment* (PBA), November 2011; 3) *San Joaquin River Restoration Program; Draft Environmental Impact Statement/Environmental Impact Report,* (April 2011; 4) The memorandum *Response and Errata in Response*, May 8, 2012; and, 5) additional information on file at the Sacramento Fish and Wildlife Office. The Service is an Implementing Agency in the SJRRP and has been working closely with Reclamation since early 2008 on the project planning and recommendations for avoidance and minimization measures for federally-listed species.

The SJRRP has been divided into two levels of actions, project level actions and program level actions. Project level actions include the actual restoring and reestablishing of flows into the San Joaquin River, along with the reestablishment of spring-and fall-runs of Chinook salmon and the reoperation of Friant Dam and the various water control infrastructure that supports the San Joaquin River water delivery complex. The program level actions will be the individual actions and construction projects that will need to be undertaken in order to realize the SJRRP. These actions will include such projects as replacing/retrofitting water control structures, moving set-back levees, regrading and recontouring the river and bypass channels, and other actions in support of the final goal of the SJRRP.

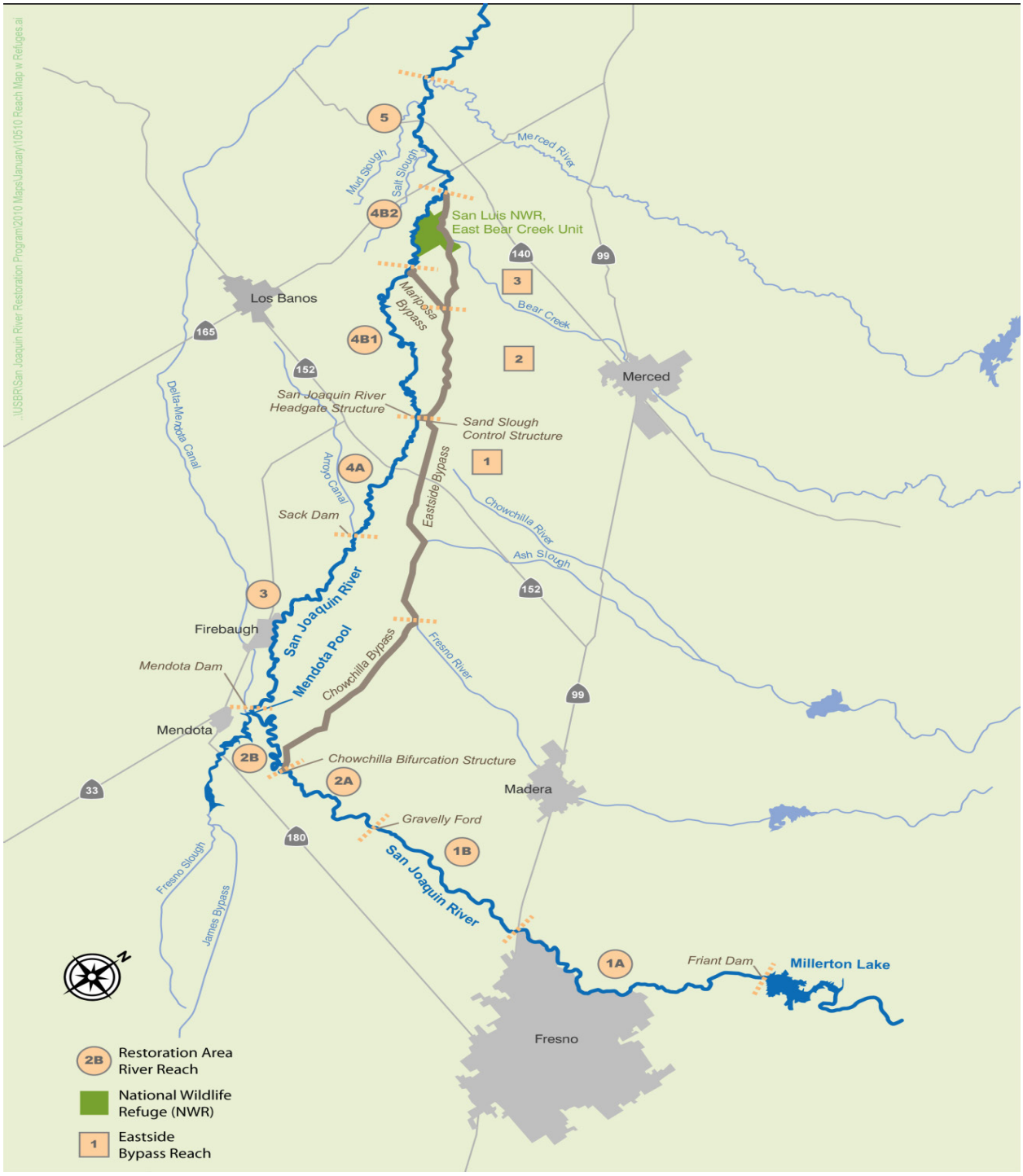

Figure 1. San Joaquin River Reaches and Flood Bypass System in Restoration Area

Reclamation and the Service have agreed to consider the project level effects of the SJRRP in a phased approach. Because of the unique nature of the SJRRP, both agencies recognize the inherent difficulty in predicting the effects as flows are reestablished within the former river channel. For this reason, the project level analysis will be separated into two phases; the first will be project level effects based on flow releases at or below 1,660 cubic feet per second (cfs) from Friant Dam. Reclamation has determined that the current data they have available for flows at or below the 1,660 cfs level is robust enough to allow them to make an effects determination for the first phase of the SJRRP and for the Service to make an effects analysis based on the data provided by Reclamation. For that reason, the Service is limiting its biological opinion to the first phase of the SJRRP, up to flows of 1,660 cfs and the program level actions that will support the first phase.

The second phase will begin when Reclamation has determined that they are able to increase the flow releases beyond 1,660 cfs to as high as 4,500 cfs. Portions of the San Joaquin River (Reaches 2A and 4A) have not experienced consistent flows for close to 40 years and in some areas the original river channel has been greatly altered during that time. For these reasons there is uncertainty as to how the geology of the channel will react to the increased restoration flows above 1,660 cfs. When Reclamation is ready to start the second phase of the SJRRP flow releases they will have completed most, if not all, of the program level construction projects planned, and will have compiled the needed data in order to make an appropriate effects determination for the increased flow amounts in the San Joaquin River channel. At that time, Reclamation will reinitiate consultation and present the Service with the data and an effects determination. The Service will then make the effects analysis using the provided data on the second phase of the SJRRP with flows of up to 4,500 cfs being released from Friant Dam.

Reclamation has made the determination that the first phase, with flow releases at or below 1,660 cfs from Friant Dam, of the SJRRP of project level effects may affect, but is not likely to adversely affect the Delta smelt, succulent owl's clover, Hoover's spurge, Colusa grass, San Joaquin Valley Orcutt grass, vernal pool fairy shrimp, valley elderberry longhorn beetle, California tiger salamander, giant garter snake, palmate-bracted bird's-beak, hairy Orcutt grass, Greene's tuctoria, Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool tadpole shrimp, Least Bell's Vireo, Fresno kangaroo rat, San Joaquin woodrat, riparian brush rabbit, San Joaquin kit fox, and the western yellow-billed cuckoo.

In addition, Reclamation has determined that the first phase is not likely to adversely affect the designated critical habitat for Delta smelt, succulent owl's-clover, Hoover's spurge, Colusa grass, San Joaquin Valley Orcutt grass, hairy Orcutt grass, Greene's tuctoria, Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, and central California tiger salamander.

Reclamation has determined that the first phase of the SJRRP, with flows from Friant Dam at or below 1,660 cfs, may affect and is likely to adversely affect the blunt-nosed leopard lizard in the Eastside and Mariposa bypasses. Reclamation is requesting formal consultation with the Service for the potential adverse effects to blunt-nosed leopard lizard as a result of the implementation of the first phase of the SJRRP.

After review of the description of first phase of the project level action and the effects analysis of the data available, the Service concurs with the effects determination of Reclamation that the first phase of the SJRRP is not likely to adversely affect Delta smelt, succulent owl's clover, Hoover's spurge, Colusa grass, San Joaquin Valley Orcutt grass, vernal pool fairy shrimp, valley elderberry longhorn beetle, central California tiger salamander, giant garter snake, palmate-bracted bird's-beak, hairy Orcutt grass, Greene's tuctoria, Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool tadpole shrimp, Least Bell's Vireo, Fresno kangaroo rat, San Joaquin woodrat, riparian brush rabbit, San Joaquin kit fox, and the western yellow-billed cuckoo. The effects of the first phase will be limited to the historic river channel and the bypasses where there is little or no habitat for these species, and the additional flows into the lower San Joaquin River below the Merced River confluence are likely to result in insignificant and discountable downstream effects.

The Service also concurs that the first phase of the SJRRP is not likely to adversely affect designated critical habitat for Delta smelt, succulent owl's-clover, Hoover's spurge, Colusa grass, San Joaquin Valley Orcutt grass, hairy Orcutt grass, Greene's tuctoria, Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, and central California tiger salamander. The flows during the first phase will be contained within the historic river channel and the bypasses, there is no critical habitat for these species within these areas, and the Service does not anticipate that any critical habitat will be affected. Flows into the lower San Joaquin River below the Merced River are likely to result in insignificant and discountable downstream effects to delta smelt critical habitat.

Reclamation began releasing Interim Flows into the San Joaquin River system in 2009 in anticipation of ultimately restoring flows to the 4,500 cfs level. The Service concurred with Reclamation's determination at that time that the Interim Flows released in 2009-2010 (WY 2010) from Friant Dam were not likely to adversely affect the listed species within the action area, but that there was special concern regarding the potential for a remnant population of blunt-nosed leopard lizards to persist above the channel along the Eastside Bypass. Because the 2009 – 2010 Interim Flows were to stay within the existing low-flow channel the Service concurred with the determination of not likely to adversely affect the blunt-nosed leopard lizard for that action (Service file #81420-2009-I-0805-1).

The potential for a remnant population of blunt-nosed leopard lizards existing in the Eastside Bypass was based on a California Natural Diversity Database occurrence for the species within 3 miles of the bypass (#116), and the persistence of potential habitat within and adjacent to the Eastside Bypass. In an effort to determine whether the population did persist in the bypass area, Reclamation promulgated habitat assessments and protocol surveys for blunt-nosed leopard lizards in 2009 and 2010 (Endangered Species Recovery Program [ESRP] 2009; California Department of Water Resources [DWR] 2010). The 2009 habitat assessment ranked the site conditions using a habitat suitability index, 1 being the least suitable for blunt-nosed leopard lizard to 10 being the most suitable. Properties within the survey area were generally ranked between 2 and 6 for habitat suitability. Twenty-eight of the 61 properties surveyed scored higher than a 5. The report concluded that the overall low to moderate habitat values along the corridor

are generally not conductive to the occurrence of blunt-nosed leopard lizard, and no blunt-nosed leopard lizards were detected by the surveys.

Surveys were conducted once again in 2010, by agreement, on those sections that ranked 4 or better in suitability. The habitat was again indexed for suitability and again ranged from 2 to 6, although many sites ranked lower in 2010 than the previous year because of increased grass growth. As in 2009, the 2010 surveys were conducted for both adult and juvenile blunt-nosed leopard lizards. The 2010 survey report made a similar conclusion as the 2009 report and also did not detect any blunt-nosed leopard lizards.

An important limiting factor for the analysis of the results derived from the surveys conducted in 2009 and 2010 was that not all properties that had a potential to support blunt-nosed leopard lizards were able to be surveyed because of lack of granted access to private property. Because of the limited access to all properties along the Eastside Bypass, and that the interim flows were to be increased to a maximum of 1,660 cfs, along with the proximity of the California Natural Diversity Data Base (CNDDB) historic occurrence of the blunt-nosed leopard lizard, the Service concluded that the Interim Flows for WY 2011 and WY 2012 were likely to adversely affect the blunt-nosed leopard lizard.

The Service has further evaluated the potential for effects to the blunt-nosed leopard lizard by the Restoration Flows of up to 1,660 cfs that will be associated with the first phase of the project level action, including historic occurrence data, current land use, frequency of flood flows, and proximity to potential source populations.

- The CNDDB historic occurrence (#116) is described as "Localities for the Blunt-nosed Leopard Lizard; A List of Museum and Observations Prepared by Inland Fisheries Branch CA Dept. of Fish and Game, 1974." "The original data from Kansas University specimen." This is followed by a site revisit in 1991 in which is stated that the "SE ¼ of Section 21 converted to cultivated cotton, no individuals found." This description does not actually say when the specimen associated with the occurrence was collected by Kansas University, but it could not have been more recent than 1974 and potentially much earlier than that.

- Recent (June 2011) observations of the current land use of the occurrence site, as in 1991, show that the land is completely under intensive agriculture.

- The Eastside Bypass periodically conveys large amounts of seasonal flows and in WY 2011 flood releases from Friant Dam resulted in flows up to 7,500 cfs through the San Joaquin River system, including the Eastside Bypass. These high flows would likely have eliminated any blunt-nosed leopard lizards that happened to be in the inundated area of the bypass. The Restoration Flows associated with the first phase project level action will be only a fraction of the WY 2011 flood flows and will be contained within the existing channel.

- There are no large preserves in or adjacent to the Eastside Bypass containing populations of blunt-nosed leopard lizards that could act as a source to augment or repopulate any potential habitat within the Eastside Bypass if that population has been extirpated. Thus, there is currently a lack of evidence that the blunt-nosed leopard lizard persists within the Eastside Bypass and it is very unlikely that they could recolonize the area.

Based on our review of the best available data regarding the potential for flows at or below 1,660 cfs to adversely affect the blunt-nosed leopard lizard within the action area, we have concluded that the first phase project level actions with flows at or below 1,660 cfs may affect, but are not likely to adversely affect the blunt-nosed leopard lizard. The effects of additional flows up to 4,550 cfs on the blunt-nosed leopard lizard, along with the other federally-listed species, will be revisited and considered at the time of reinitiation by Reclamation.

Program level actions will be considered individually at the time that they are submitted by Reclamation to the Service for consultation. The Service recognizes that program level actions may affect listed species, but cannot make a determination as to whether or not the effect may be adverse until the project description is submitted by Reclamation. At that time, the Service will review and analyze the effects of each individual, proposed action. Reclamation may request that the action be appended to this Programmatic Biological Opinion (PBO), and the Service will have the option to decide whether or not the proposed action is appropriate to be appended to this PBO.

CONSULTATION HISTORY

Technical assistance and consultation between Reclamation and National Marines Fisheries Service (NMFS) and/or the Service regarding the SJRRP generally has been regular and ongoing since 2008, primarily as part of the Environmental Compliance and Permitting Work Group (ECPWG), which includes staff from all Implementing Agencies, including Reclamation, NMFS, and Service. The ECPWG members continue to meet regularly to discuss issues and daily conference occurs between the Service and Reclamation as individuals from the SJRRP staff of both agencies are co-located. Although not summarized below, Reclamation, NMFS, the Service, California Department of Fish and Game (CDFG), DWR, and other regulatory agencies have had weekly calls to discuss streamflow, water quality, and adaptive management updates during the WY 2010 and 2011 Interim Flow releases.

March 25, 2008 The Environmental Compliance and Permitting Work Group (ECPWG) Meeting. The Service will seek input from staff regarding the specific areas in which surveys will need to be completed for specific species before releasing Interim Flows.

April 8, 2008 The ECPWG Meeting. The group discussed the differences in surveys needed to permit Interim and Restoration flows versus those needed to permit the entire program.

June 10, 2008 The ECPWG Meeting. Interim Flows in Water Year (WY) 2010 might require minimal species/habitat surveys, including surveys for the California tiger salamander. The group is assuming that Interim Flows will not use Reach 4B1.

July 23, 2008 The ECPWG Meeting. The current Interim Flows description includes flows to Mendota Pool from October 2009 through September 2010 to be recovered by the San Joaquin River Exchange Contractors. Interim Flows beyond 2010 will be covered through the PEIS/R.

July 29, 2008 Endangered Species Act/ California Endangered Species Act (ESA/CESA) Meeting. Some changes have occurred to the 2009–2010 Interim Flows project as a result of discussions with State Water Resources Control Board (SWRCB). Reclamation needs to apply for temporary change permit with SWRCB. Interim flows would be for the period between October 1, 2009, and September 30, 2010. Interim Flow releases are not expected to reach Mendota Pool. Reclamation's water rights do not include fish and wildlife habitat. Therefore, the purpose of use identified in the rights would need to be changed under Water Code Section 1705 to accommodate this use. Discussion included how more water in Reaches 1 and 2 related to the Interim Flows could affect listed species in Mendota Pool. Giant garter snake may be an issue, but the addition of more water may be beneficial to the species. Maryann Owens (Service) inquired about giant garter snake surveys completed approximately 5 years ago. Julie Vance (CDFG) will follow up about the availability of these data. The historical occurrence of bank swallow in Mendota Pool is likely not an issue, because habitat has been altered and is no longer suitable for nesting. A question was asked about what the maximum flows were for the pilot study (They were estimated to be between 600 and 1,000 cfs.). The pilot study received concurrence from the Service that there would not likely be an adverse effect on Federally-listed species. In addition, no take of State-listed species would occur. Julie Vance and Maryann Owens think that a similar conclusion may be appropriate for the Interim Flows project, but they need to discuss with John Beam (CDFG) the potential water level effects in Mendota Pool before a determination is made.

October 28, 2008 The ECPWG Meeting. The group discussed the potential to send Interim Flows in WY 2010 through the Eastside Bypass to the Delta. The compliance associated with this action is expected to require an Environmental Impact Statement/Environmental Impact Report (EIS/EIR), which would be difficult to complete in the allotted time frame, particularly considering the additional endangered species thought to be present in the bypass (e.g., button celery). For these reasons, and because of uncertainty on the authority to use the bypass, the group recommended restricting Interim Flows to Mendota Pool.

November 4, 2008 The ECPWG Meeting. The team discussed the state of the WY 2010 Interim Flows project description. The team discussed the location of potential habitat for blunt-nosed leopard lizard in Reach 2B because it relates to potential levee setbacks in this reach.

November 18, 2008 The ECPWG Meeting. The group agreed that if Interim Flows would be delivered to the Delta, the action may no longer be exempt from CEQA and could require an EIS/EIR, as well as a biological opinion (BO), and would therefore take enough time to affect the schedule. Thus, Interim Flows should not be delivered past the Merced River confluence. The group agreed to include two flow delivery points (wildlife refuges in Reach 5, Mendota Pool) in the Environmental Assessment (EA) for coverage for environmental review and permitting.

January 20, 2009 The ECPWG Meeting. Stephanie Rickabaugh requested spatial inundation information on the WY 2010 Interim Flows, which MWH Global (MWH) will provide from MEI. This information will allow a better understanding of the potential to affect special-status species.

February 3, 2009 The ECPWG Meeting. Because of potential issues with giant garter snake habitat in the backwater area of Mendota Pool, more discussion is needed in the EA on the potential changes in stage operations at Mendota Pool. Reclamation will look into operations at Mendota Pool to determine whether there is potential active storage available that could result in backwater stage changes. Because of the potential that blunt-nosed leopard lizard habitat exists in the Eastside Bypass, Stephanie Rickabaugh requested better information on the potential inundation at Interim Flow levels. Stephanie stated that a finding of not likely to adversely affect blunt-nosed leopard lizard would require informal consultation with the Service.

February 17, 2009 The ECPWG Meeting. Reclamation described the two alternatives to be included in the Environmental Assessment/Initial Study (EA/IS). The two alternatives will be the No-Action Alternative and one action alternative. The action alternative will describe sending flows as far as China Island in Reach 5; however, if there are legal constraints (such as land access) or regulatory constraints (such as discovery of a species fully protected by the State), flows will be delivered to an intermediate point (either the East Bear Creek Unit of the San Luis National Wildlife Refuge Complex or Mendota Pool) to avoid such constraints. Stephanie Rickabaugh and John Battistoni (CDFG) will develop the survey protocol for blunt-nosed leopard lizard.

March 19, 2009 The ESA/CESA Meeting. Blunt-nosed leopard lizard survey protocol from the Service and CDFG will be sent to Reclamation next week and will be used to determine the survey effort. It was noted that ESRP mapped elderberry shrubs throughout Reaches 1– 5 and surveyed most of the shrubs for exit holes in 2004–2005; however, the Service typically considers results valid for only 1 year. Leslie Mirise, Stephanie Rickabaugh and Maryann Owens.

March 24, 2009 The ECPWG Meeting. Stephanie Rickabaugh and John Battistoni have completed the blunt-nosed leopard lizard survey protocols and are awaiting a Service signature.

March 25, 2009 Technical Assistance Letter. The Service issued a letter to Reclamation, which provided survey protocols for blunt nosed leopard lizard.

April 7, 2009 The ECPWG Meeting. Blunt-nosed leopard lizard surveys were discussed.

April 16, 2009 The ESA/CESA meeting. Brad Hubbard (Reclamation) stated that there are issues related to obtaining land access in the bypass channel to survey for blunt-nosed leopard lizards; therefore, CDFG and Service will meet on April 24, 2009, to discuss the assumption of presence. The Interim Flows Biological Assessment (BA) outline will be sent to NMFS for its review and comment. It was agreed that there will be only one Interim Flows BA, which will discuss terrestrial and aquatic species. The Service would like more information on several species in the EA (e.g., riparian brush rabbit, California tiger salamander, valley elderberry longhorn beetle, and San Joaquin kit fox). The Service recommends that Reclamation make an environmental commitment in the Interim Flows BA to complete vegetation base maps. It was decided that the pictures taken during the invasive species surveys would not suffice for the recommended vegetation base map.

April 17, 2009 Reclamation Meeting. Special-status species strategy details were discussed, including the strategy for the blunt-nosed leopard lizard ESA/CESA approach for the WY 2010 Interim Flows proposal.

April 21, 2009 The ECPWG meeting. The NMFS needs to know if the Hills Ferry Barrier can withstand the expected Interim Flows, if the barrier will be replaced in early spring to block steelhead, and if this will be considered a significant effect. One BA that addresses aquatic and terrestrial species for the Interim Flows will be developed by May 15, 2009, and will not address CESA. The Service recommends that Reclamation make an environmental commitment to perform vegetation base mapping for the Interim Flows. The NMFS and Service reviewed the draft BA outline.

April 22, 2009 Interim Flows meeting. The SJRRP office staff will provide a technical paper regarding expected operational requirements for the Hills Ferry Barrier that was drafted in support of legislation. The EA/IS description of actions related to the Hills Ferry Barrier will be revised based on this paper. Generally, the project description will include no change to the operation of the Hills Ferry Barrier.

May 4, 2009 The ECPWG meeting. General discussion was held on scheduling for environmental documents. Reclamation stated that the Hills Ferry Barrier will not be put in place in spring; however, a monitoring plan will be developed.

May 14, 2009 The BA. Reclamation submitted the draft WY 2010 Interim Flows Project BA to NMFS and Service.

May 15, 2009 The BA comments. The Service issued comments to Reclamation on the draft WY 2010 Interim Flows Project BA.

May 18, 2009 ECPWG meeting. The NMFS, Service, and CDFG provided comments on the draft BA.

May 22, 2009 The BA. Reclamation submitted the WY 2010 Interim Flows Project BA to NMFS and Service to initiate Section 7 consultation on the WY 2010 Interim Flows Project.

June 2, 2009 The ECPWG meeting. The Service stated that completion of the Section 7 process will require a final project description (with all public comments incorporated). Formal consultation is underway for geotechnical borings and for WY 2010 Interim Flows. ESRP has begun blunt-nosed leopard lizard surveys in the Eastside Bypass. Reclamation is looking into the possibility of having aerial surveys conducted for baseline vegetation data.

June 16, 2009 The ECPWG meeting. The NMFS is performing a sufficiency review of the BA. The Service has started analyzing the BA and is considering issuing a concurrence letter instead of a BO, but the final decision has not been made. The Service stated that modeling development is almost complete for the USFWS 2008 Central Valley Project (CVP)/ State Water Project (SWP) Operations BO. When it is complete, MWH will complete the modeling runs for the programmatic BA. The Service stated there was no need for sensitivity analyses with the NMFS 2009 CVP/SWP Operations BO.

June 30, 2009 The ECPWG meeting. The Service reported that the BA was being routed and that it appeared that the proposed schedule (with the BO complete in September) would be met, assuming no major issues arise. The NMFS is

working on the sufficiency determination and will be sending out a letter soon requesting more information. No blunt-nosed leopard lizards have been sighted to date in the Eastside Bypass; ESRP staff members are surveying portions of the Mariposa Bypass.

June 30, 2009 The ESA/CESA meeting. Species were identified for which habitat mapping or surveys need to be conducted, including valley elderberry longhorn beetle, blunt-nosed leopard lizard, vernal pool species, and delta button-celery. Valley elderberry longhorn beetle survey protocols and approaches were discussed. The group decided to prepare two separate BAs, due in December 2009, with an annotated outline due on July 21, 2009.

July 15, 2009 Letter of concurrence. Letter of concurrence from Service that WY 2010 Interim Flows Project will not adversely affect Service-listed species or adversely modify critical habitat.

July 16, 2009 The ECPWG meeting. The Service has issued a letter of concurrence, contingent upon completing and reporting on the blunt-nosed leopard lizard surveys. Adult blunt-nosed leopard lizard surveys in the Eastside Bypass are continuing and should be completed this week; Service and CDFG agreed to a 2-day extension on the survey period.

July 23, 2009 Conservation strategy meeting. The group discussed incorporating additional mitigation measures into the conservation strategy.

August 25, 2009 The ECPWG meeting. The valley elderberry longhorn beetle and blunt-nosed leopard lizard surveys have been completed. The group discussed distributing and reviewing data and reports.

September 15, 2009 The ESA/CESA meeting. ESRP is completing surveys for blunt-nosed leopard lizard in the bypasses. The results of preliminary modeling indicate that Interim Flows would not affect this species because the flows would be restricted to the low-flow channel.

September 22, 2009 The ECPWG meeting. ESRP is to finalize the blunt-nosed leopard lizard survey report and submit it to Reclamation, Service, and CDFG on September 23, 2009. The Service anticipates releasing the concurrence letter of not likely to adversely affect for blunt-nosed leopard lizard by September 25, 2009. The NMFS anticipates releasing its concurrence letter by September 25, 2009.

September 23, 2009 Letter of concurrence. Letter of concurrence from NMFS that WY 2010 Interim Flows Project will not adversely affect NMFS-listed species or adversely modify critical habitat.

September 24, 2009 Letter of concurrence. Letter of concurrence from Service that WY 2010 Interim Flows Project will not adversely affect blunt-nosed leopard lizard.

October 6, 2009 The ECPWG meeting. The WY 2010 Interim Flows released on October 1, 2009, reached Gravelly Ford on October 4. Commitments laid out in the EA/IS/Mitigated Negative Document are being completed/managed by Reclamation and DWR.

October 13, 2009 The ESA/CESA meeting. The Service suggested that delta smelt should be evaluated separately in the BA because there may be a need for additional CVP/SWP Operations modeling.

December 1, 2009 The ECPWG meeting. Until February 2010, 120 cfs is being released from Friant Dam. Reclamation and DWR are investigating the need to install additional seepage wells on private lands.

January 14, 2010 The ECPWG meeting. At a meeting in the second week of December 2009, CDFG's legal staff determined that the threatened status of spring-run Chinook salmon from the Sacramento watershed applies to those fish (or their progeny) that migrate from the Sacramento River to the San Joaquin River. In addition, draft legislation was proposed to add language to CESA that would allow CDFG to make a determination (similar to a Section 2080.1 consistency determination) regarding the experimental population under Section 10(j) of the ESA.

June 15, 2010 The BA. Reclamation submitted the WY 2011 Interim Flows Project BA to NMFS and Service.

June 15, 2010 The ECPWG meeting. The Friant Dam release was decreased to 350 cfs and will remain at that level for the rest of the water year. The WY 2011 Interim Flows BA is now available for comment through July 9, 2010. HDR is completing the BA, which is expected to be sent to the fisheries agencies today to start the consultation process.

July 20, 2010 The ECPWG meeting. Comments on the WY 2011 Interim Flows BA are due by July 23, 2010. The NMFS will issue an insufficiency letter. The DWR finished blunt-nosed leopard lizard surveys with negative findings. A Section 10(a)1(A) permit will be submitted by the end of September for the fisheries reintroduction process. The permit will include three categories: stock, hatchery, and reintroduction. Each will have a monitoring component.

July 23, 2010 Letter of insufficiency. Letter from NMFS requesting additional information on the WY 2011 Interim Flows Project.

September 28, 2010	Letter of concurrence/ BO. Letter of concurrence from Service that WY 2011 Interim Flows Project will not adversely affect Service-listed species or adversely modify critical habitat and a BO from Service addressing the effects of the WY 2011 Interim Flows Project on blunt-nosed leopard lizard.
October 21, 2010	The ECPWG meeting. The Section 10(a)1(A) application for fisheries reintroduction was submitted on September 30, 2010, for a 30-day review. The draft programmatic BA is due out in early 2011.
December 2, 2010	Discussion of sensitivity analysis. An overview of the sensitivity analysis and modeling was presented and discussed with Service and NMFS.
January 11, 2011	The Preliminary Environmental Impact Statement/Environmental Impact Report (PEIS/EIR) analysis and BA approach meeting. Discussion of analysis for tributaries to the San Joaquin River in the PEIS/R and BA. This analysis incorporated comments from the December 2, 2010, meeting, including Instream Flow Incremental Methodology study results for Chinook salmon and steelhead.
January 21, 2011	The WY 2012 discussion. Overview and discussion of needs for WY 2012 environmental documents and discussion of what agencies need to make determinations.
January 24, 2011	The ECPWG meeting. Check-in and overview of project- and program-level projects and updates on expectations of documents needing preparation, review, and comment in 2011.
June 7, 2011	The BA. Reclamation submitted the first administrative draft Programmatic BA to NMFS and Service.
June 27, 2011	The BA comments. The Service issued comments to Reclamation on the first administrative draft Programmatic BA.
September 28, 2011	The BA. Reclamation submitted the second administrative draft Programmatic BA to NMFS and Service.
November 30, 2011	The BA. The Service received the final *Programmatic Biological Assessment* and the request from Reclamation for formal consultation.
January 10, 2012	The Service sent an Interagency Memorandum requesting additional information in response to the SJRRP BA submitted by Reclamation.

February 16, 2012	The BA. Meeting between the Service and Reclamation to discuss the need for clarification within the BA regarding Reclamation's determinations of effects to listed-species.
May 8, 2012	Reclamation sent an Interagency Memorandum and a response to the Service's request for additional information regarding formal consultation for the SJRRP.

Proposed Action

The Proposed Action includes reoperation of Friant Dam, and a range of actions to achieve the Restoration and Water Management goals, it is equivalent to Alternative A1 described in the Draft PEIS/EIR (Reclamation and DWR 2011). Under the Proposed Action, Reach 4B1, extending from the Sand Slough Control Structure to the Mariposa Bypass, will convey at least 475 cfs, and the Eastside and Mariposa bypasses will convey any remaining Interim and Restoration flows. The Proposed Action includes the potential for recapture of Interim and Restoration flows in the Restoration Area and in the Delta using existing diversion facilities, and the potential for recirculation of all recaptured Interim and Restoration flows. A Physical Monitoring and Management Plan is included in the Proposed Action to provide guidelines for observing and adjusting to changes in conditions regarding flow, seepage, channel capacity, propagation of native vegetation, and suitability of spawning gravel (see Appendix D of the Draft PEIS/EIR (Reclamation and DWR 2011). The Proposed Action also includes a Conservation Strategy consisting of management actions necessary to provide a net increase in the extent and quality of riparian and wetland habitats in the Restoration Area to avoid reducing the long-term viability of sensitive species.

Project Level – Program Level Actions

Project Level Actions

The actions at a project level are described in greater detail below, and include the Physical Monitoring and Management Plan and the Conservation Strategy.

For purposes of identifying sets of actions that are ripe for consultation, project level actions have been divided into two phases. The first phase includes flow related actions required to support flow releases of 1,660 cfs from Friant Dam, including site-specific channel improvement and related construction projects required to accommodate increases in flows from Friant Dam up to 4,500 cfs. The second phase will be the release of Restoration flows above 1,660 cfs, up to a maximum of 4,500 cfs and are not further addressed in this biological opinion.

First Phase Actions at Project and Program Level:

Reoperate Friant Dam and Downstream Flow Control Structures

Actions for reoperating Friant Dam and downstream flow control structures for the release and

conveyance of Interim and Restoration flows include the following:

- Releasing Interim and Restoration flows from Friant Dam up to the Restoration Flows stipulated by the Settlement, as constrained by then existing channel capacities

- Minimizing increases in flood risk in the Restoration Area as a result of Interim and Restoration flows

- Reoperating downstream flow control structures, which includes modifying operations of the San Joaquin River Flood Control Project (flood management system) and other structures to convey Interim and Restoration flows

- Establishing a Recovered Water Account (RWA) and managing Friant Dam to make water supplies available to Friant Division long-term contractors at a pre-established rate

Recapture Interim and Restoration Flows

Water recapture actions; including recapturing Interim and Restoration flows using existing facilities in the Restoration Area and in the Delta. These actions are analyzed at a project level. Recaptured water available for transfer to Friant Division long-term contractors will range from zero to 556 TAF. Reclamation will identify actual delivery reductions to Friant Division long-term contractors associated with the release of Interim and Restoration flows.

Recapture in the Restoration Area. The Proposed Action includes potential recapture of up to the total quantity of Interim and Restoration flows (maximum of 556 thousand acre-feet [TAF]) within the Restoration Area using existing facilities. The Settlement includes flow targets in six locations to determine achievement of the Restoration Goal. Paragraph 16(a)(1) of the Settlement provides that recapture and recirculation of Interim and Restoration Flows "shall have no adverse impact on the Restoration Goal, downstream water quality or fisheries." Because recapture within the Restoration Area could prevent the flow targets from being met, recapture within the Restoration Area will occur only if necessary to avoid interfering with in-channel construction activities associated with the Restoration Goal, or to avoid potential material adverse impacts from groundwater seepage (as described in Appendix D of the Draft PEIS/R 2011) or for other emergency actions to avoid immediate adverse impacts. Interim and Restoration flows will be recaptured consistent with Federal, State, and local laws, and future agreements with downstream agencies, entities, and landowners. Potential locations within the Restoration Area for recapture of Interim and Restoration flows include the Mendota Pool, and the East Bear Creek Unit located in Eastside Bypass Reach 3. Only diversion facilities that have potential to recirculate Interim and Restoration flows to the Friant Division will be used for recapture locations.

No change in operational requirements will be needed to recapture Interim and Restoration flows in the Restoration Area or in the Delta under the regulatory compliance standards in place at the time water is recaptured. In the event that additional operational requirements or changes in operational requirements are implemented at these diversion points, recapture of Interim and

Restoration flows will occur within those requirements. Any increase in Restoration Area or Delta exports directly resulting from the Interim or Restoration flows will be available for recirculation to the Friant Division; however, recirculation of recaptured water to the Friant Division may require subsequent exchange agreements between Reclamation, DWR, Friant Division long-term contractors, and other south-of-Delta CVP/SWP contractors who are not included in the Proposed Action. As previously described, recirculation will be subject to available capacity and existing or future operational constraints within CVP/SWP storage and conveyance facilities.

Locations available for recapture of Interim and Restoration flows within the Restoration Area include the following:

Mendota Pool – Interim and Restoration flows may be diverted from the Mendota Pool to the extent that these flows would meet demands, replacing CVP water supplies that would otherwise be delivered via the Delta-Mendota Canal (DMC). The DMC carries water from the Delta to the Mendota Pool, where the water is diverted through several existing pumps and canals with a combined capacity that exceeds upstream channel capacity. Interim and Restoration flows diverted by CVP contractors at the Mendota Pool would be in lieu of supplies typically delivered via the DMC. Therefore, CVP water supplies that would have been delivered via the DMC would be made available for delivery to the Friant Division, subject to existing contractual obligations and existing and any future agreements. In such cases, Delta exports would not change compared to existing conditions. Exported water, up to the amount diverted at the Mendota Pool, would be available for recirculation to the Friant Division using existing south-of-Delta facilities, including the Jones Pumping Plant and Banks Pumping Plant, California Aqueduct, DMC, San Luis Reservoir and related pumping facilities, and other facilities operated by CVP/SWP contractors.

East Bear Creek Unit – If considerations in Reach 5 or in downstream reaches (such as channel capacity or potential take of listed species that could not be avoided) require that less (or no) flow enters those reaches, Interim and Restoration flows could be diverted to the East Bear Creek Unit in Eastside Bypass Reach 3, to the extent that these flows would meet water supply demands. The East Bear Creek Unit has a pump lift station in the Eastside Bypass with a diversion capacity of 60 cfs. This pump station includes a 48-inch-diameter intake structure and four 125-horsepower electric motors driving 15 cfs pumps. Deliveries of Interim and/or Restoration Flows to the East Bear Creek Unit would be further constrained by actual demand for water supplies at the units. Currently, the East Bear Creek Unit receives CVP water supplies from the DMC.

Delta - Interim and Restoration flows reaching the Delta will be recaptured at existing facilities within the Delta consistent with applicable laws, regulations, BOs, and court orders in place at the time the water is recaptured. The Proposed Action includes recapture of Interim and Restoration flows in the Delta at the Jones and Banks pumping plants, operated consistent with applicable laws, regulations, BOs, and court orders in place at the time the water is recaptured. Because recapture will occur only as allowable under applicable laws, regulations, BOs, and court orders, any increase in Delta water exports under the Proposed Action will not require or

imply a change in export rules. If applicable laws, regulations, BOs, or court orders concerning the operation of existing facilities in the Delta change, the recapture of Interim and Restoration flows will be subject to the new regulations.

Actions at a program level include recirculating recaptured Interim and Restoration flows, Common Restoration actions, the Physical Monitoring and Management Plan (Appendix D of the Draft PEIS/EIR [Reclamation and DWR 2011]) and the Conservation Strategy. Actions included at a program level are described in more detail below except the Conservation Strategy which is discussed later under Proposed Conservation Measures:

The program level actions include the anticipated range of potential implementation for common actions under Paragraphs 11, 14, and 12 of the Settlement, as described below. All common Restoration actions will require future, separate project-specific planning studies and NEPA and/or CEQA documentation analyzing the effects of implementation, and, dependent upon an effects determination, a request for consultation. The following actions described are based on initial engineering concepts and information from the Fishery Management Plan (Appendix E of the Draft PEIS/R). These descriptions are subject to change as additional action-specific information is developed.

Common Restoration actions

Common Restoration actions include actions stipulated in Paragraphs 11 and 14 of the Settlement, as well as additional structural or channel improvements that may further enhance the success of achieving the Restoration Goal under Paragraph 12 of the Settlement.

Common Restoration actions include modifications to the channel and flow control structures, including levees and other portions of the Lower San Joaquin Flood Control Project. As part of any modifications that could affect operation of the Lower San Joaquin Flood Control Project, the lead agencies will conduct a study to determine needed conveyance modifications, including modifications to levees and other related hydraulic features, to maintain existing levels of flood protection. Channel and facility modifications will be designed to not adversely affect flood conveyance capacity or functionality of existing channels and facilities.

Common Restoration actions are potential physical actions to achieve the Restoration Goal, and which will be implemented within the Restoration Area. Various types of Common Restoration actions will be implemented within the Restoration Area, and these actions will be implemented under different parts of the Settlement. These include actions to modify Reach 4B1 to convey at least 475 cfs of Interim and Restoration flows. Modifications in the Eastside and Mariposa bypasses to convey Interim and Restoration flows in excess of flows routed through Reach 4B1 are described as part of the Common Restoration actions.

Paragraph 11(a). Common Restoration actions stipulated in Paragraph 11 of the Settlement include channel modifications to be completed in two phases. Phase 1 actions are the 10 actions stipulated in Paragraph 11(a) of the Settlement that are considered the highest priority channel improvements. The Settlement stipulates that those actions be completed by December 31, 2013.

Two potential actions require subsequent decisions to determine their necessity:

- **Paragraphs 11(a)(1) and 11(a)(2) – Construct Mendota Pool Bypass and Modify Reach 2B**. Paragraph 11(a)(1) of the Settlement stipulates the creation of a bypass channel around the Mendota Pool to convey at least 4,500 cfs from Reach 2B downstream to Reach 3. Paragraph 11(a)(2) of the Settlement stipulates modifications in channel capacity, and incorporation of new floodplain habitat and related riparian habitat, to convey at least 4,500 cfs between the Chowchilla Bypass Bifurcation Structure and new Mendota Pool Bypass. Because the functions of these channels are related, they are described together in this section:

    a. **Construct Mendota Pool Bypass** – Constructing Mendota Pool Bypass includes building a bypass around the Mendota Pool to convey at least 4,500 cfs from Reach 2B to Reach 3 downstream from Mendota Dam. Riparian habitat in the Mendota Pool Bypass is expected to be similar to new floodplain habitat in Reach 2B. Constructing the Mendota Pool Bypass also includes constructing a bifurcation structure in Reach 2B to convey at least 4,500 cfs to the bypass. The bifurcation structure will include a fish screen or other positive fish barrier to direct fish into the bypass channel and minimize or avoid fish passage from Reach 2B to the Mendota Pool. Additionally, the Mendota Pool Bypass will include one or more grade control structures to control bedform and create stable and suitable habitat conditions for fish in the vicinity.

    b. **Modify Reach 2B to convey at least 4,500 cfs** – Modifying Reach 2B to convey at least 4,500 cfs includes expanding the capacity of the reach to convey at least 4,500 cfs, with integrated floodplain habitat. New levees will be constructed, potentially along either or both sides of Reach 2B, to create an average floodplain width of between 500 feet and 3,700 feet, an associated levee system width of between 700 feet and 3,900 feet, and levee heights of an average 4 feet to 5 feet, depending on the level of floodplain habitat modifications incorporated. Specific levee alignments and modifications will be determined through a separate, project-specific study that will consider a variety of factors, including, but not limited to, fisheries and other environmental requirements, flood risk reduction, land uses, subsurface conditions, topography, and the condition of existing levees. Because of uncertainty regarding the life history behavior of introduced salmon, modifications to Reach 2B may or may not emphasize floodplain habitat for rearing juvenile Chinook salmon, and any modifications will be determined from results of subsequent site-specific studies.

        San Mateo Road, which crosses the river in Reach 2B, may cause backwater effects and downstream scour, and may act as a barrier to upstream Chinook salmon migration during low flows. Project-specific technical studies of this crossing will identify the type of modifications that may be necessary for flow and fish passage.

Depending on the final, constructed channel capacity of Reach 2B above the new Mendota Pool Bypass Bifurcation Structure, simultaneous release of 4,500 cfs Restoration Flows to the Mendota Pool Bypass and delivery of San Joaquin River flows to the Mendota Pool may not be possible. Similarly, because Reach 3 is anticipated to have a long-term capacity of 4,500 cfs, simultaneous release of 4,500 cfs of Restoration Flows to the Mendota Pool Bypass and conveyance of flood flows from the James Bypass will not be possible. The Secretary will prioritize flood control and water right delivery obligations over meeting flow targets for Restoration Flows, reducing Restoration Flows in these reaches if channel capacity is insufficient to meet conveyance of flood control or water delivery obligations in combination with Restoration Flows.

- **Paragraph 11(a)(3) –Modify Reach 4B1 to Convey at Least 475 cfs**. Paragraph 11(a)(3) of the Settlement stipulates required channel modifications in Reach 4B to convey at least 475 cfs. The San Joaquin Restoration Settlement Act (Section 10009(f)(2)(B)) requires that a determination be made on increasing the channel capacity to 4,500 cfs before undertaking any "substantial construction" in Reach 4B1. Therefore, modifications in Reach 4B1 to convey at least 475 cfs will not include substantial construction, such as changes to existing levees. Based on preliminary studies, these modifications are anticipated to include removing in-channel vegetation and modifying road crossings. Modifying Reach 4B1 may also include modifications to establish a low-flow channel to support fish migration, ranging from a single low-flow channel to a series of terraced channels to convey incremental low flows of up to 475 cfs or more.

  Five road crossings are present in Reach 4B1 that may require modification. These include crossings at Washington Road, Turner Island Road, and three unnamed crossings. It is not known if modifications will be required at the Washington Road or Turner Island Road crossings to allow conveyance of at least 475 cfs or to provide fish passage. Currently, all three unnamed crossings are configured with culverts that may be insufficient to convey 475 cfs and/or may present barriers to upstream migrating adult salmon. Modifying Reach 4B1 likely will include modifying these road crossings to provide flow capacity and fish passage, as necessary. These modifications may include installing culverts, restructuring the channel, and/or constructing clear span bridges. Project specific technical studies of these crossings will identify the type of modifications that will be necessary for flow and fish passage, and such modifications will be evaluated in subsequent environmental documents, as needed.

- **Paragraph 11(a)(4) – Modify San Joaquin River Headgate Structure to Enable Fish Passage and Flow Routing**. Paragraph 11(a)(4) stipulates modifications to the San Joaquin River Headgate Structure to enable fish passage and flow routing of between 500 and 4,500 cfs into Reach 4B1. The Settlement stipulates that these modifications are to be made consistent with the decision on whether to route 4,500 cfs through Reach 4B1. These modifications will be made sufficient to convey at least 475 cfs into Reach 4B1. Modifications to this structure are closely related to Restoration actions in Reach 4B1, described previously.

- **Paragraph 11(a)(5) – Modify Sand Slough Control Structure to Enable Fish Passage.** The Sand Slough Control Structure may present a barrier to upstream migration of adult salmon. Modifications to the Sand Slough Control Structure for fish passage are stipulated in Paragraph 11(a)(5) of the Settlement. Modifying the Sand Slough Control Structure may include modifying the structure for fish passage pursuant to Paragraph 11(a)(5) of the Settlement by removing the existing flume and replacing it with a gated structure. These modifications will be designed to not adversely affect flood conveyance capacity or functionality of the existing structure. Modifications to this structure are closely related to Restoration actions in Reach 4B1, described previously.

- **Paragraphs 11(a)(6) and 11(a)(7) – Screen Arroyo Canal and Provide Fish Passage at Sack Dam.** Paragraph 11(a)(6) of the Settlement stipulates required modifications to Arroyo Canal to prevent entrainment of anadromous fish. Paragraph 11(a)(7) of the Settlement stipulates required modifications at Sack Dam for fish passage. Sack Dam currently provides the water surface elevation necessary for diversion at Arroyo Canal. Diversions to Arroyo Canal range from zero to 800 cfs, and typically do not exceed 600 cfs. This action may include installing a screening device at the entrance to Arroyo Canal. The screen may be designed to operate with flows of up to 4,500 cfs in the river, while conveying flows into Arroyo Canal, to prevent entrainment of juvenile Chinook salmon in the canal. It also could include constructing a fish ladder at Sack Dam to allow flow and fish passage for a range of flows of up to 4,500 cfs.

- **Paragraphs 11(a)(8) and 11(a)(9) – Modify Eastside and Mariposa Bypasses to Enable Fish Passage.** Paragraph 11(a)(8) of the Settlement stipulates modifications to structures in the Eastside and Mariposa bypass channels to provide anadromous fish passage on an interim basis until completion of Phase 2 actions described below. Paragraph 11(a)(9) of the Settlement stipulates modifications to the Eastside and Mariposa bypass channels to establish a suitable lowflow channel if the Secretary, in consultation with the RA, determines that such modifications are necessary to support anadromous fish migration through these channels. Because the function of the structures and the channel in these bypasses are related, modifications are described together in this section.

    a. **Modify structures in Eastside and Mariposa bypasses to provide fish passage** – The Mariposa Bypass Bifurcation Structure at the head of the Mariposa Bypass will be modified to allow fish passage for a range of flows of up to 4,500 cfs. The Mariposa Bypass Drop Structure, at the downstream end of the Mariposa Bypass, presents a barrier to fish passage. Modifying the Mariposa Bypass Drop Structure may include constructing a fish ladder to allow upstream and downstream fish passage for a range of flows of up to 4,500 cfs, or removing the structure. Modifications will allow the structure to handle 8,500 cfs while not increasing upstream water levels from existing conditions.

    b. **Modify Eastside and Mariposa bypasses to provide fish passage under low flows** – The Eastside and Mariposa bypass channels were constructed with flat

channel bottoms. Although scouring flows since construction have incised low-flow channels in some areas of the bypasses, some areas may not be passable by fish during low flows. The range of potential actions to provide fish passage under low flows may include modifications to develop a single low-flow channel to convey at least 475 cfs, and/or a series of terraced channels to convey incremental low flows of up to 475 cfs.

- **Paragraph 11(a)(10) – Enable Deployment of Seasonal Barriers at Mud and Salt Sloughs.** Potential false migration pathways to migrating adult salmon may be present in Mud and Salt sloughs, tributaries to Reach 5. Modifications to Mud and Salt sloughs will be made to enable the deployment of barriers on these sloughs to prevent adult salmon from entering these potentially false migration pathways, consistent with Paragraph 11(a)(10) of the settlement.

Paragraph 11(b). The four Phase 2 actions stipulated in Paragraph 11(b) of the Settlement also are considered high priority channel improvements that may contribute to achieving the Restoration Goal. The Settlement stipulates that these projects be completed by December 31, 2016, in a manner that does not delay completion of Phase 1 actions. Subsequent decisions will be required to determine whether the Phase 2 actions are necessary and, if so, to define the scope of the actions. Phase 2 actions not included in the Proposed Action involve modifications to enable routing of up to 4,500 cfs into and through Reach 4B1 [Paragraphs 11(b)(1) and 11(b)(4)]. The following Phase 2 actions included in the Proposed Action are described in the following sections:

- **Paragraph 11(b)(2) – Modify Chowchilla Bypass Bifurcation Structure.** Paragraph 11(b)(2) of the Settlement stipulates modifications to the Chowchilla Bypass Bifurcation Structure to provide fish passage and prevent fish entrainment, if such modifications are necessary to achieve the Restoration Goal, as determined by the Secretary in consultation with the RA, and with the concurrence of NMFS and the Service. Gaps between the gates of the Chowchilla Bypass Bifurcation Structure allow some flow to leak through the gates, when closed. The gaps may be large enough to allow fish to pass through into the bypass, leaving them stranded. To address potential stranding of fish in the Chowchilla Bypass, modifying the Chowchilla Bypass Bifurcation Structure may include a range of potential actions, such as monitoring and management of fish stranding under flood conditions, ranges of flows for screening the Chowchilla Bypass to prevent fish from entering the bypass, retrofitting the gates to prevent fish from passing through gaps between the closed gates, and/or adding an additional, screened gate to the structure. Modifications to this structure will be designed to not adversely affect the flood conveyance capacity or functionality of the existing structure.

- **Paragraph 11(b)(3) – Fill or Isolate Gravel Pits.** Paragraph 11(b)(3) of the Settlement stipulates filling and/or isolating the highest priority gravel pits in Reach 1, based on their relative potential for reducing juvenile salmon mortality, as determined by the Secretary in consultation with the RA. Gravel pits may contribute to juvenile salmon mortality through effects on water temperatures and by providing habitat for predator species such

as largemouth bass (*Micropterus salmoides*). A project-specific technical study will be necessary to identify the highest priority pits; therefore, this action has a potential range of actions, including filling or isolating some or all pits, and regrading the floodplain to fill pits. Modifications to gravel pits may be implemented in connection with other potential Restoration actions.

Paragraph 12. Paragraph 12 states that additional structural or channel improvements that may further enhance the success of achieving the Restoration Goal may be recommended by the RA to the Secretary for implementation. Potential actions under Paragraph 12 are not assigned a date for completion under the Settlement. Site-specific studies and subsequent implementation of future potential Restoration actions under Paragraph 12 of the Settlement will be based on information collected through monitoring, as identified in the Physical Monitoring and Management Plan (Appendix D of the Draft PEIS/R [Reclamation and DWR 2011]), during implementation of Settlement-stipulated actions. Potential Restoration actions pursuant to Paragraph 12 that could be identified by the RA at a future date range from no modifications, to the level of implementation described below. Appendix E, "Fisheries Management Plan," of the Draft PEIS/R (Reclamation and DWR 2011) addresses specific actions, including those described below, and evaluates their merits (including uncertainty) in an action routing process. The following potential Paragraph 12 actions included in the Proposed Action are described in the following sections:

- **Enhance Spawning Gravel.** Adult Chinook salmon require suitable gravels, refuge, water depths, and velocities for spawning. The range of potential actions to provide for adequate spawning gravel will include, if necessary, or augmenting and/or conditioning gravel at existing riffles, or establishing new riffles, as described below:

    a. **Augment existing riffles** – This action consists of augmenting existing riffles with clean, spawning-sized gravel at some, or a portion of, the existing spawning areas in Reach 1.

    b. **Establish new riffles** – This action consists of establishing new riffles to increase and enhance salmonid spawning habitat in Reach 1.

- **Reduce Potential for Redd Superimposition and/or Hybridization.** Spring-run Chinook salmon typically spawn earlier than fall-run Chinook salmon, creating the potential for redd superimposition, when fall-run Chinook salmon construct their redds on top of spring-run redds and dislodge or smother some of the spring-run eggs. In addition, a small percentage of fall-run Chinook salmon may spawn at the same time and location as spring-run Chinook salmon; therefore, potential may exist for hybridization.

Hybridization may result in fish with migratory behaviors that are not viable in the San Joaquin River basin. The range of potential actions to reduce redd superimposition or hybridization includes the deployment of seasonal barriers, and separate runs of salmon, and also may include potential operation and monitoring of the Hills Ferry Barrier on a seasonal basis. The ability to control run timing via additional structures to separate spring- and fall-

run Chinook salmon, as well as the ability to manage flows to prevent run overlap and hybridization, is unknown. The location and design of barriers has yet to be determined; evaluation of spawning and holding habitat availability and quality will guide this decision and is underway.

- **Supplement Salmon Population.** Additional actions not identified in the Settlement may be necessary to supplement the naturally reproducing population, particularly in the years immediately following salmon reintroduction. The Settlement does not stipulate any actions to supplement the salmon population; therefore, a subsequent decision will be required before any such actions could be implemented. The range of potential actions to supplement the Chinook salmon population will include, if necessary, the release of hatchery fish to supplement the natural population for monitoring and management of the natural population, and/or release of hatchery fish to supplement the natural population when natural production is low as may occur during relatively dry water year types (e.g., Settlement Critical-Low, Critical-High year types) when spring flows are either absent or inadequate to sustain Chinook salmon populations. Subsequent studies will identify stock for hatchery populations and, as described for salmon reintroduction according to Paragraph 14 of the Settlement, stock for hatchery populations will likely come from a Central Valley population with behavioral and life history characteristics compatible with anticipated conditions on the San Joaquin River. As previously discussed, hatchery populations alone will not fulfill the Restoration Goal, and naturally reproduced individuals will need to be distinguished from hatchery-produced individuals.

- **Modify Floodplain and Side-Channel Habitat.** This includes additional actions not identified in the Settlement that may be necessary to modify the floodplain or side-channel habitat beyond Reaches 2B or 4B1. Such modifications could benefit migrating Chinook salmon and other native fishes by providing additional food sources, increased protection from stranding, and other habitat improvements. The range of potential actions to modify floodplain and side-channel habitat outside Reaches 2B and 4B1 will include, if necessary; creating and/or enhancing additional floodplain habitat; creating, enhancing, or isolating side channels; and/or reducing sand transport.

    a. **Create and/or enhance additional floodplain habitat** – This action may consist of creating and/or enhancing additional floodplain habitat outside Reaches 2B and 4B1 (floodplain modifications in these reaches are described previously as actions stipulated by the Settlement) to provide flexibility to accommodate variable life history strategies of future salmon populations, which may vary spatially and temporally. Modifications will be confined within the existing levee alignment. This action also includes floodplain modifications in reaches other than Reach 2B and Reach 4B1 to provide for the maintenance of floodplain vegetation at a level to be determined based on the associated contribution toward achieving the Restoration Goal.

    b. **Create, enhance, or isolate side channels** – Side channels occur throughout the river, some with perennial connectivity to the main channel, but most with

connectivity only under high-flow conditions, as previously described. In some cases, side channels could provide suitable rearing habitat for juvenile Chinook salmon, or serve as holding habitat for adult Chinook salmon, while other side channels may foster conditions that are unsuitable for salmon, including high temperatures and habitat for predatory species such as largemouth bass. Side channel enhancement activities may include dredging or widening side channels. Side-channel isolation may consist of filling a channel or constructing berms across the mouth of a channel. Additionally, new side channels may be created to provide additional habitat, if necessary. Creation of new side channels may be accomplished through dredging new channels or removing sediment blocking the connectivity of former channels.

c. **Reduce sand transport** – The quantity of sand in Reaches 1 and 2 may present challenges to channel stability, and the function of hydraulic control structures and road crossings. This sand has the potential to be mobilized by Interim and Restoration flows to lower reaches that do not currently have sediment transport issues. This action will control sources of sand in Reach 1 and the transport of sand in the downstream river and bypass reaches, in order to prevent hydraulic and facilities challenges arising from channel migration, aggradation, or degradation. Control of sediment at tributary sources may include settling basins, bed stabilization (such as floodplain widening to reduce sediment transport potential) in areas where the bed is degrading, and bank stabilization in meandering reaches. In channel sand may be removed by dredging or by constructing instream sediment detention basins, or sand traps, to capture sand. Accumulated sand will need to be removed periodically to maintain the functionality of sand traps. As previously described, portions of Reach 1 may benefit from modifications to gravel quantities and mobility.

- **Enhance In-Channel Habitat**. This action may incorporate channel modifications to provide salmon habitat, including instream cover such as undercut banks, overhanging vegetation, boulders, large wood, surface turbulence, and features providing refuge from predation. The range of potential actions to enhance in-channel habitat may include augmenting existing, and/or creating new, in-channel habitat. Enhancing in-channel habitat may also include modifications such as constructing pools, or dredging and grading to develop or maintain more desirable water temperatures. Deep pools remain cooler during warm summer months, and provide refuge from avian and terrestrial predators. Additional assessments will be conducted to identify the potential for groundwater influence on instream temperatures, and whether water temperature requirements may be met under different conditions and/or different timing of flow releases from Friant Dam.

- **Reduce Potential for Aquatic Predation of Juvenile Salmonids.** Additional actions not identified in the Settlement could be necessary to prevent aquatic predation of juvenile salmonids. Additional potential actions to prevent aquatic predation of juvenile salmonids may include capturing and removing nonnative aquatic predatory species.

- **Reduce Potential for Fish Entrainment.** Unscreened and poorly screened small diversions can entrain migrating juvenile fish. The Settlement does not stipulate actions to screen these small diversions. The range of potential actions to prevent fish entrainment at small diversions may include not screening diversions, or installing or modifying screens at small diversions throughout the Restoration Area. The number of screens installed will be determined through future studies, but could be based on the relative impact of individual diversions to fisheries.

- **Enable Fish Passage.** Obstacles to the successful migration of anadromous fish in the Restoration Area may include hydraulic conditions at road crossings; small San Joaquin River tributaries with unsuitable habitat for salmon spawning and rearing; hydraulic conditions in the river channel at low flow; and other physical features within the river. The range of potential actions to enable fish passage beyond the actions stipulated in the Settlement would, if necessary, establishing and/or maintaining low-flow channels, trapping and hauling juveniles and adults, modifying road crossings, and installing barriers to prevent straying.

    a. **Establish and/or maintain low-flow channels** – This action consists of modifying the channel in reaches outside the Eastside and Mariposa bypasses and Reach 4B1 to provide passage during low-flow conditions, as needed. As described above for the action to enhance in-channel habitat through reducing sand transport, establishing and/or maintaining low-flow channels could include bed stabilization in areas where the bed is degrading, and bank stabilization in meandering reaches. Removing in-channel sand to maintain a low-flow channel may be accomplished by dredging or grading. The range of actions described above for modifications to floodplain and side-channel habitat, such as managing invasive vegetation and creating and/or enhancing additional floodplain habitat, may also be applied to establish and/or maintain low-flow channels through bed and bank stabilization.

    b. **Trap and haul** – It may be necessary to implement a trap-and-haul operation to sustain Chinook salmon within the Restoration Area if protective features are not completed in time to reintroduce fish, if it is determined that entrainment and physical barriers exist that could hinder reintroducing and managing fish populations, or if river connectivity is disrupted (i.e., in critical water years). Implementing a trap-and-haul program would consist of trapping Chinook salmon smolts in upper reaches (likely Reach 1 or Reach 2) to transport smolts to downstream reaches for release, thereby avoiding temporary undesirable habitat conditions (such as high temperatures or discontinuous flow). In addition, implementing a trap-and-haul program would include trapping adult salmon in downstream reaches and transporting them to Reach 1, thereby avoiding temporary undesirable habitat conditions in intermediate reaches. Several trapping mechanisms may be applied under this action, including passive and active capture techniques. Trapped fish would be transported under controlled conditions by truck to suitable habitat areas and released. Trap-and-haul

operations are not envisioned as a long-term management strategy, and may only be used as a temporary measure if protective features are not completed in time to reintroduce fish, if it is determined that entrainment and physical barriers exist that would hinder reintroducing and managing fish populations, or if river connectivity is disrupted.

c. **Modify road crossings** – This action consists of modifying road crossings to provide for fish passage in Reach 1. These crossings may be modified through installing culverts, restructuring the channel, and/or constructing clear span bridges to enable the crossings to be used during Restoration Flows while providing fish passage. Modifications to road crossings in Reaches 2B and 4B that pose potential barriers to fish passage are discussed as possible actions to address Settlement Paragraphs 11(a)(2) and 11(a)(3), respectively.

d. **Install barriers to prevent straying** – This action may consist of installing temporary or permanent barriers in the channel to prevent fish from straying into tributaries, flood bypasses, or river reaches with undesirable habitat conditions. The primary categories of permanent fish barrier structures are picket barriers, velocity barriers, and vertical drop structures. Tributaries, flood bypasses, and river reaches that would be screened under this action depend in part on the flow-routing decision made consistent with Paragraph 11(b)(1) of the Settlement, but may include, but may not be limited to, Dry and Cottonwood creeks in Reach 1; Deadman's, Bear, and Owens creeks in the Eastside Bypass; the downstream end of Eastside Bypass Reach 2; the downstream end of Reach 4B; and the downstream end of Eastside Bypass Reach 3.

- **Modify Flood Flow Control Structures.** Additional actions not identified in the Settlement may be necessary to improve fish passage and flow conveyance at flood control structures within the Restoration Area, including modifications to the Chowchilla Bypass Bifurcation Structure, Sand Slough Control Structure, and structures in the Eastside and Mariposa bypasses. The range of potential additional actions to modify flood control structures will include, if necessary, retrofitting gates at flood control structures to prevent flow loss, and/or installing grade control structures to address backwater effects of the Chowchilla Bypass Bifurcation Structure.

  a. **Retrofit gates** – As described for the range of actions to address Paragraph 11(b)(2) of the Settlement, gaps between the gates of the Chowchilla Bypass Bifurcation Structure allow some flow to leak through the gates, when closed. Because of the current function of the structure in routing relatively large flows under flood conditions, the small amount of water lost through closed gates at this and other gated flood control structures in the system (including the San Joaquin River Headgates, Eastside Bypass Bifurcation Structure, and Mariposa Bypass Bifurcation Structure) is not a concern under current operations. However, during the release of Interim and Restoration flows, the loss of water from the main stem San Joaquin River through the closed gates to the bypass channel could inhibit

success of the Restoration Goal by reducing the amount of water flowing to downstream reaches. If necessary, potential actions to address flow loss will include retrofitting the gates on the existing flood control structures to prevent flow from passing the closed gates.

b. **Install grade control structures** – Local backwater effects caused by the Chowchilla Bypass Bifurcation Structure may be contributing to the accumulation of sand in Reach 2A (McBain and Trush 2002), which could mobilize under Interim or Restoration flows, thereby compromising the ability to convey Interim or Restoration flows through downstream reaches. The Settlement does not stipulate any actions to modify the Chowchilla Bypass Bifurcation Structure to address flow loss or sediment deposition due to backwater effects; therefore, a subsequent decision will be required before any such actions would be implemented. If necessary, potential actions to address sediment deposition upstream from the Chowchilla Bypass Bifurcation Structure will include installing grade control structures to prevent sediment mobilization.

Paragraph 14. **Chinook Salmon Reintroduction.** Paragraph 14 of the Settlement addresses reintroducing spring-run and fall-run Chinook salmon between Friant Dam and the confluence of the San Joaquin River with the Merced River by December 31, 2012. Paragraph 14 states that, in the event that competition, inadequate spatial or temporal segregation, or other factors beyond the control of the Settling Parties make restoring spring-run and fall-run Chinook salmon infeasible, "…then priority shall be given to restoring self-sustaining populations of wild spring-run Chinook salmon." The Secretary, through the Service, and in consultation with the Secretary of Commerce, CDFG, and the RA, will reintroduce spring- and fall-run Chinook salmon "at the earliest practical date after commencement of sufficient flows and the issuance of necessary permits." To help facilitate reintroduction of salmon, a management plan has been developed to help guide implementation of Restoration actions. The range of potential actions for Chinook salmon reintroduction spans from reintroducing only spring-run Chinook salmon to reintroducing both spring-run and fall-run Chinook salmon, and could include one or more life stages. Broodstocks will be identified through subsequent studies, and because of the uncertainty associated with broodstock life history, behavioral, and adaptive traits of potential broodstock in the Central Valley, it is most likely that broodstocks will be acquired from a variety of watersheds.

The range of potential actions for Chinook salmon reintroduction may also include the use of the existing San Joaquin Hatchery, another existing hatchery, or a new conservation facility. Although the design and capacity of a new conservation facility will be determined in part by management plans, a new conservation facility may potentially provide for initial reintroduction of spring-run Chinook salmon, fall-run Chinook salmon, and/or other native fish. Hatchery or conservation facility use will supplement the wild population until the fish population is reestablished, at which time the conservation facility will be phased out of use. The Restoration Goal and Paragraph 14 of the Settlement emphasize the need to restore self-sustaining fish populations. Therefore, hatchery or conservation facility populations alone will not fulfill the

Restoration Goal, and naturally reproduced individuals will need to be distinguished from hatchery- or conservation facility-produced individuals.

The Service submitted a 10(a)(1)(A) Enhancement of Species Permit application (permit application) to NMFS on September 29, 2010, for the collection of spring-run Chinook salmon for the SJRRP, consistent with the schedule identified in the Settlement. The permit application was revised based on public comments and a final permit application was submitted to the NMFS in December 2011. The NMFS completed a draft Environmental Assessment for the permit application in April 2012, obtained public input in May 2012, and is currently reviewing comments received. Specific environmental effects related to the reintroduction of spring-run Chinook salmon will be addressed in the subsequent project-specific NEPA analysis, and possibly CEQA analysis, in compliance with an associated Special Rule authorizing the experimental population. Any potential impacts from the introduction of the experimental population of spring-run Chinook salmon will be addressed at that time. If it is determined that the introduction of the experimental population of spring-run Chinook salmon will have an adverse effect to a Federally-listed species then the action will be appended to this PBO if appropriate.

- **Release of hatchery salmon to supplement the natural population for monitoring and management** – This action consists of releasing study fish to support evaluations during implementation and monitoring, as needed.

- **Release of hatchery salmon to supplement the natural population for survival –** This action could consist of using hatchery fish to supplement the population in years when monitoring determines that the natural production of juvenile salmon is too low.

- **The Physical Monitoring and Management Plan** – This includes monitoring activities and responses that are described in the Monitoring and management guidelines related to biological conditions for fish are separately described in Appendix E, "Fisheries Management Plan," of the Draft PEIS/R 2011.

Physical Monitoring and Management Plan

The Physical Monitoring and Management Plan (The Physical Monitoring and Management Plan is included in the Draft PEIS/R [Reclamation and DWR 2011]) provides guidelines for observing and adjusting to changes in physical conditions within the Restoration Area. The Physical Monitoring and Management Plan consists of five component plans, addressing interrelated physical conditions including flow, groundwater seepage, channel capacity, propagation of native vegetation, and suitability of spawning gravel. Each component plan identifies objectives for the physical conditions within the Restoration Area, and provides guidelines for the monitoring and management of those conditions. The plans identify potential actions that could be taken to further enhance the achievement of the objectives. The component plans include immediate actions that may be taken at a project level, and also include long-term actions that are at a program level. Finally, this Plan includes a description of monitoring activities which apply to one or more of the component plans. The five component plans include the following:

Flow – To ensure compliance with the hydrograph releases in Exhibit B of the Settlement and any other applicable flow releases (e.g., Buffer Flows)

Seepage – Reduce, redirect, or redivert Interim or Restoration flows to reduce flow in downstream reaches. This may include the following:

- **Reductions of Interim or Restoration Flow Releases at Friant Dam** – Reductions in the release rate from Friant Dam to limit the potential for seepage impacts to occur downstream. Planned thresholds for reductions at Friant will need to consider travel time and associated response delays.

- **Redirection of Interim or Restoration Flows at Chowchilla Bypass Bifurcation Structure** – Directing flow into the bypass system at the Chowchilla Bypass Bifurcation Structure will reduce flow in Reach 2B and downstream reaches.

- **Delivery of Interim or Restoration Flows at Mendota Pool** – Delivery of water to Mendota Pool will reduce flows in Reach 3 and downstream reaches.

- **Delivery of Interim or Restoration Flows at Arroyo Canal** – When San Luis Canal Company is not diverting at the full capacity of Arroyo Canal, additional water diversions to the canal will reduce flows in Reach 4A and downstream reaches.

- **Redirection of Interim or Restoration Flows at Sand Slough Control Structure** – During the first year of Interim Flows, water will not be directed into Reach 4B. In subsequent years, diverting flows into the bypass system at Sand Slough Control Structure will reduce flows in Reach 4B.

Channel capacity – Removal of vegetation and debris that will cause Interim or Restoration flows to exceed channel capacity. Vegetation will be removed by mechanical or chemical means. Nonnative plant removal will receive priority over removal of native species (see *Invasive Vegetation Monitoring and Management Biological Assessment*, Reclamation 2012).

Native vegetation – Establish and maintain native riparian habitat.

Spawning gravel – Modify releases from Friant Dam to adjust flows to flush or mobilize based on monitoring reports and recommendations of spawning gravel conditions (including potential modifications to Restoration Flow Guidelines to improve the success of Flushing Flows).

Long-Term Management Actions - Potential long-term responses have been identified to contribute to attaining the flow, groundwater seepage, channel capacity, native vegetation, and spawning gravel management objectives.

Potential long-term responses to attain the management objectives may require additional environmental documentation, and include the following:

- **Flow** – Paragraph 13(c) of the Settlement provides for adjusting releases due to unexpected seepage losses. These actions may include, but will not be limited to acquisition and release of purchased water from willing sellers.

- **Seepage –** Long-term management actions for seepage may include, but will not be limited to, purchasing easements and/or compensation for seepage effects, construction of slurry walls to reduce seepage flows, construction of seepage berms to protect against levee failure, construction of drainage interceptor ditches to protect affected lands, or installation of tile drains on affected lands.

- **Channel capacity –** Long-term management actions for channel capacity may include, but will not be limited to, providing a larger floodplain between levees through the acquisition of land and construction of setback levees, regrading of land between levees, construction of sediment traps, construction of grade control structures, or channel grading.

- **Native vegetation –** Long-term management actions for native vegetation may include, but will not be limited to, active plantings and irrigation of desired native plants.

- **Spawning gravel –** Long-term management actions for spawning gravel may include, but will not be limited to, gravel augmentation and/or conditioning at existing riffles, establishment of new riffles, engineered channel modifications, construction of sediment traps on the San Joaquin River or tributaries with high sediment loads, or construction of grade control structures.

Recapture Interim and Restoration Flows – The Proposed Action includes actions to recapture Interim and Restoration flows within the Restoration Area and/or the Delta using existing facilities. Actions to recapture Interim and Restoration flows in the Restoration Area, and Interim and Restoration flows in the Delta, are constrained by established regulatory and institutional conditions, with no new facility construction, facility modifications, or agreements. Recaptured water available for transfer to Friant Division long term contractors will range from zero to 556 TAF.

Actions to recapture Interim and Restoration flows under the Proposed Action include the following:

- Recapture of Interim and Restoration flows in the Restoration Area at Mendota Pool and the East Bear Creek Unit of the San Luis National Wildlife Refuge (NWR) (East Bear Creek Unit)

- Recapture of Interim and Restoration flows in the Delta at existing CVP/SWP facilities

- The Proposed Action includes recirculating up to the full amount of recaptured Interim and Restoration flows to the Friant Division to minimize water supply impacts to Friant Division long-term contractors caused by Interim and Restoration flows.

- Paragraph 16(a) of the Settlement stipulates that the Secretary, in consultation with the Settling Parties, is to develop and implement "…a plan for recirculation, recapture, reuse, exchange, or transfer of the Interim and Restoration flows for the purpose of reducing or avoiding impacts to water deliveries to all of the Friant Division long-term contractors caused by the Interim Flows and Restoration Flows," provided "…that any recirculation, recapture, reuse, exchange or transfer of the Interim and Restoration flows shall have no adverse impact on the Restoration Goal, downstream water quality or fisheries." The quantity of water available for recirculation to the Friant Division long-term contractors will be up to the amount of water recaptured at existing facilities. Water recaptured and recirculated to the Friant Division in this manner could require exchange agreements between Reclamation, DWR, Friant Division long-term contractors, and other south-of-Delta CVP/SWP contractors. The details of the plan for recirculation will be determined through future negotiations between affected parties.

- Recirculation will be subject to available capacity within CVP/SWP storage and conveyance facilities. Available capacity is capacity that is left after satisfying all statutory and contractual obligations to existing water service or supply contracts, exchange contracts, settlement contracts, transfers, or other agreements involving or intended to benefit CVP/SWP contractors served water through CVP/SWP facilities. No additional agreements will be required to recapture Interim and Restoration flows in the Restoration Area. Paragraph 13(i) of the Settlement provides guidance on how to manage any unreleased Restoration Flows starting in 2014, including but not limited to options to enter into mutually acceptable agreements with Friant Division long-term contractors or third parties, "…to (A) bank, store, or exchange such water for future use to supplement future Restoration Flows, or (B) transfer or sell such water and deposit the proceeds of such transfer or sale into the Restoration Fund created by this Settlement."

- Paragraph 13(i) also specifies the release of the water from Friant Dam during times of the year other than those specified in the applicable hydrograph.

Reoperate Friant Dam and Downstream Flow Control Structures

Reoperation of Friant Dam and downstream control structures includes the release of Interim and Restoration flows, reoperation of downstream flow control structures, and establishing a RWA, as stipulated by the Settlement and described in the following sections.

Release of Interim and Restoration Flows. The release of Interim and Restoration flows from Friant Dam has been analyzed at a project level. Operations at Friant Dam will change to release Interim and Restoration flows to the San Joaquin River according to the six flow schedules specified in Exhibit B of the Settlement. The flow schedules are specified in Exhibit B of the Settlement according to six year types: Critical-Low, Critical-High, Dry, Normal-Dry, Normal-Wet, and Wet. The total annual unimpaired runoff at Friant Dam for a water year is the index by which the water year type is determined (based on water years 1922 through 2004).

Paragraph 15 of the Settlement describes an interim research program that includes the release of Interim Flows beginning in October 2009 and continuing until full Restoration Flows begin (anticipated January 1, 2014), as constrained by then-existing channel capacities. The Restoration Administrator (RA), in consultation with the Technical Advisory Committee, the Secretary of the Interior (Secretary), and other appropriate Federal, State, and local agencies, will develop and recommend to the Secretary implementation of a program of Interim Flows. The Interim Flows are intended to allow collection of relevant data concerning flows, temperatures, fish needs, seepage losses, and water recirculation, recapture, and reuse.

The Settlement states that the "Secretary shall commence the Restoration Flows at the earliest possible date…provided, however, that the full Restoration Flows shall commence on a date certain no later than January 1, 2014. If, for any reason, full Restoration Flows are not released in any year beginning January 1, 2014, the Secretary, in consultation with the RA, shall release as much of the Restoration Flows as possible in light of then-existing channel capacity and without delaying completion of the Phase 1 improvements."

According to Paragraph 13(i), the RA is responsible for recommending to the Secretary the date for commencing full Restoration Flows in consideration of the completion of Phase 1 improvements (as subsequently described for common Restoration actions). Several Federal and State actions, including channel capacity modifications, are necessary before full Restoration Flows are released. The release of full Restoration Flows is subject to the provisions for flexible flow periods, buffer flows, and purchased water, as well as the provisions described above for Interim Flows. The release and conveyance of full Restoration Flows is defined as meeting Restoration Flow targets at six locations in the Restoration Area identified in Exhibit B of the Settlement, and in consultation with the RA, the six locations are as follows:

- **Friant Dam** – At or immediately below Friant Dam; designated as "Friant Release" in Exhibit B of the Settlement.

- **Head of Reach 2A** – At Gravelly Ford; designated as "Reach 2" in Exhibit B of the Settlement.
- **Head of Reach 3** – Immediately below the Chowchilla Bypass Bifurcation Structure; designated as "Reach 3" in Exhibit B of the Settlement.

- **Head of Reach 4A** – Downstream from Sack Dam; designated as "Reach 4" in Exhibit B of the Settlement.

- **Head of Reach 4B** – Designated as "Reach 5" in Exhibit B of the Settlement.

- **Confluence of Merced River** – Designated as "Confluence" in Exhibit B of the Settlement.

Flow targets vary by Restoration Year Type, and range from zero cfs (in Reaches 3, 4A, and 4B in Critical-Low years) to 4,055 cfs (at the confluence of the Merced River in Wet and Normal-Wet years). In some years, the flow targets could be met partially or entirely by flood control releases or by local runoff or return flows.

If, for any reason, full Restoration Flows are not released in any year, beginning January 1, 2014, the Secretary, in consultation with the RA, will bank, store, exchange, transfer, or sell the water through mutually acceptable agreements with Friant Division long-term contractors or third parties (with proceeds deposited into the Restoration Fund established under the Settlement), or release the water from Friant Dam during times of the year other than those specified in the applicable flow schedule. In addition, the Settlement includes provisions for the release of pulse flows in Normal-Wet and Wet Years to perform several geomorphic functions such as flushing spawning gravels, unless the Secretary, in consultation with the RA, determines that such flows are not needed. Flushing flows will be accomplished with a quantity of water based on an average flow of 4,000 cfs from April 16 to 30, and include a peak release as close to 8,000 cfs as possible for several hours, within the constraints of channel capacity. The Settlement also includes the following provisions to modify Restoration Flows, in consideration of recommendations to be made by the RA: application of flexible flow periods, as described in Exhibit B of the Settlement; the use of a 10 percent buffer flow to help meet the Restoration Goal; and the release of acquired water for unanticipated river seepage losses for Restoration Flows.

Minimize Flood Risk from Interim and Restoration Flows. Throughout Settlement implementation, the maximum downstream extent and rate of Interim and Restoration flows to be released will be limited to then-existing channel capacities. As channel or structure modifications are completed with additional environmental compliance, maximum Interim Flow releases will be correspondingly increased in accordance with then-existing channel capacities and with the release schedule.

Then-existing channel capacities within the Restoration Area correspond to flows that will not significantly increase flood risk from Interim and Restoration flows in the Restoration Area. The action to release Interim and Restoration flows includes measures that will achieve the following objectives: (1) commit Reclamation to implementing actions that will meet performance standards that minimize increases in flood risk as a result of Interim or Restoration flows; (2) limit the release and conveyance of Interim and Restoration flows to those flows that will remain in-channel until adequate data are available to apply the performance standards and until the performance standards are satisfied; and (3) enable the Settlement to be implemented in coordination with other ongoing and future actions outside of the Settlement that could address channel capacity issues identified in the Settlement or through the SJRRP or other programs. Implementation of measures that achieve these objectives will allow for the safe release and conveyance of Interim and Restoration flows throughout the duration of Settlement implementation:

- **Establish a Channel Capacity Advisory Group and Determine and Update Estimates of Then-Existing Channel Capacities as Needed –** The establishment and administration of a Channel Capacity Advisory Group to provide independent review of estimated then-existing channel capacities, monitoring results, and management actions to address vegetation and sediment transport within the system as identified by Reclamation.

- **Maintain Interim and Restoration Flows Below Estimates of Then-Existing Channel Capacities –** The process for limiting Interim and Restoration flows to reduce the risk of levee failure due to under-seepage, through-seepage, and associated levee stability issues to less-than-significant levels.

Only limited data are currently available on San Joaquin River channel capacities and levee conditions. The levee design criteria developed by U.S. Army Corps of Engineers (USACE) and presented in *Design and Construction of Levees Engineering and Design Manual* (Manual No. 1110-2-1913) will be applied throughout the Restoration Area to identify the Interim or Restoration flows that will not cause the "Factor of Safety" to be reduced below 1.4.

Until adequate data are available to determine the Factor of Safety, Reclamation will limit the release of Interim and Restoration flows to those which will remain in-channel. In-channel flows are flows that maintain a water surface elevation at or below the elevation of the landside levee toe (i.e., the base of the levee). Observation of levee erosion, seepage, boils, impaired emergency levee access, or other indications of increased flood risk identified through ongoing monitoring at potential erosion sites will trigger immediate reductions in Interim and Restoration flows at the site. Such observations will supersede channel capacity estimates, and Interim and Restoration flows will be reduced in areas where these conditions occur. Potential immediate responses to reduce, redirect, or redivert Interim or Restoration flows to reduce flow in downstream reaches are described below.

Establish a Channel Capacity Advisory Group, and Determine and Update Estimates of Channel Capacities as Needed. In coordination with DWR and prior to releasing Interim Flows in Water Year 2013, Reclamation will establish a Channel Capacity Advisory Group to provide independent review of then-existing channel capacities estimated by Reclamation in accordance with standard USACE levee performance criteria.

Maintain Interim and Restoration Flows at or Below Estimated Then-Existing Channel Capacities. Until sufficient data are available to determine the Factor of Safety, Reclamation will limit initial Interim and Restoration flow releases to those flows which will remain in-channel, as described below. When sufficient data are available to determine the Factor of Safety, Reclamation will limit the release of Interim and Restoration Flows to those flows which will maintain standard USACE levee performance criteria (i.e., a Factor of Safety of at least 1.4) at all times.

Closely Monitor Erosion and Perform Maintenance and/or Reduce Interim and Restoration Flows as Necessary to Avoid Erosion-Related Impacts. The commitment by Reclamation to implement erosion monitoring and management, including monitoring potential erosion sites, reducing Interim and Restoration flows as necessary, and reporting ongoing results of monitoring and management actions to the Channel Capacity Advisory Group.

Reoperate Downstream Flow Control Structures. In addition to management of Interim and Restoration flows at Friant Dam, the Proposed Action includes modifications to the existing operation of the Lower San Joaquin River Flood Control Project (flood management system) and the Hills Ferry Barrier, but without physical, construction related activities to modify the channels, to address the following:

- **Reoperate Chowchilla Bypass Bifurcation Structure to convey Restoration Flows into Reach 2B –** Currently, the structure is operated as part of the flood management system to direct flood flows and irrigation deliveries based on several factors, including flows in Reach 2A, the capacity of Reach 2B, flows from the Kings River system via Fresno Slough, and water demands in the Mendota Pool. Modifications to the operating criteria will incorporate the routing of Interim and Restoration flows during non-flood operations to meet flow targets in Reach 2B. If flood releases are made from Friant Dam in excess of the Interim or Restoration flows called for, Interim and Restoration flows will not be released and standard operation of the flood management system will apply. Interim and Restoration flows will have a lower priority for downstream channel capacity than flood flows or irrigation deliveries to the San Joaquin River Exchange Contractors.

- **Reoperate San Joaquin River Headgate Structure to convey Restoration Flows into Reach 4B1 –** The current conveyance capacity of Reach 4B1 is unknown and could be as low as zero in some locations. Currently, the San Joaquin River Headgate Structure, part of the flood management system, is maintained in a closed position whereby all flows in the river are routed into the bypass system. The San Joaquin River Headgate Structure will be operated to release Interim and Restoration flows to Reach 4B1 after completion of both modifications to Reach 4B1 (to provide for increased capacity) and to the headgate structure are completed. These releases will be limited by then existing channel capacity in Reach 4B1.

- **Reoperate the Eastside and Mariposa bypass bifurcation structures to convey Interim and Restoration flows into Reach 4B2 –** Modifications to the operating criteria for these structures, which are part of the flood management system, will include the routing of Interim and Restoration flows to the Eastside or Mariposa bypasses. Interim and Restoration flows will have a lower priority for downstream channel capacity than flood flows.

- **Operate and monitor Hills Ferry Barrier –** The main purpose of the Hills Ferry Barrier is to redirect upstream-migrating adult fall-run Chinook salmon into suitable spawning habitat in the Merced River and prevent migration into the main stem San Joaquin River upstream, where conditions are currently considered unsuitable for Chinook salmon and

Central Valley steelhead. The peak adult Central Valley steelhead migration period overlaps with that of fall-run Chinook salmon, with most migration occurring between October and December in the San Joaquin River basin though may continue into February, based on the migration timing of steelhead in the Sacramento River system. Because their body type is similar to salmon, Central Valley steelhead are expected to be redirected by the barrier in a similarly effective manner. Operations and maintenance of the Hills Ferry Barrier will continue for the purpose of redirecting Chinook salmon and, incidentally, Central Valley steelhead until sufficient habitat and channel improvements to support salmonids are complete, and Reclamation will continue to implement and adapt the *Central Valley Steelhead (Oncorhynchus mykiss) Monitoring Plan for the San Joaquin River Restoration Program* (Steelhead Monitoring Plan; PBA Appendix C), in coordination with NMFS. Under the Steelhead Monitoring Plan, the presence of steelhead upstream from Hills Ferry Barrier is monitored. If steelhead are observed, they will be captured and relocated downstream from the Merced River confluence. The Steelhead Monitoring Plan applies to Interim and Restoration flows but will not be implemented in flood flow conditions.

Establishing a Recovered Water Account

The RWA and managing Friant Dam to make water supplies available to Friant Division long-term contractors at a pre-established rate.

Related Projects

Federal Energy Regulatory Commission Ruling on Tuolumne River (Project No 2299-065)

The 1995 New Don Pedro Settlement Agreement contains instream flow requirements on the Tuolumne River for the anadromous fishery downstream from the project (Federal Energy Regulatory Commission (FERC) 1995). The NMFS, the Service, and CDFG (collectively, the "Fish Agencies"), as well as several non-governmental organizations, have sought to modify the requirements to provide flow and related conditions they believe are necessary to protect threatened Central Valley steelhead and their designated critical habitat and essential fish habitat for Chinook salmon pursuant to the Magnuson-Stevens Fishery Conservation and Management Act. The recommendations are being considered by FERC and no decision has been made at this time. The FERC ruling could result in increased flow releases from Don Pedro Reservoir that would increase flows in the San Joaquin River downstream from its confluence with Tuolumne River, and thus could affect flow conditions within the San Joaquin River during implementation of the Proposed Action. In such an event, Reclamation will work with the Fish Agencies to evaluate resulting changes in flows to ensure that listed species are not adversely affected by the Proposed Action.

Specific flow conditions that are being addressed and could change as a result of a FERC decision include:

• Spawning flow – October 1 to March 31
• Attraction pulse flows – Fall
• Outmigration flows – Spring
• Oversummering flow – June 1 through September 30

The November 20, 2009, Final Report of the Presiding Judge on Interim Measures recommends additional studies to determine the effects of increased stream flow releases and other modifications of operations on the viability of fall-run Chinook salmon and steelhead populations in the lower Tuolumne River (FERC 2009).

Hills Ferry Barrier

As described in the WY 2010 Final EA/IS and the Supplemental WY 2011 Final EA, the Hills Ferry Barrier is a resistance weir consisting of panels aligned perpendicular to the flow of the river with evenly spaced pipes that allow water, small fish, and particles to pass but prevent larger fish such as adult Chinook salmon from passing upstream. The barrier's main purpose is to redirect upstream-migrating adult fall-run Chinook salmon into suitable spawning habitat in the Merced River and impede migration into the mainstem San Joaquin River upstream, where conditions are currently unsuitable for Chinook salmon. The barrier has been operated by CDFG on the San Joaquin River since 1992. The SJRRP is conducting an evaluation of the Hills Ferry Barrier to assess the effectiveness of the barrier in blocking the upstream passage of Chinook salmon and steelhead into the San Joaquin River.

Proposed Conservation Measures:

Conservation Strategy

As part of Settlement implementation, a comprehensive strategy for the conservation of listed and sensitive species and habitats has been prepared, and will be implemented in coordination with the Service, NMFS, and CDFG. 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- and program-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, or are insufficient to avoid adverse effects to listed species through loss of habitat, then further consultation actions and mitigation measures will 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 Proposed Action includes this Conservation Strategy for wetland and riparian ecosystems of the Restoration Area.

The Conservation Strategy consists of management actions that will result in a net benefit for riparian and wetland habitats in the Restoration Area, to avoid reducing the long-term viability of sensitive species. The goals of the strategy are described below:

- **Conserve riparian vegetation and waters of the United States, including wetlands** – It is anticipated that implementing the Settlement will result in a net increase in the acreage of riparian and wetland vegetation in the Restoration Area. However, several program actions may disturb or eliminate riparian vegetation or waters of the United States (including wetlands). If impacts to waters of the United States (including wetlands), navigable waters, or the Federal levee system cannot be avoided, a USACE Section 404, Section 408, and/or Section 10 permit and Central Valley Regional Water Quality Control Board (RWQCB) Section 401 water quality certification will be obtained. Increased acreage of wetlands resulting from Interim and Restoration flows may be considered a means of replacing, restoring, or enhancing wetlands. However, the acreage, location, and methods of replacing, restoring, or enhancing wetlands will be determined during these permitting processes.

- **Control and manage invasive species** – Because of their adverse effects on aquatic and riparian ecosystems, the spread of invasive plant species as a result of release of Interim and Restoration flows will be controlled and managed. For each invasive plant species with known infestations, thresholds for management responses and specific management responses will be established and implemented, including species-specific control methods.

- **Conserve special-status species** – A number of special-status species will benefit from restoring and sustaining riparian and wetland habitat, and controlling invasive species. However, during the initiation of Interim and Restoration flows, and the construction of related actions, a variety of special-status species of upland, wetland, and riparian habitats may be adversely affected. Therefore, this strategy includes measures to prevent or reduce impacts that could result from loss of habitat within project footprints or from impacts on adjacent habitat or species. In addition, this strategy includes coordination with appropriate regulatory agencies to provide mitigation or compensation to minimize effects when actions will result in a net loss of habitat or other substantial adverse effects, if the implementation of avoidance and minimization measures is infeasible or impractical.

<u>Conservation Measures for Biological Resources That May Be Affected by Settlement Actions</u>

The following conservation measures can also be found in the PBA, Table 3-4.

Conservation plans (**CP**)

CP-1: Remain consistent with approved conservation plans – Program Level

a) Facility siting and construction activities will be conducted in a manner consistent with the goals and strategies of adopted habitat conservation plans, natural community conservation plans, or other approved local, regional, or State habitat conservation plans to the extent feasible. Coordination shall occur with the Service and/or CDFG, as appropriate.

CP-2: Compensate effects consistent with approved conservation plans – Program Level

a) The project proponent shall compensate effects consistent with applicable conservation plans and implement all applicable measures required by the plans.

Invasive Plants (INV)

INV-1: Implement the Invasive Vegetation Monitoring and Management Plan (IVMMP) – Project and Program Level

a) Reclamation and the project lead agencies will implement the IVMMP for the SJRRP (Appendix L of the Draft PEIS/R [Reclamation and DWR 2011]; and the *Invasive Vegetation Monitoring and Management Biological Assessment*, Reclamation 2012), which includes measures to monitor, control, and where possible eradicate, invasive plant infestations during flow releases and construction activities.
b) The implementation of the IVMMP will include monitoring procedures, thresholds for management responses, success criteria, and adaptive management measures for controlling invasive plant species.

c) The control of invasive weeds and other recommended actions in the IVMMP will be consistent with recommendation in the Fish and Wildlife Coordination Act Report (Appendix F of the Draft PEIS/R [Reclamation and DWR 2011]).

Delta smelt (**DS**)

DS-1: Avoid and minimize effects to species – Program Level

a) All in-water work within delta smelt habitat, as defined by most recent Service guidance, shall be confined to a seasonal work window of August 1 - November 30, when delta smelt are least likely to be present. Because this species does not regulate its movements strictly within this time frame, modifications to the work windows may be approved by the Service before project implementation, based on information from the various in-Delta monitoring programs.

b) If activities occur within delta smelt habitat, measures will be taken to maintain or increase shading of suitable shallow water habitat. The project will also avoid areas deemed suitable for delta smelt habitat that have established aquatic vegetation or have not been previously disturbed.

Valley elderberry longhorn beetle (**VELB**)

VELB-1: Avoid and minimize effects to species – Project and Program Level

a) 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.

b) If elderberry shrubs are found on or adjacent to the construction project site, a 100-foot-wide avoidance buffer – measured from the dripline of the plant – will be established around all 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.

VELB -2: Compensate for temporary or permanent loss of habitat – Project and Program Level

a) If impacts to elderberry shrubs are unavoidable, the project proponent will consult with the Service to determine appropriate compensation ratios. Compensatory mitigation measures will be consistent with the *Conservation Guidelines for Valley Elderberry Longhorn Beetle* (USFWS 1996), or current guidance.

b) 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 as approved by the Service.

c) 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.

Central California tiger salamander Distinct Population Segment (CTS)

CTS-1: Avoid and minimize effects to species – Program Level

a) If potential central California tiger salamander habitat or individuals are anticipated within the project area, within 1 year before project construction activities, a qualified biologist shall identify and map potential central California tiger salamander habitat (areas within 1.3 miles of known or potential central California tiger salamander breeding habitat) within the project footprint. One week before ground-disturbing activities, a qualified biologist will survey for and flag the presence of ground squirrel and gopher burrow complexes. Where burrow complexes are present, a 250-foot-wide buffer shall be placed to avoid and minimize disturbance to the species.

b) Facility construction and other ground-disturbing activities shall be sited to avoid areas of known central California tiger salamander habitat and avoidance buffers.

c) To eliminate an attraction to predators of the central California tiger salamander, all food-related trash items such as wrappers, cans, bottles, and food scraps, must be disposed of in closed containers and removed at least once every day from the entire project site.

d) Before and during construction activities, construction exclusion fencing will be installed just outside the work limit or around vernal pools where central California tiger salamander may occur. This fencing shall be maintained throughout construction and will be removed at the conclusion of ground-disturbing activities. No vehicles will be allowed beyond the exclusion fencing. A Service- and CDFG-approved biological monitor shall be present on site, during intervals recommended by the Service and CDFG, to inspect the fencing.

e) The biological monitor will be on site each day during any wetland restoration or construction, and during initial site grading or development of sites where central California tiger salamanders have been found.

f) Before the start of work each day, the biological monitor will check for animals under any equipment to be used that day, such as vehicles or stockpiles of items such as pipes. If central California tiger salamanders are present, they will be allowed to leave on their own, before the initiation of construction activities for the day. To prevent inadvertent entrapment of central California tiger salamanders during construction, all excavated steep walled holes or trenches more than 1 foot deep shall be covered, by plywood or similar materials, at the close of each working day or provided with one or more escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled, they must be thoroughly inspected for trapped animals.

g) Plastic monofilament netting (erosion control matting) or similar material shall not be used at the project site because central California tiger salamanders may become entangled or trapped. Acceptable substitutes include coconut coir matting or tackified hydroseeding compounds.

h) All ground-disturbing work shall occur during daylight hours. Clearing and grading will be conducted between April 15 and October 15, in coordination with the Service and CDFG, and depending on the level of rainfall and site conditions.

i) Revegetation of project areas temporarily disturbed by construction activities will be conducted with locally occurring native plants.

CTS-2: Compensate for temporary or permanent loss of habitat – Program Level

a) If central California tiger salamander habitat within 1.3 miles of known or potential central California tiger salamander breeding habitat will be affected by the SJRRP, the project proponent will develop and implement a compensatory mitigation plan in coordination with the Service and CDFG, as appropriate. Unavoidable effects will be compensated through a combination of creation, preservation, and restoration of habitat or purchase of credits at a mitigation bank approved by the regulatory agencies.

b) 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 and developed as part of the Service and/or CDFG coordination and consultation process. The plan will include information on responsible parties for long-term management, holders of conservation easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations. Any impacts that result in a compensation purchase will require an endowment for land management in perpetuity before any project groundbreaking activities.

Blunt-nosed leopard lizard (**BNLL**)

BNLL-1: Avoid and minimize effects to species – Project and Program Level

a) 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 Service and CDFG, 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 the Service and CDFG and implemented before ground disturbing activities.

BNLL-2: Compensate for temporary or permanent loss of habitat or species – Program Level

a) Compensation for impacts to the species, if needed, will be determined in coordination with the Service and CDFG as appropriate.

Giant garter snake (**GGS**)

GGS-1: Avoid and minimize loss of habitat for giant garter snake – Program Level

a) If giant garter snake habitat is anticipated to be present within the project area, preconstruction surveys will be completed by a qualified biologist approved by the Service and CDFG within a 24-hour period before any ground disturbance of potential giant garter snake habitat. If construction 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 construction activities. Avoidance of suitable giant garter snake habitat, as defined by the Service (USFWS 1993) and CDFG will occur by demarcating and maintaining a 300-foot-wide buffer around these areas.

b) For projects within potential giant garter snake habitat, all activity involving disturbance of potential giant garter snake habitat will be restricted to the period between May 1 and October 1, the active season for giant garter snakes. The construction site shall be re-inspected if a lapse in construction activity of 2 weeks or greater has occurred.

c) Clearing will be confined to the minimal area necessary to facilitate construction activities. Giant garter snake habitat within or adjacent to the project site will be flagged, staked, or fenced and designated as an Environmentally Sensitive Area. No activity shall occur within this area, and Service-approved worker awareness training and biological 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.

d) 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 Service and/or CDFG guidance.

e) If a giant garter snake is found during construction activities, the Service, CDFG, 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 accord. The monitor will remain in the area for the remainder of the work day to ensure the snake is not harmed. To the extent possible, escape routes for

giant garter snake should be determined in advance of construction. If a giant garter snake does not leave on its own within 1 working day, the Service and CDFG will be consulted.

f) All construction-related excavations 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 – Program Level

a) Temporarily affected giant garter snake aquatic habitat will be restored in accordance with criteria listed in the Service *Mitigation Criteria for Restoration and/or Replacement of Giant Garter Snake Habitat* (Appendix A to Programmatic Formal Consultation for USACE 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 1997a]), or the most current criteria from the Service or CDFG.

b) Permanent loss of giant garter snake habitat will be compensated at a ratio and in a manner consulted on with the Service and CDFG. 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.

Fresno kangaroo rat (**FKR**)

FKR-1: Avoid and minimize effects to species – Program Level

a) Preconstruction surveys will be conducted by a qualified biologist per Service and CDFG 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 the Service and CDFG. Transects shall be used to identify the presence of kangaroo rat burrows. When burrows are found within 100 feet of the proposed project footprint, focused live trapping surveys shall be conducted by a

qualified and permitted biologist, following a methodology approved in advance by the Service and CDFG. Additional conservation measures may be developed pending the results of surveys, and in consultation with the Service and CDFG.

b) Construction activities shall be conducted when they are least likely to affect the species (i.e., after the normal breeding season). This timing shall be coordinated with the Service and CDFG.

FKR-2: Avoid disturbance of designated critical habitat – Program Level

a) Facility construction and modification and other restoration projects shall be sited to avoid primary constituent elements of designated critical habitat for Fresno kangaroo rat

FKR-3: Compensate for temporary or permanent loss of habitat or species – Program Level

a) Compensation for impacts to the species, if needed, will be determined in coordination with CDFG and the Service, as appropriate

San Joaquin kit fox (**SJKF**)

SJKF-1: Avoid and minimize effects to species – Program Level

a) A qualified biologist will conduct preconstruction surveys no less than 14 days and no more than 30 days before the commencement of activities to identify potential dens more than 5 inches in diameter. The project proponent shall implement the Service's (1999) *Standardized Recommendations for Protection of San Joaquin Kit Fox Prior to or During Ground Disturbance*. The project proponent will notify the Service and CDFG in writing of the results of the preconstruction survey within 30 days after these activities are completed; however, if a natal or pupping den is found within the survey area, the notification procedure in "d" will be followed.

b) 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.

c) If occupied dens are present within the proposed work area, their disturbance and destruction shall be avoided. Exclusion zones will be implemented following the latest Service procedures (USFWS 1999).

d) The project proponent will notify the Service and CDFG immediately if a natal or pupping den is found in the survey area. The project proponent will present the results of preactivity den searches within 5 days after these activities are completed and before the start of construction activities in the area.

e) Construction activities shall be conducted when they are least likely to affect the species (i.e., after the normal breeding season). This timing shall be coordinated with the Service and CDFG.

SJKF-2: Compensate for loss of habitat – Program Level

a) The project proponent, in coordination with the Service and CDFG, will determine if kit fox den removal is appropriate. If unoccupied dens need to be removed, the Service-approved biologist shall remove these dens by hand-excavating them in accordance with Service procedures (USFWS 1999).

b) Additional conservation measures will be coordinated with the Service and CDFG, and may include replacing dens, installing off-site artificial dens, acquiring compensation habitat, or other options to be determined. Compensation may include dedicating conservation easements, purchasing mitigation credits, or other offsite 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.

c) The project proponent will present the results of den excavations to the Service and CDFG within 5 days after these activities are completed.

Least Bell's vireo (LBV) and Western yellow-billed cuckoo (WYBC)

LBV / WYBC -1: Avoid and minimize effects to species – Project and Program Level:

a) At sites where invasive vegetation management is scheduled April 10- August 31, Service-approved biologists will make initial visits prior to project activities to determine if suitable habitat may be present for least Bell's vireo and/or western yellow-billed cuckoo.

b) Where suitable habitat may be present, one recon-level survey per site will be conducted by Service-approved biologists adhering to guidelines documented by Haltermann et al., (May 2009) for Yellow-billed Cuckoo, and the least Bell's vireo Survey Guidelines (USFWS 2001).

c) If least Bell's vireo and/or western yellow-billed cuckoo are detected or suspected to be present, information will be collected according to the applicable guidelines and the Service will be contacted to determine next steps.

Palmate-bracted bird's beak (**PALM**)

PALM-1: Avoid and minimize effects to species – Project and Program Level

a) If palmate-bracted bird's beak is anticipated within the project area, a qualified botanist will identify and map the location of palmate-bracted bird's beak plants within the project footprint, within 1 year before the start of activities that may cause disturbance from either release of flows over 1,660 cfs or from ground-disturbing actions.

b) A minimum 500-foot-wide buffer shall be placed around occurrences of palmate-bracted bird's beak during construction activities, consistent with recommendations in the Recovery Plan for Upland Species of the San Joaquin Valley, California (USFWS 1998b). The 500-foot-wide buffer will be clearly identified in the field by staking, flagging, or fencing. Project activity will avoid buffer areas, and worker awareness training and biological monitoring will be conducted to ensure that the buffer area is not encroached on and that effects are being avoided

PALM-2: Compensate for temporary or permanent loss of occupied habitat – Project and Program Level

a) A compensatory conservation plan shall be developed in coordination with the Service and CDFG, as appropriate. The conservation plan will require the project proponent to maintain viable plant populations in the Restoration Area and will identify compensatory measures for any populations affected. The conservation plan shall include monitoring and reporting requirements for populations to be preserved in or adjacent to construction areas, or populations to be protected or enhanced off site.

b) If relocation efforts are part of the conservation plan, the plan will include details on the methods to be used: collection, relocation/transplant potential, storage, propagation, preparation of receptor site, installation, long-term protection and management, monitoring and reporting requirements, and remedial action responsibilities should the initial effort fail to meet compensation requirements.

c) 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 conservation plan and must occur with full endowment for management in perpetuity before groundbreaking. The plan will include information on responsible parties for long-term management, holders of conservation easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations.

Vernal pool habitats (**VP**) (species include: fleshy (succulent) owl's clover, Hoover's spurge, Bogg's Lake hedge-hyssop, Colusa grass, San Joaquin Valley Orcutt grass, hairy Orcutt grass, vernal pool fairy shrimp, and vernal pool tadpole shrimp).

VP-1: Avoid and Minimize effects to species – Project and Program Level

a) If vernal pools or vernal pool species are anticipated within a project area, a qualified biologist will identify and map vernal pool and seasonal wetland habitat potentially suitable for listed vernal pool plants and animals within the project footprint.

b) Facility construction and other ground-disturbing activities will be sited to avoid core areas identified in the *Vernal Pool Recovery Plan* (USFWS 2005) because conservation of these areas is a high priority for recovering listed vernal pool species.

c) If vernal pools are present, a buffer, establishing an area of avoidance, around the microwatershed or a 250-foot-wide buffer, whichever is greater, will be established before ground-disturbing activities around the perimeter of vernal pools and seasonal wetlands that provide suitable habitat for vernal pool crustaceans or vernal pool plants. This buffer will remain until ground-disturbing activities in that area are completed. Suitable habitat and buffer areas will be clearly identified in the field by staking, flagging, or fencing.

d) Appropriate fencing will be placed and maintained around all preserved vernal pool habitat buffers during ground-disturbing activities to prevent impacts from vehicles and other construction equipment.

e) Worker awareness training and on-site biological monitoring will occur during ground disturbing activities to ensure buffer areas are being maintained.

VP-2: Compensate for temporary or permanent loss of habitat – Program and Project Level

a) If activities occur within the microwatershed or 250-foot-wide buffer and vernal pool habitat will be affected by the SJRRP, the project proponent will develop and implement a compensatory mitigation plan, consistent with the USACE and EPA April 10, 2008, Final Rule for Compensatory Mitigation for Losses of Aquatic Resources (33 CFR Parts 325 and 332 and 40 CFR Part 230) and other applicable regulations and rules at the time of implementation, that will result in no net loss of acreage, function, and value of affected vernal pool habitat. Unavoidable effects will be compensated through a combination of creation, preservation, and restoration of vernal pool habitat or purchase of credits at a mitigation bank approved by the applicable regulatory agency/agencies.

b) Project effects and compensation will be determined in consideration of the *Vernal Pool Recovery Plan* goals for core areas, which call for 95 percent preservation for habitat in the Grasslands Ecological Area and Madera core areas, and 85 percent habitat preservation in the Fresno core area (USFWS 2005).

c) Appropriate compensatory ratios for loss of habitat both in and out of core areas will be determined during coordination and consultation with the Service and/or CDFG, as appropriate.

d) 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 developed as part of the Service and/or CDFG coordination and consultation process. The plan will include information on responsible parties for long-term management, holders of conservation easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations. Any impacts that result in a compensation purchase will require an endowment for land management in perpetuity before any project groundbreaking activities.

Critical Habitat (**CH**)

CH-1. Avoid and minimize effects to critical habitat – Project and Program Level

a) Designated critical habitats shall be identified and mapped.

b) All SJRRP actions will be designed to avoid adverse effects to these areas.

c) Minimization measures, such as establishing and maintaining buffers around areas of designated critical habitat, shall be implemented.

These measures address all potentially affected Federally-listed species, including candidate status. For individual project- and program-level actions under the Proposed Action, the applicable, feasible measures will guide development of action-specific conservation strategies.

Action Area
The term "action area" is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action" (50 Code of Federal Regulations [CFR] 402.02). The action area is typically larger than the area directly affected by implementation of the proposed action.

The action area for the proposed Project includes the project area and specifically covers the following (Figure 2):

- **San Joaquin River upstream from Friant Dam**. This area includes Millerton Lake and its watershed and the San Joaquin River between Kerckhoff Dam and Millerton Lake.

- **San Joaquin River from Friant Dam to the Merced River confluence (Restoration Area)**. This section of the river is referred to as the Restoration Area, and includes Reaches 1 through 5 and portions of the flood management system, and extending approximately 4,000 feet outward along either side of the San Joaquin river and the Eastside and Mariposa bypasses. The effects of actions will be constrained by the landform and structures that exist within the Restoration Area, i.e., levees, floodplains, diversions, and to the extent to which new structures such as set-back levees may be

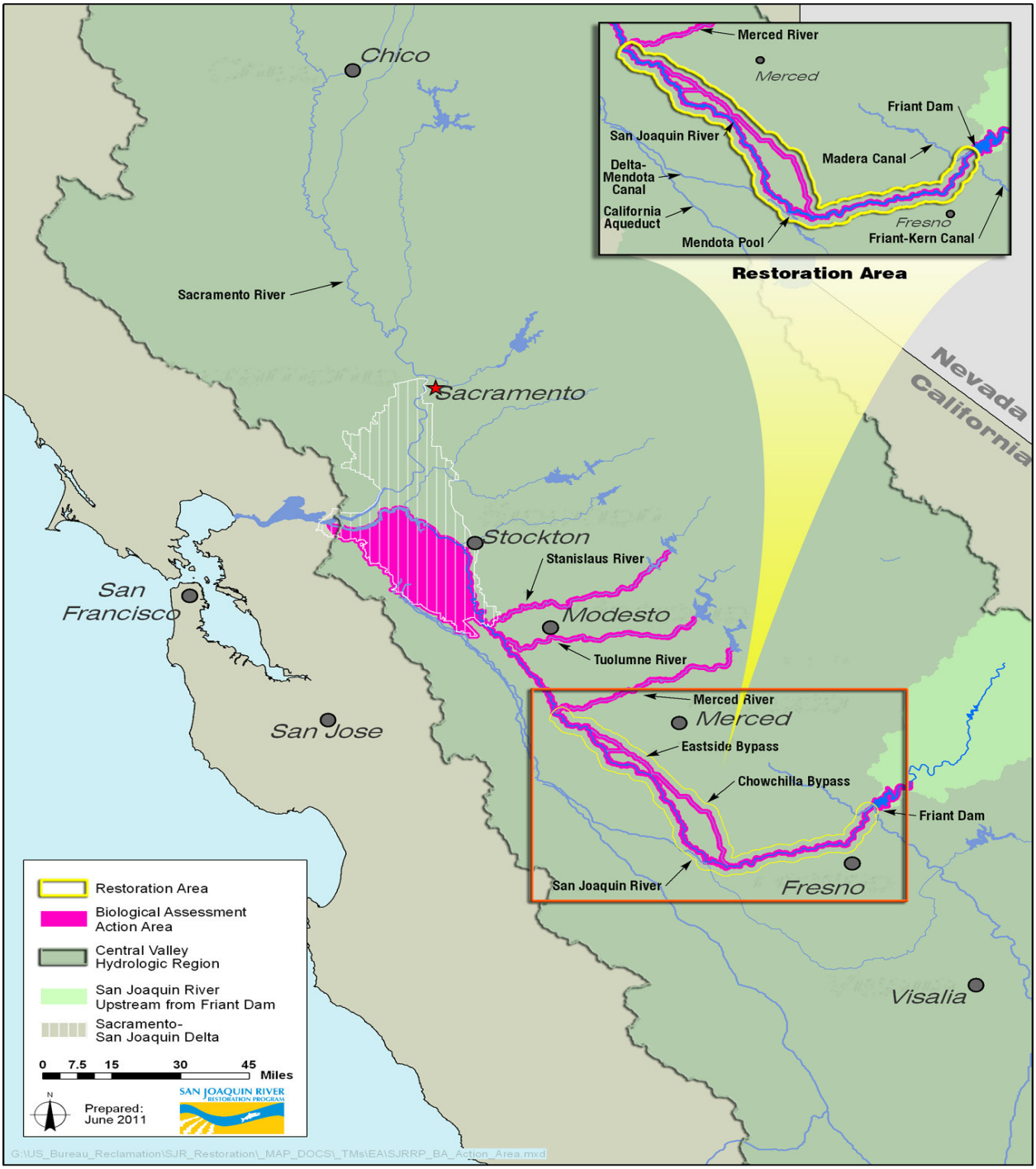

Figure 2. Action Area

constructed. All construction actions to support the Restoration Goal will be conducted in this area. Some actions to support the Water Management Goal will be conducted in the Restoration Area. The actual extent of the Action Area at any given location within the Restoration Area will be dependent upon the geological conditions of that particular location, but that it is not anticipated to ever extend beyond 4,000 feet outward from the side of the river.

- **San Joaquin River from the Merced River to the Delta, and including tributaries**. Release of Interim and Restoration flows would increase flows in this reach in most years. This reach also would support migration of Chinook salmon between the Delta and the Restoration Area. Some actions to support the Water Management Goal will be conducted in this reach.

- **South Delta**. The south Delta is defined as the San Joaquin River within the Delta west to its confluence with the Sacramento River. Release of Interim and Restoration flows would increase flows into the Delta in most years and generate changes in facilities operations within CVP/SWP operational parameters, consistent with regulatory and legal operating requirements in place at the time flows enter the Delta. Some actions to support the Water Management Goal would be conducted in the Delta.

Status of the Species

Delta Smelt

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

Blunt-nosed Leopard Lizard

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

Giant Garter Snake

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

Valley Elderberry Longhorn Beetle

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

San Joaquin Kit Fox

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

Fresno Kangaroo Rat

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

Vernal Pool Fairy Shrimp

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

Vernal Pool Tadpole Shrimp

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

Conservancy Fairy Shrimp

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

Longhorn Fairy Shrimp

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

Least Bell's Vireo

The least Bell's vireo (vireo) was listed as endangered on May 2, 1986 (51 FR 16474). Critical habitat was designated for the vireo on February 2, 1994 (59 FR 4845). A draft recovery plan was published for this species in March 1998 (USFWS 1998a). The vireo is a small migratory songbird that is olive-gray above and mostly white on its underparts, with a tinge of gray on the upper breast and yellow on the flanks (Coues 1866, USFWS 1998a). The vireo has indistinct white spectacles and two faint wing bars, with males and females having identical plumage. Male vireos are easily distinguished by their song, a rapid series of harsh, slurred notes that increase in intensity as the song progresses (Grinnell and Storer 1924, Pitelka and Koestner 1942, Barlow 1962, Beck 1996), but females rarely sing and therefore cannot generally be identified by song. Phrases of the vireo song are alternatively slurred upward and downward, and exhibit a "question-and-answer" quality (Grinnell and Storer 1924, Beck 1996). The least Bell's vireo is in the family *Vireonidae*, and is one of four subspecies of Bell's vireo (*Vireo bellii*) that have been recognized (American Ornithologists' Union [AOU] 1957).

The vireo historically occupied willow riparian habitats from Tehama County in northern California southward to northwestern Baja California, Mexico, and as far east as Owens Valley, Death Valley, and the Mojave River (Grinnell and Miller 1944, USFWS 1998a). Except for a few outlying pairs, the vireo is currently restricted to southern California south of the Tehachapi Mountains and northwestern Baja California (Wilbur 1980, Garrett and Dunn 1981, Franzreb 1989, U.S. Geological Survey [USGS] 2002). The largest current concentration of vireos is in San Diego County along the Santa Margarita River on Marine Corps Base Camp Pendleton (Griffith Wildlife Biology [GWB] 2001a, b, USGS 2002). Although originally considered to be abundant locally, regional declines of this subspecies were noticeable by the 1940s (Grinnell and Miller 1944) and the vireo was believed to have been extirpated from California's Central Valley by the early 1980s (Franzreb 1989).

Vireos are obligate riparian breeders, typically inhabiting structurally diverse woodlands along watercourses that feature dense cover within 3-6 feet of the ground and a dense, stratified canopy (Goldwasser 1981, Salata 1983, Gray and Greaves 1984, USFWS 1998a). The understory within this riparian habitat is typically dominated by mule fat (*Baccharis salicifolia*), California wild rose (*Rosa californica*), poison oak (*Toxicodendron diversiloba*), sandbar willow (*Salix hindsiana*), young individuals of other willow species (*Salix spp.*), and several perennial species (USFWS 1998a). Important canopy species include mature arroyo willows (*S. lasiolepis*) and black willows (*S. gooddingii*), and occasional cottonwoods (*Populus* spp.), western sycamore (*Platanus racemosa*), or coast live oak (*Quercus agrifolia*). Vireos primarily forage and nest in riparian habitat, but may also use adjoining upland scrub habitat (Salata 1983, Kus and Miner 1989).

Critical habitat designated for the vireo encompasses about 38,000 acres at 10 locations in Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, and San Diego Counties. Critical habitat is designated in San Diego County on the Santa Margarita, San Luis Rey, San Diego, Sweetwater, and Tijuana Rivers, and Coyote and Jamul-Dulzura Creeks. Primary constituent elements that support feeding, nesting, roosting and sheltering are essential to the conservation of the least Bell's vireo, and include riparian woodland vegetation that generally contains both canopy and shrub layers and some associated upland habitats (USFWS 1994).

Vireos primarily feed on invertebrates, especially lepidopteran larvae, within willow stands or associated riparian vegetation (Miner 1989, Brown 1993). Vireos occasionally forage in non-riparian vegetation such as coastal sage scrub, chaparral, and oak woodlands, although foraging in these other habitats usually occurs within 100 feet of the edge of riparian vegetation (Salata 1983, Gray and Greaves 1984, Kus and Miner 1989). Vireo feeding behavior largely consists of gleaning prey from leaves or woody surfaces while perched or hovering, and less frequently by capturing prey by aerial pursuit (Salata 1983, Miner 1989). Vireos concentrate most of their foraging between 0-20 feet above ground level (Salata 1983, Miner 1989).

Vireos arrive in southern California breeding areas by mid-March to early April, with males arriving before females and older birds arriving before first-year breeders (USFWS 1998a). Vireos generally remain on the breeding grounds until late September, although some post-breeding migration may begin as early as late July (USFWS 1998a). Male vireos establish and defend breeding territories through singing and physically chasing intruders (Barlow 1962, Beck 1996, USFWS 1998a). Although territories typically range in size from 0.5-7.5 acres (USFWS 1998a), no relationship appears to exist between territory size and various measures of territory quality (Newman 1992). Nest building commences a few days after pair formation, with the female selecting a nest-site location and both sexes constructing the nest (Pitelka and Koestner 1942, Barlow 1962, USFWS 1998a). Nests are typically suspended in forked branches within three feet above the ground with no clear preference for any particular plant species as the nest host (Nolan 1960, Barlow 1962, Gray and Greaves 1984, USFWS 1998a). Typically 3 or 4 eggs are laid on successive days shortly after nest construction (USFWS 1998a). The eggs are incubated by both parents for about 14 days with the young remaining in the nest for another 10-12 days (Pitelka and Koestner 1942, Nolan 1960, Barlow 1962). Each nest appears to be used only once with new nests constructed for each nesting attempt (Greaves 1987). Vireos may

attempt up to five nests within a breeding season, but are typically limited to one or two successful nests within a given breeding season (USFWS 1998a).

Multiple long-term monitoring studies indicate that approximately 59 percent of nests successfully produce fledglings, although on average only 1.8 chicks fledge per nest (USFWS 1998a). Although vireo nests appear to be more accessible to terrestrial predators because of their relatively low placement (Franzreb 1989), western scrub-jays (*Aphelocoma californica*) have been documented to account for the majority of documented depredation events (Peterson 2002, Peterson *et al.* 2004); depredation by jays and other avian predators may have selected for relatively low nest placement (Ferree 2002). Predation rates can exceed 60 percent of the vireo nests in a given area within a year (Kus 1999), but typical nest predation rates average around 30 percent (Franzreb 1989), which is comparable to predation rates for other North American passerines (Martin and Clobert 1996, Grishaver *et al.* 1998a, Ferree 2002). Nest parasitism by cowbirds is another major source of failure for vireo nests (Franzreb 1989; USFWS 1998a; Kus 1999, 2002; Griffith and Griffith 2000; Sharp 2002); nests that are parasitized are either abandoned or fledge cowbird chicks rather than vireos. It is believed that cowbirds did not historically occur within the vireo's range, and therefore vireos have not evolved adequate defenses to avoid loss of productivity due to parasitism (Franzreb 1989, Kus 2002). Parasitism of vireo nests may exceed 42 percent in some locations (Kus 1999), but extensive cowbird trapping and focused nest monitoring can substantially reduce parasitism or its effects (Franzreb 1989, USFWS 1998a, Griffith and Griffith 2000, Kus 2002).

Some individual vireos have been documented to live at least seven years (Brown 1993, USFWS 1998a), but the average lifespan for this species is substantially lower. First year survivorship has been estimated to average approximately 25 percent (Greaves and Labinger 1997, USFWS 1998a), typical for small passerines, with annual survivorship in subsequent years estimated to be approximately 47 percent (USFWS 1998a). Annual survival of females appears to be slightly lower than that for males, presumably due to the higher energetic costs of egg production by females (USFWS 1998a).

Fledgling vireos expand their dispersal distances from about 35 feet the first day to approximately 200 feet several weeks after fledging (Hensley 1950, Nolan 1960). This distance has been shown to increase to at least 1 mile prior to their first fall migration (Gray and Greaves 1984). Banding records indicate that while most first-year breeding vireos return to their natal drainage after winter migration, some disperse considerable distances to other breeding locations (Greaves and Labinger 1997, USFWS 1998a, Kus and Beck 1998a). Movement by vireos between drainages within San Diego County is not uncommon (Kus and Beck 1998a). Additionally, several vireos banded as nestlings in San Diego County have been resighted as breeding adults in Ventura County, and the opposite movement from Ventura to San Diego has also been observed (Greaves and Labinger 1997). The maximum dispersal distance currently documented is approximately 130 miles (USFWS 1998a), but this is probably an underestimate due to the limited number of vireos that are banded and insufficient resighting efforts. Although movement between sites by older birds may occur, site fidelity by vireos after the first breeding season is generally high and most dispersal between sites occurs between the time that vireos fledge from their nest and their first breeding season (USFWS 1998a).

The estimated population of vireos has increased from approximately 300 pairs in 1986 to over 1,500 pairs in 2001 (USGS 2002); this population increase is primarily attributable to the management of local cowbird populations and habitat conservation (Kus 1998a, USFWS 1998a). Populations at some locations appear to have peaked in 1998a, during the most recent El Niňo event, and limited regional population declines have occurred since that year (GWB 2001b, USGS 2002). Despite some declines, other areas continue to have increasing populations and the overall population appears to be stable or moderately increasing (Hoffman and Zembal 2002, USGS 2002, Pike *et al.* 2002).

Causes for decline of the least Bell's vireo include destruction of habitat, river channelization, water diversions, lowered water tables, gravel mining, agricultural development, and cowbird parasitism (USFWS 1986, 1994, 1998a). Vireos nesting in areas containing a high proportion of degraded habitat have lower productivity (e.g., hatching success) than those in areas of high quality riparian woodland (Pike and Hays 1992), and widespread habitat losses have fragmented most remaining populations into small, disjunct, widely dispersed subpopulations (Franzreb 1989). As much as 90 percent of the original extent of riparian woodland in California has been eliminated, and most of the remaining 10 percent is in a degraded condition (Smith 1977, Dahl 1990, Kus and Beck 1998a). Habitat fragmentation negatively affects abundance and distribution of neotropical migratory songbirds, in part by increasing incidence of nest predation and parasitism (Whitcomb *et al.* 1981, Small and Hunter 1988, Yahner and DeLong 1992, Sharp 2002, Peterson 2002). The following activities continue to destroy or degrade habitat for vireos: 1) removal of riparian vegetation; 2) thinning of riparian growth, especially near ground level; 3) removal or destruction of adjacent upland habitats used for foraging; 4) increases in human-associated or human-induced disturbances; and 5) channelization, water impoundment or extraction, and water diversion.

<u>San Joaquin (Riparian) Woodrat</u>

The riparian woodrat was federally listed as endangered on February 23, 2000 (65 FR 8881). There is no designated critical habitat for the riparian woodrat. The riparian woodrat was included in the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (Recovery Plan), issued September 30, 1998a, as a species of concern. The riparian woodrat (*Neotoma fuscipes riparia*) is a subspecies of dusky-footed woodrat, typically weighing between 200 to 400 grams, with a stocky build and a tail that is well furred and not scaled (USFWS 1998a). The riparian woodrat is a relatively large rodent with cinnamon to gray-brown fur and a white underbelly. Dusky-footed woodrats can be distinguished from other adjacent subspecies of woodrats by a generally larger size, lighter, grayer fur coloration, hind feet with a white upper surface (instead of the dusky color associated with other subspecies), and a bicolored tail that is more distinctly darker on its dorsal surface and lighter on its ventral surface than other subspecies of *Neotoma fuscipes* (USFWS 2000a). Like other woodrat species, the riparian woodrat is nocturnal and exhibits sexual dimorphism, with adult males being generally larger than adult females (Kelly *et al.* 2009). Kelly (pers. comm. 2011) has noted that riparian woodrats found at the San Joaquin River National Wildlife Refuge (SJRNWR) seem to have a darker cinnamon fur color than those at Caswell Memorial State Park (CMSP). There are two known populations in the same general area of California: one within CMSP, and the other approximately five miles

away within the SJRNWR (Kelly *et al.* 2009, Kelly *et al.* 2011). At both sites, the riparian woodrat prefers to occupy multi-storied riparian habitat, consisting of a shrubby understory, a midstory of willows or vines, and a well-developed overstory of valley oaks or other large trees (Gerber *et al.* 2003, Kelly *et al.* 2011).

It is thought that the riparian woodrat once ranged within riparian habitat from the type locality near Vernalis, California, to southern Merced County or northern Fresno County (Hooper 1938). Although the Recovery Plan preceded listing, conservation measures for the riparian woodrat had been described and included within it. Those conservation measures were based largely on the fact that the riparian woodrat was known only to exist as a single population within CMSP, information that was still thought to be accurate at the time of listing.

Since the riparian woodrat was listed, an additional population has been discovered on the SJRNWR south of the confluence of the Stanislaus and San Joaquin Rivers (Kelly *et al.* 2009, Kelly *et al.* 2011, Matocq 2002). This newly discovered population may be quite vulnerable: only 34 individuals have been captured (at different times) and no stick lodges have been observed anywhere in the refuge, although riparian woodrats are known to use downed trees, snags, or even buildings in place of constructing stick lodges (Kelly *et al.* 2011). Although the CMSP population is thought to be fairly robust, use of stick lodges appears to be relatively rare (Kelly *et al.* 2011). No focused surveys or studies have been conducted for riparian woodrats at the SJRNWR. There is no other new information about trends in spatial distribution.

At this time, based upon trapping success, it is thought that CMSP has both a higher population density and more individuals than the population at the SJRNWR (Kelly *et al.* 2009, Kelly *et al.* 2011). Abundance at CMSP is assumed to be similar to that when the species was listed, although fluctuations may have occurred in the population in response to fire and flood events. A wildfire event in 2004 and major flood events in 2006 and 2011 may have significantly reduced the riparian woodrat population at SJRNWR (Kelly *et al.* 2011).

Riparian woodrats at CMSP are most often observed in areas with a valley oak overstory and a wild grape (*Vitus californica*), willow (*Salix* sp.), blackberry (*Rubus discolor* or *Rubus ursinus*), wild rose (*Rosa californica*), or coyote bush (*Baccharis pilularis*) understory (Kelly *et al.* 2011). The best quality habitat appears to contain a significant midstory component of vines or small trees, which the riparian woodrat is thought to utilize in order to access the canopy, where they do a substantial amount of their foraging (Kelly *et al.* 2011). Other important components of riparian woodrat habitat include wooded or shrub-covered upland refugia to facilitate escape from flood events while preventing predation, and downed trees and dead snags that are used in place of stick lodges (Kelly *et al.* 2011). While specific information on the diet of the riparian woodrat is scant, most woodrat species are generalist herbivores, eating a wide variety of foliage and possibly fungi (USFWS 2000a).

Approximately 95 percent of the riparian woodrat's habitat has been lost (USFWS 2000a). Causes of habitat loss include large scale land conversions to agriculture, extensive flood control projects in the form of levees, and an altered hydrology regime in the central valley due to the construction of dams and the subsequent diversion of water for agricultural and municipal uses

(USFWS 2000a). Both known populations of riparian woodrat are on protected lands. CMSP is protected by the State of California, and the SJRNWR is protected by the federal government. Ongoing restoration of riparian vegetation at the SJRNWR is of direct benefit to the riparian woodrat, and will provide expanded habitat for the riparian woodrat once the restoration work has matured. Currently, River Partners has restored over 1700 acres of wooded riparian habitat at the SJRNWR (SJRNWR 2011).

Riparian Brush Rabbit

The riparian brush rabbit was federally listed as endangered on February 23, 2000 (65 FR 8881). There is no designated critical habitat for the riparian brush rabbit. The riparian brush rabbit is included in the *Recovery Plan for Upland Species of the San Joaquin Valley, California,* issued September 30, 1998a, as a Federal category-1 candidate-species. The riparian brush rabbit is one of eight brush rabbit subspecies found in California. The riparian brush rabbit is a small, brownish rabbit, distinguished from other brush rabbit subspecies by its relatively paled color, gray sides, darker back, and the fact that, viewed from above, its cheeks protrude outward rather than being straight or concave (Orr 1940). Riparian brush rabbits inhabit riparian areas marked by dense, bushy thickets of California wild rose (*Rosa californica)*, blackberries (*Rubus* spp.*)*, or willows (*Salix* spp.*)*. Riparian brush rabbits are dependent on this brushy cover for protection and travel via tunnels under dense vegetation to avoid predators. Thus, availability of early successional riparian habitat is crucial for the survival of this species (Hamilton *et al.* 2010).

Riparian brush rabbit breeding is restricted to the period of female receptivity, putting this species at a competitive disadvantage to the desert cottontails that breed all year (Mossman 1955; USFWS 1998b). In California, months with higher precipitation correspond with the peak breeding season for riparian brush rabbits (Hamilton 2010), but there have been few direct studies of riparian brush rabbit reproduction. Breeding occurred from February to May or June for wild riparian brush rabbits in two studies (Basey 1990; Williams 1988) and from December to May for other brush rabbits in coastal California (Mossman 1955). However, in recent captive propagation, reproduction of riparian brush rabbits was found to start earlier (December versus February) and extend much later (October versus May) than had been seen in the wild for this or other subspecies (Williams *et al.* 2008). Based on the results of geneotyping, the riparian brush rabbits in the breeding enclosures exhibited a polygynous mating system, with one male dominating mating of females but not to the exclusion of all other males. Females exhibited promiscuity in that some litters were fathered by more than one male (Williams *et al.* 2005; Williams *et al.* 2008).

Williams *et al.* (2008) found no evidence of females producing more than four litters per season, and found only a third of females have more than one or two litters. Williams *et al.* (2008) found breeding females produce an average of 5.3 young each season, much lower than the 15.2 newborns per female estimated by Chapman and Harman (1972). In addition, only 2.9 young per pregnancy survive more than a few weeks after birth (Williams *et al.* 2002; Williams *et al.* 2008).

The percentage of females reproductively active in each breeding season was not known at the time of listing, but Basey (1990) had anecdotally observed 9 of 25 female adults with no signs of reproductive activity, indicating that approximately 64 percent of females may breed. Hamilton (2010) recently estimated the proportion of breeding females is lower, approximately 46 percent, on the San Joaquin River National Wildlife Refuge (Refuge). However, the proportion of females breeding in a controlled-propagation enclosure was much greater, approximately 89 percent. It is possible that breeding in the enclosure was artificially high because rabbits were protected from predators, had ample natural food, and some veterinary care (Hamilton 2010).

Young riparian brush rabbits are born after a gestation period of 27 to 30 days, open their eyes in ten days, and are thought to remain in the nest about two weeks before venturing out; but the female may continue to suckling her young two to three weeks after their birth (Chapman and Litvaitis 2003). There is little data regarding the change in body mass and growth of wild young between birth and weaning because riparian brush rabbit nests are inaccessible under large clumps of dense blackberry vines (Williams *et al.* 2008). However, measurements on 340 captive-born young in 2002 and 2003 found mean weight-gain of approximately 6.9 grams/day (Williams *et al.* 2008).

Young riparian brush rabbits reach adult size in approximately four to five months, but were thought not to reach sexual maturity until the winter following birth (USFWS 2000a). However, Williams *et al.* (2008) found that the productivity per female in the controlled-propagation enclosures included substantial contributions from rabbits born earlier in the same breeding season, something that neither Mossman (1955) nor Chapman and Harman (1972) observed in the wild. Williams *et al.* (2008) also observed young riparian brush rabbits attained reproductive maturity when only 2.5 to 2.8 months old (77to 84 days and 550 to 600 grams) (Williams *et al.* 2008).

Adult riparian brush rabbits can live two to three years, but most riparian brush rabbits of reproductive age do not survive to the next breeding season (Chapman and Litvaitis 2003; Williams *et al.* 2008). Annual surveys on the Refuge confirm high mortality rates (Kelly and Lloyd *et al.* 2008a; Kelly and Lloyd 2009a). However, riparian brush rabbits that survive the three-week period following release tend to survive long enough to reproduce at least once (Kelly and Lloyd *et al.* 2007a; Kelly and Holt 2011). A few rabbits survive longer; recent surveys have documented survival of 1,169 days (3.2 years) at the Refuge, and 736 days (2 years) at CMSP (Kelly and Lloyd *et al.* 2008a; Kelly and Holt 2011).

Riparian brush rabbits normally confine their movements to areas of continuous cover. Williams *et al.* (2005) and Hamilton (2010) have documented translocated riparian brush rabbits dispersing with about half of each gender making long one-way movements prior to settling in a location. Maximum observed dispersal-distances were 2.5 kilometers (1.55 miles) for males and 1.1 kilometers (0.68 mile) for females (Williams *et al.* 2005). This dispersal may reflect movements of naïve rabbits exploring a novel landscape in search of suitable habitat and potential mates; or this may indicate that the release-sites were saturated, thus causing individuals to spread throughout the Refuge (Hamilton 2010).

Water-filled ditches, sloughs, creeks, and streams act as barriers to riparian brush rabbit dispersal. However, one rabbit captured in a January 2012 CMSP census was previously captured in the Refuge's East Unit (Buffington tract), on the other side of the Stanislaus River. This is the only record of a riparian brush rabbit dispersing across a major watercourse (Kelly *in litt*. 2012).

The riparian brush rabbit was first described in 1935, after it had been extirpated from much of its historical range (Orr 1940). Orr (1940) believed its historical range had been continuous along the San Joaquin river system in Stanislaus County, north into the Delta region, where, he states, the darker *S.b. macrorhinus* (the Bay-area subspecies) begins to dominate. The full historical distribution probably included the natural riparian floodplain of the lower San Joaquin River and its tributaries (the Stanislaus, Tuolumne, and Merced rivers), within San Joaquin, Stanislaus, and Merced counties (Williams 1986, 1988; Williams and Basey 1986; Larsen 1993). During historical times, this floodplain had ample brushy understory associated with riparian forests, and suitable upland areas for cover and retreat from annual floods (Larsen 1993).

In addition to the extant population at CMSP, a second extant population of riparian brush rabbit was confirmed in 1998a—in San Joaquin County on private land along Paradise Cut, a small San Joaquin River tributary in the south region of the Sacramento-San Joaquin River Delta (the South Delta) (Williams *et al.* 2000). Riparian brush rabbits occupy narrow, discontinuous patches of shrubby vegetation spread linearly over approximately 10.4 kilometers (6.5 miles) of Paradise Cut, between its confluences with Old River slough and the San Joaquin River. Subsequent surveys also found riparian brush rabbits in shrubby vegetation along the right-of-ways of two railroads that cross Paradise Cut and Tom Paine Slough. All occurrences in Paradise Cut area are on the west side of the San Joaquin River, in approximately 109 hectares (270 acre) of isolated and semi-isolated patches of shrubby vegetation. Most occupied patches are only a few meters wide between water and active agriculture or developed ground (Williams *et al.* 2000; Williams and Hamilton 2002; Williams *et al.* 2008). The riparian brush rabbit is currently found in three general locations, the South Delta, CMSP, and the Refuge.

The CMSP population has been adversely impacted by flood events and other factors, and abundance at Caswell MSP has remained very low since the 2000 listing-rule. However, the overall abundance of riparian brush rabbits has increased since the time of listing—from the discovery of the second natural population in the South Delta area of San Joaquin County, and from the reintroduction of a captive-bred population at the Refuge in Stanislaus County. The South Delta riparian brush rabbit population may consist of approximately two hundred individuals, within approximately 11 widely scattered occurrences. Currently, the Refuge population consists of approximately two occurrences, one in the West Unit (lands west of the San Joaquin River), and a second occurrence along the south bank of the Stanislaus River in the East Unit (on Buffington tract and Faith Ranch). Both Refuge occurrences are composed of captive-bred individuals and their Refuge-born offspring. The abundance of individuals in the West Unit occurrence and in the Buffington/Faith Ranch occurrence has varied since their establishments in 2002 and 2006, respectively, due to predation, flood-related mortality, fire, the release of additional captive-bred individuals, and the birth of refuge-born individuals.

Riparian brush rabbits prefer areas dominated by sandbar willow (*Salix exigua),* in addition to areas of dense blackberry, wild rose, and other tall perennial vegetation. Dense riparian vegetation, nonnative annual grassland, oak woodlands, and wetlands were used less often, even though they were available (Phillips *et al.* 2005; Hamilton 2010). Willow thickets have dense structure at ground level; which provides rabbit cover and protection from aerial and medium to large-sized terrestrial predators (Kelly *et al.* 2011). Riparian brush rabbits use a variety of riparian habitat types, and are not dependent on older or mature riparian growth with a dense tree canopy, a dense mid-story, or a layered plant-community structure (Kelly *et al.* 2011). Trees are not an essential feature for habitat; in fact, large trees can provide roosting and perching sites for aerial predators (Kelly *et al.* 2011). Habitat parameters of the South Delta metapopulation also confirm riparian brush rabbits prefer patchy, secondary successional communities to overgrown climax riparian communities (Williams *et al.* 2002).

The South Delta metapopulation inhabits various successional stages of riparian habitat, including thickets of sand bar willow, native and non-native blackberries (*Rubus* spp.)*,* wild rose, mugwort, and large patches of the non-native white topped pepperweed (*Lepidium latifolium*) (Williams and Hamilton 2002; Vincent-Williams 2004). In addition, South Delta habitat at the Oxbow Preserve supports a successional riparian forest community dominated by Fremont cottonwoods *(Populus fremontii),* Valley oaks *(Quercus lobata),* wild rose, blackberries, and annual grasses (Lloyd and Williams 2003).

Kelly *et al.* (2011) summarized five important components of riparian brush rabbit suitable-habitat. These are: (1) Large patches of dense brush composed of riparian vegetation—blackberry, wild rose, willow—or other dense shrub species; (2) Ecotonal edges of grasses and herbaceous forbs next to brushy cover; (3) Scaffolding plants (dead or alive) for blackberry and rose to grow tall enough to withstand flood events; (4) If trees are present, the overstory is open; and, (5) Vegetated high-ground areas to provide refugia during flooding.

All populations are under significant, proximate threats of extinction. The population at CMSP faces threats from random demographic events in small populations (e.g. inbreeding and loss of genetic diversity), wildfire, flooding, disease, and predation risk exacerbated by high numbers of feral cats. The South Delta population faces threats from stochastic demographic and genetic events, flooding, disease, predation, pesticide use, competition, habitat destruction, and urban edge effects. While the Refuge falls within the historic range of brush rabbits, it is not clear that available habitat reflects that historically available or needed by riparian brush rabbits (Hamilton 2010). Hamilton's (2010) population viability analysis of the new Refuge population did not present an optimistic outcome for that reintroduction of riparian brush rabbits.

Palmate-bracted Bird's-beak

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

Hairy Orcutt Grass

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

Hoover's Spurge

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

Colusa Grass

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

Greene's Tuctoria

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

San Joaquin Valley Orcutt Grass

San Joaquin Valley Orcutt grass was federally listed as threatened on March 26, 1997, it was listed by the State of California as endangered in 1979 (USFWS 1997) and is on the California Native Plant Society's List 1B. Critical habitat was first designated for the San Joaquin Valley Orcutt grass 2003, revised in 2005, with the final designation established in 2006 (USFWS 2005).

San Joaquin Valley Orcutt grass is a narrowly distributed annual of the grass family Poaceae, subfamily *Chloridoideae*, in the tribe *Orcuttieae*. San Joaquin Valley Orcutt grass was presumed to be the only member of the *Orcuttieae* tribe that was entirely endemic to the San Joaquin Valley (Stone *et al.* 1988), and is therefore commonly referred to as San Joaquin Valley Orcutt grass. In consideration of the genus, Stone also mentions that assessment-of the historical range of *Orcuttieae* species in the Central Valley is complicated by the fact that widespread agricultural development preceded study of these grasses. However, with the exception of a single population in Solano County, the historical range of San Joaquin Valley Orcutt grass believed to be the Southern Sierra Foothills Vernal Pool Region, which includes parts of Stanislaus, Merced, Madera, Fresno and Tulare Counties (Keeler-Wolf *et al.* 1998a; Service 2005c). Grasses in the tribe have pith-filled stems, lack distinct leaf sheaths and ligules, and produce a sweet-smelling exudate (Stone *et al.* 1988). San Joaquin Valley Orcutt grass typically grows in tufts comprised of several spreading to erect stems about 5 to 15 centimeters (2 to 6 inches) tall and has two distinguishing morphological features; the obvious capitate inflorescence and the middle of five lemma teeth is conspicuously elongated.

Like all plants in the *Orcuttieae* tribe, San Joaquin Valley Orcutt grass is a highly specialized C_4 plant (an evolutionary adaptation that facilitates photosynthetic productivity in arid and semi-arid climates), that is dependent on vernal pools for survival. San Joaquin Valley Orcutt grass is specifically endemic to deep vernal pools, requiring inundated soils for at least part of the year for seed germination, seed bank storage, and its juvenile aquatic growth stage (Stone *et al.* 1988). Consequently, San Joaquin Valley Orcutt grass seldom becomes established above the high water mark where Orcuttia species are competitively excluded (Keeley 1998a), and forms distinct emergent ring-patterns below the high water mark (Stebbins *et al.* 1996). Plants emerge underwater, forming a basal rosette of juvenile leaves that are maintained for roughly three

months (Keeley 1998a). As water temperatures increase, floating leaves form and remain until standing water has evaporated, at which point terrestrial leaves are formed. Flowering begins within a few days after the pool has dried and typically peaks in mid-June, but may be extended into August or September depending on growth conditions (Griggs 1980). These growth phases, as well as C_4 photosynthetic anatomy, are adaptive features that promote the dominance of San Joaquin Valley Orcutt grass in vernal pool environments for a month or more after the pools have dried (Keeley 1998a).

From phylogenetic analysis, Keeley (1998a) reported that the absence of a ligule—the membranous tooth- or hair-like projection between the leaf sheath and blade common to many grass taxa—separated *Orcuttia* and *Tuctoria* into sister groups of *Neostapfia*. *Orcuttia* species can be separated from *Tuctoria* by the presence of certain aquatic features, including the presence of floating leaves.

Rice and Emery (2003) reported that the relatively isolated character of vernal pool habitats likely restricts gene flow between species populations. Similarly, Griggs (1980) specified that gene flow among populations of San Joaquin Valley Orcutt grass is likely non-existent. Thus, fertilization is typically restricted to individuals within a given pool and out-crossing among pools is infrequent. High genetic diversity was observed among San Joaquin Valley Orcutt grass plants grown from the same seed collection source (Griggs (1980).

The flowering pattern observed among *Orcuttia* (as well as in *Tuctoria*) species may promote and maintain genetic variation among successive generation. San Joaquin Valley Orcutt grass is wind-pollinated and generally flowers from April to September (Griggs and Jain 1983; Vollmar 2002). The first two flowers on plants of these species open simultaneously and do not produce pollen until the ovaries are no longer receptive. Thus, fertilization for these flowers is solely a result of outcrossing from different plants.

San Joaquin Valley Orcutt grass is presumed to be the only member of the *Orcuttieae* tribe that is entirely endemic to the San Joaquin Valley (Stone *et al.* 1988. The historic range of *Orcuttieae* species in the Central Valley is complicated by the widespread agricultural development, which preceded study of these grasses. However, with the exception of a single putative population in Solano County, the historical range of San Joaquin Valley Orcutt grass believed to be the Southern Sierra Foothills Vernal Pool Region, which includes parts of Stanislaus, Merced, Madera, Fresno and Tulare Counties (Keeler-Wolf *et al.* 1998a; Service 2005).

Annual precipitation affects both seed production and seed germination. Vollmar (2002) reported that seed production by San Joaquin Valley Orcutt grass is largely dependent upon annual precipitation and can vary two- to three-fold among years. Population estimates are further confounded by seed germination, which requires long periods of inundation, and can vary considerably among years depending upon annual precipitation and associated water depth and duration in vernal pools. Thus, variability in annual precipitation affects the accuracy and predictability of population estimates and trends. Since listing, infrequent site visits and large inter-annual fluctuations in populations have prohibited the projection of current population trends.

There are 53 occurrences of San Joaquin Valley Orcutt grass reported in the CNDDB. Of these 53 occurrences, 17 are known to be extirpated, 3 are presumed extirpated, and 33 are presumed extant. The primary concentration of extant occurrences is discontinuously distributed across an 80-kilometer (50-mile) range from east-central Merced County to the northern boundary of Fresno County. Outside of Merced and Fresno Counties, there is a single extant occurrence in central Solano County, and one in northern Tulare County. The historical range of San Joaquin Valley Orcutt grass is reported to be from its northern extent in east-central Stanislaus County to its southern extent in northern Tulare County (CNDDB 2012). Current evidence indicates that San Joaquin Valley Orcutt grass had been extirpated from all Stanislaus County localities, and is present at only one of the two historical localities in Tulare County. Thus, with the addition of the Solano County occurrence the current range of San Joaquin Valley Orcutt grass includes portions of Solano, Merced, Madera, Fresno, and Tulare Counties.

Eastern Merced County supports the highest concentration of extant localities of San Joaquin Valley Orcutt grass (22 of 33 occurrences or 66 percent; CNDDB 2012). However, the number of individuals present may vary considerably from one locality to the next. For example, one occurrence in this area was reported to support less than 10,000 individuals in 1981, while another occurrence consisted of only a single plant in 1987 (CNDDB 2012). The Lanes Bridge area of Madera and Fresno counties supports seven (21 percent) of the presumed extant occurrences of San Joaquin Valley Orcutt grass. This is the second-highest concentration of San Joaquin Valley Orcutt grass outside of eastern Merced County. Conversely, all seven historical occurrences from Stanislaus County, as well as an additional ten occurrences from Merced (5), Madera (2), and Fresno (3) Counties have been eliminated. Three other occurrences from Merced, Madera and Tulare Counties are categorized as possibly extirpated (CNDDB 2012).

San Joaquin Valley Orcutt grass typically occurs within land forms such as remnant alluvial fans and stream terraces, as well as tabletop lava flows (Stone *et al.* 1988; Stebbins *et al.* 1995). The predominant physiographic and edaphic settings for this species include: (1) high-terrace sites with soils of the Redding and related series; (2) lower terrace sites of the San Joaquin and related series, also with an iron-silica hardpan but less strongly acid; and (3) sites with shallow, residual soils of the Pentz and related series, underlain by well-cemented tuffaceous alluvium (Ulrich and Stromberg 1962; Arkley 1962; Huntington 1971; Stephens 1982). Sawyer and Keeler-Wolf (1995) reported San Joaquin Valley Orcutt grass in Northern Claypan, Northern Hardpan, and Northern Basalt Flow vernal pool types. Research has speculated that some members of the *Orcuttieae* tribe have specific geologic affinities. Vollmar (2002) reported that San Joaquin Valley Orcutt grass populations occur on Riverbank, North Merced Gravels, and Mehrten geologic surfaces, which could relate to the tendency of these surfaces to support larger pools, noting that soil characteristics may also play a role.

Vollmar (2002) termed San Joaquin Valley Orcutt grass as a vernal pool “specialist” that has an affinity for large, deep vernal pools. Its occurrence is restricted to a narrow band of undulating topography at the base of the Sierra foothills, ranging from 30 to 755 meters (100 to 2475 feet) elevation above mean sea level (Stebbins *et al.* 1995). Stone *et al.* (1998a) reported that San Joaquin Valley Orcutt grass was found in vernal pools ranging in size from 0.14 hectares

(0.04 acre) to 4.9 hectares (12.11 acres). Most occurrences were documented in pools that were approximately one acre or greater in size (Vollmar, J., pers. comm., (2007). It has been further speculated that San Joaquin Valley Orcutt grass is associated with pools that exhibit pronounced soil surface cracking (Stebbins *et al.* 1996).

The current status of many presumed extant populations has not been reassessed, and areas of potential occurrences remain to be surveyed. Thus, reliable estimates regarding the amount and distribution of suitable habitat, such as large or deep pools that exhibit extensive periods of inundation with pronounced soil surface cracking, is currently unknown.

Habitat for the San Joaquin Valley Orcutt grass has been lost and fragmented throughout its historical range (USFWS 1997). The primary causes attributed to the reduction and the fragmentation of habitat is agricultural land conversion, urbanization, hydrologic modifications and small population size. According to Stone *et al.* (1988), all historical populations that existed in Stanislaus County had been extirpated by 1986-1987. The CNDDB, dating back to 1981, reveals no observations for Stanislaus County. Stone *et al.* (1988) noted "Habitat Eliminated" for all eight extirpations listed in his report. Vernal pool data from Holland (1978) projected that 12 historical localities had been eliminated from Madera and Fresno Counties. Therefore, it is estimated that at least 45 percent of known and projected pre-agricultural sites were eliminated before 1988. The principal cause of this pre-listing loss is widely accepted to be the elimination of habitat due to the expansion of agriculture (Stone *et al.* 1988, CNDDB 2012).

The vast majority of land on the Central Valley floor has potential for urbanization and agricultural conversion due to flat topography, and its vicinity to existing infrastructure. Twenty-four (72 percent) of the 33 extant localities of San Joaquin Valley Orcutt grass occur on private land. Twelve are currently excluded from land conversion, eight are protected by existing conservation easements through the Nature Conservancy, and four occur on State or federally administered public lands. An additional three occurrences, located on Ichord Ranch, are located on lands that have been proposed for conservation easements. The remaining 17 (56 percent) extant occurrences have potential to be adversely affected by land use conversion.

As previously described, San Joaquin Valley Orcutt grass occurs under a variety of edaphic and geologic conditions. Consequently, each habitat type exhibits various potential for land conversion. All 13 sites located on lower terrace soils were extirpated prior to listing, presumably because these soil types are relatively fertile and therefore more suitable to intensive agriculture (Stone *et al.* 1988). These occurrences include five in Stanislaus County, four in Madera County, three in Merced County, and one in Fresno County. Four other localities were also been eliminated prior to listing, due to indirect effects of agricultural conversion. These include hydrologic modifications, which likely eliminated two occurrences in Merced County and one Fresno County (Stone *et al.* 1988), and irrigated runoff which likely caused the elimination of one occurrence in Madera County (USFWS 2005).

One occurrence in Merced County, threatened by development proposed by the University of California, Merced campus, was preserved through modification of the southeast boundary of the campus prior to construction (Murray *in litt.* 2011). The habitat is now part of the proposed

Campus Vernal Pool Reserve, owned by the University of California. Additional habitat has been preserved in the Cyril Smith Trust, owned by the Nature Conservancy (UC Merced 2009).

The last known extant San Joaquin Valley Orcutt grass occurrence in Tulare County, which is located on the Stone Corral Ecological Reserve, may have been eliminated due to recent establishment of orchards and large dairies on adjacent properties (A. Ferranti, pers. comm., 2007). It is suspected that these land use changes may have affected the hydrology of the supporting vernal pool. San Joaquin Valley Orcutt grass was confirmed at the site in 2006, but was not observed in 2007. However, absence of this species during 2007 surveys may be attributable to below-normal precipitation rather than hydrologic changes (A. Ferranti, pers. comm. 2007).

Small numbers of individual San Joaquin Valley Orcutt grass plants located in Madera County are supported in a vernal pool complex owned by California Department of Transportation. These occurrences are located adjacent to State Route Highway 41, roughly 10 kilometers (6 miles) north of Fresno. This section of highway is proposed for realignment. However, current plans for highway improvements are to re-route the highway east of the vernal pool complex which supports San Joaquin Valley Orcutt grass and a multitude of other California State and federally listed species (Von Berg 2005). Thus, it is anticipated that the proposed Highway 41 expansion project may not adversely affect this San Joaquin Valley Orcutt grass occurrence.

The life cycle of San Joaquin Valley Orcutt grass is intrinsically linked to vernal pool hydrology (USFWS 2005). Seed germination, juvenile aquatic stage, reduced competition by upland and exotic species, timing of flowering, and seed production are determined by the timing and duration of the inundation period, as well as available soil moisture throughout the growing season. Thus, any changes to the hydrologic regime of the pools and/or source areas (watersheds), that effectively alter the timing, depth, or period of pool inundation will likely affect the stability of San Joaquin Valley Orcutt grass populations. Common human activities that may result in changes to the water retention capacity of soils and substrates, such as altering landscape topography through urbanization, surface compaction, land use conversion, flood control, stream channelization, gravel and aggregate mining, deep plowing, or the addition of soil amendments may significantly alter hydrologic regimes.

Alteration of hydrology from human activities have both benefited and negatively affected San Joaquin Valley Orcutt grass populations. Increases in water depth or length of pool inundation period, as it is endemic to deep water pools may benefit San Joaquin Valley Orcutt grass (Stone *et al.* 1988). Vollmar (pers. comm. 2007) observed that depth of water and the period of inundation in some vernal pools may be increased as a result of road development and associated changes in topography. Conversely, the hydrologic regime for a population within a playa pool located at the base of the spillway for Burns Creek dam in Merced County was altered such that the marginal depth and inundation period is marginal for supporting the continued existence of this occurrence. Stone *et al.* (1988) reported another population located adjacent to a railroad grade in Merced County that was extirpated due to hydrologic alterations, which resulted from changes in culvert size under the grade.

The effects of grazing on vernal pool plants are largely site-specific, and dependent upon a variety of factors including frequency, intensity, timing, duration of grazing, livestock species, and the life-stage of affected plants (i.e., emergent, vegetative, seeding, etc.) (Stone *et al.*1988). Information provided by Stone *et al.* (1988) and CNDDB (2012) suggests that roughly 70 percent of extant populations of San Joaquin Valley Orcutt grass have the potential to be adversely affected by improper grazing. Direct effects of improper grazing regimes may result in removal of above ground biomass (including inflorescences and seeds), compaction and soil disturbance, and facilitation of invasive weed species. The Table Mountain occurrence in Fresno County, which is partially protected and administered by the Bureau of Land Management, may be subjected to trespass grazing (D. Kearns, pers. comm. 2007).

Previous studies, surveys, and anecdotal sources, have described grazing as a threat to the San Joaquin Valley Orcutt grass. However, there is disagreement regarding whether grazing actually poses a threat to this species. Research by Marty (2004 and 2005) suggests that livestock grazing plays an important role in maintaining species diversity in vernal pool grasslands through control of invasive species. In some instances vernal pool vegetation, including San Joaquin Valley Orcutt grass is actively managed through seasonal grazing by cattle (S. Foreman, pers. comm., 2010). Direct effects of grazing pressure on San Joaquin Valley Orcutt grass in the winter and early spring may be limited because the majority of plants have not emerged or are in the aquatic growth stage of the lifecycle. Nonetheless, improper grazing regimes that result in overgrazing of San Joaquin Valley Orcutt grass plants may pose a threat to extant populations. Soil disturbance from overgrazing by cattle may adversely affect San Joaquin Valley Orcutt grass indirectly by facilitating invasive plant species (Stone *et al.* 1988). Invasive species that have been reported to invade vernal pool habitat include Mediterranean barley, hood canary grass, annual rabbitsfoot grass, Italian ryegrass, and alkali mallow (Stone *et al.* 1988). Soil disturbance by cattle grazing, combined with competition by the first four invasive species listed above, threatens two San Joaquin Valley Orcutt grass occurrences, and alkali mallow appears to be a threat to an occurrence at another heavily grazed site (Stone *et al.* 1988).

Grasshoppers have been observed on San Joaquin Valley Orcutt grass plants at two localities. However, San Joaquin Valley Orcutt grass appears to be only slightly susceptible to grasshopper predation. This characteristic has been attributed to the viscid-aromatic exudate produced by *Orcuttia* species, which may act as an effective deterrent to grasshoppers (Stone *et al.* 1988). San Joaquin Valley Orcutt grass occurrences on private lands may be threatened by off-road vehicle use. In addition, repeated vehicle use of undeveloped roads and trails in vernal pool habitat may result in compacted surface soils which can affect pool hydrology. According to CNDDB (2012), damage from off-road vehicle use is listed as a threat to two San Joaquin Valley Orcutt grass occurrences.

Annual precipitation may affect both seed production and seed germination. Therefore the number of individuals comprising a given population of San Joaquin Valley Orcutt grass can vary widely from year to year. In fact, some extant localities do not appear during dry years and appear the next year, under more favorable rainfall conditions, with plants numbering in the thousands (Stone *et al.* 1988). Small populations may be extremely vulnerable to extinction (Shaffer 1981, 1987; Primack 2006; Groom *et al.* 2006). In particular, small population size

makes it difficult for this species to persist while sustaining effects from competition with non-native plant species, intensive grazing, drought, minimally grasshopper predation, and other unknown factors. Small populations may be highly susceptible to extirpation due to stochastic events, inbreeding depression, or other environmental disturbances (Gilpin and Soule 1986; Goodman 1987). Populations that decline to zero individuals during a growing season may not always be capable of rebounding from the soil seed bank and become extirpated (USFWS 2005). Small population size is noted as a concern for CNDDB occurrence #'s 48, 49, 50, 53, 56 and 62 (CNDDB 2012).

Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field *et al.* 1999, Cayan *et al.* 2005, Bates *et al.* 2008). Average annual temperature increases have been reported. The effects of increased winter flooding and drought conditions in the spring and summer have the potential to adversely affect the stability of San Joaquin Valley Orcutt grass populations, and alter availability of suitable deep water vernal pool habitat. For populations existing within marginal habitat, minor environmental changes may result in higher rates of mortality in the short-term. Long-term effects for all San Joaquin Valley Orcutt grass populations may include decreased reproductive output and survivorship, and reduced population density and stability. Species restricted to a specific location by the lack of suitable dispersal habitat or stationary species, such as the San Joaquin Valley Orcutt grass, may be more susceptible to these long-term effects (Schwartz *et al.* 2001).

Vernal pools are highly specialized ecosystems, and represent a unique combination of geology, climate, and slope (Vollmar 2002). Moreover, seasonal extremes of inundation and subsequent drought promote a unique abiotic environment that facilitates the persistence of highly adapted native plant communities. These environmental conditions are the result of riverine terrace formation processes that developed across extensive geological time-scales. Holland (1978) estimated that roughly 90 percent of the Central Valley's vernal pools have been eliminated, primarily through agricultural and urban development. Further habitat elimination, through climate-induced changes in hydrology or by land use conversion, likely represents irreparable habitat loss, which can only be partially simulated through intensive vernal pool re-creation efforts.

San Joaquin Valley Orcutt grass is a highly specialized plant species that is a strict endemic of San Joaquin Valley vernal pool habitats (with the exception of the Solano County population) that are deep and typically greater than 0.4 hectare (1 acre) in size. As previously described, many factors underlying the occurrence and persistence of San Joaquin Valley Orcutt grass are dependent upon site hydrology, including: seed germination, juvenile aquatic stage, reduced competition by upland and exotic species, timing of flowering, and seed production. The principal components of the hydrologic regime tied to the persistence of this species appear to be dependent upon the timing and duration of the inundation period and availability of soil moisture during the growing season.

San Joaquin Valley Orcutt grass is covered by the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005), with recovery units that include portions of the

Action Area. This recovery plan addresses a large number of vernal pool– associated species through an ecosystem approach to recovery that is focused on habitat protection and management.

Succulent Owl's Cover

On March 26 1997, the succulent owl's clover was federally-listed as a threatened species (USFWS 1997). Owl's clovers are members of the figwort or snapdragon family (*Scrophulariaceae*). Hoover (1936) first named the species fleshy owl's clover, giving it the scientific name *Orthocarpus campestris* var. *succulentus.* The type specimen was collected at Ryer, in Merced County. Hoover (1968) raised fleshy owl's clover (i.e., succulent owl's clover) to the rank of species and assigned it the name *Orthocarpus succulentus*. Chuang and Heckard (1991) reconsidered the taxonomy of *Orthocarpus* and related genera. On the basis of floral morphology, seed morphology, and chromosome number, they transferred many species into the genus *Castilleja*. Furthermore, they determined that the appropriate rank for succulent owl's clover was as a subspecies of field owl's clover (*Castilleja campestris*). Thus, the scientific name currently assigned to succulent owl's clover is *Castilleja campestris* ssp. *succulenta*, whereas field owl's clover is *Castilleja campestris* ssp. *campestris* (Chuang and Heckard 1991).

Succulent owl's clover has rather intricate flowers, with the corolla consisting of two lips. The flower has four sepals that are fused at the base, creating the calyx tube. Together, all the flowers plus the bracts comprise the inflorescence. The plant has erect or decumbent stems up to 11.8 inches long. The stems are usually unbranched and without hairs. The leaves at the base of the stem are small and scale-like, whereas those on the upper stem are 0.6 to 1.6 inches long, lance-shaped, not lobed, thick, fleshy, and easily broken. The bracts are green, similar to but shorter than the upper leaves, and longer than the flowers. Overall, the inflorescence may occupy as much as half of the plant's height and be 0.8 to 1.2 inches wide. Succulent owl's clover has a diploid chromosome number of 24 (Chuang and Heckard 1993). The brittle leaves are a key characteristic for identification of succulent owl's clover. The most similar taxon is *C. campestris* ssp. *campestris*. *Castilleja campestris* ssp. *campestris* has branched stems; thin, flexible, non-fleshy leaves; larger, lighter yellow flowers; a stigma that protrudes beyond the upper lip of the flower; a lower anther sac that is no more than one-third the size of the upper; and more rounded seeds. *Castilleja campestris* ssp. *campestris* occurs farther north than succulent owl's clover (Hoover 1936, Hoover 1968, Heckard 1977, CDFG 1986). Other *Castilleja* species have lobed leaves and bracts, and the bracts are often colored.

Succulent owl's clover is an annual plant. As with many related species, it is a hemiparasite, meaning that it obtains water and nutrients by forming root grafts with other host plants, but manufactures its own food through photosynthesis (Chuang and Heckard 1991). Research on hemiparasitism has focused on related species of *Castilleja*, but not specifically on succulent owl's clover. Many different plants can serve as hosts for a single species or even a single individual of *Castilleja.* Seeds of *Castilleja* species do not require the presence of a host to germinate, and form root connections only after reaching the seedling stage. Some seedlings can survive to maturity without attaching to a host's roots, but, in general, reproduction is enhanced by root connections (Atsatt and Strong 1970). The conditions necessary for germination of

succulent owl's clover seeds have not been studied, nor has the timing of seed germination been documented. Flowering occurs in April and May (Skinner and Pavlik 1994). The importance of pollinating insects is not known for certain. Some aspects of succulent owl's clover biology suggest that it may be self-pollinating (Heckard 1977), but many related taxa of *Castilleja* are pollinated by generalist bees (Superfamily Apoidea) (Chuang and Heckard 1991). Among close relatives that do not require insect pollinators, flower structure and timing of stigma receptivity maximize the chances for self-fertilization and seed set. Even so, insects may transfer some pollen among individual plants and species occurring in the same area. Self-pollinating species of *Castilleja* typically occur as widely scattered individuals, rather than in dense colonies (Atsatt 1970). Succulent owl's clover follows this pattern in part, often occurring in many pools within a complex, but with fewer than 100 plants per pool. However, succulent owl's clover also may occur in large populations within a single pool (CNDDB 2012). Little is known about the demography of succulent owl's clover, although population size can fluctuate greatly from year to year. In the few populations where population size was reported for more than 1 year, fluctuations up to two orders of magnitude were noted (CNDDB 2012).

Succulent owl's clover occurs in Northern Claypan and Northern Hardpan vernal pools (Sawyer and Keeler-Wolf 1995) within annual grassland communities (CNDDB 2012). The plant is known from both small and large pools (EIP Associates 1999, J. Stebbins *in litt.* 2000*a*). Although not all pools occupied by this taxon have been studied in detail, Stebbins *et al.* (1995) collected data on six occupied pools in Fresno and Madera Counties. Some were typical "bowl-like" pools, whereas others were more similar to swales. Approximate pool area ranged from 0.07 to 1.61 acres, depth from 11.8 to 15.0 inches, and pH of the soil underlying the pools from 5.00 to 6.24 (Stebbins *et al.* 1995). This subspecies has been reported from pools with both long and short inundation periods (EIP Associates 1999) and from both shallow and "abnormally deep" vernal pools (CNDDB 2012).

Populations of succulent owl's clover have been reported from elevations of 80 feet at the San Joaquin County site to 2,300 feet at Kennedy Table in Madera County (CNDDB 2012). Plants most commonly reported as occurring with succulent owl's clover are Fremont's goldfields (*Lasthenia fremontii*) (EIP Associates 1999), downingia (*Downingia* spp.), three-colored monkey-flower (*Mimulus tricolor*), vernal pool popcorn flower (*Plagiobothrys stipitatus*), and coyote thistle (*Eryngium* spp.) (CNDDB 2012). Other plants that have been reported growing with succulent owl's clover are *Neostapfia colusana*, *Orcuttia inaequalis*, and *O. pilosa*, *Gratiola heterosepala* (EIP Associates 1999, CNDDB 2012).

The California Natural Diversity Database (2012) has catalogued 90 occurrences of succulent owl's clover. One occurrence in Fresno County is considered to be "possibly extirpated" (CNDDB 2012) because the site had been disked when it was last visited in 1981. Another unreported occurrence in Fresno County may also be extirpated (J. Stebbins *in litt.* 2000*a*). Currently, among the 91 extant occurrences, approximately 68 percent are in Merced County, 12 percent are in Fresno County, 13 percent are in Madera County, five percent are in Stanislaus County, one percent is in San Joaquin County, and one percent in Madera County (CNDDB 2012).

This information, particularly the recent records, confirms that the primary area of concentration for succulent owl's clover is in eastern Merced County, especially just northeast of the City of Merced. Additionally, Vollmar (2002) concluded that this listed plant is likely to be found throughout much of the rangeland portion of eastern Merced County wherever there are better developed, dense, interconnected vernal pools. Therefore, this area clearly represents a very important geographical region for the conservation of succulent owl's clover. Other occurrences in Merced County are somewhat farther to the north and south. In addition, a secondary area of concentration with 17 occurrences is located in southern Madera County and northern Fresno County, from just west of Highway 41 east to Academy and north to Miller's Corner. Also, two smaller areas of concentration, which include five occurrences each but contain large numbers of plants, are near Cooperstown in Stanislaus County and the "tabletop" mountains near Millerton Lake in Fresno and Madera Counties. Other more scattered occurrences include two at Castle Airport northwest of Merced, one near Wildcat Mountain in Fresno County, and one in San Joaquin County. Significant areas of suitable habitat remain unsurveyed, particularly in northern Merced County (EIP Associates 1999) and between the northern Stanislaus County and northern San Joaquin County sites (J. Stebbins *in litt.* 2000*b*). Thus, additional occurrences are likely to be found if further surveys similar to those reported by Vollmar (2002) are conducted.

Urban development that threatens known occurrences includes planned housing subdivisions in Fresno, Madera, and San Joaquin Counties; a freeway expansion in Madera County; and a proposed landfill in Fresno County (USFWS 1997, J. Stebbins *in litt.* 2000*b*, CNDDB 2012). Exclusion of grazing from sites that have been grazed historically may increase the threat of competition with non-native plants. About two-thirds of the reported occurrences of the species, were subject to cattle grazing when first discovered (EIP Associates 1999, CNDDB 2012). Grazing should be monitored, and adjusted as needed, to maintain and enhance the species. Grazing may not be appropriate for all populations. Consideration of the possible negative effects to succulent owl's clover should be given before grazing is introduced into a population that has not been previously grazed (USFWS 2005). Threats due to alterations in natural hydrology include the Merced County Stream Channel Project proposed by the USACE (USFWS 1997) and proposed enlargement of Burns Reservoir in Merced County (CNDDB 2012), which collectively threaten seven occurrences of succulent owl's clover. Expansion of agricultural operations threatens three occurrences in Fresno and Madera Counties that are surrounded by orchards, vineyards, or citrus groves (CNDDB 2012). A proposed gravel mine threatens one occurrence of succulent owl's clover in Fresno County. Two other occurrences, at the former Castle Air Force Base in Merced County, are threatened by excavation to remove soil that was contaminated by lead from skeet shooting (CNDDB 2012). Threats posed by small population size may also be a significant continuing factor because small size makes populations more vulnerable to extirpation from chance events. Among the 24 populations of succulent owl's-clover for which size estimates have been documented, 10 consisted of fewer than 100 plants at their peak size (J. Stebbins *in litt.* 2000*b*).

The Service's 2005, *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon*, identifies the need to protect a portion of suitable habitat for succulent owl's clover within each of five core areas. Specifically, the Recovery Plan recommends the protection of

85 percent of suitable habitat within the Southeastern Sacramento Valley core area, 85 percent within the Fresno core area, 95 percent within the Madera core area, 95 percent within the Merced core area, and 95 percent within the Table Mountain core area (USFWS 2005). Current information does not allow for the Service to make an assessment of the progress toward reaching these recovery goals, as values for suitable habitat and areas protected are not known. However, of the current 91 occurrences of succulent owl's clover, 28 are protected, and occur within three of the core areas (one Southeastern Sacramento Valley, 22 in Madera, and five in Table Mountain).

Central California Tiger Salamander

On May 23, 2003, the Service proposed to list the Central California Distinct Population Segment (DPS) of the California tiger salamander as threatened. At that time the Service also proposed reclassification of the Santa Barbara County DPS and Sonoma County DPS from endangered to threatened (68 FR 28647). In the same notice the Service also proposed a special rule under section 4(d) of the Act to exempt take for routine ranching operations for the Central California DPS and, if reclassified to threatened, for the Santa Barbara and Sonoma County DPSs (68 FR 28668). On August 4, 2004, the Service determined that the Central California DPS of the California tiger salamander was threatened (69 FR 47211) and that the Santa Barbara and Sonoma County populations were threatened as well, and reclassified the California tiger salamander as threatened throughout its range (69 FR 47211), removing the Santa Barbara and Sonoma County populations as separately listed DPSs (69 FR 47241). In the 2004 final rule, the Service also finalized the special rule to exempt take for routine ranching operations for the California tiger salamander throughout its range (69 FR 47248).

On August 18, 2005, as a result of litigation of the August 4, 2004, final rule on the reclassification of the California tiger salamander DPSs (*Center for Biological Diversity et al. v. United States Fish and Wildlife Service et al.*, C 04-04324 WHA (N.D. Cal. 2005), the District Court of Northern California sustained the portion of the 2004 rule pertaining to listing the Central California tiger salamander as threatened with a special rule, but vacated the portion of the 2004 rule that re-classified the Santa Barbara and Sonoma DPSs to threatened status thereby reinstating their status as endangered. On August 31, 2011, the List of Endangered and Threatened Wildlife in part 17, subchapter B of Chapter I, title 50 of the Code of Federal Regulations (CFR) was amended to reflect the vacatures contained in the 2005 court order, classifying the Santa Barbara DPS and the Sonoma DPS of the California tiger salamander as endangered, and the Central DPS of the California tiger salamander as threatened with a special rule to exempt routine ranching operations from take (76 FR 54346).

The California tiger salamander is a large, stocky, terrestrial salamander with a broad, rounded snout. Recorded adult measurements have been as much as 8.2 inches long (Petranka 1998a; Stebbins 2003). California tiger salamanders exhibit sexual dimorphism (differences in body appearance based on gender) with males tending to be larger than females. The coloration of the adults generally consists of random white or yellowish markings against a black body. The markings tend to be more concentrated on the lateral sides of the body; whereas other salamander species tend to have brighter yellow spotting that is heaviest on the dorsal surface.

The California tiger salamander is endemic to California and historically inhabited the low-elevation grassland and oak savanna plant communities of the Central Valley, adjacent foothills, and Inner Coast Ranges (Jennings and Hayes 1994; Storer 1925; Shaffer *et al.* 1993). The species has been recorded from near sea level to approximately 3,900 feet in the Coast Ranges and to approximately 1,600 feet in the Sierra Nevada foothills. Along the Coast Ranges, the species occurred from the Santa Rosa area of Sonoma County, south to the vicinity of Buellton in Santa Barbara County. The historic distribution in the Central Valley and surrounding foothills included northern Yolo County southward to northwestern Kern County and northern Tulare County.

The Central California tiger salamander occupies the Bay Area (central and southern Alameda, Santa Clara, western Stanislaus, western Merced, and the majority of San Benito counties), Central Valley (Yolo, Sacramento, Solano, eastern Contra Costa, northeastern Alameda, San Joaquin, Stanislaus, Merced, and northwestern Madera counties), southern San Joaquin Valley (portions of Madera, central Fresno, and northern Tulare and Kings Counties), and the Central Coast Range (southern Santa Cruz, Monterey, northern San Luis Obispo, and portions of western San Benito, Fresno, and Kern counties).

The California tiger salamander has an obligate biphasic life cycle (Shaffer *et al.* 2004). Although the larvae develop in the vernal pools and ponds in which they were born, the species is otherwise terrestrial and spend most of their post-metamorphic lives in widely dispersed underground retreats (Shaffer *et al.* 2004; Trenham *et al.* 2001). Because they spend most of their lives underground, the animals rarely are encountered even in areas where California tiger salamanders are abundant. Subadult and adult California tiger salamanders typically spend the dry summer and fall months in the burrows of small mammals, such as California ground squirrels and Botta's pocket gopher (Storer 1925; Loredo and Van Vuren 1996; Petranka 1998a; Trenham 1998a). Although ground squirrels have been known to eat these amphibians, the relationship with their burrowing hosts is primarily commensal (an association that benefits one member while the other is not affected) (Loredo *et al.* 1996; Semonsen 1998).

California tiger salamanders may also use landscape features such as leaf litter or desiccation cracks in the soil for upland refugia. Burrows often harbor camel crickets and other invertebrates that provide likely prey for the amphibians. Underground refugia also provide protection from the sun and wind associated with the dry California climate that can cause excessive drying of amphibian skin. Although California tiger salamanders are members of a family of "burrowing" salamanders, they are not known to create their own burrows. This may be due to the hardness of soils in the California ecosystems in which they are found. California tiger salamanders depend on persistent small mammal activity to create, maintain, and sustain sufficient underground refugia for the species. Burrows are short lived without continued small mammal activity and typically collapse within approximately 18 months (Loredo *et al.* 1996).

Upland burrows inhabited by California tiger salamanders have often been referred to as aestivation-sites. However, "aestivation" implies a state of inactivity, while most evidence suggests that the animals remain active in their underground dwellings. One study has found that salamanders move, feed, and remain active in their burrows (Van Hattem 2004). Because the

adults arrive at breeding ponds in good condition and are heavier when entering the pond than when leaving, researchers have long inferred that they are feeding while underground. A number of direct observations have confirmed this (Trenham 2001; Van Hattem 2004). Thus, "upland habitat" is a more accurate description of the terrestrial areas used by California tiger salamanders.

California tiger salamanders typically emerge from their underground refugia at night during the fall or winter rainy season (November-May) to migrate to their breeding ponds (Stebbins 1985, 1989; Shaffer *et al.* 1993; Trenham *et al.* 2000). The breeding period is closely associated with the rainfall patterns in any given year with less adults migrating and breeding in drought years (Loredo and Van Vuren 1996; Trenham *et al.* 2000). Male California tiger salamander are typically first to arrive and generally remain in the ponds longer than females. Results from a 7-year study in Monterey County suggested that males remained in the breeding ponds for an average of 44.7 days while females remained for an average of only 11.8 days (Trenham *et al.* 2000). Historically, breeding ponds were likely limited to vernal pools, but now include livestock stock ponds. Ideal breeding ponds are typically fishless, free of non-native predators, and seasonal or semi-permanent (Barry and Shaffer 1994; Petranka 1998a).

While in the ponds, adult California tiger salamanders mate and then the females lay their eggs in the water (Twitty 1941; Shaffer *et al.* 1993; Petranka 1998a). Egg laying typically reaches a peak in January (Loredo and Van Vuren 1996; Trenham *et al.* 2000). Females attach their eggs singly, or in rare circumstances, in groups of two to four, to twigs, grass stems, vegetation, or debris (Storer 1925; Twitty 1941). Eggs are often attached to objects, such as rocks and boards in ponds with no or limited vegetation (Jennings and Hayes 1994). Clutch sizes from a Monterey County study had an average of 814 eggs (Trenham *et al.* 2000). Seasonal pools may not exhibit sufficient depth, persistence, or other necessary parameters for adult breeding during times of drought (Barry and Shaffer 1994). After breeding and egg laying is complete, adults leave the pool and return to their upland refugia (Loredo *et al.* 1996; Trenham 1998a). Adult California tiger salamanders often continue to emerge nightly for approximately the next two weeks to feed amongst their upland habitat (Shaffer *et al.* 1993).

California tiger salamander larvae typically hatch within 10 to 24 days after eggs are laid (Storer 1925). The peak emergence of these metamorphs is typically between mid-June and mid-July (Loredo and Van Vuren 1996; Trenham *et al.* 2000). The larvae are totally aquatic and range in length from approximately 0.45 to 0.56 inches (Petranka 1998a). They have yellowish gray bodies, broad fat heads, large, feathery external gills, and broad dorsal fins that extend well up their back. The larvae feed on zooplankton, small crustaceans, and aquatic insects for about six weeks after hatching, after which they switch to larger prey (J. Anderson 1968). Larger larvae have been known to consume the tadpoles of Pacific tree frogs, western spadefoot toads, and California red-legged frogs (J. Anderson 1968; P. Anderson 1968). California tiger salamander larvae are among the top aquatic predators in seasonal pool ecosystems. When not feeding, they often rest on the bottom in shallow water but are also found throughout the water column in deeper water. Young California tiger salamanders are wary and typically escape into vegetation at the bottom of the pool when approached by potential predators (Storer 1925).

The California tiger salamander larval stage is typically completed in 3 to 6 months with most metamorphs entering upland habitat during the summer (Petranka 1998a). In order to be successful, the aquatic phase of this species' life history must correspond with the persistence of its seasonal aquatic habitat. Most seasonal ponds and pools dry up completely during the summer. Amphibian larvae must grow to a critical minimum body size before they can metamorphose (change into a different physical form) to the terrestrial stage (Wilbur and Collins 1973). Larval development and metamorphosis can vary and is often site-dependent. Larvae collected near Stockton in the Central Valley during April varied between 1.88 to 2.32 inches in length (Storer 1925). Feaver (1971) found that larvae metamorphosed and left breeding pools 60 to 94 days after eggs had been laid, with larvae developing faster in smaller, more rapidly drying pools. Longer ponding duration typically results in larger larvae and metamorphosed juveniles that are more likely to survive and reproduce (Pechmann *et al.* 1989; Semlitsch *et al.* 1988; Morey 1998a; Trenham 1998b). Larvae will perish if a breeding pond dries before metamorphosis is complete (P. Anderson 1968; Feaver 1971). Pechmann *et al.* (1989) found a strong positive correlation between ponding duration and total number of metamorphosing juveniles in five salamander species. In Madera County, Feaver (1971) found that only 11 of 30 sampled pools supported larval salamanders, and 5 of these dried before metamorphosis could occur. Therefore, out of the original 30 pools, only 6 (20 percent) provided suitable conditions for successful reproduction that year. Size at metamorphosis is positively correlated with stored body fat and survival of juvenile amphibians, and negatively correlated with age at first reproduction (Semlitsch *et al.* 1988; Scott 1994; Morey 1998a).

Following metamorphosis, juvenile California tiger salamanders leave their pools and move to upland habitat. This emigration can occur in both wet and dry conditions (Loredo and Van Vuren 1996; Loredo *et al.* 1996). Wet conditions are more favorable for upland travel but summer rain events seldom occur as metamorphosis is completed and ponds begin to dry. As a result, juveniles may be forced to leave their ponds on rainless nights. Under dry conditions, juveniles may be limited to seeking upland refugia in close proximity to their aquatic larval pool. These individuals often wait until the next winter's rains to move further into more suitable upland refugia. Juveniles remain active in their upland habitat, emerging from underground refugia during rainfall events to disperse or forage (Trenham and Shaffer 2005). Depending on location and other development factors, metamorphs will not return as adults to aquatic breeding habitat for 2 to 5 years (Loredo and Van Vuren 1996; Trenham *et al.* 2000).

Lifetime reproductive success for the California tiger salamander is low. Results from one study suggest that the average female bred 1.4 times over their lifespan and produced 8.5 young per reproductive effort that survived to metamorphosis (Trenham *et al.* 2000). This resulted in the output of roughly 11 metamorphic offspring over a breeding female's lifetime. The primary reason for low reproductive success may be that this relatively short-lived species requires two or more years to become sexually mature (Shaffer *et al.* 1993). Some individuals may not breed until they are four to six years old. While California tiger salamanders may survive for more than ten years, many breed only once, and in one study, less than 5 percent of marked juveniles survived to become breeding adults (Trenham 1998b). With such low recruitment, isolated populations are susceptible to unusual, randomly occurring natural events as well human-caused

factors that reduce breeding success and individual survival. Factors that repeatedly lower breeding success in isolated pools can quickly extirpate a population.

Dispersal and migration movements made by California tiger salamanders can be grouped into two main categories: (1) breeding migration; and (2) interpond dispersal. Breeding migration is the movement of salamanders to and from a pond from the surrounding upland habitat. After metamorphosis, juveniles move away from breeding ponds into the surrounding uplands, where they live continuously for several years. At a study in Monterey County, it was found that upon reaching sexual maturity, most individuals returned to their natal/ birth pond to breed, while 20 percent dispersed to other ponds (Trenham *et al.* 2001). After breeding, adult California tiger salamanders return to upland habitats, where they may live for one or more years before attempting to breed again (Trenham *et al.* 2000).

California tiger salamanders are known to travel long distances between breeding ponds and their upland refugia. Generally it is difficult to establish the maximum distances traveled by any species, but salamanders in Santa Barbara County have been recorded dispersing up to 1.3 miles from their breeding ponds (Sweet 1998a). As a result of a 5-year capture and relocation study in Contra Costa County, Orloff (2007) estimated that captured California tiger salamanders were traveling a minimum of 0.5 miles to the nearest breeding pond and that some individuals were likely traveling more than 1.3 miles to and from breeding ponds. California tiger salamanders are also known to travel between breeding ponds. One study found that 20 to 25 percent of the individuals captured at one pond were recaptured later at other ponds approximately 1,900 and 2,200 feet away (Trenham *et al.* 2001). In addition to traveling long distances during juvenile dispersal and adult migration, salamanders may reside in burrows far from their associated breeding ponds.

Although previously cited information indicates that California tiger salamanders can travel long distances, they typically remain close to their associated breeding ponds. A trapping study conducted in Solano County during the winter of 2002/2003 suggested that juveniles dispersed and used upland habitats further from breeding ponds than adults (Trenham and Shaffer 2005). More juvenile California tiger salamanders were captured at traps placed at 328, 656, and 1,312 feet from a breeding pond than at 164 feet. Approximately 20 percent of the captured juveniles were found at least 1,312 feet from the nearest breeding pond. The associated distribution curve suggested that 95 percent of juvenile California tiger salamanders were within 2,099 feet of the pond, with the remaining 5 percent being found at even greater distances. Preliminary results from the 2003-04 trapping efforts at the same study site detected juvenile California tiger salamanders at even further distances, with a large proportion of the captures at 2,297 feet from the breeding pond (Trenham 1998a). Surprisingly, most juveniles captured, even those at 2,100 feet, were still moving away from ponds. In Santa Barbara County, juvenile Santa Barbara County DPS California tiger salamanders have been trapped approximately 1,200 feet away while dispersing from their natal pond (Science Applications International Corporation, unpublished data). These data show that many California tiger salamanders travel far while still in the juvenile stage. Post-breeding movements away from breeding ponds by adults appear to be much smaller. During post-breeding emigration from aquatic habitat, radio-equipped adult California tiger salamanders were tracked to burrows between 62 to 813 feet from their breeding

ponds (Trenham 2001). These reduced movements may be due to adult California tiger salamanders exiting the ponds with depleted physical reserves, or drier weather conditions typically associated with the post-breeding upland migration period.

California tiger salamanders are also known to use several successive burrows at increasing distances from an associated breeding pond. Although previously cited studies provide information regarding linear movement from breeding ponds, upland habitat features appear to have some influence on movement. Trenham (2001) found that radio-tracked adults were more abundant in grasslands with scattered large oaks, than in more densely wooded areas. Based on radio-tracked adults, there is no indication that certain habitat types are favored as terrestrial movement corridors (Trenham 2001). In addition, captures of arriving adults and dispersing new metamorphs were evenly distributed around two ponds completely encircled by drift fences and pitfall traps. Thus, it appears that dispersal into the terrestrial habitat occurs randomly with respect to direction and habitat types.

Documented or potential Central California tiger salamanders predators include coyotes, raccoons, striped skunks, opossums, egrets, great blue herons, crows, ravens, garter snakes, bullfrogs, California red-legged frogs, mosquito fish, and crayfish. The Central California tiger salamander is imperiled throughout its range due to a variety of human activities (USFWS 2004). Current factors associated with declining Central California tiger salamander populations include continued habitat loss and degradation due to agriculture and urbanization; hybridization with the non-native eastern salamander (Fitzpatrick and Shaffer 2004; Riley *et al.* 2003); and predation by introduced species. Central California tiger salamander populations are likely threatened by multiple factors but continued habitat fragmentation and colonization of non-native salamanders may represent the most significant current threats. Habitat isolation and fragmentation within many watersheds have precluded dispersal between sub-populations. Other threats include predation and competition from introduced exotic species; possible commercial over-utilization; diseases; various chemical contaminants; road kill; and certain mosquito and rodent control operations. Currently, these various primary and secondary threats are largely not being offset by existing Federal, State, or local regulatory mechanisms. The Central California tiger salamander is also prone to chance environmental or demographic events to which small populations are particularly vulnerable.

Western Yellow-billed Cuckoo

Western yellow-billed cuckoo, which is a candidate species for Federal listing, breeds throughout much of North America and winters in South America (Hughes 1999). The California breeding range of western yellow-billed cuckoo is restricted to the Sacramento Valley, the South Fork of the Kern River, the lower Colorado River Valley, and sometimes the Prado Basin in Riverside and San Bernardino counties (Gaines and Laymon 1984). Most recent Sacramento Valley records are from the Sacramento River, from Todd Island in Tehama County south to Colusa State Park in Colusa County, and from the Feather River in Yuba and Sutter counties (Gaines and Laymon 1984). Yellow-billed cuckoo nest sites are associated with large and wide patches of riparian habitat (Laymon and Halterman 1989). In the western United States, yellow-billed cuckoos breed in broad, well-developed, low-elevation riparian woodlands composed primarily

of mature cottonwoods (*Populus spp.*) and willows (*Salix spp.*). They have also been observed nesting in orchards adjacent to riparian habitats (Gaines and Laymon 1984). Typical nest sites in California have moderately high canopy closure and low total ground cover and are close to water (Laymon and Halterman 1987). In the late 1960s, a few yellow-billed cuckoos were observed regularly near the confluence of the Tuolumne and San Joaquin rivers, but this area was subsequently subject to intensive logging, and no cuckoos have been observed in recent years (McBain and Trush 2002). The yellow-billed cuckoo has been considered a rare migratory species in Stanislaus County during spring (Reeve 1988). This species has potential to nest in suitable habitat in the Restoration Area.

In California, the yellow-billed cuckoo is threatened by the loss or degradation of suitable large tracts of riparian habitat, pesticide poisoning, and possibly reduced prey abundance resulting from widespread application of pesticides (Gaines and Laymon 1984). Conservation projects of the CVP have preserved habitat for yellow-billed cuckoo (DFG 2005). This species also has been included in habitat conservation and multispecies conservation planning efforts in southern California. These efforts have focused on conserving suitable breeding habitat by preserving and restoring large patches of riparian vegetation.

Analytical Framework for the Jeopardy and Adverse Modification Determinations

Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this PBO relies on four components: (1) the *Status of the Species*, which evaluates the range-wide condition, the factors responsible for that condition, and the survival and the recovery needs for each species; (2) the *Environmental Baseline,* evaluates the condition of the listed species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of those species; (3) the *Effects of the Action*, which determines the direct and indirect effects of the proposed Federal action and the effects of any interrelated or interdependent activities on these species; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on these species.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of each species current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild.

The jeopardy analysis in this biological opinion places an emphasis on consideration of the range-wide survival and recovery needs of each species and the role of the action area in survival and recovery of those species as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination. Because of the dynamic nature of the Program, the service has analyzed the project alternatives that will likely present the greatest impact to habitat and listed species to make the jeopardy determination.

Adverse Modification Determination

This Biological Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

In accordance with policy and regulation, the adverse modification analysis in this Biological Opinion relies on four components: (1) the *Status of Critical Habitat*, which evaluates the range-wide condition of designated critical habitat for Colusa grass in terms of primary constituent elements (PCEs), the factors responsible for that condition, and the intended recovery function of the critical habitat overall; (2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected critical habitat units; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat units.

For purposes of the adverse modification determination, the effects of the proposed Federal action on Colusa grass critical habitat are evaluated in the context of the range-wide condition of the critical habitat, taking into account any cumulative effects, to determine if critical habitat range-wide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for Colusa grass.

The analysis in this Biological Opinion places an emphasis on using the intended range-wide recovery function of Colusa grass critical habitat and the role of the action area relative to that intended function as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

Environmental Baseline

Habitats

San Joaquin River from Friant Dam Downstream to Merced River. The lower San Joaquin River and the valley sections of its major tributaries – the Merced, Tuolumne, and Stanislaus rivers – have changed dramatically since the early part of the 19th century. These rivers are now largely confined within constructed levees and bounded by agricultural and urban development, flows are regulated by dams and water diversions, and floodplain habitats have been fragmented and reduced in size and diversity (McBain and Trush 2002). As a result, the riparian communities have substantially changed from historic conditions (McBain and Trush 2000; Jones and Stokes Associates 1998a). The presence of Friant Dam on the San Joaquin River and a series of dams on the eastside tributaries reduce the frequency of scouring flows, resulting in a gradual decline of bare

gravel and sandbar surfaces, which are required to recruit growth of new riparian plants. The vast majority of the surrounding upland land use is some form of agriculture, with only small fragmented remnants of native habitat mostly confined to preserves and refuges.

Eastside Bypass. Upland vegetation in the Eastside Bypass is grassland and ruderal vegetation (i.e., nonnative herbaceous opportunistic colonizers of disturbed lands). The reach between the Sand Slough Control Structure and the Merced NWR (approximately 4.5 miles) supports several ponds. For the next 2.2 miles, the bypass passes through the Merced NWR, which encompasses more than 10,000 acres of wetlands, native grasslands, vernal pools, and riparian habitat. Further downstream, the Eastside Bypass passes through the Grasslands Wildlife Management Area, an area of private lands with conservation easements held by the Service, and through the East Bear Creek Unit of the San Luis NWR Complex. Patches of riparian trees and shrubs occur along the banks of the Eastside Bypass in these areas. Side channels and slough (e.g., Duck, Deep, and Bravel sloughs) are present along the lower Eastside Bypass, and some support remnant patches of riparian vegetation.

Mariposa Bypass. The Mariposa Bypass is bordered to the south by agricultural land and vernal pool grasslands to the north. Scattered riparian trees are present along the Mariposa Bypass.

Species

Appendix A contains maps depicting the relationship of the Action Area to CNDDB occurrences of listed plant (Maps 1-3) and animal (Maps 4-6) species, designated Critical Habitat for listed plants (Map 7) and animals (Map 8), and Recovery Areas for listed species (Map 9).

Delta Smelt. Delta smelt are present within the Sacramento – San Joaquin River Delta (Delta), but do not enter the San Joaquin River system as far as the confluence with the Merced River. Delta smelt numbers have fluctuated in recent years, but have trended downward overall. Where delta smelt are found is greatly influenced by the salinity levels within the Delta. Delta smelt are not likely to occur within the San Joaquin River where program level actions will occur, but their Delta habitat is likely to be affected by the overall project.

Palmate-bracted Birds-beak. Palmate-bracted birds-beak is known to occur in the vicinity of the Restoration Area near Reach 3 and the Chowchilla Bypass. Suitable habitat (i.e., alkaline soils in valley sink scrub and alkali meadow communities and along drainage channels [USFWS 1998a]) for this species may be present in the Restoration Area. This species is unlikely to be present on alluvial soils in areas that are seasonally inundated or periodically inundated by flood flows along the San Joaquin River. Potential habitat may be present along the Eastside Bypass.

Vernal Pool Species. Vernal pool habitat is present along Reaches 1A, 4B, and 5 and the Eastside and Mariposa bypasses. The Eastside and Mariposa bypasses were created in uplands that historically contained northern claypan vernal pools. Land conversion for agricultural development, subsequent hydrologic modification related to creating the bypasses, and agricultural diversions and discharge have eliminated natural vernal pools from many areas. However, because of the high clay content of soils in the area, depressions caused by previous construction activities in upland habitats still tend to hold rainwater for an extended period;

therefore, soil and hydrologic conditions may be suitable to support vernal pool species in some areas.

Valley Elderberry Longhorn Beetle. Valley elderberry longhorn beetle may occur in locations in the Restoration Area where its host plant is present. During 2004 and 2005, surveys for elderberry shrubs and evidence of valley elderberry longhorn beetle were conducted for 77 percent of the San Joaquin River between Friant Dam and the Merced River confluence (ESRP 2006). Blue elderberry shrubs were found to be abundant along Reaches 1 and 2 of the San Joaquin River and were sparsely distributed along or absent from Reaches 3, 4, and 5 (ESRP 2006). Approximately 410 elderberry shrubs were mapped in Reaches 1 and 2. In Reaches 3, 4, and 5, three elderberry shrubs were observed from the air but could not be located during kayak or ground surveys. Evidence of valley elderberry longhorn beetle was found to occur in 14 shrubs in Reach 1A and 2 shrubs in Reach 2, out of more than 400 shrubs examined (ESRP 2006).

Central California Tiger Salamander. Central California tiger salamanders use vernal pools and seasonal wetlands for breeding and upland grassland habitats for dispersal, foraging, and refuge. This species is not expected to occur in the San Joaquin River corridor; however, suitable wetland habitat (e.g., vernal pools and seasonal wetlands) may exist in the Eastside and Mariposa bypasses, outside the channels and lower floodplain terraces. Central California tiger salamanders are known to occur north of the Eastside Bypass in the Merced NWR in floodplain wetlands, slough channels, vernal pools, and artificially created pools adjacent to levees and roads (CNDDB 2012).

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 2006b). Although no sightings of giant garter snakes south of the Mendota Wildlife Area have occurred since the time of listing (Hansen 2002), 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.

Blunt-nosed Leopard Lizard. The blunt-nosed leopard lizard is associated with alkali scrub habitat or other sparsely vegetated habitats with sandy soils. 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.

San Joaquin Kit Fox. San Joaquin kit fox occupies grassland and scrub habitats in the Restoration Area but otherwise is not expected to occur in riparian or riverine habitats that encompass most of the Action Area. These mammals create burrows for denning and refuge.

San Joaquin kit fox dens may be located near the river corridor, and foxes may forage and disperse through the river corridor or the Eastside Bypass. The San Joaquin kit fox is mobile and wide-ranging and often uses road crossings to traverse aquatic features. It preys on a wide variety of terrestrial animals, and foraging habitat is plentiful along the river corridor, Eastside Bypass, and adjacent uplands.

Fresno Kangaroo Rat. The Fresno kangaroo rat is a small burrowing mammal that has been reported in the vicinity of the Restoration Area, having been observed at the Alkali Sink Ecological Reserve and Mendota Wildlife Area. This species is considered by some to be extirpated along the San Joaquin River because of repeated negative findings during survey efforts since 1993 (CDFG 2005). This species inhabits grassland and scrub habitats but does not occupy riparian areas, although it may disperse through dry river washes. Suitable upland habitats and occupied burrows may be located adjacent to the Restoration Area. Potential habitat on private land adjacent to Reach 2B has not been surveyed. Critical habitat has been designated for Fresno kangaroo rat, adjacent to the Restoration Area, approximately 4 miles from the Restoration Area in Reaches 2A and 2B.

Riparian (San Joaquin) Woodrat. The riparian woodrat has not been documented in the Restoration Area or its vicinity. Potentially suitable habitat is present in riparian vegetation that would be inundated by Interim and Restoration flows. The only verified extant population of this species is located on the Stanislaus River at Caswell Memorial State Park.

Riparian Brush Rabbit. The riparian brush rabbit has limited distribution along the lower portions of the San Joaquin and Stanislaus rivers. Recent captive breeding and recovery efforts have included establishing one population in 2002 in restored habitat on the SJRNWR and releasing another small population in 2005 on private lands adjacent to the SJRNWR, west of Modesto. Other populations are known from Caswell Memorial State Park near Ripon and from Paradise Cut and the San Joaquin River west of Manteca. Riparian brush rabbit is not expected to occur upstream from the confluence of the San Joaquin River with the Merced River.

Least Bell's Vireo and Western Yellow-billed Cuckoo. By 1980, least Bell's vireo was extirpated from the entire Central Valley, although the species' range is currently expanding northward (RHJV 2004); it successfully nested at the SJRNWR in 2005 and 2006 (USFWS 2006c). The least Bell's vireo nests in dense, low, shrubby vegetation, generally in riparian areas but also brushy fields, young second-growth forest or woodland, scrub oak, coastal chaparral, and mesquite brushlands, where it may build nests as low as 1 foot above the ground. This species may occur in suitable habitat in the Action Area, including along portions of the San Joaquin River.

Western yellow-billed cuckoos were observed in an area near the confluence of the Tuolumne and San Joaquin rivers regularly in the late 1960s. This area was subsequently subject to intensive logging, and no cuckoos have been observed in recent years (McBain and Trush 2002). The yellow-billed cuckoo has been considered a rare migratory species during spring in Stanislaus County (Reeve 1988). This species has potential to nest in suitable habitat in the Restoration Area. It also may occur in suitable habitat in other locations in the Action Area,

including along portions of the San Joaquin River channel that would be inundated by the release of Interim and Restoration flows. Yellow-billed cuckoo nest sites are associated with large and wide patches of riparian habitat (Laymon and Halterman 1989). In the western United States, yellow-billed cuckoos breed in broad, well-developed, low-elevation riparian woodlands composed primarily of mature cottonwoods (*Populus spp*.) and willows (*Salix spp*.). They have also been observed nesting in orchards adjacent to riparian habitats (Gaines and Laymon 1984).

Critical Habitat

Critical habitat for 11 federally-listed species is within the action area of the proposed action, the delta smelt, central California tiger salamander, and 9 species of vernal pool endemics. The final rule designating critical habitat for each species contains a full description of the critical habitat boundaries, the essential features and primary constituent elements (PCEs).

Delta smelt
Delta smelt Critical Habitat includes the entire Sacramento – San Joaquin River Delta and extends south to the San Joaquin River confluence with the Stanislaus River. Additional information on delta smelt critical habitat can be found in 59 FR No. 242.

Succulent owl's-clover
In Madera County, Unit 4C of Succulent (Fleshy) owl's-clover Critical habitat borders the north side of the San Joaquin River starting about two miles downstream from the City of Friant and continuing for about seven miles to State Route 41. Additional information on succulent owl's-clover critical habitat can be found in 69 FR No. 153.

Hoover's spurge
In Merced County, Hoover's spurge Critical Habitat Unit 6(A-C) is within the action area for the proposed project. Approximately 1.75 miles of the Eastside Bypass transects Unit 6B. The portion of Unit 6B that over lays the Eastside Bypass has been subject to annual winter and spring flood flows of as much as 7,500 cfs. It is reasonable to assume that there are no longer any primary constituent elements (PCEs) existing within that portion of Unit 6B. The PCEs for the Hoover's spurge include; (1) vernal pools, swales ad other ephemeral wetlands and depressions of appropriate size and depth and the adjacent upland margins of these depressions that sustain Hoover's spurge germination; and (2) the associated watershed and hydrologic features, including the pool basin, swales, and surrounding uplands that contribute to the filling and drying of the vernal pool or ephemeral wetland, and that maintain suitable periods of inundation, water quality, and soil moisture for Colusa grass germination, growth, and reproduction. The conditions found within the Eastside Bypass would not support the PCEs necessary for Hoover's spurge to persist. Additional information on Hoover's spurge critical habitat can be found in 69 FR No. 153.

Colusa grass
Unit 7F of Critical Habitat is entirely contained within the Eastside Bypass about 1.25 miles north of the terminus of the Chowchilla Bypass and the bifurcation of the Eastside Bypass and the Mariposa Bypass. Unit 7F being entirely within the Eastside Bypass has been subject to

annual winter and spring flood flows of as much as 7,500 cfs. It is reasonable to assume that there are no longer any primary constituent elements (PCEs) existing within Unit 7F. The PCEs for Colusa grass include; (1) vernal pools, swales ad other ephemeral wetlands and depressions of appropriate size and depth and the adjacent upland margins of these depressions that sustain Colusa grass germination; and (2) the associated watershed and hydrologic features, including the pool basin, swales, and surrounding uplands that contribute to the filling and drying of the vernal pool or ephemeral wetland, and that maintain suitable periods of inundation, water quality, and soil moisture for Colusa grass germination, growth, and reproduction. The conditions found within the Eastside Bypass would not support the PCEs necessary for Colusa grass to persist. Additional information on Colusa grass critical habitat can be found in 69 FR No. 153.

San Joaquin Valley Orcutt grass
Unit 3B of San Joaquin Valley Orcutt grass Critical habitat is within 2,500 feet of Reach 1A, in Madera County, north of Fresno. No other San Joaquin Valley Orcutt grass Critical Habitat is within the action area for the proposed project. Additional information on San Joaquin Orcutt grass critical habitat can be found in 69 FR No. 153.

Hairy Orcutt grass
Unit 6 of hairy Orcutt grass Critical Habitat borders the north side of Reach 1A for about 3 miles of the San Joaquin River in Madera County. No other hairy Orcutt grass Critical Habitat is within the action area for the proposed project. Additional information on hairy Orcutt grass critical habitat can be found in 69 FR No. 153.

Conservancy fairy shrimp
In Merced County, Conservancy fairy shrimp Critical Habitat Unit 7(A-D) is within the action area for the proposed project. Approximately 1.75 miles of the Eastside Bypass transects Unit 7C. The portion of Unit 7C that over lays the Eastside Bypass has been subject to annual winter and spring flood flows of as much as 7,500 cfs. It is reasonable to assume that there are no longer any primary constituent elements (PCEs) existing within that portion of Unit 7C. The PCEs for the Conservancy fairy shrimp include; (1) vernal pools, swales ad other ephemeral wetlands and depressions of appropriate size and depth that typically become inundated during winter rains and hold water for sufficient lengths of time necessary for the vernal pool tadpole shrimp incubation, reproduction, dispersal, feeding, and sheltering, but which are dry during the summer and do not necessarily fill with water every year; and (2) the geographic, topographic, and edaphic features that support aggregations or systems of hydrologically interconnected pools, swales, and other ephemeral wetlands and depressions within a matrix of surrounding uplands that together form hydrologically and ecologically functional units called vernal pool complexes. Additional information on Conservancy fairy shrimp critical habitat can be found in 69 FR No. 153.

Longhorn fairy shrimp
In Merced County, approximately 8 miles south of the San Joaquin River – Merced River confluence is Unit 2 of longhorn fairy shrimp Critical Habitat. About 3 river miles of the San Joaquin River border this unit, and is within the action area. Additional information on longhorn fairy shrimp critical habitat can be found in 69 FR No. 153.

Vernal pool fairy shrimp
In Merced County, vernal pool fairy shrimp Critical Habitat Unit 23(A-D) is within the action area for the proposed project. Approximately 1.75 miles of the Eastside Bypass transects Unit 23C. The portion of Unit 23C that over lays the Eastside Bypass has been subject to annual winter and spring flood flows of as much as 7,500 cfs. It is reasonable to assume that there are no longer any primary constituent elements (PCEs) existing within that portion of Unit 23C. The PCEs for the vernal pool fairy shrimp include; (1) vernal pools, swales ad other ephemeral wetlands and depressions of appropriate size and depth that typically become inundated during winter rains and hold water for sufficient lengths of time necessary for the vernal pool tadpole shrimp incubation, reproduction, dispersal, feeding, and sheltering, but which are dry during the summer and do not necessarily fill with water every year; and (2) the geographic, topographic, and edaphic features that support aggregations or systems of hydrologically interconnected pools, swales, and other ephemeral wetlands and depressions within a matrix of surrounding uplands that together form hydrologically and ecologically functional units called vernal pool complexes. Additional information on vernal pool fairy shrimp critical habitat can be found in 69 FR No. 153.

Vernal Pool tadpole shrimp
In Merced County, vernal pool tadpole shrimp Critical Habitat Unit 16(A-D) is within the action area for the proposed project. Approximately 1.75 miles of the Eastside Bypass transects Unit 16C. The portion of Unit 16C that over lays the Eastside Bypass has been subject to annual winter and spring flood flows of as much as 7,500 cfs. It is reasonable to assume that there are no longer any primary constituent elements (PCEs) existing within that portion of Unit 16C. The PCEs for the vernal pool tadpole shrimp include; (1) vernal pools, swales ad other ephemeral wetlands and depressions of appropriate size and depth that typically become inundated during winter rains and hold water for sufficient lengths of time necessary for the vernal pool tadpole shrimp incubation, reproduction, dispersal, feeding, and sheltering, but which are dry during the summer and do not necessarily fill with water every year; and (2) the geographic, topographic, and edaphic features that support aggregations or systems of hydrologically interconnected pools, swales, and other ephemeral wetlands and depressions within a matrix of surrounding uplands that together form hydrologically and ecologically functional units called vernal pool complexes. Additional information on vernal pool tadpole shrimp critical habitat can be found in 69 FR No. 153.

Central California tiger salamander
In Madera County, Unit 1 of the Southern San Joaquin Region California tiger salamander Critical habitat borders the north side of the San Joaquin River starting about two miles downstream from the City of Friant and continuing for about seven miles to State Route 41. In Merced County, two units of Central Valley Region California tiger salamander Critical Habitat are within the action area. Unit 12 is within the San Luis National Wildlife Refuge and the San Joaquin River flows through it, and Unit 13 borders the northeast side of the Chowchilla Bypass just before it terminates into the Eastside Bypass and the Mariposa Bypass. Additional information on central California tiger salamander critical habitat can be found in 71 FR No. 28.

Effects of the Proposed Action

The proposed action comprised of first phase project and program level actions necessary to reestablish flows to the existing San Joaquin River channel, and to modify the channel to ultimately contain flows up to 4,500 cfs. The SJRRP is also mandated by the Settlement to restore self-sustaining Fall- and Spring-runs of Chinook salmon to the San Joaquin River. The first phase project level actions (reoperate Friant Dam and downstream control structures; recapture interim and restoration flows) are not likely to adversely affect the 21 federally-listed species and one candidate species addressed in this consultation. The restoration of river flows above the confluence of the Merced River will, to a limited extent, restore some former habitats that existed until fairly recently along the San Joaquin River corridor (Reclamation 2011). The restoration of riparian habitat and river flows are reasonably likely to benefit those species that are still occupying the remaining fragments of such habitat, or may reoccupy lost habitats once they have been restored, such as the western yellow-billed cuckoo, the least Bell's vireo, and the valley elderberry longhorn beetle. However, it is reasonably likely that during the past years when the natural flows of the San Joaquin River have been severely altered to the extent of disappearing completely in some reaches of the San Joaquin River; species not associated with riparian habitat may have colonized those altered habitats. However, recent flood flow releases, such as occurred in 2010, together with interim flow releases since 2009, have likely eliminated opportunities for recolonization.

During the first phase of the SJRRP, the Service anticipates that there will be no incidental take of listed species from project level actions associated with flows at the 1,660 cfs level.

Reclamation will request consultation for, and provide an individual project description and effects determination for, each program level action that they propose. The second phase project level effects (Restoration Flows released from Friant Dam greater than 1,660 cfs) will be analyzed when Reclamation determines that the San Joaquin River system is adequate to convey Restoration Flows beyond the 1,660 cfs of the first phase and reinitiates consultation with the Service. A number of program level actions involve ground disturbance that may affect or more of the 21 federally-listed and one candidate species addressed in this consultation. The scope and extent of ground disturbance associated with these actions will in all cases be localized and limited. The action area does not contain significant amounts of habitat for any of these species. In light of the conservation measures proposed by Reclamation to survey, avoid, minimize and compensate for residual effects these actions may cause, we do not anticipate significant reductions in distribution, population, or reproduction of any of the 21 federally-listed species. Until such time as site specific actions are described and brought forward by Reclamation, we cannot at this time address the specific amount of habitat or number of individuals that may be affected by the program level actions

Unit 7F of Colusa grass Critical Habitat (approximately 1.6 acres) is within the action area and is entirely contained within the Eastside Bypass about 1.25 miles north of the terminus of the Chowchilla Bypass and the bifurcation of the Eastside Bypass and the Mariposa Bypass. Unit 7F being entirely within the Eastside Bypass has been subject to annual winter and spring flood flows of as much as 7,500 cfs. The proposed project may affect, but is not likely to adversely

affect Unit 7F of Colusa grass Critical Habitat because it is reasonable to assume that there are no longer any primary constituent elements (PCEs) existing within Unit 7F. The PCEs for Colusa grass include; (1) vernal pools, swales ad other ephemeral wetlands and depressions of appropriate size and depth and the adjacent upland margins of these depressions that sustain Colusa grass germination; and (2) the associated watershed and hydrologic features, including the pool basin, swales, and surrounding uplands that contribute to the filling and drying of the vernal pool or ephemeral wetland, and that maintain suitable periods of inundation, water quality, and soil moisture for Colusa grass germination, growth, and reproduction. The conditions found within the Eastside Bypass would support none of the PCEs necessary for Colusa grass to persist.

Critical habitat for the vernal pool tadpole shrimp (Unit 16C), vernal pool fairy shrimp (Unit 23C), Conservancy fairy shrimp (Unit 7C), and Hoover's spurge (Unit 6B) are transected by the Eastside Bypass. Because of the nature of the management of the bypass and that it typically conveys periodic flood flows it is unlikely that any PCEs exist within the bypass, for that reason the Restoration and interim flows of the first phase project level actions are not likely to adversely affect any of the critical habitat within the Eastside Bypass.

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 Federal actions unrelated to the proposed action are not considered in this section, because they require separate consultation pursuant to section 7 of the Act.

The overwhelmingly predominate land use within the action area is some form of agriculture, whether that be row crop, orchards, dry farming, livestock grazing, etc. It is reasonable to assume that all effects to federally listed species that are associated with the agricultural activities that currently occur in the action area will continue to occur. The Service assumes that these ongoing, background effects from agricultural practices within the action area will remain throughout the life of the proposed action and would be very difficult to quantify or predict the nature that they will take throughout the life of the proposed action. These agricultural practices do constitute a cumulative effect. Beyond these ongoing agricultural activities, Reclamation is unaware of any specific future State, Tribal, local, or private actions that are reasonably certain to occur in the action area.

Conclusion

Listed species

After reviewing the status and range of the listed species that occur within the action area, the environmental baseline for the action area, the effects of the proposed project and the known cumulative effects, it is the Service's biological opinion that the proposed project, as described, is not likely to jeopardize the continued existence of the species, and is not likely to cause an appreciable reduction in the likelihood of both the survival and recovery of those species in the wild.

Critical Habitat

Critical habitat has been designated within the action area for the proposed project; however, the Service does not anticipate any destruction or adverse modification of that critical habitat.

Candidate species

After reviewing the status and range of the proposed species that occur within the action area, the environmental baseline for the action area, the effects of the proposed project and the known cumulative effects, it is the Service's conference opinion that the proposed project, as described, is not likely to jeopardize the continued existence of the species and is not likely to destroy or adversely modify proposed critical habitat.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purpose of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities that can be implemented to further the purposes of the Act, such as preservation of endangered species habitat, implementation of recovery actions, or development of information and databases.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations. We propose the following conservation recommendations to Reclamation:

1. Assist the Service in implementing recovery actions identified within the Recovery Plans for federally listed species, and their critical habitat areas.

2. Encourage or require the use of appropriate California native species in revegetation and habitat enhancement efforts associated with projects authorized or undertaken by Reclamation.

3. Sightings of any listed or sensitive animal species should be reported to the California Natural Diversity Database of the CDFG. A copy of the reporting form and a topographic map or adequate aerial photograph clearly marked with the location the animals were observed also should be provided to the Service.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the first phase of the SJRRP. 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 maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that 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 the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

Any questions or comments regarding these comments should be directed to Kenneth Sanchez, Assistant Field Supervisor, or Rocky Montgomery, Senior Biologist, Watershed Planning Branch at (916) 414-6600.

Attachment:
Appendix A

cc:
Ms. Rhonda Reed, NMFS, Sacramento, CA
Ms. Maria Rea, NMFS, Sacramento, CA
Mr. Kevin Faulkenberry, DWR, South Central Region Office, Fresno, CA
Mr. Gerald Hatler, CDFG, Fresno, CA

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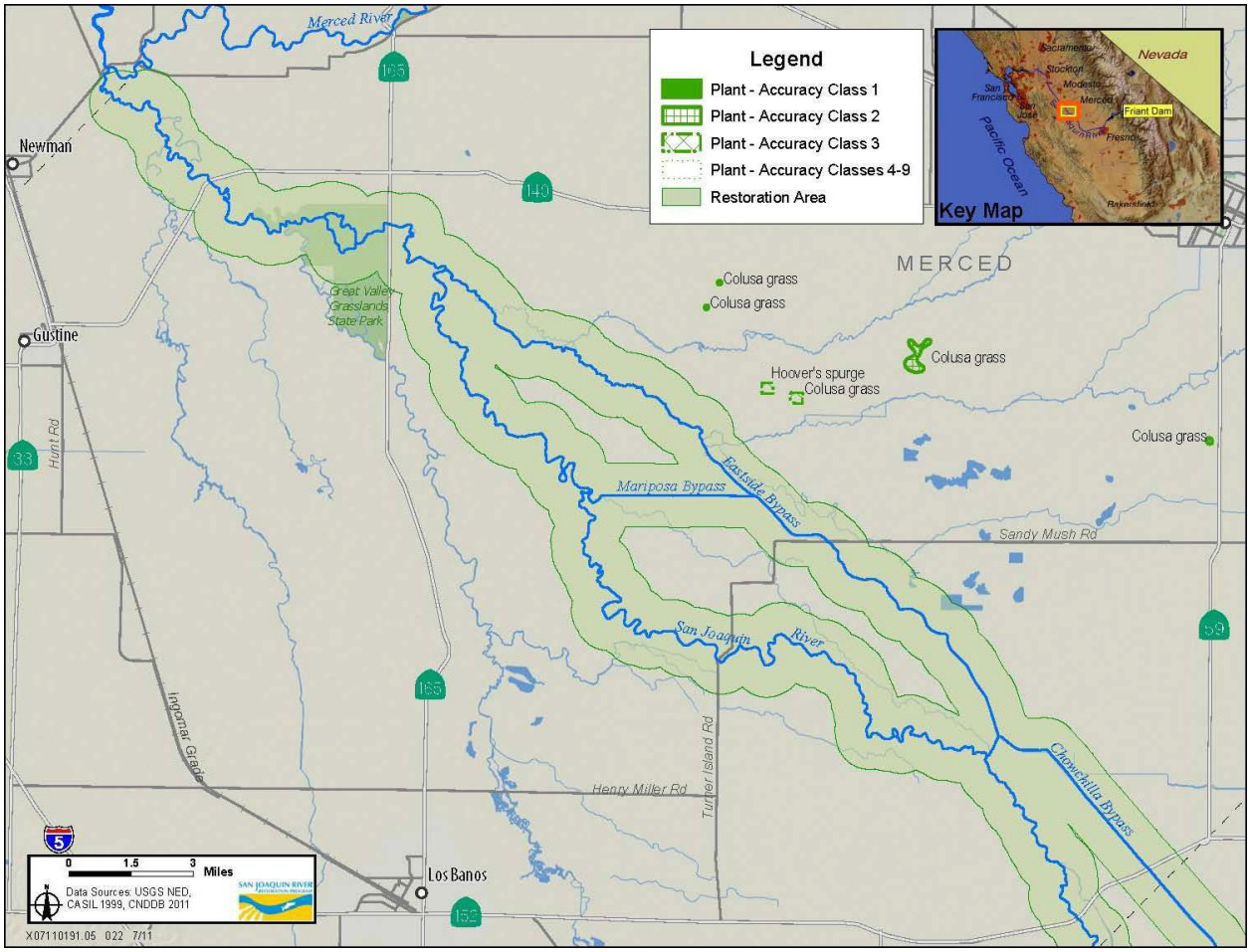
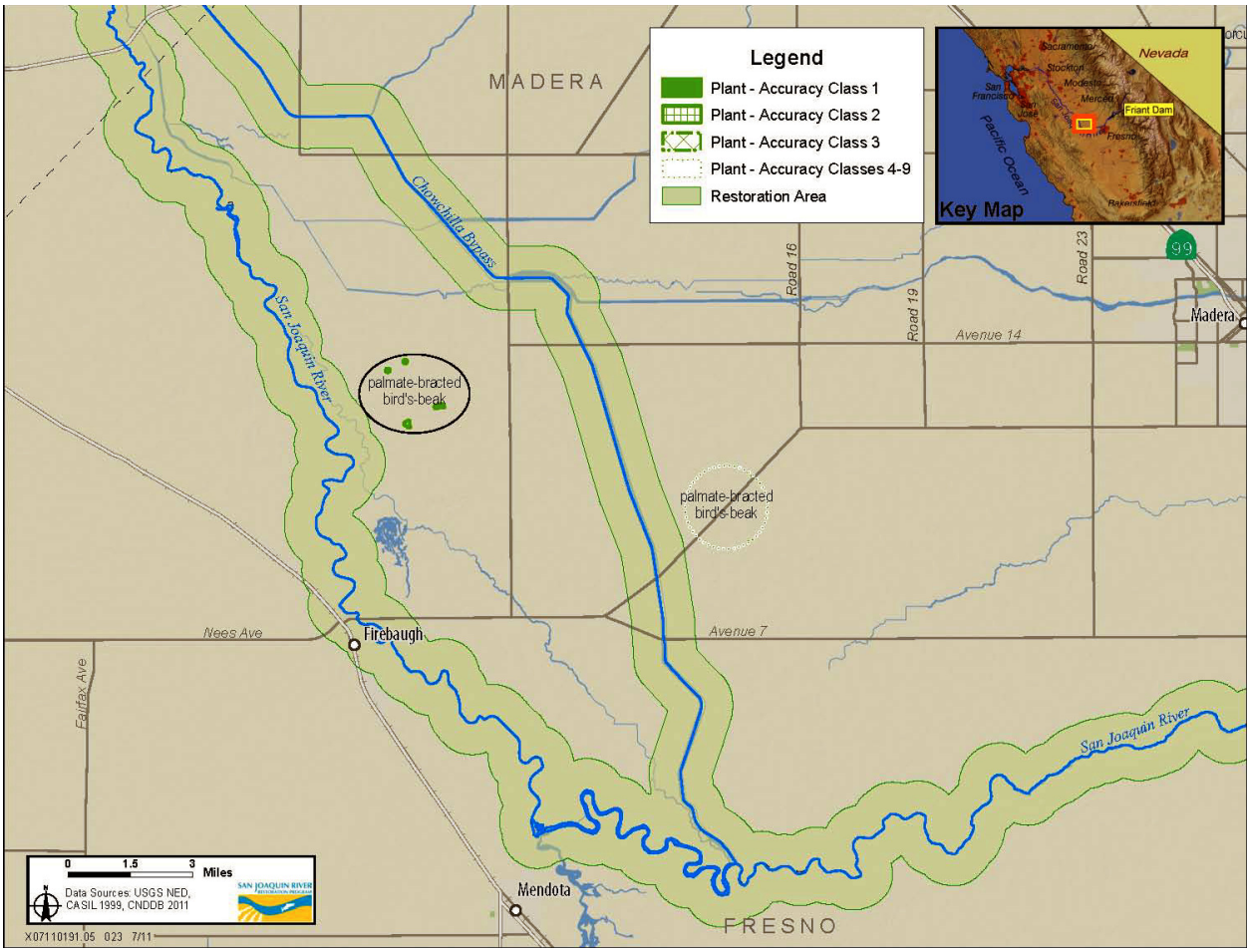
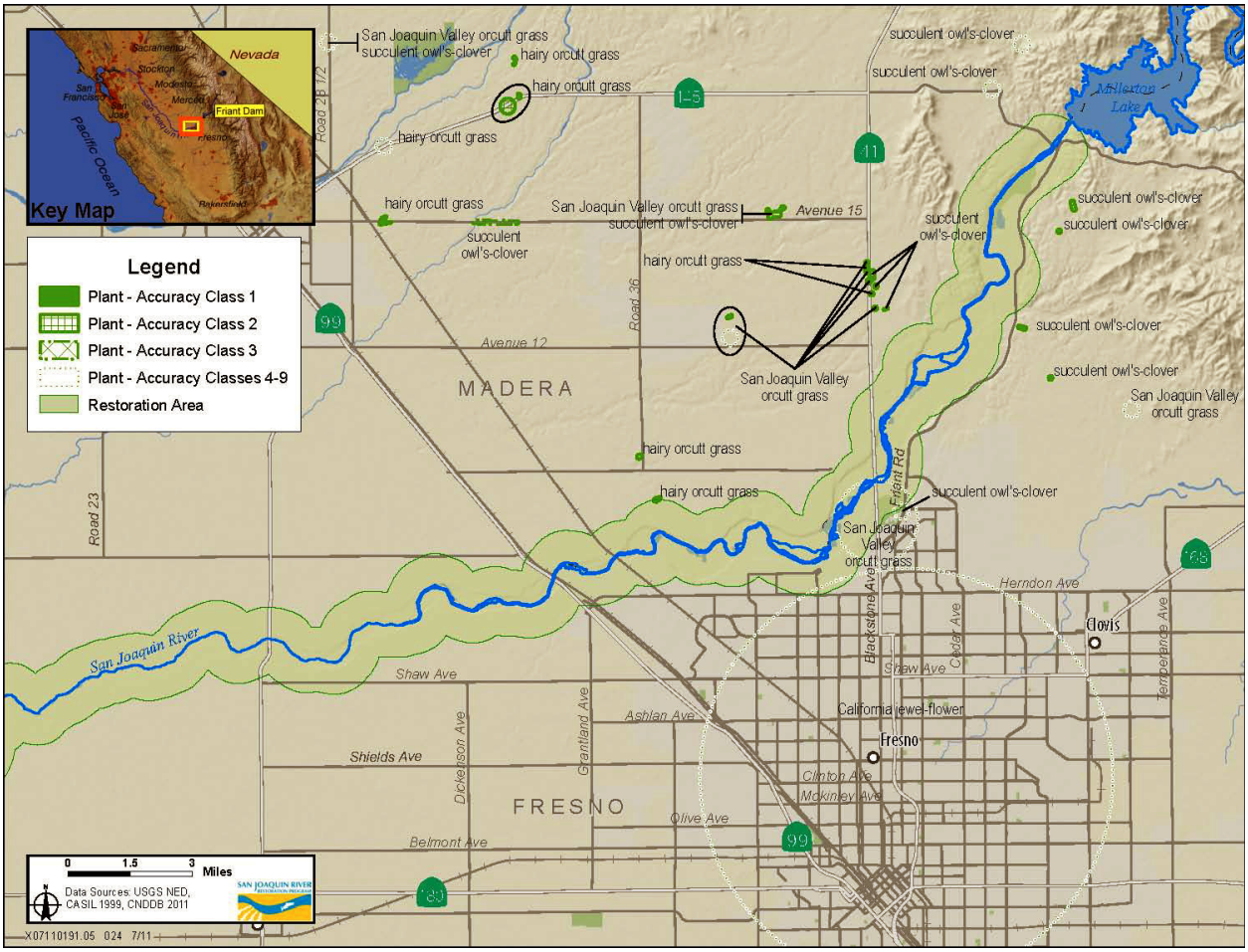
Appendix A:
Maps 1 - 9



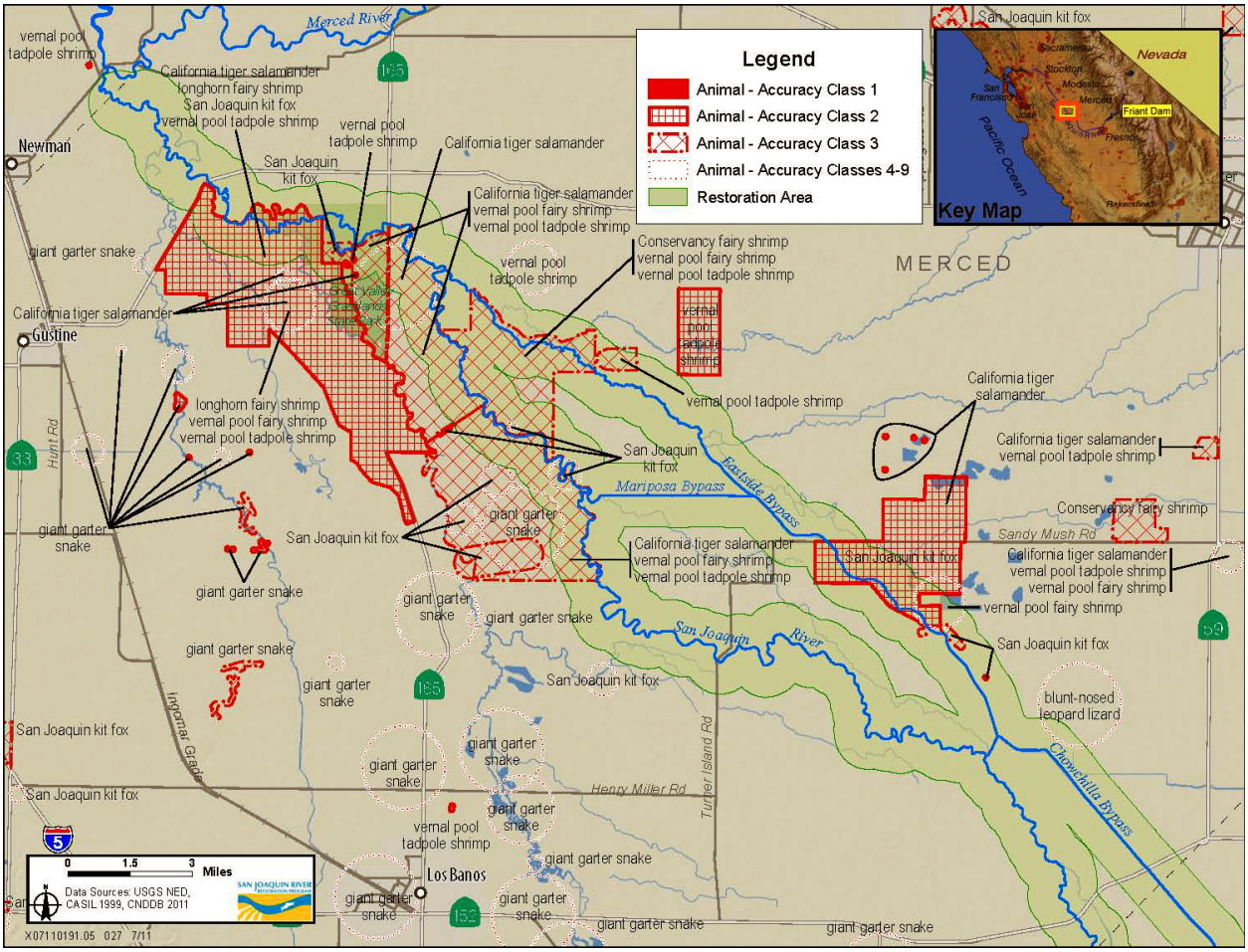
Occurrences of Federally Listed Plants In Action Area
Map1



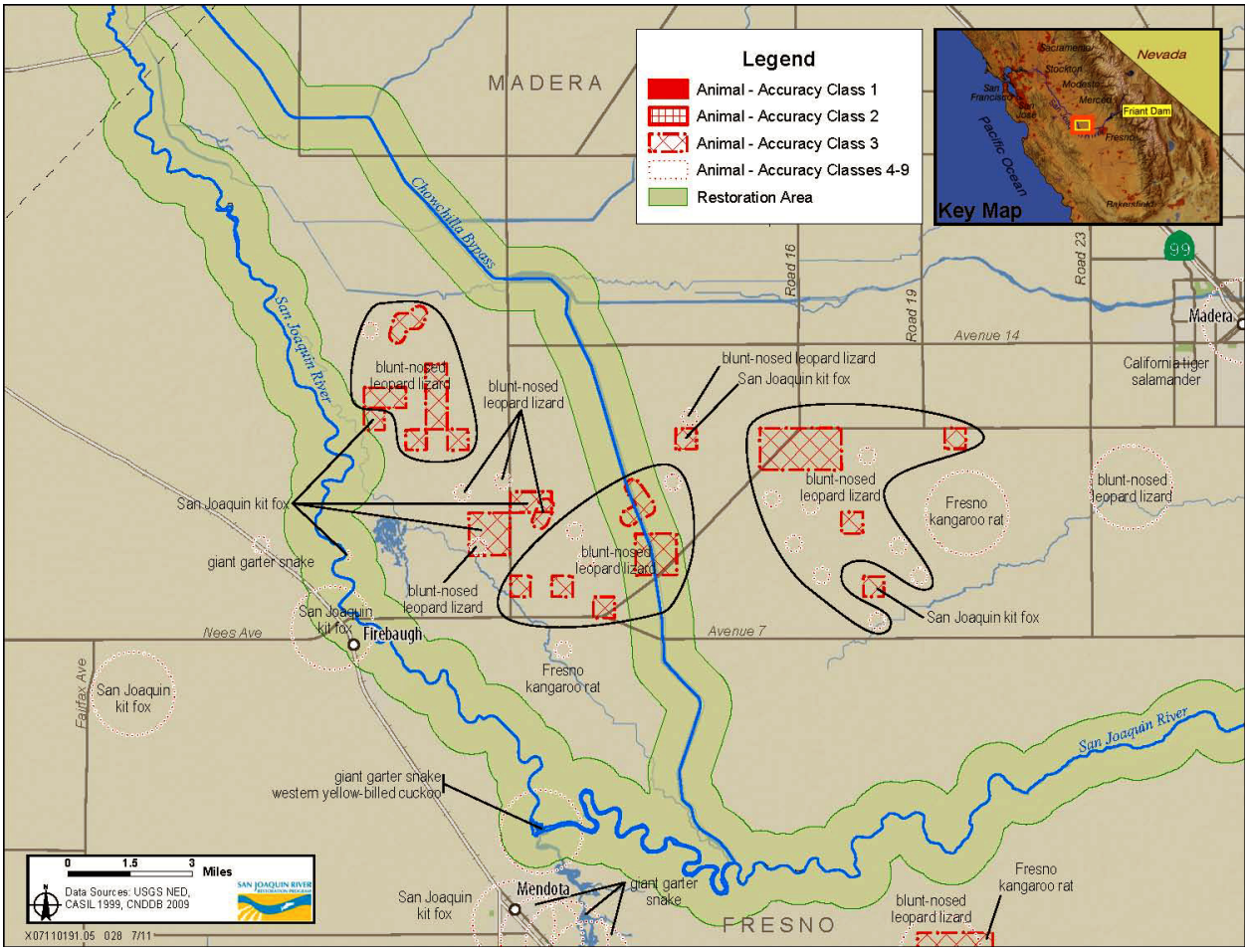
Occurrences of Federally Listed Plants In Action Area
Map 2



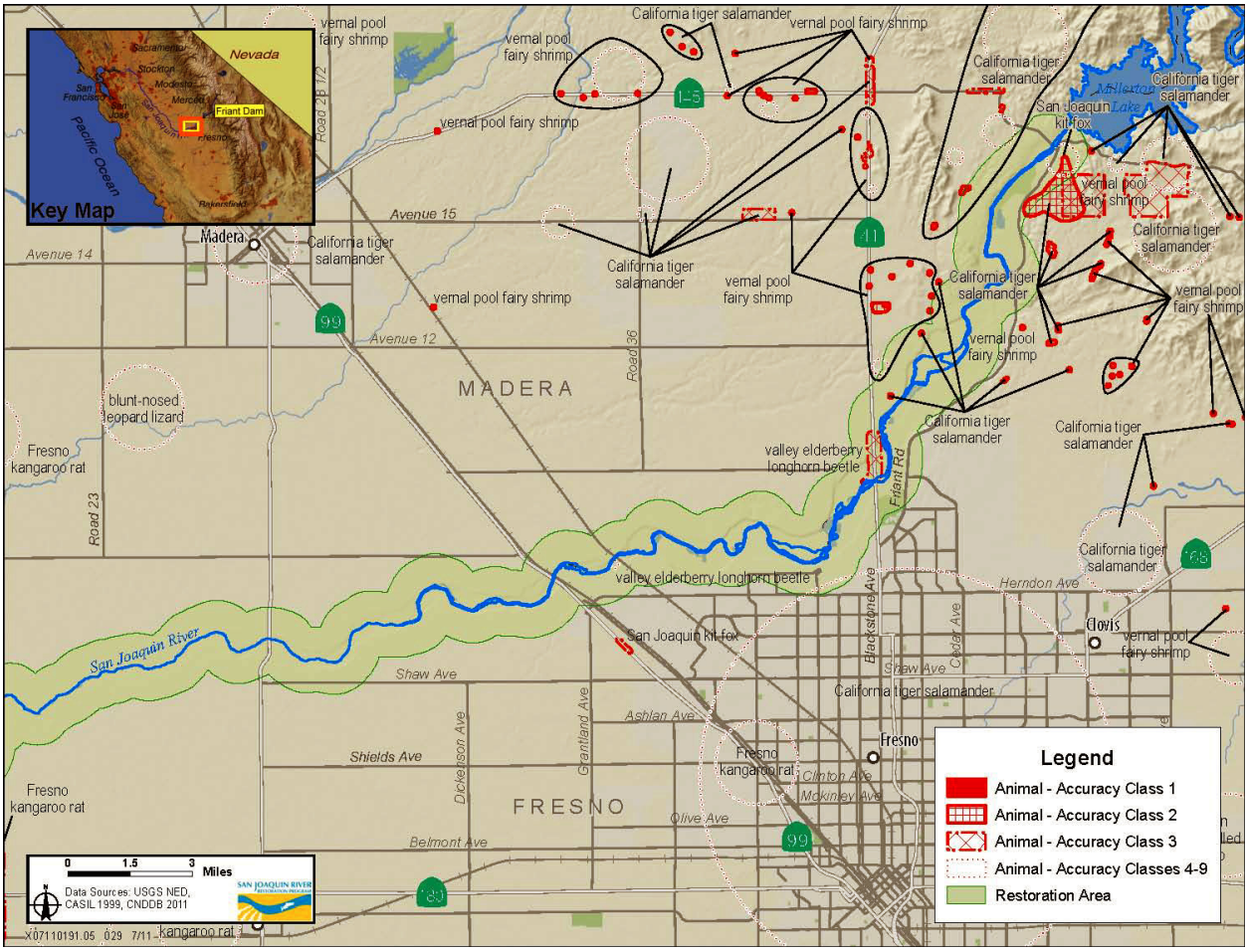
Occurrences of Federally Listed Plants In Action Area
Map 3



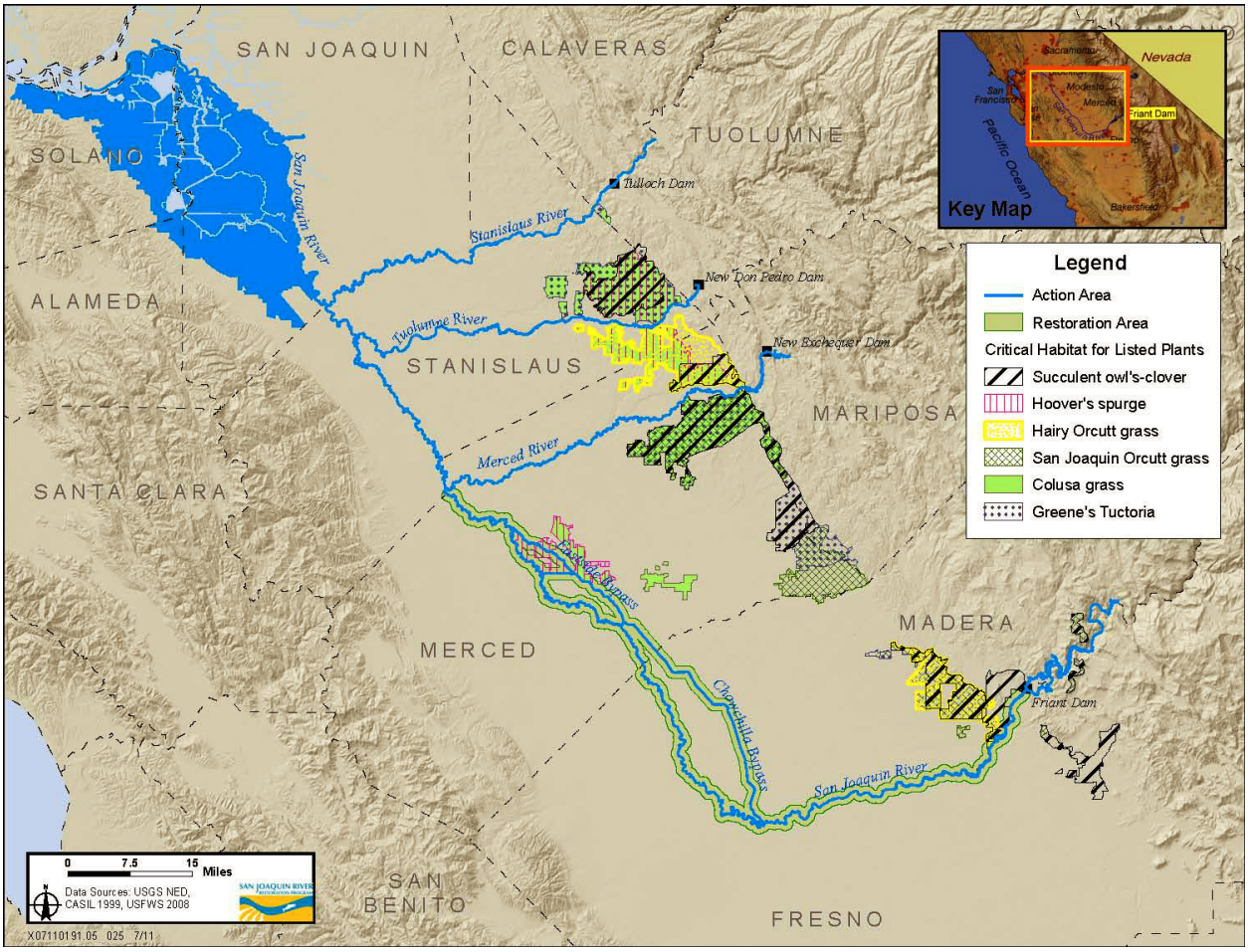
Occurrences of Federally Listed Wildlife In Action Area
Map 4



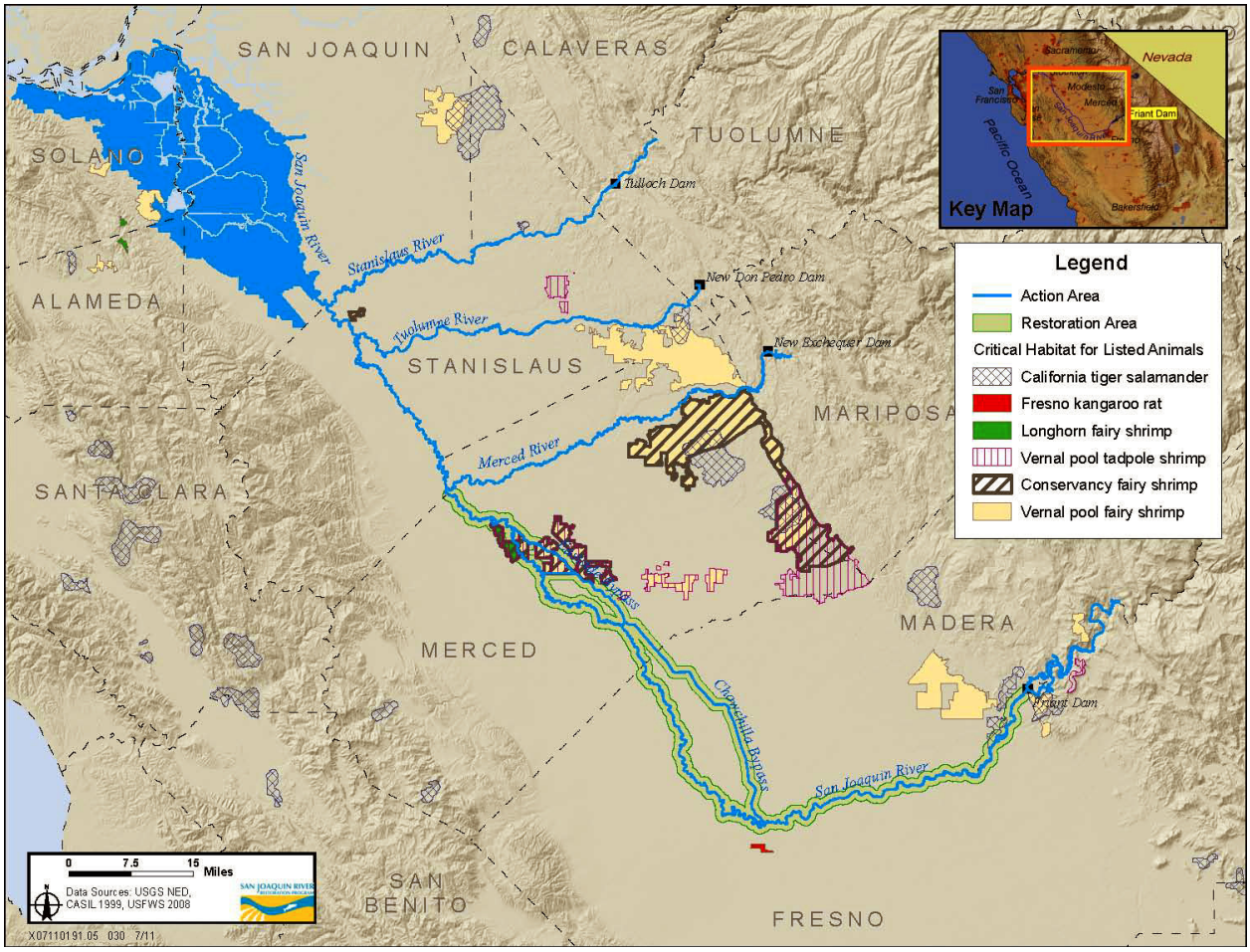
Occurrences of Federally Listed Wildlife In Action Area
Map 5



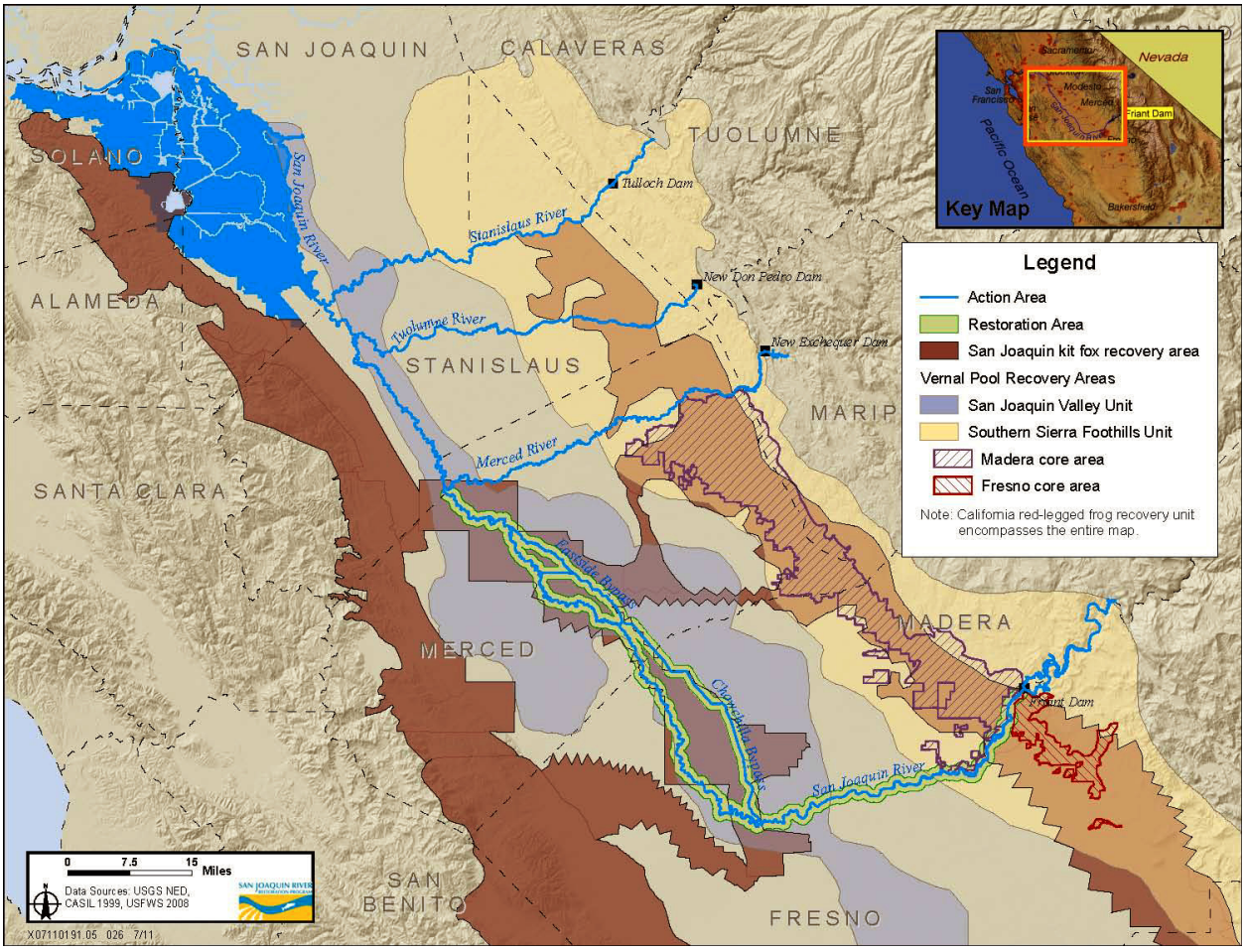
Occurrences of Federally Listed Wildlife In Action Area
Map 6



Critical Habitat for Federally Listed Plants in Action Area
Map 7



Critical Habitat for Federally Listed Wildlife in Action Area
Map 8



Recovery Areas for Federally Listed Species in Action Area
Map 9

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