SAN LUIS UNIT

FINAL ENVIRONMENTAL ASSESSMENT

INTERIM CONTRACT RENEWAL 2010-2013

Appendix F
San Luis Unit Interim Contract Biological Opinions

February 2010

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

IN REPLY REFER TO:
81420-2008-F-0944-2

FEB 19 2009

Memorandum

To: Chief, Resources Management Division, South Central California Area Office, U.S. Bureau of Reclamation, Fresno, California

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

Subject: Consultation on the Renewal of Interim Water Service Contracts for the 24-Month Period from March 1, 2010 through February 29, 2012 for Cross Valley and Delta Division Contractors in San Joaquin, Santa Clara, Tulare, Fresno, Kings, and Kern Counties, California

This document transmits the Fish and Wildlife Service's (Service) biological opinion based on our review of the Bureau of Reclamation's (Reclamation) September 15, 2009 proposal to issue 14 Interim Renewal Contracts (IRC) for up to two consecutive one year periods, beginning March 1, 2010 and ending February 29, 2012, in accordance with section 7 of the Endangered Species Act (ESA) (16 U.S.C. 1531 *et seq.*). This document also addresses the consolidation of the Kern-Tulare Water District (KTWD) and the Rag Gulch Water District (RGWD) into a single district using the KTWD name through the assignment of RGWD's IRC to KTWD. Reclamation and KTWD have committed as part of this IRC process to deliver amounts of water within the former KTWD boundaries that would have been delivered without the assignment; similarly, water deliveries within the former RGWD boundaries will be as they would have been without the assignment. Reclamation will include the consolidated ("new") KTWD boundaries and consolidated water use within those boundaries as part of the long-term contract consultation.

Based on Reclamation's project description and our evaluation of the status of the species, the environmental baseline, together with effects of the action and cumulative effects, the Service has concluded that Reclamation's request to renew the interim water contracts is a non-jeopardy Federal action within the meaning of the Endangered Species Act of 1973.

The Service completed a consultation on February 29, 2008 (Service File 81420-2008-F-0944-1), that determined that issuing 24-month IRC's for the contractors listed in Table 1 would not be likely to adversely affect listed species because the continued delivery of CVP water would not result in a change from the base condition over the 24-month period of the IRCs.

This biological opinion is a reinitiation and amendment of the U.S. Fish and Wildlife Service's (Service) February 29, 2000 biological opinion on Interim Water Contract Renewals (Service File 1-1-00-F-0056, as amended by our biological opinions of February 27, 2002, Service File 1-

1-02-F-0070), February 27, 2004 (Service File 1-1-04-F-0360), February 28, 2006 (Service File 1-1-06-F-0070), and February 29, 2009 (Service File 81420-2008-F-0944-1) in accordance with section 7 of the Endangered Species Act of 1973, as amended (ESA). This fourth amendment to the February 29, 2000 biological opinion addresses the effects of the proposed renewal of the contracts addressed in the 2004 opinion (Table 1) in accordance with Section 3404(c) of the Central Valley Project Improvement Act (CVPIA), for a maximum period of 2 years. The water will be used within the interim contract service areas for agricultural, municipal, and industrial purposes, and will not exceed water allocations determined by existing CVP operations criteria. Interim CVP water contract renewals are consistent with the tiered implementation of the CVPIA, as described in the biological opinion on Implementation of the CVPIA (CVPIA opinion, Service File No., 1-1-98-F-0124).

Table 1. Interim renewal contractors for period of March 1, 2010 through February 29, 2012

	CVP Contractor name and Contract Number	Contract amount (af/year)
	Delta Division - Delta-Mendota Canal Unit	
1.	Tracy, City of (partial assignment from West Side ID – 14-06-200-4305A-IR12-B)	5,000
2.	Tracy, City of (partial assignment from Banta Carbona ID – 7-07-20-W0045-IR12-B)	5,000
	CROSS VALLEY UNIT	
3.	Fresno, County of – 14-06-200-8292A-IR13	3,000
4.	Hills Valley Irrigation District – 14-06-200-8466A-IR13	3,346
5.	Kern-Tulare Water District – 14-06-200-8601A-IR13 (KTWD 40,000 af + RGWD 13,300 af)	53,300
6.	Lower Tule River Irrigation District – 14-06-200-8237A-IR13	31,102
6.	Pixley Irrigation District – 14-06-200-8238A-IR13	31,102
6.	Tri-Valley Water District – 14-06-200-8565A-IR13	1,142
6.	Tulare, County of – 14-06-200-8293A-IR13	5,308

1 - Partial assignment of Mercy Springs contract 14-06-200-3365A-IR9-B

Concurrence with Determinations of "Not Likely to Adversely Affect"

Because of the wide geographic variation in service areas for interim contractors and overlap of species among different contractors, we will address these determinations by contractor.

City of Tracy

The renewal of the City of Tracy's interim contracts # 14-06-200-4305A-IR12-B and 7-07-20-W0045-IR12-B will be used to support additional urban growth in the City of Tracy. These contracts were assigned from Banta Carbona Irrigation District and West Side Irrigation District to the City of Tracy. The effects of this water delivered to the City of Tracy, together with the effects of interdependent actions, have been addressed through the section 10(a)(1)(B) permit issued to the City of Tracy for implementation of the San Joaquin Multi-Species Conservation Plan for a period of fifty years. The permit expires in the year 2051. Reclamation has completed Endangered Species Act compliance through our April 15, 2003, biological opinion on these assignments (Service file # 1-1-03-F-0128). Approval of these assignments by Reclamation will not result in effects to listed species not anticipated and covered by the section 10(a)(1)(B) permit issued to the City of Tracy, and the biological opinion for the contract assignments.

Cross Valley Unit

The 2010 contract renewals will use the same "interim form of contract" used in the previous interim contracts. The interim form of contract includes a mixture of agricultural/irrigation (Ag) use and municipal/industrial (M&I) purpose of each of the 2010 interim renewal contracts. Use of contract water under the proposed interim contracts will not change from the purpose of use specified in the existing interim contracts. For the purposes of this consultation, all conservation measures and non-discretionary terms and conditions described in the biological opinion on long-term contract renewal of the Friant and Cross Valley Unit Contracts (Friant-Cross Valley Opinion, Service File No. 1-1-01-F-0027) apply to the interim renewal of the Cross Valley Unit contracts for the period of March 1, 2010 through February 29, 2012, or until long-term contracts for the Cross Valley Unit are executed, whichever comes first. Therefore, all conservation measures and non-discretionary terms and conditions of the Friant-Cross Valley Opinion of 2000 relevant to Cross Valley contracts are incorporated by reference into this consultation.

Our concurrence with the NLAA determination concludes consultation for this action. Therefore, unless new information reveals effects of the proposed action that may affect listed species in a manner or to an extent not considered, or a new species or critical habitat is designated that may be affected by the proposed action, no further action pursuant to the Endangered Species Act of 1973, as amended, is necessary. If you have questions regarding this action, please contact Michael Welsh or Dan Russell at (916) 414-6600.

cc: USBR Sacramento, CA (Attn: Michael Chotkowsky, MP-150)
USBR Sacramento, CA (Attn: Michael Kinsey)

Mail to:

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In reply refer to: 81420-2008-F-0538-3

Memorandum

FEB 26 2010

To: Area Manager, Bureau of Reclamation, South-Central California Area Office, Fresno, California

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

Subject: Consultation on the Interim Renewal of Ten Water Service Contracts including Five with Westlands Water District for March 1, 2010 – February 29, 2012; Four Municipal and Industrial Water Service Contracts with Department of Fish & Game, and the Cities of Avenal, Coalinga, and Huron, for March 1, 2011 – February 28, 2013, and the 3-way Partial Assignment from Mercy Springs Water District to Pajaro Valley Water Management Area, Santa Clara Valley Water District, and Westlands Water District for March 1, 2010 – February 29, 2012

This is in response to the request from the U.S. Bureau of Reclamation (Reclamation) for consultation with the U.S. Fish and Wildlife Service (Service) dated September 15, 2009, on the potential effects to listed species from the execution of Interim Renewal Contracts (IRC) for two-years beginning on March 1, 2010 and ending February 29, 2012, for Westlands Water District (WD), Santa Clara Valley WD and Pajaro Valley Water Management Area. Consultation was also requested for several IRCs that do not expire until February 28, 2011. Four IRCs including California Department of Fish and Game (CDFG), the cities of Avenal, Coalinga and Huron will be renewed for two years beginning March 1, 2011 and ending February 28, 2013. Your request was received in our office on September 17, 2009. This document represents the Service's biological opinion on the effects of the action on the endangered San Joaquin kit fox (*Vulpes macrotis mutica*), California least tern (*Sterna antillarum browni)*, blunt-nosed leopard lizard (*Gambelia silus)*,. California jewelflower (*Caulanthus californicus)*, San Joaquin woolly-threads (*Monolopia congdonii)*, and the threatened giant garter snake (*Thamnophis gigas)* Critical habitat has not been designated for any of the species considered in this opinion. This response has been prepared pursuant to section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.*), and in accordance with the regulations governing interagency consultations (50 CFR §402).

Reclamation and the Service have determined that the proposed action will have no effect on the federally listed species or critical habitats as follows: Buena Vista Lake shrew (*Sorex ornatus relictus*), Fresno kangaroo rat (*Dipodomys nitratoides exilis*), Tipton kangaroo rat (*D. nitratoides nitratoides)*,giant kangaroo rat (*D. ingens*), riparian woodrat (*Neotoma fuscipes riparia*), bald eagle (*Haliaeetus leucocephalus*), California condor (*Gymnogyps californianus*), California red-legged frog (*Rana aurora draytonii*), California tiger salamander (*Ambystoma californiense*), vernal pool fairy shrimp (*Branchinecta lynchi*), vernal pool tadpole shrimp (*Lepidarus packardi*), palmate-bracted bird's-beak (*Cordylanthus palmatus*), Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), Delta smelt (*Hypomesus transpacificus*), delta smelt critical habitat, and the California clapper rail (*Rallus longirostrus obsoletus.* We have reached this determination because either the current range for the species does not extend into the San Luis Unit (SLU) or there are no known occurrences of the species inside the action area that would be affected by the continued delivery of Central Valley Project (CVP) water during the interim contract period. Bald eagle (*Haliaeetus leucocephalus*) is not being considered because it was delisted on July 9, 2007 (50 CFR 17 37346 – 37372).

This biological opinion is based on the information provided for the SLU long term contract renewal (LTCR) consultation (the 2004 Biological Assessment (BA) and Draft Environmental Impact Statement and Draft Supplemental Environmental Impact Statement), Reclamation responses to the Service's insufficiency memoranda related to SLU contract renewals, additional information generated by the Endangered Species Recovery Program, the May 2007 Draft Environmental Assessment (EA), "San Luis Unit Water Service Interim Renewal Contracts— 2008- 2011", the January 2010 Draft EA, "Renewal of Cross Valley Interim Water Service Contracts and Delta/San Felipe Division Contracts through February 29, 2012", EA-09-126, and the January 2009 Draft EA," San Luis Unit Water Service Interim Renewal Contracts 2010 – 2013", EA-09-101).

Introduction

This biological opinion is a reinitiation of the Service's *February 29, 2000* biological opinion on IRCs (Service File No. 00-F-0056), and our consultations of *February 27, 2002* (Service File No., 02-F-0070), *February 27, 2004* (Service File No., 04-F-0360), *February 28, 2006* (Service File No., 06-F-0070), *December 15, 2008* (Service File No. 08-F-0538-1), and of *December 22, 2009* (Service File No. 08-I-0538-2) in accordance with section 7 of the ESA. This consultation addresses the effects of the proposed renewal of ten IRCs in the SLU and San Felipe Division of the Central Valley Project (CVP), in accordance with Section 3401(c) of the Central Valley Project Improvement Act (CVPIA) for a maximum period of 2 years. The water will be used within the IRC service areas for agricultural, municipal and industrial purposes, and will not exceed water allocations determined by existing CVP operations criteria as established in the Biological Opinions that have been issued by National Oceanographic and Atmospheric Administration Fisheries Service (NMFS) (2009) and Service (2008) for the effects of the continued long-term operation of the (CVP and State Water Project (SWP) (OCAP Opinion) described in more detail below. Interim CVP water contract renewals are consistent with the tiered implementation of the CVPIA, as described in the Biological Opinion on Implementation of the CVPIA (Service File No. 98-F-0124).

Consultation History

In November 2000, the Service issued a Biological Opinion on the Implementation of the Central Valley Project Improvement Act (CVPIA) and Continued Operation and Maintenance of the

Central Valley Project (CVPIA BO) (Service 2000). The CVPIA BO addressed both the overall operation and maintenance of the CVP and implementation of the CVPIA. Because the CVPIA BO is a programmatic document, subsequent site-specific evaluations are being prepared to analyze the effects of implementing specific actions of the CVPIA on listed species, and the Interim water service contract renewals are an action requiring site-specific evaluation.

Reclamation and the Service also continue to consult on several other large-scale projects within the San Joaquin Valley and the Delta that may affect listed species. The results of these other consultations are or will be Biological Opinions that stand on their own merits and that establish thresholds to ensure the survival and recovery of listed species. These Biological Opinions are also listed below. Where applicable, the Service file numbers are in parentheses and species addressed in each are provided for additional information.

April 5, 2000: Reclamation provides a memo to the Service regarding the status of Coordination with California Department of Pesticide Regulation (CDPR) in a joint effort to provide endangered species information to pesticide users consistent with conservation measure *2a.* of the 2000 Interim Contract Renewal (IRC) Biological Opinion.

December 12, 2000: The Service submits an insufficiency memo to Reclamation regarding initiation of formal consultation for the long term contract renewal (LTCR) of contracts in the Delta Mendota Canal (DMC) Unit of the CVP. The memo includes a review of status and compliance with the IRC Biological Opinion of 2000.

January 30, 2001: Request from Reclamation to the Service initiating formal consultation for interim CVP water service contracts for the period of February 2001 to February 2002.

February 5, 2001: Reclamation provides to the Service a copy of the Draft Supplemental EA for the Renewal of Interim Water Service Contracts through February 28, 2002, CVP, California, and the draft Finding of No Significant Impact (FONSI) dated February 2, 2001.

February 28, 2001: Reclamation seeks concurrence (via memo) of the Service that the partial assignment of the Mercy Springs CVP contract will not adversely affect any listed species under the jurisdiction of the Service.

February 28, 2001: The Service extends for 1-year until February 28, 2002, the 2000 IRC Biological Opinion and concurs with Reclamation's conclusion that the delivery of the partial assignment of CVP contract water from Mercy Springs WD to the Santa Clara Valley WD and Westlands WD (Mercy Springs partial assignment) for use of up to 6,260 acre-feet of CVP water for 1 year from March 1, 2001 to February 28, 2002, is not likely to adversely affect federally listed species.

June 19, 2001: The Service submits a memo to Reclamation regarding concerns over exceedences of selenium levels in wetland water supply channels in the Grasslands Area, and how actions that Reclamation undertakes may influence these exceedences. The memo asked Reclamation to determine if reinitiation of the Interim contract biological opinion was warranted, and further asked Reclamation take steps to correct these selenium issues before initiating consultation with the Service on LTCR for the DMC Unit, or an additional IRC.

June 27, 2001: Letters to the Service from the Board of Supervisors, County of Santa Clara and from Board of Directors, Santa Clara Valley WD which includes commitments on the part of Santa Clara County to participate in the 1) preparation of a multi-species HCP/NCCP with the goal of completing a final HCP/NCCP and submitting an application for incidental take permits within 5 years; and, 2) establish an interim process that will keep conservation and recovery options open for affected species, and to ensure County compliance with ESA and the California ESA with regard to the issuance of discretionary permits, excluding agricultural activities, where Federal jurisdiction applies, during the period prior to approval of the HCP.

October 19, 2001: Memo from Reclamation advising the Service that Reclamation is developing a proposed action of executing IRCs for a period of 2 years, from 2002 to 2004.

November 19, 2001: Reclamation submits a memo to the Service requesting initiation of informal consultation with the Service on IRCs for the period from March 1, 2002 through February 29, 2004.

December 18, 2001: The Service receives a memo from Reclamation dated December 14, 2001 providing supplemental information for the IRC consultation.

December 19, 2001: The Service submits a memo to Reclamation requesting additional information and requesting that Reclamation initiate formal consultation on IRCs.

January 17, 2002: The Service submits a memo responding to Reclamation's request to initiate formal consultation, and requesting additional information status of implementation of conservation measures/terms and conditions of the IRC biological opinion of 2000.

January 31, 2002: Reclamation submits a memo to the Service responding to the Service's January 17, 2002 for additional information on IRCs.

February 7, 2002: Reclamation and the Service meet to discuss conservation measures proposed by the Service to be added to the project description of the IRC biological opinion.

February 20, 2002: Reclamation provides a written response to the Service regarding the Service's proposed conservation measures to be added to the project description of the biological opinion of IRCs.

November 6, 2003: Reclamation requests initiation on 59 IRCs for the period March 1, 2004, through February 28, 2006.

January 8, 2004: Service receives amended information for interim contractor City of Shasta Lake dated December 23, 2003.

February 19, 2004: Service receives supplemental information regarding presence of critical habitat, Natural Diversity Database records, and other baseline information for interim contractors.

July 19, 2004: Service receives memo from Reclamation's Regional Environmental Officer on consultation parameters related to full contractual entitlement for LTCRs

September 14, 2004: Service receives Reclamation's submittal of a BA and request for formal consultation for the LTCR of South Central California Area Office (SCCAO) Water contracts for the SLU unit.

November 3, 2004: Reclamation requests formal reinitiation of consultation on OCAP to address critical habitat issues and effects on delta smelt.

November 24, 2004: Service issues an insufficiency memorandum outlining lack of information and requesting additional information from SCCAO on SLU LTCR consultation.

February 15, 2005: Biological Opinion (05-F-0055), delta smelt and critical habitat.

May 19 and September 27, 2005: Reclamation provides additional information (and requests that consultation be initiated in their September 27 memorandum) for SLU LTCR consultation.

January 12, 2006: Service issues a no jeopardy biological opinion to Reclamation for long term renewal of CVP water service contracts for El Dorado Irrigation District (Service File No. 04-F-0489).

January 13, 2006: Reclamation initiates consultation on interim renewal of 18 CVP water service contracts for the period of March 1, 2006 through February 29, 2008.

January 19, 2006: Service concurs that long term renewal of the CVP water service contract for San Juan Water District is not likely to adversely affect listed species (Service File Number 04-I-1821).

February 28, 2006: Service receives supplemental information on each 2006 IRC indicating the contract's "purpose of use", the interim contract's existing "water shortage reliability", and states the year each 2006 interim contract's "purpose of use" became mixed Ag and M&I.

July 6, 2006: Reclamation requests that the Service reinitiate consultation on delta smelt.

May 2007: Draft EA, "San Luis Unit Water Service Interim Renewal Contracts— 2008- 2011."

July 17, 2007: Reclamation requests initiation of formal consultation pursuant to section 7(a) of the ESA, for the execution of 26-month IRCs.

August 20, 2007: Service responds to request for formal consultation with an insufficiency memo (07-I-1405), identifying additional information needs.

October 25, 2007: Reclamation responds to information request (via email) with the requested additional information.

December 18, 2007: Consultation on the IRCs with Westlands WD, CDFG, and the Cities of Avenal, Coalinga, and Huron.

December 15, 2008: Formal ESA Consultation on the Proposed Coordinated Operations of the Central Valley Project (CVP) and State Water Project (SWP) (OCAP Opinion).

December 15, 2008: Reclamation submits a memo to the Service provisionally accepting the Reasonable and Prudent Alternative (RPA) developed by the Service and included in the Biological Opinion on the effects of the continued long-term operation of the Central Valley Project (CVP) and State Water Project (SWP) (OCAP Opinion).

December 22, 2008: Consultation on the IRCs in the San Luis WD and Panoche WD.

September 15, 200: The Service receives a memo from Reclamation requesting ESA consultation on CVP Interim contracts.

January 8, 2010: Reclamation Releases Draft EA and FONSI "San Luis Unit Water Service Interim Renewal Contacts 2010-2013" and Draft EA and FONSI "Renewal of Cross Valley Interim Water Service Contracts and Delta/San Felipe Division Contracts through February 29, 2012"

Relationship of the Proposed Action to Other Reclamation Actions

<u>M&I Shortage Policy</u>
The interim renewal contracts will apply the same interim shortage provisions that are currently applied to existing contracts, in accordance with the June 9, 1997, CVPIA Administrative Proposal on Urban Water Supply Reliability (p. 2-29, CVPIA BO, Service file no. 98-F-0124). These IRCs will not change contract terms or conditions governing the allocation of project water during a drought emergency, so would not provide additional water reliability. As a result, we do not anticipate the 2010 IRCs to affect water allocations identified by existing CVP operations criteria. We expect Reclamation to analyze the effects of permanently converting CVP contracts to a mixed Ag/Municipal and Industrial (M&I) purpose of use within the Long Term Renewal Contract (LTRC) consultations, and to also analyze possible service-area effects of Reclamation's M&I Shortage Policy under the LTRC consultations (see **Environmental Baseline**).

<u>San Luis Drainage Feature Re-evaluation ROD and ESA consultation</u>
In 2006 Reclamation completed an Environmental Impact Report (EIS) and Record of Decision (ROD) under the National Environmental Policy Act (NEPA), and the Service completed a Biological Opinion under section 7 of the Act (Service File No. 06-F-0027) and a Fish and Wildlife Coordination Act Report (CAR) in accordance with, the provisions of section 2(b) of

the Fish and Wildlife Coordination Act (48 stat. 401, as amended; 16 U.S.C. 661, et seq.) on San Luis Drainage Feature Re-evaluation (SLDFR). Congress has not yet acted to authorize and make appropriations to implement the ROD, although Reclamation has the authority to complete some of the actions described in the EIS.

The purpose of the SLDFR project is to meet Reclamation's obligations under the Federal San Luis Unit Act of June 3, 1960, Public Law 86-488, 74 Stat. 156, Section 5, to provide drainage service to drainage-impacted lands within the SLU. Once fully implemented, Reclamation anticipated in the EIS and ROD that the drainage discharge from the SLU would be reduced to sufficient standards to meet the statutory and judicial requirements imposed. Any changes to drainage service not considered in the SLDFR Biological Opinion will require separate section 7 consultation.

Third Use Agreement for the Grassland Bypass Project, 2010-2019
In 2009, Reclamation completed an EIS and ROD under NEPA, and the Service completed a Biological Opinion under section 7 of the Act (Service File No. 09-F-1306) on the proposed continuation of the Grassland Bypass Project (GBP), 2010-2019. The Proposed Federal Action (GBP Extension) is the execution of the Third Use Agreement between Reclamation and the Water Authority for the federally-owned San Luis Drain (SLD) (Use Agreement). The term of the new Use Agreement is January 01, 2010, through December 31, 2019. Under the Proposed Action, the GBP Extension will continue to consolidate subsurface drainwater collected from the 97,400-acres of agricultural lands in the Grasslands Drainage Area (GDA) and use a portion of the San Luis Drain (SLD) to convey some of the highly contaminated drainwater around wetland habitat areas of the Grasslands. The collected drainwater is discharged from the SLD into Mud Slough (North) for six miles before reaching the San Joaquin River at a location three miles upstream of its confluence with the Merced River. The Federal action is the implementation of that Use Agreement.

The purposes of the 2010 GBP Extension are:

1. To extend the SLD Use Agreement to allow the grassland area farmers more time to acquire funds and develop, test and implement feasible drainwater treatment and disposal technologies to meet revised Basin Plan Objectives and waste discharge requirements for full implementation (including zero discharge into Mud Slough (North) and the San Joaquin River) by December 31, 2019;

2. To continue collection and discharge of contaminated agricultural drainwater from the GDA into the SLD and away from wetland water supply conveyance channels for the period 2010 to 2019; and,

3. To facilitate drainage management that maintains the viability of agriculture lands in the GDA and promotes improvement in water quality in the San Joaquin River over the life of the project.

The GBP has been in operation since October 1996. The Project has reduced the volume of drainwater discharged from the GDA into the San Joaquin River (by means of recycling and in-valley drainage reuse), and has rerouted drainage away from the Grassland wetland supply channels (where drainage had been discharged prior to 1996). Implementation of the GBP has resulted in significant reductions in selenium loading and contamination in the Grassland wetland water supply channels and the San Joaquin River. The Biological Opinion includes conservation measures and terms and conditions to reduce and minimize effects to listed species.

Operations Criteria and Plan (OCAP)

The OCAP describes the coordinated operation of the CVP and SWP by Reclamation and the California Department of Water Resources (DWR). On July 30, 2004, the Service issued Biological Opinion 04-F-0140, which addressed the effects of operating the CVP/SWP and delivering CVP water for renewing water contracts and other actions on the threatened delta smelt (*Hypomesus transpacificus*). On February 15, 2005, the Service issued Biological Opinion -05-F-0055 in response to Reclamation's November 3, 2004 request for reinitiation of formal consultation on the OCAP to further address effects of the OCAP on delta smelt critical habitat.

On April 7, 2006, NMFS listed the southern distinct population segment of North American green sturgeon as threatened under the ESA. The operators of the CVP and SWP facilities may be required to alter the releases from the dams or to change the pumping regime from the Delta to avoid affecting this species or habitat suitable for its use. Because this newly listed species had not been consulted on under Section 7 of the Act, Reclamation requested that the NMFS consultation on OCAP be reinitiated. Because of the potential for revising the OCAP, Reclamation requested that the Service also reinitiate consultation on delta smelt. This request was received by the Service on July 6, 2006.

Subsequent to receiving this request to reinitiate consultation, Reclamation and the Natural Resources Defense Counsel (NRDC) et al reached a settlement on the long-standing lawsuit over the reestablishment of flows in the San Joaquin River from Friant Dam to the confluence with the Merced River. See the Friant Division (below) for additional details. Biological Opinions have been issued by NMFS (2009) and Service (December 15, 2008, Service File No. 08-F-1481-5) for the effects of the continued long-term operation of the CVP and State Water Project (SWP) (OCAP Opinion). The Service found that proposed operations were likely to jeopardize the continued existence of delta smelt and adversely modify its critical habitat. The Service provided a Reasonable and Prudent Alternative (RPA) with five components. On December 15, 2008, Reclamation submitted a memo provisionally accepting the RPAs developed by the Service and included in the OCAP Opinion. The provisional acceptance of the RPA was conditioned upon the further development and evaluation of the two RPA components directed at habitat. Reclamation stated that the two RPA components, RPA Component 3 – the fall action, and RPA Component 4 – the tidal habitat restoration action, both need additional review and refinement before Reclamation would be able to determine whether implementation of these actions by the CVP and SWP is reasonable and prudent. If Reclamation, in coordination with DWR, ultimately determines that these two RPA Components are not reasonable and prudent, Reclamation will reinitiate consultation on OCAP.

Friant Division and San Joaquin River Settlement

The Friant Division consists of three units having a total of forty-one water districts; the Cross Valley Unit consists of eight water districts; and the Hidden and Buchannan Divisions. Recently the Service completed a consultation on the consolidation of Kern-Tulare and Rag Gulch WDs; thus, there will be seven in the near future. The consultation for the execution of long-term water service contracts for the Friant and Cross Valley Division Contractors (Service File No., 01-F-0027) was completed on January 19, 2001. The CVP water delivery contracts for the Cross Valley Unit have never been executed and the Friant Division was the subject of on-going litigation that has challenged the validity of the biological opinions issued for these water delivery contracts.

Reclamation and the NRDC et al have reached a settlement on the long-standing lawsuit over the reestablishment of flows in the San Joaquin River from Friant Dam to the confluence with the Merced River.

This settlement, formally announced on September 13, 2006, is based on two goals and objectives:

1. A restored San Joaquin River with continuous flows to the Sacramento-San Joaquin River Delta and naturally reproducing populations of Chinook salmon.

2. A water management program to minimize water supply impacts to San Joaquin River water users.

The parties are working together on a series of projects to improve the river channel in order to restore and maintain healthy salmon populations. Flow restoration is to be coordinated with these channel improvements, with spring and fall run Chinook salmon populations reintroduced in approximately six years. At the same time, the Settlement limits water supply impacts to Friant Division long-term water contractors by providing for new water management measures that are to be undertaken by Reclamation. These measures include: (1) a recirculation plan that would allow Friant Division contractors to capture water from downstream areas after it has served its ‘Restoration Purpose’ and the water could be delivered to the contractor using either the SWP or CVP delivery system and (2) the creation of a ‘Recovered Water Account’ which would allow participating contractors to purchase water during certain wet conditions when water is available that is not needed to meet contractual obligations or Restoration Flows

Restoring continuous flows to the approximately 60 miles of dry river will take place in a phased manner. Planning, design work, and environmental reviews have begun, and interim flows for experimental purposes started in 2009. The flows will be increased gradually over the next several years, with salmon being re-introduced by December 31, 2012. The settlement continues in effect until 2026, with the U.S. District Court retaining jurisdiction to resolve disputes and enforce the settlement. After 2026, the court, in conjunction with the California State Water Resources Control Board (SWRCB), would consider any requests by the parties for changes to the restoration program.

The agreement also requires that long-term Friant Division water service contracts be amended to conform to the contracts to the terms of the settlement.

BIOLOGICAL OPINION

Preamble

The Service's consultations on the LTRCs addressed the diversion of water at prescribed diversion points and times for the use of that water on a specified land area (the contractors' service area). All IRCs, while identifying a full contract amount, recognize that the delivery of full contract amount is subject to availability of water and other obligations of the CVP (such as CVPIA and ESA consultation requirements). In other words, the contracts address a demand (among other demands) for CVP water and the OCAP consultation addresses how the CVP projects are operated to meet those demands. There is a clear linkage between contract renewals and the operation of the CVP. These linkages must, and are being addressed in separate but parallel individual consultations to ensure that all effects on listed species and designated critical habitat are being identified and consulted on.

The Service is working with Reclamation's SCCAO to accumulate the information necessary to evaluate the effects of LTRCs for the City of Tracy in the DMC Unit and the San Felipe Division which includes the San Benito County WD and the Santa Clara Valley WD. The Service is also working with SCCAO to conclude the consultation on the LTRCs for the eight SLU contractors.

Our approach to water contract consultations is that the environmental baseline represents environmental conditions/species' status prior to the renewal of the contract; impacts of future water deliveries are not part of the environmental baseline. The direct; interrelated and interdependent actions; indirect effects; and cumulative effects of the action are determined based on the effects of water deliveries over the Interim contract period, including continuation of any ongoing actions. In short, we view them as effects from a proposed Federal action that have not undergone section 7 consultation.

Direct effects – We intend to address the effects of future implementation of IRCs, including the effects of interrelated and interdependent actions, as effects of the Federal action, not as part of the environmental baseline. The jeopardy analysis will compare the environmental baseline that exists at the time of the Federal action to the adverse effects of the Federal action projected into the future, starting at the time the Federal action is taken, including the effects of interrelated and interdependent actions.

Indirect Effects – Indirect effects are effects caused by or result from the proposed action, will occur later in time, and are reasonably certain to occur. Indirect effects may also occur outside of the area directly affected by the action. Indirect effects to listed species or suitable habitat has likely occurred as a result of the delivery of CVP water to the individual water districts or municipalities during the life of the existing water delivery contract. Many of these activities took place prior to implementation of the ESA in 1973 and prior to the listing of the species listed below and were not subject to the provisions of the ESA. Land use decisions subsequent to that time have continued to result in adverse effects to the species and suitable habitat and have not been authorized incidental take under section 9 or 10 of the ESA.

Area Manager, Bureau of Reclamation, South Central California Area Office, Fresno, CA

DESCRIPTION OF THE PROPOSED ACTION

The proposed action is the execution of Interim CVP water service contracts up to the maximum quantity of water identified in Table 1 below. However, under the terms of the IRC's, the "maximum quantity of water (is) subject to hydrological and regulatory constraints", as described in Reclamation's September 27, 2005, Memorandum and attachments (which responded to a request for additional information for the section 7 consultation on renewal of the long-term SLU contracts. That consultation was been suspended pending completion of the section 7 consultation for the OCAP. The water delivered under the IRC's will be used for agricultural and/or municipal and industrial (Ag and/or M&I) within the designated CVP place of use identified in the Attachment A maps for the individual contracts.

The purpose of the proposed action is the execution of ten IRCs including five IRCs for two years (24 months) each, beginning March 1, 2010, and ending February 29, 2012, for Westlands WD; four M&I IRCs for 24 months beginning on March 1, 2011, and ending February 28, 2013, for the CDFG Mendota Wildlife Management Area and the cities of Avenal, Coalinga and Huron; and the partial assignment from Mercy Springs that is shared between Pajaro Valley Water Management Area, Santa Clara Valley WD, and Westlands WD.

A map of the SLU Contractors' Service Areas considered in this opinion is provided in Figure 1. Execution of IRCs is needed to continue delivery of CVP water to interim contractors until the long-term contracts can be executed. The period of renewal for each interim contract would normally be for up to two years, as permitted under subsection 3404(c)(1) of the CVPIA. The current contract provisions are those that are included in the existing water service contracts, with only minor, administrative changes to the contract provisions. Existing contract provisions such as payment, water quality, water measurement, water conservation, water shortages, discretionary provisions of the Reclamation Reform Act (RRA), ESA compliance, and standard articles have not changed. IRCs are consistent with the tiered implementation of the CVPIA, as described in the biological opinion on Implementation of the CVPIA (CVPIA BO, Service File no., 98-F-0124).

IRCs are needed to provide the mechanism for the continued beneficial use of the water developed and managed by the CVP and for the continued reimbursement to the Federal government for costs related to the construction and operation of the CVP by the five contractors. Additionally, CVP water is essential to continue agricultural production and municipal viability for these contractors.

In addition, Article 3(b) of the existing IRCs contracts includes mutual and dependent covenants mutually agreed upon by the parties, related to Water to be Made Available and Delivered to the Contractor as follows, "The Contractor shall utilize the Project Water made available to it pursuant to this interim renewal contract in accordance with all applicable requirements of any Biological Opinion addressing the execution of this interim renewal contract developed pursuant to section 7 of the ESA of 1973 as amended, and in accordance with environmental documentation as may be required for specific activities, including conversion of Irrigation Water to M&I Water." Part of the Service and Reclamation strategy to ensure compliance with the ESA includes a commitment for Reclamation to "provide necessary information to the

Service's SFWO Endangered Species Division in situations where a determination of *no affect* [*sic*] has been made, sufficiently in advance, to enable the Service's review. Reclamation actions subject to this requirement include conversion of Irrigation Water to M&I water (CVPIA programmatic biological opinion, p. 2-70, Service File no. 98-F-0124).

Water will be delivered to the interim water service contractors in quantities up to the contract totals. These 2010 IRC quantities remain the same as in the existing water service contracts.

No changes to district boundaries are part of the proposed action. Reclamation will consult with or notify the Service (as appropriate) on future inclusions and exclusions to any interim renewal contract service-area boundaries to determine if any inclusions or annexations affect listed species.

No water transfers are part of the proposed action. Appropriate environmental compliance and section 7 consultations will be completed for any other requests from interim contractors for Reclamation approval of CVP water transfers.

Warren Act contracts for conveyance of non-Federal water using Federal facilities are not part of the proposed action. The Mendota Pool Pumpers Exchange Agreement and other non-CVP Waters that are pumped into the DMC and Mendota Pool are also not part of the proposed action.

Potential impacts arising from future assignments of water are also not included in the proposed action. They are separate independent actions and require their own NEPA and ESA compliance.

Table 1. **CVP Interim Water Service Contract Amounts**

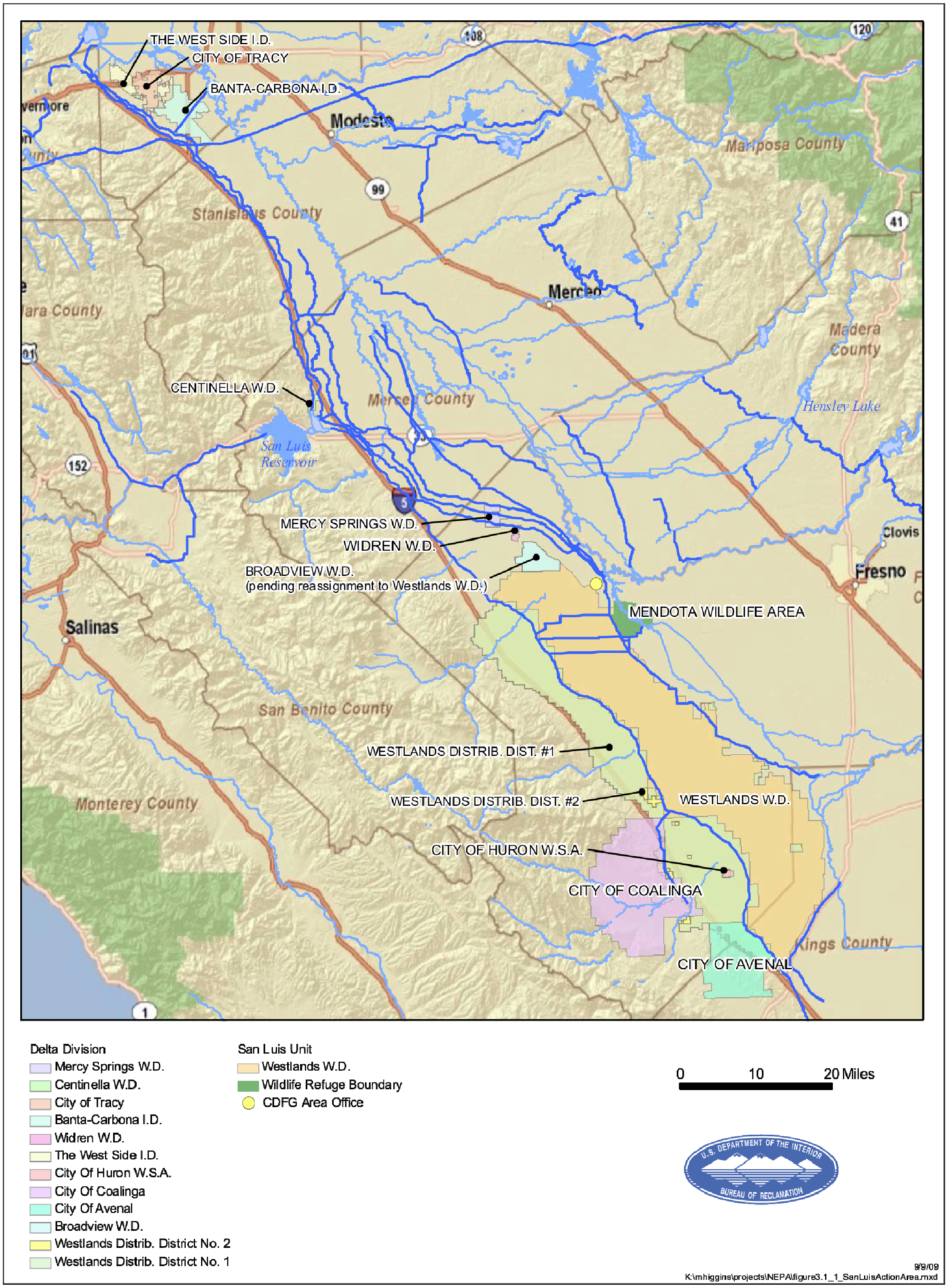
Contractor – Contract Number	Purpose	Amount
Pajaro Valley Water Management Area, Santa Clara Valley Water District, Westlands Water District #1 (3-way partial assignment from Mercy Springs WD – 14-06-200-3365A-IR12-B[1])	Agriculture	6,260
Westlands Water District, Distribution District #1 (assignment from Broadview Water District – 14-06-200-8092-IR12)	Agriculture	27,000
Westlands Water District, Distribution District #1 (assignment from Centinella ID – 7-07-20-W0055-IR12-B)	Agriculture	2,500
Westlands Water District, Distribution District #1 (assignment from Widren ID – 14-06-200-8018-IR12-B)	Agriculture	2,990
Westlands Water District, Distribution District #2 (partial assignment from Mercy Springs WD – 14-06-200-3365A-IR12-C)	Agriculture	4,198
Westlands Water District – 14-06-495A-IR2	Agriculture	1,150,000
CDFG (Mendota WMA) – 14-06-200-8033A-IR2	M&I	10
City of Avenal – 14-06-200-4619A-IR2	M&I	3,500
City of Coalinga14-06-200-4173A-IR2	M&I	10,000
City of Huron – 14-06-7081A-IR2	M&I	3,000

City of Avenal: The City of Avenal's water supply source is CVP water from the San Luis Canal. All of Avenal's CVP water supply is used for M&I purposes. Under a formal agreement, Avenal supplies Avenal State Prison with 1,411 acre-feet of water annually. The City of Avenal also provides water service to the urbanized portions of Avenal and a limited number of connections in the northern portion of the community. Avenal does not pump any groundwater. The poor quality of the groundwater and its high concentrations of sulfate, nitrates, and sodium preclude its use for domestic purposes. The City of Avenal's water needs analysis completed by Reclamation in July 2000 estimated that there would be an unmet demand of 391 acre-feet for 2025 with an estimated population of 12,000; however the City of Avenal's web page (www.city-data.com/city/Avenal-California.html) lists a current population of 17,174.

City of Coalinga: The City of Coalinga's sole water supply source is CVP water obtained at a single turnout from the Coalinga Canal, which is fed by the San Luis Canal. Because WWD operates the federally-owned pipeline, the City of Coalinga pays an operation and maintenance charge to WWD for transporting CVP water to obtain its CVP supply. The City of Coalinga supplies potable water to almost all of the residences within its service area. The current long-term contract required Coalinga to abandon its former source of water supply (i.e., pumping water from groundwater wells) and to depend on its CVP supply as its M&I water supply. The City of Coalinga's water needs analysis completed by Reclamation in July 2000 estimated that there would be no unmet demand for 2025; however the City of Coalinga's web page (www.coalinga.com) lists a current population of 12,200 and the Draft General Plan Update 2005-2025 projects a population of 22,185.

Area Manager, Bureau of Reclamation, South Central California Area Office, Fresno, CA

Figure 1. San Luis Unit Contract Service Area Boundaries



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City of Huron: The City of Huron's only water supply is CVP water received from a lateral connection to the San Luis Canal. Water is transported to Huron via Lateral 27, which is operated by Westlands WD. Huron pays Westlands WD O&M costs for transportation of their CVP supply. Huron does not pump groundwater. Groundwater in the area is very deep, of poor quality and almost non-potable. The City of Huron's water needs analysis completed by Reclamation in July 2000 estimated that there would be no unmet demand for 2025; however the City of Huron's web page (www.fresnoco.org/city) lists a current population of 7,493 and the water needs assessment projects a population of 12,810.

CDFG Mendota Wildlife Management Area: The CDFG currently receives 10 acre-feet of M&I water for domestic use at the headquarters of the Mendota Wildlife Management Area. On January 1, 1976, the CDFG signed a long-term contract (Contract 14-06-200-8033A-LTR1) with Reclamation to supply 10 acre-feet of supply for domestic use at the Mendota Wildlife Management Area headquarters, near the City of Mendota. The CVP supply is the CDFG's only long-term water supply used at this facility.

Westlands WD: Westlands WD's permanent distribution system consists of 1,034 miles of closed, buried pipeline that conveys CVP water from the San Luis and Coalinga Canals and 7.4 miles of unlined canal that conveys CVP water from the Mendota Pool. The area served by the system encompasses about 88 percent of the irrigable land in the district, including all land lying east of the San Luis Canal. The district also operates and maintains the 12-mile-long, concrete-lined Coalinga Canal, the Pleasant Valley Pumping Plant, and the laterals that supply CVP water to Coalinga and Huron. Westlands WD provides water via gravity water service and pumping from the San Luis Canal depending on location.

On June 5, 1963, Westlands WD entered into a long-term contract (Contract 14-06-200-495-A) with Reclamation for 1,008,000 acre-feet of CVP supply from the San Luis Canal, Coalinga Canal, and Mendota Pool. In a stipulated agreement dated September 14, 1981, the contractual entitlement to CVP water was increased to 1.15 million acre-feet. The long-term contract will expire on December 31, 2007. The first deliveries of CVP water from the San Luis Canal to Westlands WD began in 1968.

In 1999, Reclamation stated that the estimated average long-term supply for Westlands WD was 70 percent of its water supply contract, or about 805,000 acre-feet per year. Prior to 1990, its average CVP water supply, including interim CVP water when it was available, was approximately 1,250,000 acre-feet per year, and associated groundwater pumping in the district averaged about 150,000 acre-feet per year. The needs analysis completed by Reclamation in July 2000 estimated that the unmet demand in Westlands WD for 2025 would be about 74,287 acre-feet per year.

As noted above, in addition to the CVP supply, groundwater is available to some of the lands within Westlands WD. The safe yield of the aquifer underlying Westlands WD is about 200,000 acre-feet (Westlands WD 2009). Westlands WD supplies groundwater to some district farmers and owns some groundwater wells, with the remaining wells privately owned by water users in WWD. Other water supply sources available to the district for purchase include floodwater diverted from the Mendota Pool in periods of high runoff.

Effects of contract water deliveries under the subject contracts within the Westlands WD have been addressed in our 2000, 2002, and 2004 biological opinions on interim renewal of CVP contracts. We hereby incorporate by reference those opinions, and provide the supplemental analysis below. No new species have been listed, or critical habitat designated, within this water district since the 2004 biological opinion.

Santa Clara Valley WD: Santa Clara Valley WD includes all of Santa Clara County. The CVP place of use, however, does not include the entire county. Although water is commingled, CVP water can only be applied in the CVP place of use and the Santa Clara Valley WD must show they have needs for the water within the CVP place of use (N. Gruenhagen, Reclamation, pers. comm., 2006). As a result, this analysis is based on use of water within the CVP place of use within Santa ClaraValleyWD.

Included in the 2002, 2004, 2006, 2008 and this interim renewal is the delivery of water from the partial assignment of Mercy Springs WD in the DMC Unit to Westlands WD Distribution District #1 (DD#1), and Santa Clara Valley WD. Mercy Springs WD assigned 6,260 acre-feet of its CVP Contract to the Pajaro Valley Water Management Agency, Westlands WD DD #1, and the Santa Clara Valley WD in 1999. (In conjunction with this Partial Assignment, Pajaro Valley Water Management Agency, Santa Clara Valley WD and Westlands WD DD #1 executed the "Agreement Relating to Partial Assignment of Water Service Contract" (Related Agreement).)

- Generally, the Related Agreement allows Santa Clara Valley WD and Westlands WD DD #1 to take delivery of the water on an interim basis unless and until the Pajaro Valley Water Management Agency is eventually ready to take delivery of the CVP water for beneficial use in its service area. Pajaro Valley Water Management Agency could begin to take delivery in year 10 of the contract (2009), but for purposes of this project description, Pajaro Valley Water Management Agency is assumed to take water after year 20 of the assignment. According to the contract, …"during the first Ten (10) years following the effective date of this Agreement, the total quantity of the water delivered to Santa Clara shall not exceed Twenty-five (25) percent of the total Subject Water Supply provided by the United States during said Ten (10) year period,…" No water was delivered to Santa Clara Valley WD under this contract in water year 2004 or 2005 (USBR in litt., 2006).

The proposed action does not include an analysis of the construction of a conveyance structure or effects of the delivery of CVP water to Pajaro Valley Water Management Agency's service area. The Pajaro Valley Water Management Agency currently has no infrastructure to divert and convey CVP water to its water service area, and will not have that capability at any time during the 2-year interim period. As a result, Pajaro Valley Water Management Agency will not be further addressed in this consultation.

Effects of contract water deliveries under the subject contract within the Santa Clara Valley Water District to federally listed species were addressed in our 2000, 2002, 2004, 2006 and 2008 biological opinions on interim renewal of CVP contracts. We hereby incorporate by reference those opinions, and find that the effects to listed species within Santa Clara Valley WD need not be further addressed here.

Conservation Measures from Previous IRC Consultations

As described in previous IRC consultations, Reclamation developed and implemented a short-term conservation program for IRC Service Areas. The proposed action includes a commitment to develop and implement a long-term program to address the overall effects of the continued operation of the CVP on listed, proposed, and candidate species, and a short-term program to minimize the adverse effects on these species in any areas affected by CVP water deliveries, other than those effects addressed here.

The short-term program to minimize adverse effects of continued water delivery to the IRC water districts included the following measures:

1(a) Notify districts regarding ESA requirements (Completed);
1(b) Develop information on distribution and habitat of listed, proposed and candidate species (Ongoing);
1(c) Map and distribute information in 1(b) above (Ongoing);
1(d) Monitor land use changes and ongoing activities to ensure project water is not used in a manner that adversely affects listed, proposed or candidate species. Coordinate with the Service on any activities adversely affecting these sensitive species (Ongoing);
2(a) Work with the Service, CDPR and others to develop guidelines and information assessing the effects of pesticides on listed, proposed and candidate species. (Completed);
2(b) Develop and distribute guidance on construction and maintenance activities (Completed);
2(c) Review District water conservation plans. (Completed);
2(d) Amend criteria for water conservation plans (Completed);
3(a) Identify lands critical to listed and proposed species (Ongoing);
3(b) Identify land and water use activities critically impacting listed and proposed species (Ongoing);
3(c) Develop and implement critical need plan (Ongoing);
4 Develop a long-term program to address overall effects of the CVP and Implementation of the CVPIA (Ongoing).

New Conservation Measure

Reclamation commits to seeking from the cities of Avenal, Coalinga, and Huron, and from Westlands WD, a letter from the City/District to Reclamation, confirming that CVP water will not be used to develop or convert habitat without confirmation from the Service that compliance with the ESA has occurred with respect to the subject land either through Section 7 or Section 10 of the Act. Reclamation will seek these letters by September 1, 2010, and will provide copies to Service upon receipt (Kinsey *in litt.*, 2.22.2010).

Key Assumptions

Because of the complex history as well as the complex present environmental and regulatory context of IRCs, and because this action is related to a number of other Reclamation actions, the Service has had to make a number of assumptions about likely future events and context of the interim renewal action. While not exhaustive, the following list of key assumptions has been central to our effects analysis and no jeopardy findings. As such, the failing of any key assumption should be considered reason for reinitiating consultation IRCs. The Service assumes the following:

1. The County of Santa Clara; Valley Transportation Authority, Santa Clara Valley WD, and the cities of San Jose, Morgan Hill, and Gilroy (Local Partners) are developing the Santa Clara Valley Habitat Conservation Plan/Natural Community Conservation Plan (SCVHP) (http://www.scv-habitatplan.org/www/default.aspx). A second Administrative Draft was completed in June 2009, and a public review draft is anticipated in September 2010. The Local Partners hope to obtain both ESA and NCCP permits by early 2011. Due to both funding and scheduling issues, the Santa Clara Valley WD, with concurrence from the original HCP/NCCP Local Partners, agreed in February 2010 to removed fish (*Oncorhynchus mykiss, Oncorhynchus tschawytscha,* and *Lampetra tridentata*) from the proposed covered species list. The Santa Clara Valley WD Board is currently negotiating reduction in its cost share of the SCVHP, as a result of this decision.

   Although fish have been removed from the covered species list of the SCVHP, the Santa Clara WD plans to continue its concurrent efforts on a separate but related HCP, referred to as the 3 Creeks HCP (3C HCP). The 3C HCP study area greatly overlaps with the SCVHP proposed permit area, however, it includes the Stevens Creek Watershed, which is not covered under the SCVHP. The 3C HCP is the sole endeavor of the Santa Clara WD, in response to a Draft Settlement Agreement regarding its water rights on Coyote, Guadalupe, and Steven's Creeks.

2. Reclamation will continue to implement in a timely manner relevant environemtnal commitments, conservation measures, and terms and conditions from other biological opinions as appropriate. These commitments include implementation of the CVPIA and Continued O&M of the CVP (November 21, 2000, Service File No., 98-F-0124), the Friant LTRCs (Service File No., 01-F-0027) and the Grassland Bypass Project (Service File No., 09-F-1036). Other CVP-related, non-CVPIA actions benefiting fish, wildlife, and associated habitats and related to effects of IRCs will continue, with at least current funding levels, including:
   a. the Central Valley Habitat Monitoring Program’s Comprehensive Mapping;
   b. implementation of the Central Valley Habitat Monitoring Program’s Land Use Monitoring and Reporting;
   c. CVP Conservation Program and CVPIA B(1)(other) Habitat Restoration Program.

3. Reclamation will implement the Proposed Action in a manner consistent with implementation of any listed species recovery plans as applicable, including the Final Recovery Plan for California red-legged frog (USFWS 2002), Draft Recovery Plan for

the Giant Garter Snake (USFWS 1999), Final Recovery Plan for Gabbro Soil Plants of the Central Sierra Nevada foothills (USFWS 2002), Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area (USFWS, September 1998a), Recovery Plan for Upland Species in the San Joaquin Valley (USFWS, September 1998b), Draft Recovery Plan for the Least Bell's Vireo (USFWS, 1998), Recovery Plan for the Large-flowered Fiddleneck (USFWS,1997), Recovery Plan for the Sacramento/San Joaquin Delta Native Fishes (USFWS,1995), and Recovery Plan for Valley Elderberry Longhorn Beetle (USFWS, 1984).

4. We assume the proposed action will be implemented as described in the Description of the Proposed Action section, above, and any documentation referenced in that section, such as appendices or attached documents.

5. We assume Reclamation will consult on actions interrelated with this consultation, including but not limited to operations and maintenance, exchanges, assignments, transfers, conveyance, and management of flood waters (215 water, *etc*.), and other actions described in the Introduction as being under simultaneous consultation with this action, including requesting concurrence for any determination that an action is not likely to adversely affect listed species or critical habitat. Reclamation has completed consultation on operations and maintenance of Reclamation water conveyance facilities as described in the Environmental Baseline.

6. The analysis for this opinion is based on the assumption that CVP water contract amounts and deliveries will remain consistent with those provided and analyzed in the Final PEIS for CVPIA and the 2008 OCAP biological opinion. We assume Reclamation will initiate consultation under section 7 of the ESA on any infrastructure modifications or other actions which result in modification of the current delivery regime.

7. Reclamation commits to the continued implementation of the conservation actions that were included in the programmatic consultation on the implementation of the CVPIA and Continued O&M of the CVP (98-F-0124, November 21, 2000).

8. Reclamation is not consulting on any "on-farm" actions such as cropping practices, fallowing, and enrollment in conservation programs.

9. Reclamation and the Service assume end users of water (those that are actually responsible for on-the ground activities) will comply with Federal laws such as the ESA. Reclamation has, and will continue to, inform contractors of ESA requirements.

10. The proposed action does not include any non-Federal actions on non-Federal land relative to the end use of water. "Take" coverage for these private actions is not being requested by the contractors or Reclamation.

11. Any water delivered pursuant to the proposed interim contracts will comport with all biological opinions addressing CVP operations (i.e., the existing and any new biological opinions addressing CVP/SWP Operational Criteria and Plan (OCAP).

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION ANALYSES

Jeopardy Determination

In accordance with policy and regulation, the jeopardy analyses in this Biological Opinion rely on four components: (1) the *Status of the Species*, which evaluates the species' range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species; (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 species; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the giant garter snake, San Joaquin kit fox, blunt-nosed leopard lizard, California least tern, California jewelflower, and San Joaquin woolly-threads.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the 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 the giant garter snake, San Joaquin kit fox, blunt-nosed leopard lizard, and California least tern and the role of the action area in the survival and recovery of these species as the context for evaluating the significance of the effects on the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

ACTION AREA

The action area is determined based on consideration of all direct and indirect effects of the proposed agency action [50 CFR 402.02 and 402.14(h)(2)]. The action area for this opinion falls mainly within portions of western Fresno and Kings Counties (Figure 1 shows the location for the SLU water districts considered in this consultation) and a portion of Santa Clara County. The action area primarily consists of lands within the boundary of the CVP's SLU and San Felipe Division. The action area also includes the Sacramento – San Joaquin Delta (Delta) as the source for the water delivered to meet these CVP contracts, and the canals and waterways that return the agricultural runoff and subsurface drainage flows from agricultural lands within and down slope of the SLU back to the San Joaquin River. For this reason, the action area includes the San Joaquin River to the estuary for aquatic species. The estuary was selected for aquatic species, as there is some evidence that contaminant loading may be detectable and significant to that point. The effect of water exports from the Delta on protected species was evaluated in a separate Biological Opinion for the OCAP in 2008.

Specifically, the action area includes the CVP Service Areas of the five SLU contractors and Santa Clara Valley WD. The service area for the City of Avenal encompasses an area of approximately 13,120 acres or 20.5 sq mi (sq mi) of which 2.5 sq mi is urbanized and the sphere of influence contains an additional 2.25 sq mi; the City of Coalinga covers 5,248 acres or 4.1 sq mi and its sphere of influence encompasses and additional 8.2 sq mi; the City of Huron covers 994 acres or 1.6 sq mi and is completely surrounded by Westlands WD; and the Westlands WD boundary covers 605,422 acres of which 595,884 acres are within the CVP Place of Use Boundary (permitted to receive CVP water). In 2006, Westlands WD purchased 9,100 acres of lands previously owned by Broadview WD and these lands are now considered part of Westlands WD (Reclamation 2009). The CDFG service area is the headquarters for the Mendota Wildlife Management Area in the community of Mendota. Santa Clara Valley WD which is within the San Felipe Division of the CVP, encompasses the entire Santa Clara County; however, the permitted place of use for the CVP water is considerably smaller.

STATUS OF THE SPECIES

San Joaquin Kit Fox

Listing
The San Joaquin kit fox was listed as an endangered species on March 11, 1967, (USFWS 1967) (32 **FR** 4001) and was listed by the State of California as a threatened species on June 27, 1971. This canine is the umbrella species for the Recovery Plan for Upland Species of the San Joaquin Valley, California (USFWS 1998).

Description
The kit fox is the smallest canid species in North America and the San Joaquin kit fox is the largest subspecies in skeletal measurements, body size, and weight. Adult males average 80.5 centimeters (31.7 inches) in total length, and adult females average 76.9 centimeters (30.3 inches in total length (Grinnell *et al.* 1937). Kit foxes have long slender legs and are approximately 30 centimeters (12 inches) high at the shoulder. The average weight of adult males is 2.3 kilograms (5 pounds), and the average of adult females is 2.1 kilograms (4.6 pounds) (Morrell 1972).

General physical characteristics of kit foxes include a small, slim body, relatively large ears set close together, narrow nose, and a long, bushy tail tapering slightly toward the tip. The tail is typically carried low and straight.

Color and texture of the fur coat of kit foxes varies geographically and seasonally. The most commonly described colorations are buff, tan, grizzled, or yellowish-gray dorsal coats (McGrew 1979). Two distinctive coats develop each year: a tan summer coat and a silver-gray winter coat (Morrell 1972). The ear pinna (external ear flap) is dark on the back side, with a thick border of white hairs on the forward-inner edge and inner base. The tail is distinctly black-tipped.

Historical and Current Range
In the San Joaquin Valley before 1930, the range of the San Joaquin kit fox extended from southern Kern County north to Tracy, San Joaquin County, on the west side, and near La Grange, Stanislaus County, on the east side (Grinnell *et al.* 1937; USFWS 1998). Historically, this species occurred in several San Joaquin Valley native plant communities. In the southernmost

portion of the range, these communities included Valley Sink Scrub, Valley Saltbush Scrub, Upper Sonoran Subshrub Scrub, and Annual Grassland.

Kit foxes currently inhabit some areas of suitable habitat on the San Joaquin Valley floor and in the surrounding foothills of the coastal ranges, Sierra Nevada, and Tehachapi Mountains, from southern Kern County north to Contra Costa, Alameda, and San Joaquin Counties on the west, and near La Grange, Stanislaus County on the east side of the Valley, and some of the larger scattered islands of natural land on the Valley floor in Kern, Tulare, Kings, Fresno, Madera, and Merced Counties**.**

Table 2 provides the most current information on the status of kit fox populations including areas where the kit fox has declined or become locally extirpated. The largest extant populations of kit foxes are in western Kern County on and around the Elk Hills and Buena Vista Valley, Kern County, and in the Carrizo Plain Natural Area, San Luis Obispo County**.** Though monitoring has not been continuous in the central and northern portions of the range, populations were recorded in the late 1980s at San Luis Reservoir, Merced County (Briden *et al.* 1987); North Grasslands and Kesterson NWR area on the Valley floor, Merced County (Paveglio and Clifton 1988); and in the Los Vaqueros watershed, Contra Costa County in the early 1990s (USFWS 1998). Smaller populations are also known from other parts of the San Joaquin Valley floor, including Madera County and eastern Stanislaus County (Williams 1990).

Table 2. Core and satellite areas identified as historically and/or currently occupied by subpopulation units of the San Joaquin kit fox.

Name	Current trend	Last observed	Last surveyed	Reference
Western Kern County Core Area	Inter-annual fluctuation based on environmental conditions. Slow overall decline expected due to continuing habitat loss.	2008	2008	Smith *et al*. 2006; CNDDB 2008; B. Cypher**; B. Cypher ***
Carrizo Plains Core Area	Inter-annual fluctuation	2006	2008	CNDDB 2008
Ciervo-Panoche Core Area	Presumed declining	2007	2005 - 2007	EG&G 1981; Smith *et al*. 2006; CNDDB 2008; B. Cypher ***
Alameda, Contra Costa, and San Joaquin Counties	Have declined, no known breeding	2002	Area-specific surveys§ in 1983, 2003	Orloff *et al*. 1986; Smith *et al*. 2006; CNDDB 2008; B. Cypher**
Western Merced and Stanislaus Counties	Have declined, presence in S. portion	2005	Area-specific surveys§ in 2003	CNDDB 2008; B. Cypher**
Central Merced County	Presumed extirpated	2000		Parris *in litt*. 2007, 2008; CNDDB 2008; B. Cypher**
Western Madera County	Presumed extirpated	1990	Area-specific surveys§ in 2003	Smith *et al*. 2006; CNDDB 2008,
Southwestern Fresno County	Isolated	2005	None	CNDDB 2008
Southwestern Kings County	Isolated	2005	Area-specific surveys§ 2000, 2001	CNDDB 2008; CNDDB 2008,
Southwestern Tulare County	Isolated **(Pixley NWR extirpated)**	2004	Area-specific surveys§ 2004	Smith *et al*. 2006; CNDDB 2008; B. Cypher**
Tulare County Foothills	Unknown	1992	Area-specific surveys§ 2004	Smith *et al*. 2006; CNDDB 2008, B. Cypher**
Northwestern Kern County	Unknown	2006	Area-specific surveys§ 2004, 2005, 2006	CNDDB 2008, B. Cypher**
Northeast Bakersfield	Stable	2008	Area-specific surveys§ 2002-2006	CNDDB 2008, B. Cypher**
Metropolitan Bakersfield	Stable	2008	2008	CNDDB 2008, B. Cypher**
Cuyama Valley (San Luis Obispo and Santa Barbara Counties)	Unknown, presumed extant	1979	1979	CNDDB 2008, B. Cypher**
Salinas-Pajaro (San Luis Obispo, Monterey and San Benito Counties)	Camp Roberts: potentially extirpated **Fort Hunter Liggett: extirpated**	CR: 2007 FHL: 2000	Area-specific surveys§ at Camp Roberts: 2008 FHL: 2008	Moonjian 2007; Moore *in litt*. 2008. L. Clark 2008 *pers. comm.*

Bold = extirpated, with occasional sightings of presumed dispersers. ** B. Cypher, pers. comm. 2008 *** B. Cypher *in litt*. 2008.
§ Area-specific surveys are surveys occurring in specific areas within the core or satellite area.

Currently, the entire range of the kit fox appears to be similar to what it was at the time of the 1998 Recovery Plan; however, population structure has become more fragmented, at least some of the resident satellite subpopulations, such as those at Camp Roberts, Fort Hunter Liggett, Pixley National Wildlife Refuge NWR, and the San Luis NWR, have apparently been locally extirpated (White *et al*. 2000; Moonjian 2007; P. Williams, Kern NWR, *in litt.* 2007; B. Cypher, ESRP, *in litt.* 2007; R. Parris, San Luis NWR, *in litt*. 2007; M. Moore, Camp Roberts, *in litt*. 2008), and portions of the range now appear to be frequented by dispersers rather than resident animals (Moore *in litt*. 2008; M. Mueller, Contra Costa Water District, *in litt*. 2008; Cypher *in litt*. 2009). For example, at Fort Hunter Liggett, although approximately 36,000 acres is considered to be potential kit fox habitat, the greatest number of kit fox observed in one year was

22 (in 1990), and no kit fox have been observed since 2000 (USFWS 2007a). Kit fox abundance appears to be below detection levels in much of San Luis Obispo County outside of the Carrizo Plains (Moonjian 2007). Recent surveys have generally failed to detect kit fox subpopulations in the most northerly portion of the range (San Joaquin, Alameda, and Contra Costa Counties), although individual kit foxes have been observed periodically (CDFG 2008; Mueller *in litt.* 2008).

Essential Habitat Components

Kit foxes prefer loose-textured soils (Grinnell *et al.* 1937; Hall 1946; Egoscue 1962; Morrell 1972), but are found on virtually every soil type. Dens appear to be scarce in areas with shallow soils because of the proximity to bedrock (O'Farrell and Gilbertson 1979; O'Farrell *et al.* 1980), high water tables (McCue *et al.* 1981), or impenetrable hardpan layers (Morrell 1972). However, kit foxes will occupy soils with a high clay content, such as in the Altamont Pass area in Alameda County, where they modify burrows dug by other animals (Orloff *et al.* 1986). Sites that may not provide suitable denning habitat may be suitable for feeding or providing cover.

[Note: The following sections discussing land values for kit fox were prepared for Reclamation by Brian Cypher in the report *Kit Fox Conservation in the San Luis Drainage Unit Study: Ecological Considerations Relevant to the Development of a Conservation Strategy for Kit Foxes* (Cypher 2006).]

<u>Natural Land Values</u>: Kit foxes are an aridland-adapted species. They occur in arid regions, typically deserts, throughout North America (Cypher 2003). Accordingly, in the San Joaquin Valley, optimal habitats for San Joaquin kit foxes generally are those in which conditions are more desert-like. These include arid shrublands and grasslands (USFWS 1998). These areas are characterized by sparse or no shrub cover, sparse ground cover with patches of bare ground, short vegetative structure (herbaceous vegetation < 18 inches tall), and sandy to sandy-loam soils.

Tall and/or dense vegetation generally is less optimal for foxes (Smith *et al.* 2005). Such conditions make it difficult for foxes to detect approaching predators or capture prey. Kit foxes also tend to avoid rugged, steep terrain. Predation risk apparently is higher for foxes under such topographic conditions (Warrick and Cypher 1998). In general, flat terrain or slopes under 5% are optimal, slopes of 5-15% are suitable, and slopes greater than 15% are unsuitable. For this reason, the foothills of the Coast Ranges generally are considered to demark the western boundary for suitable kit fox habitat. Finally, kit foxes appear to be strongly linked ecologically to kangaroo rats. Kit foxes are especially well adapted for preying on kangaroo rats, and consequently, kit fox abundance and population stability are highest in areas where kangaroo rats are abundant (USFWS 1998, Cypher 2003). Kangaroo rats also are aridland-adapted species, and thus, reach their greatest densities in the San Joaquin Valley in arid habitats.

Following are assessments of relative value for various natural habitats present in the San Joaquin Valley:

Saltbush scrub: This is an aridland habitat generally dominated by saltbush shrubs *(Atriplex* spp.), and with ground cover dominated by non-native Brome grasses *(Bromus* spp.). Kangaroo rats are abundant. This habitat is **optimal** for kit foxes, and they generally achieve their highest densities in areas with this habitat type (e.g., Lokern Natural Area, Buena Vista Valley, Carrizo Plain, Elkhorn Plain). Although this habitat is favorable for foxes, it should be noted that dense patches of shrubs provide cover for kit fox predators and may be avoided by foxes.

Arid grasslands: This is an aridland habitat with few or no shrubs, and which is dominated by non-native grasses, particularly red brome *(Bromus madritensis rubens)***.** Vegetation structure is low and patches of bare ground are common. Kangaroo rats are abundant. This habitat is **optimal** for kit foxes. Grazing can further reduce the vegetative structure rendering this habitat even more suitable.

Alkali sink: This habitat occurs in lower regions closer to the Valley center, and thus is subject to soil saturation and seasonal flooding in the winter and spring. It usually is dominated by iodine bush (*Allenrolfea* spp.) or sinkweed (*Suaeda* spp.) shrubs with a patchy, low-structure ground cover. Kangaroo rats can be abundant. This habitat can be **suitable** for kit foxes, particularly if slightly higher topography is available for dens.

Mesic grasslands: This habitat type is more common in the eastern and northern portions of the Valley where precipitation is more abundant. This type tends to have few or no shrubs and is dominated by non-native wild oat grasses *(Avena* spp.). Vegetation structure may be higher than 18 inches and dense, particularly in years with above-average precipitation, and this could result in increased predation risk for kit foxes. Bare ground may be sparse. The rodent community tends to be dominated by California ground squirrels instead of kangaroo rats. This habitat can be **suitable** for kit foxes, particularly if it is moderately-to-heavily grazed.

Oak woodland savannah: This habitat occurs primarily off the Valley floor up in the Coast Ranges. Oak trees *(Quercus* spp.) tend to form a sparse to moderate canopy, and the herbaceous cover is dominated by non-native wild oats and other grasses. Vegetation structure and density tends to be high with little bare ground. Kangaroo rats are not abundant and California ground squirrels are common. This type probably is **marginally suitable** for kit foxes at best, although grazing can improve vegetation structure for kit foxes.

Chaparral: This habitat occurs in higher, more-mesic areas in the Coast Ranges. It is characterized by a diverse and dense shrub community. Predation risk is high and kangaroo rats are uncommon. This habitat is **unsuitable** for kit foxes.

Wetland and riparian forests: These habitats are characterized by wetland and riparian vegetation that can be quite dense. Constant or periodic flooding preclude den establishment and kangaroo rats are less common. These habitats are **unsuitable** for kit foxes.

<u>Agricultural Land Values:</u> Agricultural lands inherently present challenges for kit foxes. Ground disturbance is frequent (e.g., tilling, maintenance, harvesting), which can destroy dens. Also, most agricultural lands in the Valley are irrigated, which can flood and collapse dens. Agricultural lands also are subject to intensive chemical applications, including fertilizers, pesticides, and defoliants. Use of rodenticides is common in some agricultural environments and is particularly problematic for kit foxes due to the potential for secondary poisoning. Finally, all of the factors above in addition to the relative sterility of most agricultural fields (e.g., weed suppression) result in a lack of prey availability for kit foxes.

Another detrimental attribute of agricultural lands is the presence of coyotes and non-native red foxes. Coyotes are the primary cause of mortality for kit foxes in most areas (Cypher *et al.*

2003). The threat to kit foxes from red foxes is still being evaluated, but the potential for both interference and exploitative competition is high (Cypher *et al.* 2001). These highly adaptable species are able to persist in agricultural lands. They are not dependent on dens for cover, they are highly mobile which facilitates avoiding dangers and locating food, and they are highly omnivorous. Also, kit foxes are more vulnerable to predation in agricultural areas due to the relative scarcity of den sites, as described previously. Thus, agricultural lands are generally not suitable for long-term occupation by kit foxes, although lands adjacent to natural habitats may be used for occasional foraging (Warrick *et al.* 2007).

Most available information on the value of agricultural lands to kit foxes is qualitative in nature, but one quantitative investigation has been conducted (Warrick *et al.* 2007). Following are assessments of relative value for several types of agricultural lands:

Annual crops (e.g., cotton, tomatoes, alfalfa, carrots): Lands with these crops usually have low to no prey (except possibly alfalfa), and are subject to frequent disturbance, irrigation, and chemical application. Kit foxes do not appear able to permanently occupy these lands, and use primarily appears limited to occasional foraging when these lands are adjacent to natural habitats.

Orchards (e.g., fruit trees, nut trees): Lands with these crops are not always cleared of all herbaceous vegetation, and therefore sometimes may support some prey (primarily ground squirrels, deer mice, and house mice). Also, the open understory of orchards facilitates predator detection by kit foxes. Kit foxes have been observed to forage in orchards as well as to occasionally spend a day or so resting, usually in man-made structures (e.g., pipes, rubble piles). Orchards are probably relatively permeable for kit foxes, although the risk of an unsuccessful crossing most likely increases with distance.

Vineyards: Lands with these crops are not always cleared of all herbaceous vegetation, and therefore sometimes may support some prey (primarily ground squirrels, mice). Vineyards probably are permeable to kit foxes, but as with orchards, the risk of an unsuccessful crossing most likely increases with distance. Also, the rodent-proof fences erected around some vineyards would severely inhibit entry by kit foxes.

Fallow lands: Some agricultural lands may be fallowed for a season, a year, or multiple years. The value of these lands for kit foxes is highly dependent upon the duration of fallowing and the location of the lands. Lands that are fallowed for only a season likely have little value to foxes. Generally, a season is not sufficient time for a prey base to reestablish. Also, renewed ground disturbance and irrigation at the end of the season likely would result in the destruction of any fox dens created during the fallow period. Lands that are fallowed for 1 or more years could have greater value to kit foxes. This time period might be sufficient for the reestablishment of some prey and the creation of dens. Lands fallowed for multiple years could even potentially be used by kit foxes to produce and raise young. Kit foxes likely would be forced from these lands when they were returned to agricultural production. Kit foxes would be at risk of injury or death during the reinitiation of agricultural activities if they failed to vacate the property in a timely manner. Foxes that did vacate also would be at greater risk if they were forced into unfamiliar areas.

Fallow lands immediately adjacent to natural lands might be used relatively quickly by kit foxes. In Kern County near Bakersfield, foxes have been observed to utilize agricultural lands within weeks of being fallowed with use increasing as these lands remained fallowed (B. Cypher, pers.

comm. 2008). As the distance between fallow lands and occupied habitat increases, the potential for use by kit foxes decreases. As described above, kit foxes face risks when crossing agricultural lands and this risk may preclude colonization or use of fallow lands that are not adjacent to occupied habitat.

Foraging Ecology
The diet of the San Joaquin kit fox varies geographically, seasonally, and annually, based on temporal and spatial variation in abundance of potential prey. In the southern portion of their range, kangaroo rats, pocket mice, white-footed mice (*Peromyscus* spp.), and other nocturnal rodents comprise about one-third or more of their diets. Kit foxes are also known to prey on California ground squirrel, black-tailed hares, San Joaquin antelope squirrels, desert cottontails, ground nesting birds, and insects (Scrivner *et* al. 1987a; Cypher and Brown 2006). Known prey species of the kit fox include white-footed mice, insects, California ground squirrels, kangaroo rats (*Dipodomys* spp.), San Joaquin antelope squirrels, black-tailed hares (*Lepus californicus*), and chukar (*Alectoris chukar*) (Jensen 1972, Archon 1992), listed in approximate proportion of occurrence in fecal samples. Kit foxes also prey on desert cottontails (*Sylvilagus audubonii*), ground-nesting birds, and pocket mice (*Perognathus* spp.).

Recent studies have supported early observations that kit fox appear to be strongly linked ecologically to kangaroo rats. In natural areas, kit fox density and population stability are highest in areas with abundant kangaroo rats (Spiegel *et al*. 1996; Cypher *et al*. 2000; Cypher 2006; see also Bean and White 2000). Cypher *et al*. (2000) has documented that annual finite growth rates were positively correlated with consumption of kangaroo rats and negatively correlated with consumption of other prey items, suggesting that kit fox in the area feed preferentially on kangaroo rats and that declines in kangaroo rat densities negatively affect kit fox survival. An annual finite growth rate (or annual finite rate of increase) is a measure of the relative rate of growth of a population. Local extirpation of kit fox communities has also been linked to the previous loss of kangaroo rat populations (Bean and White 2000; Williams *in litt*. 2007).

In some locations ground squirrels have been identified as the primary prey consumed by the kit fox (Orloff *et al*. 1986). California ground squirrels were found to be the most common prey item in the Bethany Reservoir area of Alameda County (Orloff *et al*. 1986). No kangaroo rats were detected at this site (Orloff *et al*. 1986), but ground squirrels have also been important food items in some areas where kangaroo rats appeared to be abundant (Balestreri 1981), although the relative densities of kangaroo rats in these areas is not known. In eastern Contra Costa County, a crash in the kit fox population was associated with extirpation of the California ground squirrel due to a ground squirrel eradication program (Orloff *et al*. 1986). To date no studies have addressed the energetic relationships for the kit fox associated with capture effort and food value of different prey species. In the Bakersfield vicinity, urban fox have access to anthropogenic food resources to supplement available natural prey so, in general, food is abundant and fox abundance shows little inter-annual variation (Cypher *in litt*. 2007, as cited in Ralls *et al.* 2007).

Precipitation-mediated changes in prey availability are most often related to changes in vegetation. Low precipitation levels characteristic of droughts result in reduced seed production in the natural habitats of the San Joaquin Valley (Germano and Williams 2005; Rathbun 1998; Williams *et al*. 1993, all cited in Bureau of Land Management [BLM] 2008). During several years of drought, seed resources for granivorous rodents, such as kangaroo rats, become scarce, resulting in declining abundance of these kit fox prey species (see Williams *et al*. 1993, Rathbun 1998, Germano and Williams 2005, all cited in BLM 2008j). Declining prey levels usually continue until higher germination of annual plants resumes with average precipitation levels (Cypher *et al*. 2000). In many locations, population abundance of kit fox responds to lower prey abundance by declining, although there generally is a lag-time of one or more years before kit fox declines occur (Cypher *et al*. 2000; Dennis and Otten 2000). High rainfall events also are known to reduce prey abundance dramatically (Cypher *in litt.* 2007; Williams *in litt.* 2007).

The diets and habitats selected by coyotes and kit foxes living in the same areas are often quite similar. Hence, the potential for resource competition between these species may be quite high when prey resources are scarce such as during droughts, which are quite common in semi-arid, central California. Competition for resources between coyotes and kit foxes may result in kit fox mortalities. Coyote-related injuries accounted for 50 to 87 percent of the mortalities of radio collared kit foxes at Camp Roberts, the Carrizo Plain Natural Area, the Lokern Natural Area, and the Naval Petroleum Reserves (Cypher and Scrivner 1992; Standley *et* al. 1992).

Reproductive Ecology and Demography

Adult San Joaquin kit foxes are usually solitary during late summer and fall. In September and October, adult females begin to excavate and enlarge natal dens (Morrell 1972). Typically, pups are born between February and late March following a gestation period of 49 to 55 days (Egoscue 1962; Morrell 1972). Mean litter sizes reported for San Joaquin kit foxes range from 2.0 young (White and Ralls 1993) to 3.8 young at the Naval Petroleum Reserve (Spencer *et al.* 1992; Spiegel and Tom 1996; Cypher *et al.* 2000). Pups appear above ground at about age 3 to 4 weeks, and are weaned at age 6 to 8 weeks.

The proportion of females bearing young, of adult San Joaquin kit foxes vary annually with environmental conditions, particularly food availability. Annual rates range from 0 to 100 percent, and reported mean rates include 61 percent at the Naval Petroleum Reserve (Cypher *et al.* 2000), 64 percent in the Lokern area (Spiegel and Tom 1996), and 32 percent at Camp Roberts (Spencer *et al.* 1992). Although some yearling female kit foxes will produce young, most do not reproduce until age 2 years (Spencer *et al.* 1992; Spiegel and Tom 1996; Cypher *et al.* 2000). Some young of both sexes, but particularly females may delay dispersal, and may assist their parents in the rearing of the following year's litter of pups (Spiegel and Tom 1996). The young kit foxes begin to forage for themselves at about four to five months of age (Koopman *et al.* 2000; Morel1 1972).

Mean annual survival rates reported for adult San Joaquin kit foxes range from 44 to 60 percent (Cypher *et al.* 2000; Standley *et* al. 1992; Spiegel and Disney 1996; Ralls and White 1995). However, survival rates vary widely among years (Spiegel and Disney 1996; Cypher *et al.* 2000). Mean survival rates for juvenile San Joaquin kit foxes (< 1 year old) are lower than rates for adults. Survival to age 1 year ranged from 14 to 21 percent (Cypher *et al.* 2000; Standley *et al.*1992; Ralls and White 1995). For both adults and juveniles, survival rates of males and females are similar. San Joaquin kit foxes may live to ten years in captivity (McGrew 1979) and 8 years in the wild (Berry *et al.* 1987).

Estimates of fox density vary greatly throughout its range, and have been reported as high as 1.2 animals per square kilometer in optimal habitats in good years (USFWS 1998). At the Elk Hills in Kern County, density estimates varied from 0.7 animals per square kilometer in the early

1980s to 0.01 animals per square kilometer in 1991 (USFWS 1998). Kit fox home ranges vary in size from approximately 2.6 square kilometers to 31.2 square kilometers (Spiegel and Tom 1996; USFWS 1998). Knapp (1978) estimated that a home range in agricultural areas is approximately 2.5 square kilometers. Individual home ranges overlap considerably, at least outside the core activity areas (Morrell 1972; Spiegel 1996).

Movements and Habitat Use
Although most young kit foxes disperse less than 8 kilometers (Scrivner *et al.* 1987b), dispersal distances of up to 122 kilometers have been documented for the San Joaquin kit fox (Scrivner *et al.* 1993; USFWS 1998). Dispersal can be through disturbed habitats, including agricultural fields, and across highways and aqueducts. The age at dispersal ranges from 4 to 32 months (Cypher 2000). Among juvenile kit foxes surviving to July 1 at the Naval Petroleum Reserve, 49 percent of the males dispersed from natal home ranges while 24 percent of the females dispersed (Koopman *et al.* 2000). Among dispersing kit foxes, 87percent did so during their first year of age. Some kit foxes delay dispersal and may inherit their natal home range.

San Joaquin kit foxes are primarily nocturnal, although individuals are occasionally observed resting or playing (mostly pups) near their dens during the day (Grinnell *et al.* 1937). A mated pair of kit foxes and their current litter of pups usually occupy each home range. Other adults, usually offspring from previous litters, also may be present (Koopman *et al.* 2000), but individuals often move independently within their home range (Cypher 2000). Average distances traveled each night range from 9.3 to 14.6 kilometers and are greatest during the breeding season (Cypher 2000).

Kit foxes maintain core home range areas that are exclusive to mated pairs and their offspring (White and Ralls1993, Spiegel 1996, White and Garrott 1997). This territorial spacing behavior eventually limits the number of foxes that can inhabit an area owing to shortages of available space and per capita prey. Hence, as habitat is fragmented or destroyed, the carrying capacity of an area is reduced and a larger proportion of the population is forced to disperse. Increased dispersal generally leads to lower survival rates and, in turn, decreased abundance because greater than 65 percent of dispersing juvenile foxes die within 10 days of leaving their natal range (Koopman *et al.* 2000).

Kit fox establish home ranges that are extensive, but home range sizes vary among locations. Home range size is thought to be related to prey abundance (White and Ralls 1993; White and Garrott 1997). At the National Petroleum Reserves (NPRC), Cypher *et al*. (2001) determined the mean adult home range size to be 1,071.7± 352.1 acres, while the mean home range for pups was 525.4±61.8 acres. Kit fox on the Carrizo Plains establish home ranges estimated to average approximately 2866 acres in size (White and Ralls 1993). In western Merced County, Briden *et al*. (1988) found that denning ranges (the area encompassing all known dens for an individual) average 1169 acres (1.8 square miles) in area. However, at Camp Roberts Army National Guard Training Site (Camp Roberts), the average home range was found to be 5,782 acres, based on a radio-telemetry study (Root and Eliason 2001, as cited in CANG 2008). Urban fox have access to anthropogenic food sources and fox in this urban area have smaller home ranges than those in non-urban areas.

The San Joaquin kit fox seems to prefer more gentle terrain and decreases in abundance as terrain ruggedness increases (Grinnell *et al.* 1937; Morrell 1972; Warrick and Cypher 1998). The kit fox is often associated with open grasslands, which form large contiguous blocks within the eastern portions of the range of the animal. San Joaquin kit foxes also exhibit a capacity to utilize habitats that have been altered by humans. The listed canine can utilize some types of agriculture (e.g. orchards and alfalfa), although the long-term suitability of these habitats is unknown (Jensen 1972; USFWS 1998). Orchards sometimes support prey species if the grounds are not manicured; however, denning potential is typically low and kit foxes can be more susceptible to predation by coyotes within the orchards (Orloff 2002). Alfalfa fields provide an easily accessible prey base (Woodbridge 1998; Young 1989), and berms adjacent to alfalfa fields sometimes provide good denning habitat (Morrell 1972).

Kit foxes use some types of agricultural land where uncultivated land is maintained, allowing for denning sites and a suitable prey base (Knapp 1978; Hansen 1988; Warrick *et al.* 2007). In the Lost Hills area, radio collared kit foxes predominantly used natural habitat remaining in the California Aqueduct right-of-way (Warrick *et al.* 2007), even though this habitat had lower availability relative to other habitats. Orchards were the second most frequently used habitats, followed by row crops and other habitats (residential, grassland, and fallow fields). Kit foxes were documented to travel a maximum distance of 1.5 kilometers into orchards and 1.1 kilometers into row crops (Warrick *et al.* 2007). No dens were observed in the agricultural areas. Kit foxes appear reluctant to cross these lands due to insufficient refugia from predators (Cypher *et al.* 2005). The lack of kit fox occupancy in farm land is in contrast to observations of the closely related swift fox in western Kansas (Jackson and Choate 2000; Matlack *et al.* 2000). Differences in habitat use between the species may be due to differences in farming practices (Warrick *et al.* 2007). Farmland in the San Joaquin Valley is more heavily disturbed. The farmlands are irrigated, and fields are not left fallow for as long a duration as the farmlands in Kansas. These practices in California likely result in a sparse prey base and unsuitable habitat for denning, discouraging the kit fox from occupying agricultural lands.

Dens are used by kit foxes for temperature regulation, shelter from adverse environmental conditions, and escape from predators. Kit foxes are reputed to be poor diggers, and their dens are usually located in areas with loose-textured, friable soils (Morrell 1972; O'Farrell 1984). However, the depth and complexity of their dens suggest that they possess good digging abilities, and kit fox dens have been observed on a variety of soil types (USFWS 1998). Some studies have suggested that where hardpan layers predominate, kit foxes create their dens by enlarging the burrows of California ground squirrels (*Spermophilus beecheyi*) or badgers (*Taxidea taxus)* (Jensen 1972; Morrell 1972; Orloff *et al.* 1986). In parts of their range, particularly in the foothills, kit foxes often use ground squirrel burrows for dens (Orloff *et al.* 1986). Kit fox dens are commonly located on flat terrain or on the lower slopes of hills. About 77 percent of all kit fox dens are at or below midslope (O'Farrell 1984), with the average slope at den sites ranging from 0 to 22 degrees (CDFG 1980; O'Farrell 1984; Orloff *et al.* 1986). Natal and pupping dens are generally found in flatter terrain. Common locations for dens include washes, drainages, and roadside berms. Kit foxes also commonly den in human-made structures such as culverts and pipes (O'Farrell 1984; Spiegel and Tom 1996). In the Bakersfield vicinity, kit fox selection of den sites appears to be associated with areas of open space, or areas having light or infrequent disturbance, such as canal right of ways and detention basins (Bjurlin *et al*. 2005).

Natal and pupping dens may include from two to 18 entrances and are usually larger than dens not used for reproduction (O'Farrell *et al.* 1980; O'Farrell and McCue 1981). Natal dens may be reused in subsequent years (Egoscue 1962). It has been speculated that natal dens are located in the same location as ancestral breeding sites (O'Farrell 1984). Active natal dens are generally 1.9 to 3.2 kilometers from the dens of other mated kit fox pairs (Egoscue 1962; O'Farrell and Gilbertson 1979). Natal and pupping dens usually can be identified by the presence of scat, prey remains, matted vegetation, and mounds of excavated soil (i.e., ramps) outside the dens (O'Farrell 1984). However, some active dens in areas outside the valley floor often do not show evidence of use (Orloff *et al.* 1986). During telemetry studies of kit foxes in the northern portion of their range, 70 percent of the dens that were known to be active showed no sign of use (e.g., tracks, scats, ramps, or prey remains) (Orloff *et al.* 1986).

A kit fox can use more than 100 dens throughout its home range, although on average, an animal will use approximately 12 dens a year for shelter and escape cover (Cypher *et al.* 2001). Kit foxes typically use individual dens for only brief periods, often for only one day before moving to another den (Ralls *et al.* 1990). Possible reasons for changing dens include infestation by ectoparasites, local depletion of prey, or avoidance of coyotes. Kit foxes tend to use dens that are located in the same general area, and clusters of dens can be surrounded by hundreds of hectares of similar habitat devoid of other dens (Egoscue 1962). In the southern San Joaquin Valley, kit foxes were found to use up to 39 dens within a denning range of 129 to 195 hectares (Morrell 1972). An average den density of one den per 28 to 37 hectares was reported by O'Farrell (1984) in the southern San Joaquin Valley.

Reasons for Decline and Threats to Survival
The distribution and abundance of the kit fox have decreased since its listing in 1967. This trend is reasonably certain to continue into the foreseeable future unless measures to protect, sustain, and restore suitable habitats, and alleviate other threats to their survival and recovery, are implemented. Threats that are seriously affecting kit foxes are described in further detail in the following paragraphs.

<u>Loss of habitat:</u> Less than 20 percent of the habitat within the historical range of the kit fox remained when the subspecies was listed as endangered in 1967, and there has been substantial net loss of habitat since that time. Historically, San Joaquin kit foxes occurred throughout California's Central Valley and adjacent foothills. Extensive land conversions in the Central Valley began as early as the mid-1800's with the Arkansas Reclamation Act. By the 1930s, the range of the kit fox had been reduced to the southern and western parts of the San Joaquin Valley (Grinnell *et al.* 1937). The primary factor contributing to this restricted distribution was the conversion of native habitat to irrigated cropland, industrial uses (e.g., hydrocarbon extraction), and urbanization (Laughrin 1970; Jensen 1972; Morrell 1972, 1975). About one-half of the natural communities in the San Joaquin Valley were tilled or developed by 1958 (USFWS 1980).

This rate of loss accelerated following the completion of the CVP and the SWP, which diverted and imported new water supplies for irrigated agriculture (USFWS 1995). About 7,972 square kilometers of habitat, or about 267 square kilometers per year, were converted in the San Joaquin region between 1950 and 1980 (Mayer and Laudenslayer 1988). The counties specifically noted as having the highest wildland conversion rates included Kern, Tulare, Kings and Fresno, all of which are occupied by kit foxes. From 1959 to 1969 alone, an estimated 34 percent of natural lands were lost within the then-known kit fox range (Laughrin 1970).

Land conversions contribute to declines in kit fox abundance through direct and indirect means: mortalities, displacement, reduction of prey populations and denning sites, changes in the distribution and abundance of larger canids that compete with kit fox for resources, and reductions in carrying capacity (Jensen 1972; Morrell 1975). Dens are essential for the survival and reproduction of kit fox, as the fox use dens year-round for shelter and escape, and in the spring for rearing young (Cypher *et al*. 2000). Kit fox may be buried in their dens during land conversion activities (Branco 2007), or permanently displaced from areas where structures are erected or the land is intensively irrigated (Jensen 1972; Morrell 1975). In addition to the direct loss of habitat for denning and foraging by kit fox, land conversion and associated human-intensive uses can bring additional stressors, including human disturbance, fire suppression, and pest control (Bunn *et al*. 2007).

Moderate fragmentation or loss of habitat may be an important factor impacting the abundance and distribution of kit fox (Bjurlin *et al*. 2005; Warrick *et al*. 2007). Capture rates of kit foxes at the Naval Petroleum Reserve in Elk Hills were negatively associated with the extent of oil-field development after 1987 (Warrick and Cypher 1998). Likewise, the CEC found that the relative abundance of kit foxes was lower in oil-developed habitat than in nearby undeveloped habitat on the Lokern (Spiegel 1996). Researchers from both studies inferred that the most significant effect of oil development was the lowered carrying capacity for populations of both foxes and their prey species owing to the changes in habitat characteristics or the loss and fragmentation of habitat (Spiegel 1996, Warrick and Cypher 1998).

Land conversions and associated human activities can lead to widespread changes in the availability and composition of mammalian prey for kit foxes. For example, oil field disturbances in western Kern County have resulted in shifts in the small mammal community from the primarily granivorous species that are the staple prey of kit foxes, to species adapted to early successional stages and disturbed areas (e.g., California ground squirrels) (Spiegel 1996). Because more than 70 percent of the diets of kit foxes usually consist of abundant leporids (*Lepus*, *Sylvilagus*) and rodents (e. g., *Dipodomys* spp.), and kit foxes often continue to feed on their staple prey during ephemeral periods of prey scarcity, such changes in the availability and selection of foraging sites by kit foxes could influence their reproductive rates, which are strongly influenced by food supply and decrease during periods of prey scarcity (White and Garrott 1997, 1999).

Dens are essential for the survival and reproduction of kit foxes that use them year-round for shelter and escape, and in the spring for rearing young. Kit foxes generally have dozens of dens scattered throughout their territories. However, land conversion reduces the number of typical earthen dens available to kit foxes. For example, the average density of typical, earthen kit fox dens at the Naval Hills Petroleum Reserve was negatively correlated with the intensity of petroleum development (Zoellick *et al*. 1987), and almost 20 percent of the dens in developed areas were found to be in well casings, culverts, abandoned pipelines, oil well cellars, or in the banks of sumps or roads (USFWS 1983). These results are important because the California Energy Commission (CEC) found that, even though kit foxes frequently used pipes and culverts as dens in oil-developed areas of western Kern County, only earthen dens were used to birth and wean pups (Spiegel 1996). Similarly, kit foxes in Bakersfield use atypical dens, but have only been found to rear pups in earthen dens (P. Kelly, Endangered Species Recovery Program, Fresno, pers. comm. to P. White, Fish and Wildlife Service, Sacramento, 2000). Hence, the fragmentation of habitat and destruction of earthen dens could adversely affect the reproductive success of kit foxes. Furthermore, the destruction of earthen dens may also affect kit fox survival by reducing the number, distribution and availability of escape refuges.

Habitat loss and modification due to agricultural conversion: In the San Joaquin and associated valleys, and in the border foothill areas, conversion of natural habitat to intensive agriculture continues to be the primary cause of habitat loss for the San Joaquin kit fox (Cypher *et al*. 2007). Conversion of natural lands to agriculture has continued since the kit fox was listed. By 1979, only approximately 1,497 square kilometers (370,000 acres) out of a total of approximately 34,400 square kilometers (8.5 million acres) on the San Joaquin Valley floor remained as undeveloped land (Williams 1985; USFWS 1980). Data from the CDFG (1985) and USFWS file information indicate that between 1977 and 1988, essential habitat for the blunt-nosed leopard lizard, a species that occupies habitat that is also suitable for kit foxes, declined by about 80 percent – from 311,680 acres to 63,060 acres, an average of about 22,000 acres per year (Biological Opinion for the Interim Water Contract Renewal, Service File no. 00-F-0056, February 29, 2000). Virtually all of the documented loss of essential habitat was the result of conversion to irrigated agriculture.

During 1990 to 1996, a gross total of approximately 71,500 acres of habitat were converted to farmland in 30 counties (total area 23.1 million acres) within the Conservation Program Focus area of the CVP. This figure includes 42,520 acres of grazing land and 28,854 acres of “other” land, which was predominantly comprised of native habitat. During this same period, about 101,700 acres were converted to urban land use within the Conservation Program Focus area (California Department of Conservation 1994, 1996, 1998). This figure comprises 49,705 acres of farmland, 20,476 acres of grazing land, and 31,366 acres of “other” land, which is predominantly comprised of native habitat. Because these assessments included a substantial portion of the Central Valley and adjacent foothills, they provide the best scientific and commercial information currently available regarding the patterns and trends of land conversion within the kit fox’s geographic range.

Recent unauthorized conversions of suitable kit fox habitat to agriculture have also been documented on a smaller scale in the San Joaquin Valley. For example, in 2006, about 1,300 acres of saltbush scrub and sink scrub habitat along I-5 north of the Kings-Kern county line were disked and converted to agriculture (J. Vance, CDFG, *in litt.* 2006).

Denning opportunities on land converted to agriculture are limited due to agricultural practices, such as cultivation, irrigation, chemical treatments, and other disturbances. The loss of denning habitat can impede successful migration of kit fox across agricultural lands because of greater vulnerability to predation resulting from a lack of possible escapes.

Kit foxes use some types of agricultural land where uncultivated land is maintained, allowing for denning sites and a suitable prey base (Jensen 1972; Knapp 1978; Hansen 1988). Kit foxes also den on small parcels of native habitat surrounded by intensively maintained agricultural lands (Knapp 1978), and adjacent to dryland farms (Jensen 1972; Kato 1986; Orloff *et al.* 1986).

Habitat loss and modification due to urbaninzation: Loss and modification of habitat to urban development continues to be a threat to the kit fox throughout its range. Development along the San Joaquin Valley periphery continues to restrict both core habitat and movement corridors for the kit fox. The increasing human population of California, with the concomitant high demand for limited supplies of land, water, and other resources, has been identified as the primary underlying cause of habitat loss and degradation (Bunn *et al*. 2007). Between 1970 and 2000, the human population of the San Joaquin Valley doubled in size; it is expected to more than double again by 2040 (Field *et al.* 1999; Teitz *et al*. 2005). In roughly the same period (between 1987 and 2007), the Biological Opinions and Habitat Conservation plans completed by the Service's SFWO covered projects with permanent impacts to approximately 114,000 acres of natural habitat considered to be suitable for the San Joaquin kit fox. These projects also resulted in temporary impacts to close to an additional 20,100 acres of kit fox habitat (USFWS, unpublished data).

On the floor of the valley, urbanization occurs most often on previously cultivated lands, where natural habitat has been lost or degraded (Bunn *et al*. 2007). However, urbanization is also occurring along all edges of the San Joaquin Valley in areas of extant natural habitat that is important to the kit fox. Within these areas, cities that are undergoing substantial growth include, but are not limited to, Livermore, Antioch, Tracy, and Los Banos, in the northwestern portion of the fox's range; and Paso Robles, Tulare, and Bakersfield in the southern portion of the range. The City of Tracy has grown by 41 percent between 2000 and 2006, resulting in the loss and fragmentation of remaining kit fox habitat in the area. For example, a development proposed for the Tracy Hills would occupy all natural habitat having less than a 15 percent slope for a 2-mile portion of the kit fox corridor, while only preserving steeper areas for the kit fox, thereby reducing the width and viability of the needed kit fox corridor. Because the planned corridor is an integral part of the kit fox strategy for this area, construction of the proposed development is expected to place the strategy at risk (N. Pau, Service, *in litt*. 2002). Although the project has not been built as of 2009, Service files indicate that it is once again moving forward.

Habitat loss, modification, and fragmentation due to construction of solar facilities: A number of large-scale solar development projects that would threaten kit fox population clusters are currently proposed for construction in kit fox habitat. Within the Carrizo Core Area, two solar firms propose to install solar panels on 13 square miles of land on the valley floor of the Carrizo Plain, San Luis Obispo County, just north of the Carrizo Plain National Monument (DeBare 2008). Although this area of the Carrizo has a fair amount of dryland farming and is less likely to be optimal kit fox habitat than land within the National Monument (B. Cypher pers. comm. 2008), these projects will create barriers to the linkage between the Carrizo Plain Core Area, the Western Kern core area, and core and satellite areas to the north and west, thereby impeding kit fox dispersal and increasing habitat fragmentation. The Service expects that additional solar projects will be proposed on lands important to the kit fox at the southern extent of its range.

Habitat loss and modification due to oil extraction and mining activities: At the time that the San Joaquin kit fox was federally listed, extraction of petroleum products (including crude oil, propane, natural gas, etc.) was not considered to be a threat to the kit fox, as most of the petroleum-producing land was still relatively undisturbed (Jensen 1972). The Service has not found information to indicate that gravel and sand mining activities were considered to be a threat to the kit fox at the time of listing.

Currently, oil extraction and gravel mining may pose both direct and indirect risks to the San Joaquin kit fox. Direct risks to kit fox from oil-field development include human disturbance, loss of habitat and den sites (Zoellick *et al*. 1987; Spiegel and Small 1996; Warrick and Cypher 1998; Cypher *et al*. 2000; P. Kelly, Endangered Species Recovery Program, pers. comm. to P. White, USFWS, 2000; BLM 2008j), entombment, entrapment in sumps or oil spills, and exposure to contaminants (Spiegel and Disney 1996; Warrick and Cypher 1999; Cypher *et al*. 2000). San Joaquin kit fox have appeared to be tolerant of human activities; they have frequently been observed around facilities and are known to use manmade structures (pipe, culverts, foundations) as dens, although with some mortality (Cypher *et al*. 2000; BLM 2008j), suggesting that the direct effects of low density oil-field development on kit fox dynamics may be minimal (Warrick and Cypher 1998).

Indirect effects of oilfield development on kit fox include changes to remaining habitat, and changes in predator and prey community composition and abundance. Oil spills may create short-term disruptions of primary travel routes and foraging areas for fox (BLM 2008j). Between 1976 and 1995 oil spills that occurred on 64 sites resulted in effects to an unquantified number of acres that were contaminated by chromium, arsenic, and other materials, although all sites were remediated by 1995 (USFWS 1995). Short-term effects of oil spills have included a 67 percent difference in abundance of Heerman's kangaroo rats (*Dipodomys heermanni*) between spill areas and control areas (Warrick *et al.* 1997). Similarly, oil field disturbances in western Kern County have been found to result in shifts in the small mammal community from the primarily granivorous (seed-eating) species (kangaroo rats) that are a staple prey of kit fox, to species adapted to disturbed areas (murid, or old world rodents) (Spiegel *et al*. 1996). The effect of an altered prey community on the energetics of the kit fox is not currently known, but early studies suggest that such altered prey composition may result in lower kit fox density (Jensen 1972). The most significant effect of oil-field development appears to be lowered carrying capacity for populations of both fox and their prey species due to changes in habitat characteristics, and to loss and fragmentation of habitat (Warrick and Cypher 1998; Cypher *et al*. 2000).

The southwestern extent of the San Joaquin Valley harbors a high proportion of the remaining San Joaquin kit fox occurrences (Cypher *et al*. 2000; CNDDB 2008), and lands in this region that are important to the kit fox also support numerous areas of potential oilfield development. Development of these areas has continued since listing of the kit fox. By 2007, the Western Kern County Core Area included a number of high-density oil fields on private lands (e.g., Midway-Sunset, Elk Hills Oilfield [formerly the National Petroleum Reserve-1], Cymric, and South Belridge). The Midway-Sunset Oilfield contains the highest-producing BLM lease in the United States (BLM 2008i). The 74 square-mile Elk Hills Oilfield, the seventh largest oilfield in the United States, is surrounded on three sides by oil and gas fields and agricultural lands, while on the northwest side, it is adjacent to the 30,000-acre Lokern Natural Area (also known as the Lokern Road area), an area of relatively undisturbed publicly and privately-owned habitat (USFWS 1995). Federal lands under the jurisdiction of the BLM, including the Buena Vista

Oilfield (formerly the Naval Petroleum Reserve No. 2), an area south of Lokern Road in Kern County, and lands in the Temblor Range east of Carrizo Plain National Monument occupy another 59,703 acres of the core area. Subsequent to passage of the Energy Policy Act in 2005, the BLM leased an additional 2,500 acres of Federal lands in September 2006 (BLM 2008i).

In the Carrizo Plain National Monument (Carrizo Plains Natural Area core area), about 130,000 acres of mineral rights are privately owned (Whitney, 2008a, b), including 30,000 acres of privately-held subsurface mineral rights in the center of the monument (BLM 2008h). In addition, five of the 13 "satellite areas", which have been designated as important for recovering subpopulations of the kit fox, have substantial petroleum production areas. Between 5 and 8 percent of the acreage in each of these areas is comprised of lands currently open to oil and gas leasing. Most of the BLM lands in this area are scattered in a checkerboard pattern of one-square-mile (640-acre) parcels or smaller. Oil and gas leases on lands under the jurisdiction of BLM are subject to limited surface-use stipulations for the protection of threatened and endangered species (BLM 1984, 1997; Lowe *in litt.* 2006, 2007).

On public lands, including the Carrizo Plains National Monument and other BLM lands, oil and gas leasing continues to pose a threat to kit fox populations. Most oil and gas leasing and development activities on public lands occur in the San Joaquin Valley on lands managed by the BLM's Bakersfield Office (BLM 2008i). About 440,000 acres of Federal mineral estate holdings are located in the San Joaquin Valley (BLM 2008j). In past 10 years, oilfield development has increased in this area, with extensive new development initiated in shallow diatomite oil-bearing formations. During the period from 2001 to 2005, 10,873 wells were drilled, with 10,746 completed. During the same period, 8,844 wells were abandoned (BLM 2008j). This 10-year time period includes periods of very high, and very low, gas prices (BLM 2008j), suggesting that development will continue despite fluctuations in the oil and gas market. Additional incentive for development stems from new technology that is predicted to result in recovery of up to 3.5 billion additional barrels of undiscovered oil from existing reserves (USGS 2004). BLM lease offerings have included lands that were previously in row crops, and natural lands, including sparse saltbush scrub. Based on data collected in the past 10 years, the BLM predicts that up to 25,000 wells may be drilled on Federal, State, and private lands in the San Joaquin Valley over the next 10 years, with 1,250 – 2,500 wells on Federal Lands (BLM 2008j).

While BLM lands are subject to degradation by oil and gas exploration activities, the BLM Oil and Gas Programmatic Biological Opinion for Kings and Kern Counties limits modification of high quality habitat to less than 10 percent of each 640-acre section, and modification of lower quality habitat to less than 25 percent. The BLM Oil and Gas Programmatic also limits total permanent modification of kit fox habitat on BLM lands throughout Kings and Kern Counties to 1,725 acres. However, several sections within National Petroleum Reserve-2, however, had already exceeded the modification thresholds when the BLM acquired the properties (USFWS 2001, 2003) and are not subject to these limitations.

Currently, the southern half of the San Joaquin Valley continues to be an area of expansion and development activity for extraction of petroleum products. Recent and continuing oil and gas leases are being offered within the range of the kit fox in Kern, Kings, Fresno, San Benito, and Monterey Counties (BLM 2008a, b, c, d, e, f, and j) where they have the potential to affect kit fox habitat and dispersal corridors. In addition, within the Carrizo National Monument, Vintage Production LLC, a subsidiary of Occidental Petroleum, recently submitted a permit request to the BLM to explore for oil on 30,000 acres of subsurface mineral holdings in the heart of the Monument's valley floor grasslands (BLM 2008h; Whitney 2008a, b). Work is projected to start in spring or summer of 2009 (BLM 2008h). Although exploration could set the stage for negotiations to purchase the oil rights (Whitney 2008a), it is also possible that exploration will result in development of oil resources in high-value kit fox habitat.

In addition to oil field development, existing and additional proposed sand and gravel mining activities are expected to affect areas in the Western Kern County Core area (e.g., the Johnny Cat mine) and in areas such as the Salinas River Watershed in northern San Luis Obispo County, where proposed linear sand/gravel mines are expected to present barriers to the movement of San Joaquin kit fox in the habitat corridor between the Carrizo Plain and Camp Roberts (USFWS 2006c; USFWS 2008).

The most robust kit fox populations now occur in the oil-producing region of the San Joaquin Valley, suggesting that kit fox can persist well with low-density oil development. The cumulative and long-term effects of oil extraction activities on kit fox populations are not fully known, but studies included herein indicate that moderate to high density oil fields contribute to a decrease in carrying capacity for kit fox through outright habitat loss and through changes in characteristics of remaining habitat over time (Spiegel 1996; Warrick and Cypher 1998; Cypher *et al*. 2000). Currently, the areas in which kit fox populations are most robust are also the areas slated for expansion of oil extraction activities, including focused activities on Federal lands that are usually thought to offer protection from development. It is therefore reasonably certain that oil field development will continue to threaten the kit fox into the foreseeable future, while increased development in the arid oil lands of Kern County may present exceptional threats to critical kit fox localities.

Oil fields in the southern half of the San Joaquin Valley also continue to be an area of expansion and development activity. This expansion is reasonably certain to increase in the near future owing to market-driven increases in the price of oil. The cumulative and long-term effects of oil extraction activities on kit fox populations are not fully known, but recent studies indicate that moderate- to high-density oil fields may contribute to a decrease in carrying capacity for kit foxes owing to habitat loss or changes in habitat characteristics (Spiegel 1996, Warrick and Cypher 1998). There are no limiting factors or regulations that are likely to retard the development of additional oil fields. Hence, it is reasonably certain that development will continue to destroy and fragment kit fox habitat into the foreseeable future.

Habitat loss, modification, and fragmentation due to construction of infrastructure: Construction of infrastructure projects continues to result in the direct loss and indirect modification of remaining kit fox habitat throughout the range of the kit fox. Paved roads, canals, reservoirs, water banks, sound walls, and similar facilities present both permanent loss of habitat and potential barriers to kit fox movement that fragments habitat.

Road construction in the San Joaquin Valley has resulted in the loss of kit fox habitat since listing. The Service does not have data to show the historic and current loss of kit fox habitat rangewide that is the direct result of road construction. However, rough calculations of the acreage of land lost to road development indicate that by 2003, over 7,000 acres of land had been transferred to Caltrans jurisdiction, including 590 acres in Kings County, 1,065 acres in Merced County, and 2,020 acres in Fresno County (K. Hau, Caltrans, pers. comm., as cited in Bjurlin and Cypher 2003).

Canals also present substantial barriers to kit fox movement across the canal features. Canals are known to be hazards that can result in wildlife drownings (J. Lowe, BLM, *in litt.* 2007). Monitoring has shown that some wildlife species, including red and gray fox, will utilize flumes, pipelines, and other structures to cross canals, including the California aqueduct and the DMC (Johnson *et al*. 1994), potentially suggesting that kit fox may achieve some cross-canal movement, although the mortality due to drowning is not known. However, use of such structures by kit fox predators may serve to deter kit fox from using the structures when available, and the Service has no information quantifying the use of these features by kit fox.

In contrast, several canal right-of-ways have been proposed as travel corridors between northern and central occurrences of the species along either side of the canal (Clark *et al*. 2003a). The natural lands in canal right-of-ways can provide relatively abundant prey, and are utilized by kit fox (Warrick *et al*. 2007), so may serve as linkages that facilitate north-south movement of the kit fox (Warrick *et al*. 2007). However, kit fox competitors, including red fox, also utilize these corridors (Clark *et al*. 2003a) and may inhibit their successful use by kit fox (Johnson *et al*. 1994; Clark *et al*. 2005; Cypher *et al*. 2005b; Smith *et al*. 2006).

San Luis Reservoir, Los Vaqueros Reservoir, Bethany Reservoir, and Clifton Court Forebay are impoundments that present barriers to kit fox movement in the northern portion of the kit fox range. The Los Vaqueros Reservoir was first constructed in 1999, causing permanent effects to 1,550 acres of kit fox habitat, and resulting in protection of 3,000 acres of kit fox habitat near the reservoir (McHugh 2004; USEPA 2005). Current CALFED Bay-Delta long-term plans call for enlarging Los Vaqueros Reservoir, which would inundate an additional 1,950 acres of kit fox habitat, including about 500 acres of the kit fox habitat conserved as compensation for the initial project (McHugh 2004). This added inundation is within a critical dispersal corridor linking kit fox in the northern extent of its range to the other kit fox populations. Construction of the project is expected to reduce the options for dispersal of kit fox in Eastern Contra Costa County.

<u>Predation and competition</u>***:*** Studies in the last 20 years have shown that predation has become a significant cause of kit fox mortality. This predation has been noted to have strong effects on the demography and ecology of kit fox, at least locally (Cypher and Scrivner 1992). Predation (by coyotes [*Canis latrans*] and some bobcats [*Lynx rufus*]) was the primary cause of mortality for the kit fox population at the Naval Hills Petroleum Reserve (Cypher and Spencer 1998; Cypher *et al*. 2000). The percentage of mortality due to interactions with predators, primarily coyotes, ranged between 57 percent and 89 percent in the southern San Joaquin Valley (Cypher and Scrivner 1992; Standley *et al*. 1992; Ralls and White 1995; Spiegel and Disney 1996; Spiegel *et al*. 1996; Cypher and Spencer 1998; Cypher *et al*. 2000; Nelson *et al*. 2007), while in Western Merced County it averaged 46 percent (Briden *et al*. 1992). In some locations coyotes only infrequently consume the kit fox they kill, suggesting that coyote attacks are competitive interactions that can include prey consumption rather than a strict predator-prey interaction

(Cypher and Spencer 1998; Cypher *et al*. 2000; Nelson *et al*. 2007). Free-ranging dogs (*Canis familiaris*), non-native red fox (*Vulpes vulpes*), badgers (*Taxidea taxus*), and golden eagles (*Aquila chrysaetos*) have also been documented as kit fox predators (Briden *et al*. 1992; Cypher *et al*. 2000).

The diets and habitats selected by coyotes and kit foxes living in the same areas are often quite similar (Cypher and Spencer 1998). Competition between coyotes and kit foxes may not be significant in all areas or all years (Cypher et al. 2001), but may be high when prey resources are scarce, such as during droughts that are common in semi-arid, central California (Cypher and Spencer 1998). Land conversions and associated human activities have led to changes in the distribution and abundance of coyotes, which compete with kit foxes for resources.

Coyotes occur in most areas with abundant populations of kit foxes and, during the past few decades, coyote abundance has increased in many areas owing to a decrease in ranching operations, favorable landscape changes, and reduced control efforts (Orloff *et al.* 1986; Cypher and Scrivner 1992; White and Ralls 1993; White *et al.* 1995). Although coyotes are common in both natural and agricultural landscapes, they pose a greater predation threat to the kit fox on agricultural lands because of the decreased availability or absence of escape dens and vegetative cover (Cypher *et al.* 2005). Coyotes may kill kit foxes in an attempt to reduce resource competition. Coyote-related injuries accounted for 50 to 87 percent of the mortalities of radio collared kit foxes at Camp Roberts, the Carrizo Plain Natural Area, the Lokern Natural Area, and the Naval Petroleum Reserves (Cypher and Scrivner 1992; Standley *et al.* 1992; Ralls and White 1995; Spiegel 1996). Coyote-related deaths of adult foxes appear to be largely additive (i.e., in addition to deaths caused by other mortality factors such as disease and starvation) rather than compensatory (i.e., tending to replace deaths due to other mortality factors; White and Garrott 1997). The survival rates of adult foxes decrease significantly as the proportion of mortalities caused by coyotes increase (Cypher and Spencer 1998; White and Garrott 1997), and increases in coyote abundance may contribute to significant declines in kit fox abundance (Cypher and Scrivner 1992; Ralls and White 1995; White *et al.* 1996). There is some evidence that the proportion of juvenile foxes killed by coyotes increases as fox density increases (White and Garrott 1999). This density-dependent relationship would provide a feedback mechanism that reduces the amplitude of kit fox population dynamics and keeps foxes at lower densities than they might otherwise attain. In other words, coyote-related mortalities may prevent fox population growth, and may instead prolong population declines.

Land-use changes have also contributed to the expansion of normative red foxes into areas inhabited by kit foxes. Historically, the geographic range of the red fox did not overlap with that of the San Joaquin kit fox. By the 1970s, however, introduced and escaped red foxes had established breeding populations in many areas inhabited by San Joaquin kit foxes (Lewis *et al.* 1993). Red foxes are rarely observed in natural settings, and are much more abundant on agricultural lands. They appear to be dependent on the presence of water (Cypher *et al.* 2001), a resource readily available on irrigated farmlands, while kit foxes do not drink free water (Golightly and Ohmart 1983). Thus, there is no concern here that contaminated water may be directly ingested by kit fox. The larger and more aggressive red foxes are known to kill kit foxes (Ralls and White 1995), and could displace them, as has been observed in the arctic when red foxes expanded into the ranges of smaller arctic foxes (Hersteinsson and Macdonald 1982). The increased abundance and distribution of normative red foxes is perhaps a greater threat to kit foxes than coyotes because red foxes and kit foxes are closer morphologically and taxonomically, and would likely have higher dietary overlap, potentially resulting in more intense competition for resources. Two documented deaths of kit foxes due to red foxes have been reported (Ralls and White 1995), and red foxes appear to be displacing kit foxes in the northwestern part of their range (Lewis et al. 1993). At Camp Roberts, red foxes have usurped several dens that were used by kit foxes during previous years (California Army National Guard, Camp Roberts Environmental Office, unpubl. data). In fact, opportunistic observations of red foxes in the cantonment area of Camp Roberts have increased 5-fold since 1993, and no kit foxes have been sighted or captured in this area since October 1997. Also, a telemetry study of sympatric red foxes and kit foxes in the Lost Hills area has detected spatial segregation between these species, suggesting that kit foxes may avoid or be excluded from red fox-inhabited areas (P. Kelly, Endangered Species Recovery Program, pers. comm. to P. White, USFWS, 2000). Such avoidance would limit the resources available to local populations of kit foxes and possibly result in decreased fox abundance and distribution.

Disease: Wildlife diseases do not appear to be a primary mortality factor that consistently limits kit fox populations throughout their range (McCue and O'Farrell 1988; Standley and McCue 1992). However, central California has a high incidence of wildlife rabies cases (Schultz and Bairett 1991), and high seroprevalences of canine distemper virus and canine parvovirus indicate that kit fox populations have been exposed to these diseases (McCue and O'Farrell 1988; Standley and McCue 1992). Hence, disease outbreaks could potentially cause substantial mortality or contribute to reduced fertility in seropositive females, as was noted in closely-related swift foxes (*Vulpes velox)*.

There are some indications that rabies virus may have contributed to a catastrophic decrease in kit fox abundance at Camp Roberts, San Luis Obispo County, California, during the early 1990s. San Luis Obispo County had the highest incidence of wildlife rabies cases in California during 1989 to 1991, and striped skunks (*Mephitis mephitis*) were the primary vector (Barrett 1990; Schultz and Barrett 1991; Reilly and Mangiamele 1992). A rabid skunk was trapped at Camp Roberts during 1989 and two foxes were found dead due to rabies in 1990 (Standley *et al.* 1992). Captures of kit foxes during annual live trapping sessions at Camp Roberts decreased from 103 to 20 individuals during 1988 to 1991. Captures of kit foxes were positively correlated with captures of skunks during 1988 to 1997, suggesting that some factor(s) such as rabies virus was contributing to concurrent decreases in the abundances of these species. Also, captures of kit foxes at Camp Roberts were negatively correlated with the proportion of skunks that were rabid when trapped by County Public Health Department personnel two years previously. These data suggest that a rabies outbreak may have occurred in the skunk population and spread into the fox population. A similar time lag in disease transmission and subsequent population reductions was observed in Ontario, Canada, although in this instance the transmission was from red foxes to striped skunks (Macdonald and Voigt 1985).

Pesticides and rodenticides: Some methods of pest and rodent control pose a threat to kit foxes through direct or secondary poisoning, and these threats are often encountered in agricultural settings. Kit foxes may be killed if they ingest rodenticide in a bait application, or if they eat a rodent that has consumed the bait (Orloff *et al.* 1986; Berry *et al.* 1992; Huffman and Murphy

1992; Standley *et al.* 1992; CDFG 1999; Hosea 2000; L. Briden, CDFG, *in litt.* 2006). Even sublethal doses of rodenticides may lead to the death of these animals by impairing their ability to escape predators or find food. Pesticides and rodenticides may also indirectly affect the survival of kit foxes by reducing the abundances of their staple prey species. For example, the California ground squirrel, which is the staple prey of kit foxes in the northern portion of their range and on agricultural lands, was thought to have been eliminated from Contra Costa County in 1975, after extensive rodent eradication programs. Field observations indicated that the long-term use of ground squirrel poisons in this county severely reduced kit fox abundance through secondary poisoning and the suppression of populations of its staple prey (Orloff *et al.* 1986). There also is the potential that availability of den sites may be impacted by rodent control programs, as kit fox can depend on ground squirrels to create potential burrows in areas with hardpan soil layers (Orloff *et al*. 1986; Orloff 2002).

The range of the San Joaquin kit fox overlaps with agricultural areas on about 10 million acres in 14 counties, mostly in the San Joaquin Valley (CDPR 2007). Although kit fox have been excluded from large portions of agricultural lands, kit fox currently utilize agricultural lands that border natural lands. Kit foxes occupying habitats adjacent to agricultural lands are also likely to come into contact with insecticides applied to crops owing to runoff or aerial drift. Kit foxes could be affected through direct contact with sprays and treated soils, or through consumption of contaminated prey. Data from the California Department of Pesticide Regulation (CDPR 2007) indicate that acephate, aldicarb, azinphos methyl, bendiocarb, carbofuran, chlorpyrifos, endosulfan, s-fenvalerate, naled, parathion, pernnethrin, phorate, and trifluralin are used within one mile of kit fox habitat. A wide variety of crops, as well as buildings, Christmas tree plantations, commercial/industrial areas, greenhouses, nurseries, landscape maintenance, ornamental turf, rangeland, rights of way, and uncultivated agricultural and non-agricultural land, occur in close proximity to San Joaquin kit fox habitat.

Efforts have been underway to reduce the risk of rodenticides to kit foxes (USFWS 1993b). The Federal government began controlling the use of rodenticides in 1972 with a ban of Compound 1080 on Federal lands pursuant to Executive Order. Above-ground application of strychnine within the geographic ranges of listed species was prohibited in 1988. A July 28, 1992, biological opinion regarding the Animal Damage Control (now known as Wildlife Services) Program by the U.S. Department of Agriculture (USDA) found that this program was likely to jeopardize the continued existence of the kit fox owing to the potential for rodent control activities to take the fox. As a result, several reasonable and prudent measures were implemented, including a ban on the use of M-44 devices, toxicants, and fumigants within the recognized occupied range of the kit fox. Also, the only chemical authorized for use by the Wildlife Services within the occupied range of the kit fox was zinc phosphide, a compound known to be minimally toxic to kit foxes (USFWS 1993b). Zinc phosphide became the only chemical authorized for use by the USDA to accomplish control of animal damage within the occupied range of the kit fox (USFWS 1992; USDA 2007). Zinc phosphide is considered a restricted use material and may only be legally applied by state-certified pesticide applicators (University of California 2009). Based on a 2007 concurrence letter from the Service, qualified individuals (certified applicators, biologists, Federal and State employees, county and UC extension agents) who have been trained to distinguish between dens and burrows of target and non-target species may also use sodium nitrate gas cartridges to kill coyotes inside active dens where the qualified personnel have positively observed coyotes (by sight or sound) at the time of, or immediately prior to treatment (USDA 2007; USFWS 2007b; C. Coolahan, APHIS, pers. comm. 2009).

In the intervening period since use of these original compounds became more restricted, two new generations of rodenticides have been developed. Currently both first and second-generation anticoagulant rodenticides may be used as rodent control agents within the range of the kit fox, although the appropriate use of individual anticoagulants differs depending on the terms of their registration. First-generation anticoagulant rodenticides (FGARs) include warfarin, chlorophacinone, and diphacinone, while brodifacoum, bromadiolone, difethialone, and difenacoum are considered second-generation anticoagulant rodenticides (SGARs). Both FGARs and SGARs interfere with blood clotting, leading to death from hemorrhaging. First-generation anticoagulant rodenticides require several days of consecutive feedings to deliver a lethal dose to the target species, while SGARs can deliver a lethal dose in only one night of feeding. However, with either type of anticoagulant, death does not occur until 5 to 7 days after the feeding (USEPA 2008), providing opportunities for secondary poisoning of diurnal predators and scavengers (Cox and Smith 1992). Secondary exposure to SGARs is particularly problematic due to the high toxicity of the compounds and their long persistence in body tissues. For example, brodifacoum, a common SGAR, is persistent in tissue, bioaccumulates, and appears to impair reproduction (Alterio 1996; Alterio and Moller 2000; Chen and Deng 1986; Eason *et al.* 1999; Eason *et al.* 2001; Eason *et al.* 2002; Hedgal and Colvin 1988; Howald *et al.* 1999; Mount and Feldman 1983; Munday and Thompson 2003). In addition, because these compounds are designed to be toxic after a single night's feeding, but death does not occur for 5 to 7 days, rodents may accumulate (and carcasses may contain) residues that may be many times the lethal dose. Finally, because compounds persist for extended periods in body tissues, predators and scavengers may sustain adverse or lethal effects from additive exposures through feedings that may be separated by days or weeks (Jackson and Kaukeinen 1972; Padgett *et al.* 1998; Stone *et al*. 1999; Eason *et al.* 2001; Munday and Thompson 2003; USEPA 2008). Exposed individuals are known to become progressively weaker and lethargic due to blood loss prior to death. Even in cases where the proximate cause of death has been identified as automobile strike, predation, or disease, toxicologists and pathologists have attained sufficient toxicological evidence to conclude that rodenticide-induced blood loss increased animal vulnerability to the proximate cause of death (USEPA 2008).

Rodenticides are used in urban, suburban, and rural areas to control a variety of rodents, including house mice, voles, pocket gophers, ground squirrels, and Norway rats (USEPA 2008), animals that may comprise prey for the kit fox. Both FGARs and SGARS are registered for use in and around buildings, transport vehicles, in alleys, and inside sewers, although difethialone and bromadiolone are not labeled for outdoor use in "non-urban" areas (B. Erickson, USEPA, *in litt*. 2006). Diphacinone and chlorophacinone are also registered for agricultural and field uses, including use in crop land, orchards and rangelands, in irrigation ditches, and on ditch banks, river banks, railroad tracks, fence lines, garbage dumps, and landfills (B. Erickson *in litt*. 2006; USEPA 2008). Chlorophacinone is used on rangelands to control rodents, including the Belding's ground squirrel (*Spermophilus beldingi*), California ground squirrel, pocket gopher (*Thomomys spp*.), deer mouse (*Peromyscus spp*.), and house mouse, and may be used for spot baiting for rodents in alfalfa (Ramey *et al*. 2007). Currently, about 4.53 million kg (10 million pounds) of anticoagulants are sold in California each year (O'Neill 2004), of which about 75 percent (by weight) is diphacinone (Timm *et al*. 2004).

Rodenticide use is known to occur in a variety of counties within the range of the kit fox, including Fresno, Merced, Kern, San Luis Obispo, and Monterey Counties (D.F. Williams *in litt.* 1989, as cited in USFWS 1998; Berry *et al*. 1992; Hosea *in litt.*1999; Hosea 2000; Briden *in litt*. 2006). For example, rodenticides were utilized at Camp Roberts in the past to reduce rodent populations (Berry *et al*. 1992). Between 1991 and 1998, rodenticide poisoning on adjacent private lands was determined to be a factor in the deaths of two, and possibly four kit fox (Berry *et al*. 1992; Standley *et al*. 1992). Limited use of the rodenticide, chlorophacinone, continued at Camp Roberts until 2003, when its use was discontinued. Currently zinc phosphide is the only rodenticide approved for use at Camp Roberts (M. Moore, Camp Roberts ANG, pers. comm. 2008). Rodenticide use on private rangelands adjacent to Fort Hunter Liggett has also been implicated in decreased rodent presence in the area (M. Littlefield, USFWS, pers. comm. 2007). Rodenticides have been used on Reclamation property to kill rodents threatening adjoining agricultural fields (USFWS 2000a).

Predatory mammals (particularly the kit fox) from the urban-suburban environment surrounding Bakersfield experience high levels of exposure to anticoagulant rodenticides (L. R. Broderick, CDFG, *in litt*. 2007). In 1987, a necropsy of a kit fox carcass found on a nursery in Bakersfield indicated chlorophacinone poisoning from bait spread at the site (E. Littrell, CDFG, *in litt*. 1987). Since then, ongoing toxicology studies of the carcasses of kit fox and other wild canids collected in the Bakersfield area show that the animals had elevated levels of anticoagulants in their livers (CDFG 1999; R. Hosea, CDFG, *in litt.* 1999; Hosea 2000; S. McMillin, CDFG, *in litt*. 2008). Between 1999 and the current time, 39 out of 51 kit fox livers sampled have contained residues of anticoagulant rodenticides: particularly brodifacoum, but also bromadiolone, pival, and chlorophacinone. Use of these rodenticides by the untrained public is thought to be the likely source of exposure for these animals (Broderick *in litt*. 2007). The carcasses of kit fox and other wild canids have also been collected from conserved lands in the Lokern Natural Area, which is remote high-quality desert habitat, has little agriculture, and is relatively undeveloped. Kit fox carcasses from the Lokern Natural Area do not contain anticoagulant residues, indicating that animals in the Lokern Natural Area do not experience exposure to these compounds. The other canids have shown the same pattern with exposure to rodenticides at Bakersfield and lack of exposure in the Lokern (McMillin *et al*. in review; McMillin *in litt*. 2008).

A September 22, 1993, biological opinion issued by the Service to the U.S. EPA regarding the regulation of pesticide use (31 registered chemicals) through administration of the Federal Insecticide, Fungicide, and Rodenticide Act found that use of the following chemicals would likely jeopardize the continued existence of the kit fox: (1) aluminum and magnesium phosphide fumigants; (2) chlorophacinone anticoagulants; (3) diphacinone anticoagulants; (4) pival anticoagulants; (5) potassium nitrate and sodium nitrate gas cartridges; and (6) sodium cyanide capsules (USFWS 1993b). Reasonable and prudent alternatives to avoid jeopardy included restricting the use of aluminum/magnesium phosphide, potassium/sodium nitrate within the geographic range of the kit fox to qualified individuals, and prohibiting the use of chlorophacinone, diphacinone, pival, and sodium cyanide within the geographic range of the kit fox, with certain exceptions (e.g., agricultural areas that are greater than 1 mile from any kit fox habitat) (USFWS 1993b). For example, chlorophacinone could be used in agricultural areas that were one or more miles from kit fox habitat, as mapped by the California Environmental Protection Agency in consultation with the Service, or in areas where Service-approved surveys indicated that kit fox were not present within 1 mile of the use location (USFWS 1993b). In contrast, use of brodifacoum was not expected to jeopardize the kit fox's existence because of its restricted area of recommended use (around urban and agricultural buildings). Although kit fox occurrences around buildings at military bases, in urban/suburban Bakersfield, and in Kern County oil fields were noted, the Service concluded that use of the rodenticide would not jeopardize the kit fox due to the fact that many kit fox habitats are far removed from areas of rodenticide use, and prescribed only that brodifacoum be placed in tamper proof containers, and not be accessible to wildlife within the range of the kit fox (USFWS 1993b). The biological opinion, in effect, allowed for local adjustments to the rule based on detailed State-Federal coordination on preventive measures; however, to date measures are provided on a voluntary basis.

Due to ongoing concerns about exposure of non-target species to rodenticides, the U.S. EPA re-evaluated 10 rodenticides in 2007, and considered classifying all products containing brodifacoum, bromadiolone, and difethialone as restricted use products (USEPA 2008). However, the U.S. EPA stopped short of classifying these ingredients as restricted-use products, relying instead on sales and distribution limits on SGARs (brodifacoum, bromadiolone, difethialone, and difenacoum) that are intended to prevent general consumers from purchasing these compounds as residential use products (USEPA 2008). New requirements will go into effect in 2011 (USEPA 2008). It is unlikely that these new regulations will fully protect non-target wildlife such as kit fox from exposure. Kit fox may be exposed to products used legally or illegally, or even to products whose use has been discontinued (McMillin *et al*. In review). Although U.S. EPA agreed to informally consult with the Service on the new regulations pertaining to SGARs, to date no consultation has been completed (N. Golden, USFWS, Arlington VA, pers. comm. 2008). In 2005, the Service submitted comments on the new regulations governing SGARS (USFWS 2005) that concluded, "*Rodenticide use under current regulations has resulted in wildlife exposure and mortality that may be in violation of the Endangered Species Act, the Bald and Golden Eagle Protection Act, and the Migratory Bird Treaty Act.*"

To date, no specific research has been conducted on the effects of different pesticide or rodent control programs on the kit fox (USFWS 1998). However, given the potential for secondary exposure of kit fox in agricultural areas, on rangelands, and along infrastructure projects, such as canals, that are utilized as foraging and denning habitat by kit fox, the Service expects that effects of rodenticide exposure could have substantial population level effects where exposure is present, especially where kit fox populations are small and where they rely on target species, such as ground squirrels and murid rodents, for prey. The reduction and elimination of prey species by pesticide use is a threat to kit fox. As discussed above, rodenticides are utilized specifically to reduce or eliminate rodents in rangelands, agriculture, and developed areas. In addition to loss of target species, rodenticide use is known to poison non-target rodent prey, such as kangaroo rats, and deer mice, etc. (Salmon *et al*. 2007). Past rodent eradication programs are thought to have eliminated the prey base for kit fox in areas such as Contra Costa County, severely reducing kit fox abundance in the area (Orloff *et al*. 1986; Bell *et al*. 1994). In recent years, use of rodenticides by individual landowners has continued to result in low densities of kit fox prey species on at least a local level (Orloff 2002; Briden *in litt*. 2006). The population consequences of this use have not been quantified, but could be substantial in areas where rodenticides are commonly used.

In addition to rodents, insects can be important prey for the San Joaquin kit fox, especially during periods of low prey availability (Hawbecker 1943; Scrivner *et al.* 1987; Archon 1992). In the northern portion of the kit fox' range, insects, especially grasshoppers and crickets, currently provide the primary prey for kit fox during the summer months, particularly July and August (Briden *et al.* 1992; Archon 1992). Insecticides that target grasshoppers and crickets (Scrivner *et al.* 1987) may suppress kit fox populations, reduce juvenile survivorship, or inhibit successful dispersal.

Organophosphate insecticides are used to control insect pests, and have been used since the 1980s in almond orchards, but may also be used on alfalfa, and on other stone fruits to control pests. Malathion, a broad-spectrum organophosphate insecticide, has been used to control the beet leaf-hopper (*Circulifer tenellus*) in rangeland habitat, fallow fields, oil fields, and cultivated areas on both public (BLM) and private lands in the San Joaquin Valley, and in adjacent valleys and foothills (USFWS 1997; BLM 2002; California Department of Food and Agriculture [CDFA] 2008a, b). The beet leaf-hopper is a vector for curly top virus, which negatively affects a number of crop types grown in the range of the kit fox. In the western and southern portions of the San Joaquin Valley, aerial spraying may occur during winter, spring, or fall control periods, and may include treatment of about 80,000 acres in years with low beet leaf-hopper populations, although annual treatment is not required in all areas (CDFA 2008a, b). Increases in beet leaf-hopper populations appear to be correlated with drought-mediated reductions in rangeland vegetation. In drought periods, increased beet leaf-hopper populations may require treatment of up to 200,000 acres of agricultural and natural lands, and also require treatment of the Salinas and Cuyama Valleys (CDFA 2008a, b). Treatment usually results in a target population decline of over 90 percent (CDFA 2008b); however, loss of insects important to the kit fox has not been quantified. Although the project is potentially immense in scale, the actual areas treated on an annual basis appear to be more restricted, but do include kit fox habitat in core, satellite, and linkage areas in the western and southern portions of the valley (CDFA 2008a). Depending on the baseline prey conditions and the magnitude of prey loss, lowered prey levels associated with pesticide usage could have the potential to contribute directly or indirectly to starvation of individual animals. Lowered prey abundance is expected to require kit fox to expend more effort and cover more territory while foraging, which increases their exposure to predation. Effects of prey reductions on kit fox populations would be hard to quantify, but have the potential to have observable population-level effects.

<u>Reduction in prey availability:</u> Kit fox have been strongly linked ecologically to kangaroo rats, with kit fox densities and population stability highest in areas with abundant kangaroo rats (Spiegel *et al*. 1996; Cypher *et al*. 2000; Cypher 2006; see also Bean and White 2000). Abundance of prey species, particularly abundance of kangaroo rats, has been linked with successful recruitment of young kit fox and increases in kit fox population numbers (Morell 1972; Orloff *et al.* 1986; White and Ralls 1993; Cypher *et al*. 2000; Bidlack 2007; L. Saslaw,

BLM, pers. comm. 2008). Conversely, prey scarcity has been a primary factor contributing to decreased reproductive success during droughts (White and Ralls 1993), or to extirpation of kit fox in specific localities (Williams *in litt*. 2007). Early studies suggested that kangaroo rats were a preferred food for the kit fox throughout the range (Laughrin 1970), and that kit fox densities were lower in areas like those near Bakersfield where plant associations changed and abundant ground squirrels replaced kangaroo rats (Jensen 1972). Current studies have shown that kit fox subsist primarily on ground squirrels in some portions of their range, including areas around Bakersfield, and in valleys within the inner Coast Range (Balestreri 1981; Orloff *et al.* 1986; Cypher and Warrick 1993), while they may subsist on a variety of native and nonnative species in disturbed areas or areas near to agriculture, and often also rely upon insect prey during portions of the year (Spiegel *et al*. 1996; Cypher and Brown 2006).

Concurrent with the decline in kit fox, the kangaroo rat species and subspecies native to the range of the kit fox have also declined. Three taxa are currently State and federally-listed as endangered (giant kangaroo rat [*D. ingens*], Tipton kangaroo rat [*D. n. nitratoides*], and Fresno kangaroo rat [*D. n. exilis*]), although habitat loss also threaten other subspecies within the San Joaquin and associated valleys (Williams and Germano 1992). These small mammals are believed to have declined due to loss of habitat to agriculture (Williams and Germano 1992), increases in thick cover of exotic plant species and the related thatch build-up (Germano *et al*. 2001; L. Saslaw, pers. comm. 2008), and use of rodenticides and pesticides for pest control in rangelands and agricultural crops (Orloff *et al*. 1986; Bell *et al*. 1994). By 1979, the giant kangaroo rat occupied only about 1.6 percent of its historic geographic range, while the Tipton kangaroo rat occupied only 3.7 percent of its historic range by 1985 and the Fresno kangaroo rats was only known from several small, isolated, natural parcels west of Fresno (see review in Williams and Germano 1992). Since 1994, kangaroo rats and other small native mammals have declined precipitously in the southern San Joaquin Valley (Single *et al*. 1996, as cited in Germano *et al*. 2001). Loss of habitat and changes in vegetation have been covered elsewhere in this document in relation to direct effects to kit fox and will not be covered again here, but also negatively affect presence of kangaroo rats (Williams and Germano 1992; Germano *et al*. 2001; L. Saslaw pers. comm. 2008), which appear to be critical to kit fox recovery. Livestock grazing may affect individual kangaroo rats by damaging burrows (Germano *et al*. 2001), and potentially killing individuals. The Service expects these effects to comprise a threat primarily where livestock are concentrated in areas of kangaroo rat precincts (e.g. by watering and feeding stations, or by penning). While livestock grazing may damage individual precincts, cessation of grazing may also lead to larger-scale declines in kangaroo-rat populations during wet years due to negative effects related to dense growth of vegetation (Germano *et al*. 2001).

<u>Fragmentation and isolation of populations:</u> Historically, kit foxes may have existed in a metapopulation structure of core and satellite populations, some of which periodically experienced local extinctions and recolonization (USFWS 1998). Today's populations exist in an environment drastically different from the historic one, however, and extensive habitat fragmentation will result in geographic isolation, smaller population sizes, and reduced genetic exchange among populations, thereby increasing the vulnerability of kit fox populations to extirpation. Populations of kit foxes are extremely susceptible to the risks associated with small population size and isolation because they are characterized by marked instability in population density. For example, the relative abundance of kit foxes at the Naval Petroleum Reserves,

California, decreased ten-fold during 1981 to 1983, increased seven-fold during 1991 to 1994, and then decreased two-fold during 1995 (Cypher and Scrivner 1992; Cypher and Spencer 1998).

The destruction and fragmentation of habitat could also eventually lead to reduced genetic variation in populations of kit foxes that are small and geographically isolated. Genetic assessments indicate that historic gene flow among populations was quite high, and that gene flow between populations is still occurring (Schwartz *et al.* 2005). However, extensive habitat loss and fragmentation continues to form more or less geographically distinct populations of foxes, which could reduce genetic exchange among them. An increase in inbreeding and the loss of genetic variation could increase the extinction risk for small, isolated populations of kit foxes by interacting with demography to reduce fecundity, juvenile survival, and lifespan (Lande 1988; Frankham and Rails 1998; Saccheri *et al.* 1998).

Kit fox groups in smaller patches of habitat are thought to be extremely vulnerable to local extinctions due to catastrophic or environmental events (Cypher *in litt*. 2007). An area of particular concern is Santa Nella in western Merced County where pending development plans threaten to eliminate the little suitable habitat that remains and provides a dispersal corridor for kit foxes between the northern and southern portions of their range. Preliminary estimates of expected heterozygosity from foxes in this area indicate that this population may already have reduced genetic variation.

Although status is unknown for kit fox in many of the satellite areas (CNDDB 2008), it appears that at least several of these small and isolated resident subpopulations have recently become locally extinct, including subpopulations at the Fort Hunter Liggett military reserve, and at San Luis and Pixley NWRs (Williams *in litt*. 2007; Cypher *in litt*. 2007; USFWS 2007a; Cypher pers. comm. 2008). In addition, at Camp Roberts military reserve, resident kit fox are no longer detected, while the last sighting of a kit fox was in 2003 (Moonjian 2007; M. Moore, Camp Roberts ANG, pers. comm. 2008).

The impacts of genetic isolation may already be apparent in the Salinas-Pajaro River watershed (i.e., Camp Roberts and Fort Hunter Liggett), Lost Hills area and Panoche populations. Estimates of the mean number of alleles per locus from foxes in these populations indicate that allelic diversity is lower than expected. The population in the Camp Roberts region may have been historically small, as evidenced by the lack of historical occurrences. Relatively low allelic diversity could be the result of a few individuals recolonizing the Camp Roberts area (founder event), and a subsequent low number of migrants contributing to genetic diversity. The Panoche population is located in a small, relatively isolated valley, and also appears to be experiencing a low number of migrants into the population (Schwartz *et al.* 2005).

Arid systems are characterized by unpredictable fluctuations in precipitation, which lead to high frequency, high amplitude fluctuations in the abundance of mammalian prey for kit foxes (Goldingay *et al.* 1997; White and Garrott 1999). Because the reproductive and neonatal survival rates of kit foxes are strongly depressed at low prey densities (White and Ralls 1993; White and Garrott 1997, 1999), periods of prey scarcity owing to drought or excessive rain events can contribute to population crashes and marked instability in the abundance and distribution of kit foxes (White and Garrott 1999). In other words, unpredictable, short-term fluctuations in precipitation and, in turn, prey abundance can generate frequent, rapid decreases in kit fox density that increase the extinction risk for small, isolated populations.

Vehicle strikes: Vehicle strikes are a consistent, but small source of kit fox mortality on natural lands (Cypher *et al*. 2000; see table summarizing study results in Bjurlin and Cypher 2003), with vehicle strikes accounting for 9 percent of mortality at the NPRC (Cypher *et al*. 2000). In natural lands, kit fox are sometimes killed by vehicle strikes (M. Stockton, Bitter Creek NWR, pers. comm. 2006; Williams *in litt.* 2007), but impacts of roads on kit fox ecology are generally thought to be low (Cypher *et al*. 2005a, b) although mortality due to vehicle strikes may significantly affect small populations (Williams *in litt*. 2007). Although vehicle strikes may not have population-level effects in natural lands where traffic volume is low, vehicle strikes appear to be a more substantial source of mortality in human-altered landscapes, including urban environments (Bjurlin *et al*. 2005; Cypher *et al*. 2003, as cited in Cypher and Brown 2006; Briden *in litt*. 2006). In urban settings such as Bakersfield, vehicle strikes can be the largest source of kit fox mortality and may impact urban fox populations (Bjurlin *et al*. 2005).

Accidental shooting and harrassment: Although the effects of this threat have been reduced, it appears that kit fox are still subject to accidental and illegal shooting throughout most of their range. Kit fox may potentially be mistaken for other wild canids, especially coyotes. Inexperienced hunters could also potentially mistake kit fox for gray fox or red fox. Kit fox superficially resemble juvenile coyotes (Clark *et al*. 2007b), suggesting that kit fox may be particularly vulnerable to misidentification at particular times of the year. Both the coyote and the gray fox are nongame species that may be taken in any number. While the coyote may be taken all year, hunting gray fox is restricted to a season that runs from November 24 through February (CFGC 2008). Within the range of the kit fox, a closure on night hunting is in effect in those portions of Monterey and San Benito Counties lying east of Highway 101, but legal in the rest of the range (CFGC 2008). Coyote hunting by people using predator calls, and by sheepherders, has been reported in lands surrounding the former Nation Petroleum Reserve-1 (J.R. Bennett, USDA, pers. comm., as cited in Warrick and Cypher 1998).

Documented kit fox mortality due to shooting occurs occasionally on both public and private lands, including protected lands (Briden *et al*. 1992; Standley *et al*. 1992; Warrick and Cypher 1998). In addition, kit fox harassment in association with hunting has been reported (J. Vance, CDFG, pers. comm. 2007). Hunting is allowed at Fort Hunter Liggett, on most BLM lands, at a variety of Ecological Reserves managed by the CDFG (USDOD 2008; CDFG 2008), and at one or more conservation banks (see Service 1997 files). However, at one unit of CDFG's Carrizo Plains Ecological Reserve hunting of coyotes and ground squirrels has been prohibited to prevent incidental take of the kit fox (CDFG 2008). In total, the Service does not have information to suggest that illegal shooting of kit fox is a threat to kit fox subpopulations where animals are abundant, but loss of individual kit fox due to shooting could represent significant stochastic events where extant kit fox are rare, where only several family groups exist, or where recruitment and successful dispersal are key to continuation of small population groupings.

Off-road vehicle use: Use of off-road vehicles (ORVs) poses an unquantified threat to the San Joaquin kit fox, primarily through the potential for off-road travel to disturb soil, reduce or destroy herbaceous vegetation, and to destroy burrow systems of prey species, such as the kangaroo-rat, and to damage kit fox dens. Off-road travel also increases access to areas that are otherwise remote and little used. Off-road travel is expected to increase impacts to animals on large expanses of natural lands including both publicly and privately held lands (see Hammitt and Cole 1998). The southern San Joaquin Valley is experiencing increased demand for dispersed recreation and ORV use on public and private lands, including oil field holdings (Dixon pers. comm. 2009; Saslaw pers. comm. 2009). Near Taft, the BLM has experienced a spike in ORV use on 30,000 acres of holdings (Shepard 2007) that are within the range of the kit fox. ORV use is occurring in the Temblor Hills, California Aqueduct, and Chico Martinez areas where most use has been on existing roads, but where cross-country travel that creates new disturbance is also occurring (Shepard 2007; BLM 2008j). On public and oil company lands in western Kern County, increasing off-road vehicle use has resulted in a substantial increase in new, unauthorized roads and trails (Saslaw pers. comm. 2009). In addition, the recent, rapid increase in off-road use has expanded to privately-held conservation lands where ORV use has caused varying amounts of damage to good quality kit fox habitat (Dixon pers. comm. 2009). Land managers are working together to contain off-road vehicle use. Efforts include coordinated construction of fencing to preclude ORV use in conserved lands in the Lokern Natural Area and several other areas (Dixon pers. comm. 2009; Saslaw pers. comm. 2009). Efforts to contain and eliminate illegal off-road use in these areas and in protected areas is expected to increase ORV pressure on less-protected areas, such as unfenced lands in the Buena Vista Hills area (Dixon pers. comm. 2009). Kit fox present within the Carrizo Plains National Monument are protected from ORV use, as the core area of the Monument has been closed to off-road vehicle travel (Saslaw pers. comm. 2009), although areas peripheral to the monument may be accessible to increased use.

In summary, the increase in off-road vehicle use in this area appears to be an increasing threat to the kit fox in otherwise suitable habitat. Although effects to habitat have not been quantified in large portions of the western Kern County area (Dixon pers. comm. 2009; Saslaw pers. comm. 2009), in specific areas the recent increased use has substantially degraded soil and vegetation conditions on lands targeted for conservation.

<u>Climate change:</u> 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; Cayan *et al*. 2006; IPCC 2007). Although predictions of future climatic conditions for smaller sub-regions in California remain uncertain (Christensen et al. 2007; Field *et a*l. 2007; Moser *et al*. 2009), daily minimum and maximum temperatures have begun to change (Moser *et al*. 2009), and interannual precipitation variability has already begun to increase (Kelly and Goulden 2008; Loarie *et al*. 2008). Across the mid-latitudes of the northern hemisphere, spring plant green-up has advanced by almost two weeks and animals in many areas are responding to such changes by breeding earlier and shifting their ranges (see review in Field *et al*. 2007). The Service expects that kit fox populations are also subject to these commonly observed patterns.

Interannual precipitation variability increased in both Central and Southern California regions, beginning in the early to mid-1970s (McLaughlin *et al*. 2002; Kelly and Goulden 2008). As climate change models predict increased precipitation variability in the future (McLaughlin *et al*. 2002), the Service expects these weather events to continue to increase. Population extirpations have been linked to the amplified population fluctuations that are due to these increases in variability of precipitation (McLaughlin *et al.* 2002).

Kit fox subpopulations, including the relatively large subpopulations at the National Petroleum Reserve and Carrizo Plains areas, demonstrate large fluctuations in abundance in response to weather-mediated prey levels, which increases the potential for these groups to be extirpated (Cypher *et al*. 2000; Bean and White 2000; Bidlack 2007). Weather conditions usually vary over larger landscape scales, leading to the general expectation that drought-mediated decreases in kit fox abundance, or local extirpation of some groups, should not affect persistence of the species as long as healthy core kit fox populations are not limited to one portion of the range. However, the loss and fragmentation of habitat documented herein has reduced the likelihood that lost sites will be re-colonized (Williams *in litt*. 2007; Cypher 2006; Cypher *et a*l. 2007), which is expected to result in a cumulative loss of small groupings over time (Clark *et al*. 2007a). Because increased drying and droughts, and substantial precipitation events are expected to negatively affect the native prey species upon which the kit fox depends, the Service expects climate change to pose a substantial threat to the species by further exacerbating interannual fluctuations in kit fox reproductive success and abundance.

Recovery Status: **A** recovery plan approved in 1983 proposed interim objectives of halting the decline of the San Joaquin kit fox and increasing population sizes above 1981 levels (USFWS 1983). Conservation efforts subsequent to the 1983 recovery plan have included habitat acquisition by BLM, CDFG, CEC, Reclamation, the Service, and the Nature Conservancy. Purchases most significant to conservation efforts were the acquisitions in the Carrizo Plain, Ciervo-Panoche Natural Area, and the Lokern Natural Area. Other lands have been acquired as mitigation for land conversions, both temporary and permanent.

An updated recovery plan covering upland species of the San Joaquin Valley, including the kit fox, was written in 1998. The primary goal of the recovery strategy for kit foxes identified in the Recovery Plan is to establish a complex of interconnected core and satellite populations throughout the species' range. The long-term viability of each of these core and satellite populations depends partly upon periodic dispersal and genetic flow between them. Therefore, kit fox movement corridors between these populations must be preserved and maintained. In the northern range, from the Ciervo Panoche in Fresno County northward, kit fox populations are small and isolated, and have exhibited significant decline. The core populations are the Ciervo Panoche area, the Carrizo Plain area, and the western Kern County population. Satellite populations are found in the urban Bakersfield area, Porterville/Lake Success area, Creighton Ranch/Pixley Wildlife Refuge, Allensworth Ecological Reserve, Semitropic/Kern NWR, Antelope Plain, eastern Kern grasslands, Pleasant Valley, western Madera County, Santa Nella, Kesterson NWR, and Contra Costa County. Major corridors connecting these population areas are on the east and west side of the San Joaquin Valley, around the bottom of the Valley, and cross-valley corridors in Kern, Fresno, and Merced Counties.

The recovery criteria for the kit fox include site-specific objectives for habitat protection in each of the identified core and satellite areas (USFWS 1998, page 188). In the Carrizo Plains Natural Area (including BLM, CDFG, The Nature Conservancy (TNC), and private lands) in San Luis Obispo County, the protection level was set at 100 percent of existing potential habitat. In western Kern County (including BLM, CDFG, Kern County Water Agency, CDWR, US Dept of Energy, CNLM, and private lands) the protection level was set at 90 percent of the existing potential habitat, and at the Ciervo-Panoche Natural Area (including BLM, CDFG, and private lands) in Fresno and San Benito Counties, the “Protection Level” was set at 90 percent of the existing potential habitat. For the nine or more proposed satellite populations, the protection level was set at 80 percent of the existing potential habitat. The term “potential habitat” is not defined in the Recovery Plan; however, the Service expects that to achieve recovery, habitat must include components, such as appropriate physical conditions, vegetative structure and community structure needed by the kit fox.

The first downlisting criterion, to secure and protect the three core populations and three satellite populations from incompatible uses, has not yet been achieved. Service files indicate that, although lands have been protected in many of the satellite areas though use of Habitat Conservation Plans (HCPs), conservation banks, etc., no satellite areas are sufficiently secured from incompatible uses (USFWS 2010).

The second recovery criterion requires that all protected lands identified as important to the kit fox’s continued survival have management plans that include survival of the kit fox as a management objective. It has not yet been achieved (USFWS 2010).

The third recovery criterion stipulates that population in the specified recovery areas shows that the three core areas have stable or increasing populations through one precipitation cycle and that there is population interchange between one or more core populations and the three satellite populations. Because population dynamics of most kit fox populations can greatly fluctuate, and the isolation and loss of small subpopulations due to stochastic events and habitat fragmentation, this recovery criterion has not been achieved (USFWS 2010).

Conservation Needs of San Joaquin Kit Fox in the Action Area

Habitat protection/restoration of Kit fox core population and corridors**:** A potential core population of kit foxes has been identified in close proximity to the action area (USFWS 1998). This "Panoche Core Population" is generally located on lands west of 1-5 in the Panoche Valley and suitable lands to the north and south, such as the Silver Creek Ranch and lands from Little Panoche Creek up to Route 152. Because of the amount of available optimal habitat (e.g., saltbush scrub, arid grasslands), this population is probably not as extensive as the Western Kern County and Carrizo Plain Core Populations. Thus, it is critical that connectivity be maintained between the Panoche Core Population and the two core populations further south. This necessitates that a viable corridor be maintained on remaining natural lands between 1-5 and the foothills of the Coast Ranges. The need to conserve this corridor is identified prominently in Tasks 5.3.4, 5.3.5, 5.3.6, and 5.3.7 in the Recovery Plan for Upland Species of the San Joaquin Valley, California (USFWS 1998).

The recovery plan for the San Joaquin kit fox includes strategies for habitat protection that will maintain population interchange between areas adjacent to the action area. Connecting corridors for movement of kit foxes around the western edge of the Pleasant Valley and Coalinga in Fresno County should be maintained and enhanced. Existing natural lands in the Mendota area should be expanded and connected with the Ciervo-Panoche area, through restoration of habitat on retired, drainage-problem farmland. Natural lands that would provide a connection are scarce, because the land between these two populations is dominated by agriculture (USFWS

1998). Although kit fox will move up to 1.5 kilometers into farmland, they appear reluctant to cross large expanses of agricultural land due to the lack of escapes from predators (Cypher *et al.* 2005b). Six occurrences of kit fox in the lands connecting these populations were recorded in 1920; there have been no subsequent recorded observations in the agricultural lands connecting Ciervo-Panoche and the Mendota area. Retired agricultural lands may provide important stepping stones to maintain connectivity throughout the action area.

The Ciervo-Panoche core area includes over 52,000 acres of BLM holdings that offer some protection to the kit fox, although most BLM holdings in the core area are not suitable for kit fox due to their rugged character and shallow soils. Most suitable kit fox habitat in the core area occurs on private lands in the valley floors (EG&G 1981). About 21,000 additional acres of potential kit fox habitat could be set aside for conservation by 2010 as required by the SWRCB Decision 1641 requiring mitigation for the unpermitted loss of alkali scrub habitat in agricultural areas in western Fresno County (primarily in Westlands Water District) that received water through the CVP (SWRCB 2000). However, there are no requirements that stipulate that lands for this mitigation be purchased in locations that would benefit the kit fox.

Land acquisitions to benefit kit fox should focus on the establishment of large blocks of land (at least 10,000 acres in size) on the San Joaquin Valley floor and western fringes. Such large parcels are critical to supporting sustainable populations of kit fox for long-term conservation, and should be linked with protected broad dispersal corridors. These acquisitions are most likely to aid kit fox recovery if they build on existing protected lands to achieve larger expanses of protected land, if acquired lands possess the vegetative structure and native prey base that are associated with thriving kit fox populations, and if acquired lands are not isolated from extant populations of either the kit fox or its prey species. Large holdings of native habitat are also expected to be less suitable for coyotes and red fox that are responsible for high levels of kit fox mortality. Lands no longer suitable for agriculture, such as those targeted for land retirement, may be restored and conserved through fee title acquisition, conservation easement acquisition, or conservation banking arrangements from willing sellers or participants. However, on suboptimal habitat, conservation planning should recognize the lag times inherent in restoration of the ecological community needed to support the kit fox. Linkages will be most effective in contributing to kit fox recovery where they link to habitat that retains the characteristics needed to sustain resident populations.

<u>Mapping</u>: Mapping efforts that quantify the acreage of suitable/native habitat and altered or degraded habitat in core, satellite, and linkage areas at 1) the time of the 1998 Recovery Plan, and 2) the current time, will assist the Service and other conservation entities in prioritizing conservation strategies and in determining progress in meeting recovery goals for protection of core and satellite areas. The locations, acreage, and quality (or characteristics) of protected habitat could also be compiled and mapped.

<u>Contaminant Studies</u>: Studies that assist in determining the population-level effects of contaminants, including first and second generation anticoagulant rodenticides, on kit fox or surrogate species are needed. Studies that test correlations between rodenticide use and kit fox population parameters, measure sublethal effects on behavior, or quantify rodenticide/pesticide effects on availability of prey in relation to the energetic needs of the fox would provide

information useful to recovery actions. The U.S. EPA should complete ESA consultation on the effects of the use of SGAR's on the kit fox.

California Least Tern

Listing
The California least tern, which is one of three subspecies of least tern in the United States, was listed as endangered in 1970 (35 **FR**16047). No critical habitat has been designated for this species; a recovery plan was prepared in 1980 (Service 1980a) and revised in 1985 (Service 1985). The California least tern is a fully protected species under California law.

Description
California least terns are the smallest members of the subfamily Steminae (family Laridae), measuring about nine inches long with a twenty inch wingspan. Sexes look alike, being characterized by a black cap, gray wings with black wingtips, orange legs, and a black-tipped yellow bill. Immature birds have darker plumage, and a dark bill, and their white heads with dark eye stripe are quite distinctive. The California least tern cannot be reliably differentiated from other races of tern on the basis of plumage characteristics alone (Burleigh and Lowery 1942).

Historical and Current Range
The California least tern breeds along the Pacific Coast from San Francisco Bay to San Jose del Cabo, Baja California, Mexico. As reported in the 1985 Recovery Plan (Service 1985), the California least tern nest in large nesting colonies which are discontinuous along the California coast and generally are spread out along beaches at the mouths of larger estuaries. At that time, there was no discussion of terns occurring away from the breeding colonies along the coast. About 32 active nesting locations exist from San Francisco Bay south to the Mexican border. There are eight active nesting locations in Santa Barbara and Ventura counties. Although this subspecies is considered a colonial nester, some observations of single pairs nesting have been made at some of these locations. The Santa Margarita River mouth in San Diego County now hosts the largest number of birds among all locations. However, in the California Least Tern Breeding Survey, 1998 Season, Keane (CDFG 1999) reported that there were 28 locations that reported successfully producing fledglings, and all but 2 were located along the coast. The two non-coastal nesting sites are located at a Pacific Gas and Electric (PGE) power plant at Pittsburgh in the western Sacramento-San Joaquin Delta and at Kettleman City in the San Joaquin Valley at the southern boundary of Westlands WD and Lemoore Naval Air Station is within the district boundaries of Westlands WD. There was one nest reported from the terminal cells of evaporation basins at the Kettleman City location that produced one fledgling from two eggs in 1998 (CDFG 1999).

A few least terns have been observed foraging at the sewage ponds at LNAS in 1997 and 1998 but no nesting has been documented there. The birds at both LNAS and Kettleman City arrive on site in June or July and are either "second wave" nesters which are first time breeders (2-year old birds) or birds that have nested at a coastal site (either successfully or unsuccessfully) as a "first wave" breeder (CDFG 1999). There is no definitive information that links the Central

Valley least terns to any of the coastal colonies, so they may be refugees from a coastal colony or a pair of young birds that got lost on their way to the breeding grounds. There have also been reports of single pairs nesting at evaporation ponds in the Tulare Lake Basin.

Reproductive Ecology and Demography
The California least tern breeding season typically begins in April. Most commonly, two eggs are laid in the first part of May and hatching occurs in early June. Fledgling of chicks usually occurs by late June. A second wave of nesting often occurs from early June to late July which is usually instigated by the failure of the first nest. Parents and fledglings remain close to the breeding site before beginning their migration southward, usually no later than mid-September. Their wintering localities are not well known, although some banded birds have been observed in Colima, Mexico. California least terns appear to have strong nesting site fidelity and most return to their natal breeding beach year after year. Mass relocations have been documented when a breeding site has been destroyed or heavy predation has occurred.

For nesting, California least terns require areas that have relatively flat, open, sandy beaches, in proximity to foraging habitat, and have relative seclusion from disturbance and predation. California least terns have been known to nest on artificial surfaces, such as airfields, landfills, and vacant parking lots. During the nesting season, coastal California least terns feed on small fish captured either in ponds, bays and estuaries, or immediately offshore. Prey items include northern anchovy (*Engraulis mordax*), topsmelt (*Atherinops afinis*), California grunion (*Leuresthes tenuis*), and killifish (*Fundulus pawipinnis*). Typically, in these two Central Valley locations, the species forages on inland silversides (*Menidia beryllina*) or gambusia, which was introduced into one of the evaporation ponds near Kettleman City; the gambusia could only persist in the cells with the deepest, least saline water. Both the male and female select a suitable site to begin scraping their nest if it is located on sand. If no sand is available in their nesting location, the birds will select a natural depression in the ground, such as a boot or tire depression in dried mud. After the eggs are laid, the nest is sometimes lined with shell fragments and small pebbles. Eggs are incubated primarily by the female for 20 to 25 days,

Least terns hover over standing or flowing water and dive to capture fish. They also may catch aquatic macroinvertebrates. The diet of the California least tern is known to consist mostly of small fish (Tomkins 1959; Atwood and Kelly 1984) and this appears to be true of least terns in the Tulare Basin. In some locations, other least terns are known to forage heavily on invertebrates, including shrimp and ants in South Carolina (Thompson et al 1997) and flying insects (nesting birds in Texas) (McDaniel and McDaniel 1963).

Reasons for Decline and Threats to Survival
The decline of the California least tern has been attributed primarily to destruction of breeding and foraging habitat, and human disturbances at nesting locations. Their decline was a gradual process as European settlers began establishing along the California coast. The Pacific Coast Highway, constructed in the early 1900s, is thought to have contributed substantially to the decline of California least terns as the highway paved over many nesting locations, and promoted development and recreation along the coast. At the time of listing, a census revealed only 600 pairs of breeding California least tern in the entire state, but recovery efforts instituted after the time of listing have helped raise numbers of breeding birds. Statewide surveys conducted in

1995 counted 2,598 pairs (Caffrey 1995). Dramatic fluctuations in the number of breeding pairs after listing have been attributed to severe El Niño Southern Oscillations, which affect the birds' food supply.

Recovery Status
The California Least Tern Recovery Plan's primary objective is to restore and maintain the breeding populations to secure levels. To achieve that objective, the breeding population must increase to at least 1,200 breeding pairs distributed among secure colonies in at least 20 secure coastal management areas throughout their breeding range. Concurrent efforts should also be undertaken in the Mexican portion of the breeding population. A requirement for maintaining the population levels would be: (1) sufficient habitat to support at least one viable tern colony (defined as consisting of at least 20 breeding pairs with a 5-year mean reproductive rate of at least 1.0 young fledged per year per breeding pair) at each of the 20 coastal management areas (including San Francisco Bay, Mission Bay, and San Diego Bay, which should have 4, 6, and 6 secure colonies respectively), that are managed to conserve least terns; and (2) land ownership and management objectives are such that future habitat management for California least tern at these locations can be assured. The chief limiting factor influencing the number of least tern breeding pairs is the availability of undisturbed suitable habitat on the breeding grounds.

Blunt-nosed Leopard Lizard

Listing
The blunt-nosed leopard lizard was federally listed as endangered on March 11, 1967, (32 **FR**4001) and was listed by the State of California as endangered on June 27, 1971. A recovery plan for the blunt-nosed leopard lizard was first prepared in 1980, revised in 1985, and then superseded by the Recovery Plan (Service 1998). The recovery strategy requires that the Service: (1) determine appropriate habitat management and compatible land uses for the blunt-nosed leopard lizard; (2) protect additional habitat for them in key portions of their range; and (3) gather additional data on population responses to environmental variation at representative sites in their existing geographic range (Service 1998).

Description
The blunt-nosed leopard lizard was originally described and named from a specimen collected from Fresno County in 1890. This lizard is a relatively large lizard of the family Iguanidae (Stebbins 1985). Adult males are typically 3.4 to 4.7 inches from snout to vent and weigh between 3 1.8 and 37.4 grams. The adult females are similar in length (range 3.4 to 4.4 inches), but weigh only 20.6 to 29.3 grams (Tollestrup 1982, Uptain et al. 1985 in Service 1998).

Historical and Current Range
The blunt-nosed leopard lizard was distributed historically throughout the San Joaquin Valley and adjacent interior foothills and plains, extending from central Stanislaus County south to extreme northeastern Santa Barbara County (Service 1998). Today its distribution is limited to scattered parcels of undeveloped land, with the greatest concentrations occurring on the west-side of the valley floor and in the foothills of the Transverse Range.

The current range is thought to include scattered populations throughout the undeveloped land of the San Joaquin Valley and in the foothills of the Coast Range below 2,600 feet (Montanucci 1970, Service 1998). Lizards occur on scattered parcels of undeveloped land on the valley floor, most commonly annual grassland and valley sink scrub. The lizards also inhabit alkali playa and valley saltbush scrub. This species occurs in the San Joaquin Valley from Stanislaus County through Kern County, and along the eastern edges of San Luis Obispo and San Benito Counties. In the southern San Joaquin Valley, extant populations are known to occur in the Kern and Pixley National Wildlife Refuges, Liberty Farms, Allensworth, Antelope, the Casrizo and Elkhorn Plains, Buttonwillow, Elk Hills and Tupman Essential Habitat Areas, north of Bakersfield around Poso Creek, and western Kern County around the towns of Maricopa, McKittrick, and Taft.

Essential Habitat Components

The blunt-nosed leopard lizard prefers open, sparsely vegetated areas of low relief and inhabits valley sink scrub, valley saltbush scrub, valley/plain grasslands, and foothill grasslands vegetation communities. The blunt-nosed leopard lizard inhabits Nonnative Grassland, Valley Sink Scrub, Valley Needlegrass Grassland, and Alkali Playa communities on the floor of the San Joaquin Valley (Holland 1986). It also is found in low foothills, canyon floors, plains, washes, arroyos, and open areas with scattered low bushes on alkali flats, particularly those Saltbush Scrub communities within the foothills of the southern San Joaquin Valley and the adjacent Carrizo Plain. The above habitat classifications by Holland (1986) are subsumed within the more general Alkali Desert Scrub and Annual Grassland habitat types described by Mayer and Laudenslayer (1988).

Blunt-nose leopard lizards are typically absent where habitat conditions include steep slopes, dense vegetation, or areas subject to seasonal flooding (Montanucci 1965). Preferred substrates range from sandy or gravelly soils to hardpan. It prefers flat terrain and tends to avoid dense or tall herbaceous cover that restricts vision for foraging and escape from predators (Warrick et al 1998).

Foraging Ecology

The diet of the blunt-nosed leopard lizard consists primarily of insects and other lizards (Service 1998). Insects consumed include grasshoppers and crickets in the Order Orthoptera and moths of the Lepidoptera. Other lizards consumed by blunt-nosed leopard lizards include: side-blotched lizards (*Uta stansburiana*), coast horned lizards (*Phrynosoma coronatum*), California whiptails (*Cnemidophorus tigris*), and the spiny lizards (Sceloporus spp.) (Service 1998). Interspecific competition is hypothesized to occur between blunt-nosed lizards and California whiptails because they consume similar food items (Montanucci 1965, Service 1998).

Reproductive Ecology and Demography

Breeding begins within a month of emergence from dormancy and typically lasts from the end of April through the beginning of June, but occasionally may last through the end of June. Adults are paired and frequently occupy the same burrow during the breeding period and for up to several months afterwards (Montanucci 1965, Service 1998). Two to six eggs are laid in June or July in a chamber excavated for a nest or in an existing burrow system. Adverse conditions can delay or halt reproduction, while variable environmental conditions may result in more than one clutch of eggs being produced per year (Service 1998).

Movements and Habitat Use
Above ground activity of blunt-nosed lizards is primarily dependent on temperature with optimal activity occurring when air temperatures are between 74 and 104 degrees Fahrenheit (°F) and ground temperatures are between 72 and 97 °F. Smaller lizards and young have a wider activity range than adults and as a result they emerge from hibernation earlier than adults, remain active later in the year, and begin their activity earlier during the day (Montanucci 1965). These temperature-related patterns result in adult lizards being active above ground from March or April through June or July. By the end of June or July, the majority of sightings are of sub-adult and hatchling lizards (Service 1998).

These lizards frequently seek refuge in small mammal burrows (Stebbins 2003), using small rodent burrows for shelter from predators and temperature extremes. Burrows are usually abandoned ground squirrel tunnels or kangaroo rat burrows (abandoned or occupied). In areas of low mammal burrow density, lizards will construct shallow, simple tunnels in earth berms or under rocks. Burrows are important structures that enable blunt-nosed lizards to moderate temperature extremes and avoid a wide-range of predators. Species preying upon blunt-nosed lizards include: snakes, shrikes, hawks, owls, eagles, squirrels, skunks, badgers, coyotes, and foxes (Montanucci 1965, Tollestrup 1979).

Reasons for Decline and Threats to Survival
Populations of the blunt-nosed leopard lizard declined to levels warranting listing because of the conversion and degradation of suitable habitat (Service 1998). Agricultural, urban, petroleum, mineral, and other development activities altered an estimated 94 percent of the wildlands on the Valley floor by 1985. The conversion of land for agricultural purposes along the Friant Kern Canal has led to a loss of patches of suitable habitat large enough likely to be inhabited by blunt-nosed leopard lizard. Ground disturbance, including that associated with agricultural practices, including but not limited to pesticide application, may kill or harm individuals. Due to its obligate use of burrows, the blunt-nosed leopard lizard can be adversely impacted by rodent control programs (through loss of burrows over time). Also, there is some concern that the application of broad-spectrum insecticides on natural lands that harbor blunt-nosed leopard lizards-to combat agricultural pest species-may be an additional threat to their survival. It also is threatened by overgrazing and rodent control. Those lands where the species still exists are often heavily grazed or treated with pesticides, both of which have been shown to have detrimental effects on the lizard (Germano and Williams 1992).

The recovery plans for the blunt-nosed leopard lizard identified habitat units that are considered essential for the continued persistence of viable populations within the San Joaquin Valley but, having no legal status equivalent to critical habitat; the conversion of suitable habitat within these units has continued (Service 1980b). Consequently, habitat disturbance, conversion, and fragmentation continue to be the greatest threats to blunt-nosed leopard lizard populations. Other direct and indirect effects result from automobile and off-highway vehicle traffic, livestock grazing, and pesticides (Service 1998). The recovery strategy for this species includes identifying and protecting existing habitat, determining the best habitat management practices, and conducting public information and education programs (Service 1998).

Recovery Status
Long-term studies have shown the instability of blunt-nosed leopard lizard populations especially during years of above average precipitation (Germano *et al.* 2005, Germano *et al.* 2004, Germano and Williams 2005, Germano *in litt.* 2006, Williams *in litt.* 2006). Based on this population instability and the continued degradation and fragmentation of habitat by agricultural, residential, and oil and gas exploration activities, the overall species status is judged to be decreasing (USFWS 2007).

Threats to blunt-nosed leopard lizards continue through the degradation of habitat by oil and gas exploration activities, the expansion of residential, commercial, and agricultural developments, and the dense growth of exotic grasses. In summary, based on the lack of protection of sufficient habitat representing the geographic range of the species, the low density and instability of the populations, and the continuation of threats to the species, the blunt-nosed leopard lizard continues to be in danger of extinction throughout its known range (USFWS 2007).

Conservation Needs in the Action Area
There has never been a comprehensive survey of the entire historical range of the blunt-nosed leopard lizard, and therefore less is known about this animal's distribution than giant and Tipton kangaroo rats (Service 1998). The recovery strategy for the blunt-nosed leopard lizard includes identifying and protecting existing habitat, determining the best habitat management practices, And conducting public information and education programs (Service 1998).

Giant Garter Snake

ListingThe Service published a proposal to list the giant garter snake as an endangered species on December 27, 1991 (USFWS 1991) (56 **FR** 67046). The Service reevaluated the status of the snake before adopting the final rule, which was listed as a threatened species on October 20, 1993 (USFWS 1993a) (58 **FR** 54053).

Description
The giant garter snake is one of the largest garter snake species reaching a total length of approximately 64 inches (162 centimeters). Females tend to be slightly longer and proportionately heavier than males. Generally, the snakes have a dark dorsal background color with pale dorsal and lateral stripes, although coloration and pattern prominence are geographically and individually variable (Hansen 1980; Rossman *et al*. 1996).

Historical and Current Range
Giant garter snakes formerly occurred throughout the wetlands that were extensive and widely distributed in the Sacramento and San Joaquin Valley floors of California (Fitch 1940; Hansen and Brode 1980; Rossman and Stewart 1987). The historical range of the snake is believed to have extended from the vicinity of Chico, in Butte County, southward to Buena Vista Lake, near Bakersfield, in Kern County (Fitch 1940; Fox 1948; Hansen and Brode 1980; Rossman and Stewart 1987). Early collecting localities of the giant garter snake coincide with the distribution of large flood basins, particularly riparian marsh or slough habitats and associated tributary

streams (Hansen and Brode 1980). Loss of habitat due to wetlands reclamation, agricultural activities and flood control have extirpated the snake from the southern one third of its range in former wetlands associated with the historic Buena Vista, Tulare, and Kern lake beds (Hansen 1980; Hansen and Brode 1980).

Upon Federal listing in 1993, the Service identified 13 separate populations of giant garter snakes, with each population representing a cluster of discrete locality records (USFWS 1993). These 13 populations largely coincide with historical flood basins and/or tributary streams throughout the Central Valley: (1) Butte Basin, (2) Colusa Basin, (3) Sutter Basin, (4) American Basin, (5) Yolo Basin/Willow Slough, (6) Yolo Basin/Liberty Farms, (7) Sacramento Basin, (8) Badger Creek/Willow Creek, (11) North and South Grasslands, (12) Mendota, and (13) Burrel Lanare. Population clusters 1 through 4 above were associated with rice production areas, especially channels and canals that delivered or drained agricultural irrigation water. These populations were determined to be extant in 1993. Population clusters at Butte, Sutter, and Colusa Basins (1,2, and 3) were determined to be not imminently threatened with extirpation. Populations 4 through 13 were determined to be imminently threatened with extirpation. The area covered by these populations (4 through 13) included the San Joaquin Valley, portions of the eastern fringes of the Delta, and the southern Sacramento Valley; an area encompassing about 75 percent of the species' known geographic range (USFWS 1993a).

The known range of the giant garter snake has changed little since the time of listing. The northern-most population of giant garter snakes was found 5 miles west of the city of Chico at the Chico Water Pollution Control Plant in 2005 (Kelly 2007). The southernmost known occurrence is in Fresno Slough at Mendota WA in Fresno County. Only one individual giant garter snake has been trapped in Mendota WA since 2002 (Hansen 2008b). No sightings of giant garter snakes south of Mendota WA within the historic range of the species have been made since the time of listing (Hansen 2002; Wylie and Amarello 2008).

Essential Habitat Components

Endemic to wetlands in the Sacramento and San Joaquin valleys, the giant garter snake inhabits marshes, sloughs, ponds, small lakes, low gradient streams, and other waterways and agricultural wetlands, such as irrigation and drainage canals, rice fields and the adjacent uplands (USFWS 1999). Essential habitat components consist of: (1) wetlands with adequate quantity and quality of water during the snake's active season (early-spring through mid-fall) to provide food and cover; (2) emergent, herbaceous wetland vegetation, such as cattails and bulrushes, for escape cover and foraging habitat during the active season; (3) upland habitat with grassy banks and openings in waterside vegetation for basking; and (4) higher elevation uplands for overwintering habitat with escape cover (vegetation, burrows) and underground refugia (crevices and small mammal burrows) (Hansen 1988). Summer aquatic habitat is essential because it supports the frogs, tadpoles, and small fish on which the giant garter snake preys. Rice and natural wetlands adjacent to the ditches and canals may serve as vital nursery habitat for young giant garter snakes and as "way stations" for snakes as they make their way through systems of ditches and canals. Females will often give birth in rice fields and the newly born snakes will feed on the small prey items that are prevalent in rice fields, but are rare or absent from other permanent aquatic habitat types (E. Hansen, pers. comm. 2008). Snakes are typically absent from larger rivers and other bodies of water that support introduced populations of large, predatory fish, and from wetlands with sand, gravel, or rock substrates (Hansen 1988; Hansen and Brode 1980: Rossman and

Stewart 1987). Riparian woodlands do not provide suitable habitat because of excessive shade, lack of basking sites, and absence of prey populations (Hansen 1988). Giant garter snakes require water during the active phase of their life cycle in the summer (Paquin *et al.* 2006).

Foraging Ecology

Giant garter snakes are the most aquatic garter snake species and are active foragers, feeding primarily on aquatic prey such as fish and amphibians such as Pacific chorus frogs (*Pseudacris regila*) (Fitch 1941). As long as there are abundant prey species present, giant garter snakes share wetland areas communally, and only extend into other areas when the prey base declines (E. Hansen, pers. comm. 2008). Because prey species historically foraged upon by giant garter snakes are either declining, extirpated, or extinct, the predominant food items are now introduced species such as carp (*Cyprinus carpio*), mosquitofish (*Gambusia affinis*), other small fish, and larval and sub-adult bullfrogs (*Rana catesbiana*) (Fitch 1941; Hansen 1988; Hansen and Brode 1980; Rossman *et al.* 1996).

Reproductive Ecology

The giant garter snake breeding season begins in March and April and females give birth to live young from late July through early September (Hansen and Hansen 1990). The breeding season for the giant garter snake begins soon after emergence from overwintering sites and extends from March into May, and resumes briefly during September (G. Hansen, pers. comm. 1998). Males immediately begin searching for mates after emerging (G. Hansen, pers. comm. 1991). Females brood young internally, and typically give birth to live young from late July through early September (Hansen and Hansen 1990). Young immediately scatter into dense cover and absorb their yolk sacs, after which they begin feeding on their own (USFWS 1993a). Although growth rates are variable, they typically more than double in size by one year of age, and sexual maturity averages three years in males and five years for females (USFWS 1993a).

Movements and Habitat Use

The giant garter snake is highly aquatic but also occupies a terrestrial niche (USFWS 1999; Wylie *et al.* 2004a). The snake typically inhabits small mammal burrows and other soil and/or rock crevices during the colder months of winter (*i.e.,* October to April) (Hansen and Brode 1993; Wylie *et al.* 1996; Wylie *et al.* 2003a), and also uses burrows as refuge from extreme heat during its active period (Wylie *et al.* 1997; Wylie *et al.* 2004a). Giant garter snakes can be communal in their habits, sharing burrows during the colder months and when escaping extreme heat (E. Hansen, pers. comm. 2008). While individuals usually remain in close proximity to wetland habitats, Wylie *et al.* (1997) documented snakes using burrows as much as 165 feet (50 meters) away from the marsh edge to escape extreme heat; and as far as 820 feet (250 meters) from the edge of marsh habitat for over-wintering habitat.

In studies of marked snakes in the Natomas Basin, snakes moved about 0.25 to 0.5 miles (0.4 to 0.8 kilometers) per day (Hansen and Brode 1993). Total activity, however, varies widely between individuals. Individual snakes have been documented to move up to 5 miles (8 kilometers) over a few days in response to dewatering of habitat (Wylie *et al.* 1997) and more than 8 miles (12.9 kilometers) of linear aquatic habitat over the course of a few months. Estimated home ranges in the Natomas Basin and Colusa NWR of giant garter snakes have averaged about 0.1 mile^2 (25 hectares) in both the Natomas Basin and the Colusa NWR (Wylie

1998a; Wylie *et al.* 2002a; Wylie *et al.* 2002b). Home range estimates for giant garter snakes near the restored wetlands at Colusa NWR were generally smaller than previously found at the refuge when the lands were managed for waterfowl and in other off-refuge study areas (Wylie *et al.* 2000a). Wylie hypothesized that maintaining water in restored wetlands and nearby habitat provided sufficient conditions to meet the biological requirements of the giant garter snakes; individuals were less likely to move further distances as in previous years when conditions were drier and water was not maintained specifically to benefit giant garter snakes (Wylie *et al.* 2000a).

Recent studies provide limited information on the use of agricultural wetlands by giant garter snakes. Wylie *et al.* (1997) found that giant garter snake densities were highest, and average home range was smallest, in permanent wetlands (Badger Creek, Sacramento County) compared to agricultural wetlands (Gilsizer Slough, Sutter County) or managed marshes (Colusa NWR, Colusa County). However, Wylie *et al.* (2000) reported that in wetlands managed specifically to benefit giant garter snakes, home range estimates were smaller than for those areas lacking comparable management (wetlands managed for waterfowl). Wylie (1998b) also documented 14 captures and recaptures of giant garter snakes using natural channels or sloughs in the Grasslands Area in Merced County, compared to four captures and recaptures of snakes using irrigation canals. These observations may indicate that giant garter snakes may concentrate in the best habitat when all other surrounding habitat has been eliminated or highly degraded. It also may indicate that habitat in agricultural wetlands and some managed marshes are meeting some of their biological needs, but not to the fullest extent possible.

As noted in the Draft Recovery Plan, giant garter snakes use rice lands extensively and depend on them for habitat (USFWS 1999). Giant garter snake seasonal activity associated with rice cultivation occurs as follows:

> **Spring:** Rice is planted and the fields are flooded with several inches of water. Rice fields that contain prey species such as small fish or frogs attract giant garter snakes.
>
> **Summer:** While the rice grows, garter snakes continue to use rice fields as long as their prey is present in sufficient densities.
>
> **Late Summer/Fall**: The water is drained from the rice fields and garter snakes move off the fields to other adjacent habitats. Rice is harvested at this time and female garter snakes have just borne young and need food to regain their body weight. In August and September the snakes can get a good supply of food from the rice lands because prey animals are concentrated in the rice drains. The dry-down of the rice fields in fall is thought to be important because prey, which have been proliferating, are concentrated in the remaining pockets of standing water where snakes can gorge prior to the period of winter inactivity.
>
> **Winter**: Giant garter snakes are dormant in the winter and rice fields are fallow.

Giant garter snakes require water during the active phase of their life cycle in the summer, and this summer aquatic habitat is essential because it supports the frogs, tadpoles, and small fish on which the giant garter snake preys (Paquin *et al.* 2006). Rice fields have become important for spring and summer habitat when the snakes are active and winter habitat when the snakes are hibernating, particularly where rice is associated with canals and their banks (Hansen 2004; Wylie 1998). While within the rice fields, snakes forage in the shallow water for prey, using rice plants and vegetated berms dividing rice checks for shelter and basking sites (Hansen and Brode 1993). If there is a shallow warm water wetland available to a gravid female as the time for birth approaches, she will move into that area to give birth. These shallow wetland areas (either a natural area or a rice field) are very productive during the July-August timeframe when the young of the year are born (E. Hansen, pers. comm. 2008). The presence of persistent shallow summer wetlands are vital for the survival of snake neo-nates to juvenile and adult because these wetlands provide ideal forage in the very productive water column and shelter areas where dense vegetation is present (E. Hansen, pers. comm. 2008.).

In the Natomas Basin in the Sacramento Valley, habitat used by snakes consisted almost entirely of irrigation ditches and established rice fields (Wylie 1998; Wylie *et al.* 2004b), while in the Colusa NWR, snakes were regularly found on or near edges of wetlands and ditches with vegetative cover (Wylie *et al.* 2003a). Telemetry studies also indicate that active snakes use uplands extensively, particularly where (wetland) vegetative cover exceeds 50 percent in the area (Wylie 1998).

Reasons for Decline and Threats to Survival

<u>Loss and degradation of habitat:</u> The current distribution and abundance of the giant garter snake is much reduced from former times (USFWS 1999). Prior to reclamation activities beginning in the mid- to late-1800s, about 60 percent of the Sacramento and San Joaquin Valleys was subject to seasonal overflow flooding providing expansive areas of snake habitat (Hinds 1952). Now, less than 10 percent, or approximately 319,000 acres (129,000 hectares) of the historic 4.5 million acres (1.8 million hectares) of Central Valley wetlands remain (USDOI 1994), of which very little provides habitat suitable for the giant garter snake. Loss of habitat due to wetland reclamation, agricultural activities and flood control have extirpated the snake from the southern one-third of its range in former wetlands associated with the historic Buena Vista, Tulare, and Kern lakebeds (R.W. Hansen 1980, Hansen and Brode 1980).

Valley floor wetlands are now subject to cumulative effects of upstream watershed modifications, water storage and diversion projects, as well as urban and agricultural development. The CVP, the largest water management system in California, created an ecosystem altered to such an extent that remaining wetlands depend on highly managed water regimes (USDOI 1994). For instance, on-going residential and commercial growth in the Central Valley between 1990 and 2004 is consuming an estimated 10,646 acres of Central Valley farmland each year, with an estimated additional loss of 821,046 acres by the year 2050 (American Farmland Trust 2007). Environmental impacts associated with urbanization include loss of biodiversity and habitat, alteration of natural fire regimes, fragmentation of habitat from road construction, and degradation due to pollutants. Further, encroaching urbanization can inhibit rice cultivation (J. Roberts, pers. comm. 2006). Rapidly expanding cities within the snake's range include Chico, Marysville, Yuba City, Galt, Stockton, Gustine, Los Banos and the cities of the Sacramento metropolitan area.

The primary threats to the giant garter snake continue to be habitat loss and degradation. For example, the American Farmland Trust (2007) projects a loss of more than one million acres of Central Valley farmland to residential and commercial uses by the year 2040 if the current rates of urbanization continue. Farmland lost to urbanization includes land that is presently cultivated in rice. The relatively abundant populations of giant garter snake in the Sacramento Valley may reflect the expansion of available habitat that is provided from rice cultivation. Dependence of populations on rice cultivation leaves the giant garter snake vulnerable to wide-scale habitat loss in the event of changes in crop type (e.g., grapes, fruit or nut producing orchards, or annual row crops such as wheat, tomatoes or cotton) to those less water intensive or land fallowing (Paquin *et al.* 2006) or encroaching urbanization, which may inhibit rice cultivation (J. Roberts, pers. comm. 2008) and changes in precipitation patterns and water availability and timing associated with climate change (CDWR 2008). Unlike flood irrigated rice fields, other agricultural cropping systems do not hold sufficient water for long enough time periods to create artificial, temporary wetlands. Giant garter snakes in the San Joaquin Valley are threatened by a lack of summer surface water in wetlands and fields, and the age structure of populations in this part of the range has been found to be senescing with very few if any young individual snakes being found during trapping surveys conducted over the last 5 years (Hansen 2008a). Availability of clean summer water is especially important for young snakes to survive and grow (E. Hansen, pers. comm. 2008).

The Final Rule to list giant garter snake noted the typical waterfowl habitat management prescription involves flooding when garter snakes are inactive and draining to promote dry conditions when garter snakes need the water during the active period of their life cycle from mid-spring to early fall. This is antithetical to the habitat requirements of the giant garter snake, which requires ponded water throughout this period. As such, water is drained during the giant garter snake birthing season of July to September, thereby eliminating any potential habitat value during this critical reproductive period. Receding water levels act to concentrate prey species and giant garter snakes in small depressions that hold residual water, which in turn attract large numbers of predators, especially predatory birds, such as herons, egrets, and hawks. Thus, these areas may function a population sinks, which attract adult and juvenile giant garter snakes but expose them to high levels of mortality, to the extent that recruitment to the population is negated. Consequently, the many State and Federal wildlife refuges and private lands managed primarily for waterfowl likely afford little or no habitat value to the giant garter snake (USFWS 1993a).

Ongoing maintenance of aquatic habitats for flood control and agricultural purposes eliminates or prevents the establishment of habitat characteristics required by snakes for survival, growth and reproduction (Hansen 1988). Such practices can fragment and isolate available habitat, prevent dispersal of snakes among habitat units, and adversely affect the availability of habitat required to produce the snakes' food items (Hansen 1988; Brode and Hansen 1992). For example, tilling, grading, harvesting and mowing may kill or injure giant garter snakes (Wylie *et al.* 1997). Biocides applied to control aquatic vegetation reduce cover for the snake and may be toxic to the snake or it's prey (Wylie *et al.* 1996). Rodent control threatens the snake's upland estivation habitat (Wylie *et al.* 1996; Wylie *et al.* 2004a). Restriction of suitable habitat to water canals bordered by roadways and levee tops renders snakes vulnerable to vehicular mortality (Wylie *et al.* 1997). Rolled erosion control products, which are frequently used as temporary berms to control and collect soil eroding from construction sites, can entangle and kill snakes (Stuart *et al.* 2001; Barton and Kinkead 2005). Livestock grazing along edges of water sources degrades water quality and can contribute to the reduction of available quality snake habitat (Hansen 1988; E. Hansen, pers. comm. 2008). Giant garter snakes have been observed avoiding areas that have been grazed by cattle (E. Hansen 2003). Fluctuation in rice and agricultural production affects stability and availability of habitat (Paquin *et al.* 2006; Wylie and Casazza 2001; Wylie *et al.* 2003b; Wylie *et al.* 2004b).

<u>Harassment associated with recreational activities:</u> Other land use practices also currently threaten the survival of the snake. Recreational activities such as fishing can disturb snakes and disrupt thermoregulation and foraging activities (E. Hansen, pers. comm. 2008). While large areas of seemingly suitable snake habitat exist in the form of private duck clubs and waterfowl management areas, water management of these areas typically does not provide summer water needed by the species (Beam and Menges 1997; Dickert 2005; Paquin *et al.* 2006).

<u>Predation:</u> Nonnative predators, including introduced predatory game fish, bullfrogs, and domestic cats, can threaten snake populations (Dickert 2003; Hansen 1986; USFWS 1993a; Wylie *et al.* 1995; Wylie *et al.* 2003c). Nonnative competitors such as the introduced water snake (*Nerodia fasciata*) in the American River and associated tributaries near Folsom, may also threaten the giant garter snake (Stitt *et al.* 2005). Giant garter snake populations appear to be much reduced or absent from areas supporting permanent populations of nonnative predators or competitors. Observations made during fish kills and episodic drying of ditches and canals throughout the study area suggest that the composition and population structure of predatory fishes in the San Joaquin Valley differ from those noted in the rice growing regions of the Sacramento Valley. Striped bass frequently exceeding three to five pounds have been commonly observed in all permanent ditches and drains observed throughout much of the San Joaquin Valley (Hansen 2008b). In addition, channel catfish and black basses from two to eight pounds were not uncommon to San Joaquin Valley waterways where giant garter snakes were once historically abundant. Striped bass have not been observed in the rice growing regions of the Sacramento Valley (Hansen 2005).

Predation by native species upon the giant garter snake has not been well documented. Anecdotal information includes observations of hawks, herons, and river otters preying upon the giant garter snake. Although no quantitative data exist on predation of giant garter snakes by river otters, three to four giant garter snakes have been observed that were believed to be killed by otters (G. Wylie *in litt.* 2006). According to Rossman *et al.* (1996), garter snakes may be important prey for several vertebrate predators including jays (*Cyanocitta cristata*) and crows (*Corvus brachyrhynchos*), carnivorous fish, and small mammals. Small native mammalian predators are likely to include raccoons, skunks, opossums, and foxes. Anthropogenic (human caused) changes in ecosystem dynamics and reductions in suitable habitat for giant garter snakes may favor and subsidize these predator populations. The result may be an increase in predation pressure upon the giant garter snake (USFWS 2006).

In rice growing regions, irrigation systems are dried down at the end of each growing season, preventing predatory fish from becoming large enough to consume giant garter snakes. Because much of the water conveyance infrastructure in the San Joaquin Valley is also used to divert tile and surface drainage and to provide water for overwintering waterfowl, the water in canals and ditches tends to be more permanent. Subsequently, unlike their counterparts in the rice growing regions of the Sacramento Valley, predatory fishes in the San Joaquin Valley likely grow through multiple seasons and attain larger sizes. Because much of the private wetlands in the San Joaquin Valley are dried down in the summer months (during the snake's active season) to support moist soil management, giant garter snakes are likely forced to forage and inhabit the waterways that form the foundation of irrigation and drainage systems, which likely exposes them to elevated rates of predation by these larger fishes (Hansen 2008b).

Contaminants: The disappearance of giant garter snakes from much of the west-side San Joaquin Valley was approximately contemporaneous with the expansion of subsurface drainage systems in the area, providing circumstantial evidence that the resulting contamination of ditches and sloughs with drainwater contstituents (principally selenium) may have contributed to the reduction in range of giant garter snake populations in this area (USFWS 1993a; 2006). As top predators, giant garter snakes are at risk of exposure to elevated levels of contaminants that bioaccumulate such as mercury and selenium. Over the life of the giant garter snake it is possible for snakes to accumulate contaminants that can impact the growth, behavior, survival, and reproduction of individuals, leading to declines in numbers and distribution. Water quality impairment of aquatic habitat that supports giant garter snakes could also reduce the prey base for the species. Dietary uptake is the principal route of toxic exposure to selenium in wildlife, including reptiles such as the giant garter snake (Beckon *et al*. 2003; Lemly 1996; Maier and Knight 1994). Many open ditches in the San Joaquin Valley carry subsurface drainwater with elevated concentrations of selenium within the range and concentrations associated with adverse effects on predatory aquatic reptiles (Hopkins *et al.* 2002; Saiki 1998).

Fragmentation and isolation of populations: Extensive habitat destruction and fragmentation have contributed to smaller, more isolated populations of giant garter snakes. Small populations have a higher probability of extinction than large populations because their low abundance renders them susceptible to stochastic (i.e., random) events such as high variability in age and sex ratios, and catastrophes such as floods, droughts, or disease epidemics (Lande 1988; Frankham and Rails 1998; Saccheri et al. 1998). Similarly, isolated populations are more susceptible to extirpation by accidental or natural catastrophes because the likelihood of recolonization has been diminished. These chance events can adversely affect small, isolated populations with devastating results. Extirpation can even occur when the members of a small population are healthy, because whether the population increases or decreases in size is less dependent on the age-specific probabilities of survival and reproduction than on chance (sampling probabilities). Owing to the probabilistic nature of extinction, many small populations will eventually go extinct when faced with these stochastic risks (Caughley and Gunn 1996).

Climate change and drought: At present, there is no quantitative analysis of how ongoing climate change is currently affecting giant garter snakes in the San Joaquin Valley. 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; Cayan *et al*. 2006; IPCC 2007). Although predictions of future climatic conditions for smaller sub-regions in California remain uncertain (Christensen et al. 2007; Field *et a*l. 2007; Moser *et al*. 2009), daily minimum and maximum temperatures have begun to change (Moser *et al*. 2009), and interannual precipitation variability has already begun to increase (Kelly and Goulden 2008; Loarie *et al*. 2008). Across the mid-latitudes of the northern hemisphere, spring plant green-up has advanced by almost two weeks and animals in many areas are responding to such changes by breeding earlier and shifting their ranges (see review in Field *et al*. 2007). The California Department of Water Resources (CDWR) has described current climate change effects including reductions in early spring snowpack in the Sierra Nevada over the last century, a loss of 1.5 million AF of snowpack storage; sea level rise and ambient winter and night time temperature increases in a White Paper titled, "*Managing An Uncertain Future, Climate Change Adaptation Strategies for California's Water"* (CDWR 2008).

The giant garter snake's dependence upon permanent wetlands signifies the importance of water availability on survival and recovery. In a state where wetland habitat is maintained by managed water regimes, competing interests may preclude consistent and timely delivery of water to sustain suitable habitat. Drought conditions will place additional strains on the water allocation system. Where populations persist on only marginal habitat, the addition of drought conditions is likely to result in high rates of mortality in the short term with the effects of low fecundity and survivorship persisting after the drought has ceased. It is unknown how quickly giant garter snake populations may rebound after severe climatic conditions (USFWS 2006).

Status with Respect to Recovery

The draft recovery plan for the giant garter snake subdivides its range into four proposed recovery units (USFWS 1999): (1) Sacramento Valley Recovery Unit; (2) Mid-Valley Recovery Unit; (3) San Joaquin Valley Recovery Unit; and (4) South Valley Recovery Unit.

The Sacramento Valley Unit at the northern end of the species' range contains sub-populations in the Butte Basin, Colusa Basin, and Sutter Basin (USFWS 1999; USFWS 2006). Protected snake habitat is located on State refuges and refuges of the Sacramento NWR Complex in the Colusa and Sutter Basins. Suitable snake habitat is also found in low gradient streams and along waterways associated with rice farming. This northernmost recovery unit is known to support relatively large, stable sub-populations of giant garter snakes (Wylie *et al* 1995; Wylie *et al.* 1997; Wylie *et al.* 2002a; Wylie *et al.* 2003a; Wylie *et al.* 2004a). Habitat corridors connecting subpopulations, however, are either not present or not protected, and are threatened by urban and agricultural encroachment; or changes in cropping patterns.

Studies by U.S. Geological Survey (USGS) Western Ecological Research Center are underway at the Colusa NWR and in the Colusa Basin Drainage Canal (Wylie 2000, 2003; Wylie and Martin 2004; Wylie *et al.* 1997; Wylie *et al.* 2002a; Wylie *et al.* 2003a, 2004a). Density estimates range from 58 to 152 snakes per mile (36 to 95 snakes per kilometer) depending on the trapping location (Wylie *et al.* 2004a). The size distributions found in the Colusa NWR continue to reflect a healthy population of giant garter snakes with successful recruitment of young (Wylie *et al.* 2004a). The Colusa NWR represents a stable, relatively protected sub-population of snakes within the Colusa Basin. Outside of protected areas, however, snakes in these Basin clusters are still subject to all threats identified in the final rule, including habitat loss due to development, maintenance of water channels, and secondary effects of urbanization. As reported in the Five Year Status Review (USFWS 2006), the abundance and distribution of giant garter snakes have not changed significantly since the time of listing. Although some snakes have been discovered in several southern populations that were thought to be extirpated, these populations remain in danger of extirpation because their numbers remain very low and discontinuous, and they are located on isolated patches of limited quality habitat. Further, the available information indicates a tenuous connection between sub-populations clustered at the northern and the southern end of the Basin.

Stony, Logan, Hunters, and Lurline Creeks, as well as the Colusa Drain, and Glenn-Colusa, Tehama-Colusa, and Colusa Basin Drainage Canals, Little Butte Creek between Llano Seco (NWR unit) and Upper Butte Basin WA; and Butte Creek between Upper Butte Basin and Gray Lodge WA; Lands adjacent to Butte Creek, Colusa Drainage Canal, Gilsizer Slough, the land side of the Toe Drain along the Sutter Bypass, Willow Slough and Willow Slough Bypass in Yolo County, and associated wetlands, are important as snake habitat and movement corridors for the animal. These waterways and associated wetlands provide vital permanent aquatic and upland habitat for snakes in areas with otherwise limited habitat.

The Mid-Valley Unit includes sub-populations in the American, Yolo, and Delta Basins (USFWS 1999; USFWS 2006). The status of Mid-Valley sub-populations is very uncertain; each is small, highly fragmented, and located on isolated patches of limited quality habitat that is increasingly threatened by urbanization (Hansen 2002, 2004; USFWS 1993a; Wylie 2003b; Wylie and Martin 2004; Wylie *et al.* 2004b; Wylie *et al*. 2005; G. Wylie, pers. comm. 2005).

The San Joaquin Valley Unit, which includes sub-populations in the San Joaquin Basin, formerly supported large snake populations, but numbers have severely declined, and recent survey efforts indicate numbers are extremely low compared to Sacramento Valley sub-populations (Dickert 2002, 2003; Hansen 1988; Williams and Wunderlich 2003; Wylie 1998). Giant garter snakes currently occur in the northern and central San Joaquin Basin within the Grassland Wetlands of Merced County and the Mendota WA of Fresno County; however, these sub-populations are extremely small, fragmented, and unstable; the numbers of individual snakes trapped over the last decade have declined dramatically in this area of the snake's historic range (Dickert 2003, 2005; G. Wylie, pers. comm. 2006; Hansen 2008a).

The South Valley Unit included sub-populations in the Tulare Basin, however, agricultural and flood control activities and lack of summer water habitat are presumed to have extirpated the snake from the Tulare Basin (Hansen 1995; Wylie and Amarello 2008). Wylie and Amarello (2008) surveyed locations in the Tulare Basin in 2006 including Buena Vista Lake, Fresno Slough, Kern Refuge, Kings River and North Kings River. No snakes were detected at any of the locations sampled. Wylie and Amarello noted that suitable habitat does exist in Kern NWR so that reintroduction may be considered feasible in the future should summer water supplies (incremental Level 4) be secured.

The draft recovery criteria require multiple, stable sub-populations within each of the recovery units, with sub-populations well-connected by corridors of suitable habitat. This entails that corridors of suitable habitat between existing snake sub-populations be maintained or created to enhance sub-population interchange to offset threats to the species (USFWS 1999). Currently, only the Sacramento Valley Recovery Unit is known to support relatively large, stable giant garter snake populations.

It is important to note that habitat corridors connecting sub-populations, even in the Sacramento Valley Recovery Unit, are either not present or not protected. Overall, the future availability of habitat in the form of canals, ditches, and flooded fields are subject to market-driven crop choices, agricultural practices, and urban development, and are, thus, uncertain and unpredictable.

Conservation Needs of Giant Garter Snake in the Action Area
The decline of giant garter snakes in the action area is due principally to loss and degradation of both aquatic and upland habitat and insufficient availability of summer wetland water supplies. Conservation measures, therefore, should protect and secure habitat in the Grasslands, and Mendota areas with an emphasis on protection and enhancement of habitat and connectivity between populations. These measures are listed as priority task one in the revised draft Giant Garter Snake Recovery Plan (USFWS 1999) and recommended future tasks in the Five-Year Review (USFWS 2006a). Additional priority task one measures include the development and implementation of management plans, acquisition of water rights for restoration of aquatic habitat and provision of summer water habitat, and studies to determine the effects of selenium to the species. Conservation easements in the Grasslands could be re-negotiated to include suitable management of lands to increase population numbers and to broaden distribution. Corridors, primarily aquatic corridors, could either be re-established and/or protected such that suitable habitat may be recolonized throughout the action area. Reconnecting the habitats occupied by the various sub-populations would also allow for an exchange of genetic material improving viability. Further, sources of selenium contamination in the Grassland wetland supply channels should be reduced or minimized from entering this water supply.

California jewelflower

Listing
The California jewelflower (*Caulanthus californicus*) was listed as an endangered species on July 19, 1990 (55 **FR** 29361).

Description
This is an annual herb belonging to the mustard family (Brassicaceae), and has flattened, sword-shaped fruits. Known populations of California jewelflower occur in non-native grassland, upper Sonoran subshrub scrub, and cismontane juniper woodland and scrub communities. Historical records suggest that it also occurred in the valley saltbush scrub community in the past. Populations of California jewelflower have been reported from subalkaline, sandy loam soils at elevations of approximately 240 to 2,950 feet.

Historical and Current Distribution
The historical distribution of California jewelflower is known from 40 herbarium specimens, which were collected in 7 counties between 1880 and 1973. Approximately half of the collection sites were on the floor of the San Joaquin Valley in Fresno, Kern, and Tulare Counties. Several other collections came from two smaller valleys southwest of the San Joaquin Valley: the Carrizo Plain (San Luis Obispo County) and the Cuyama Valley (Santa Barbara and Ventura Counties). Three occurrences (i.e., collection sites separated by 0.4 kilometer [0.25 mile] or more) were in the Sierra Nevada foothills at the eastern margin of the San Joaquin Valley in Kern County. The remainder of the historical sites are in foothills west of the San Joaquin Valley, in Fresno, Kern, and Kings Counties. By 1986, all the occurrences on the San Joaquin and Cuyama Valley floors had been eliminated, and the only natural population known to be

extant (i.e., still in existence) was in Santa Barbara Canyon, which is adjacent to the Cuyama Valley in Santa Barbara County. A small, introduced colony also existed at the Paine Preserve in Kern County at that time.

Since then, several more introductions have been attempted (see Conservation Efforts in the Recovery Plan for Upland Species of the San Joaquin Valley), and a number of colonies were rediscovered in two other areas where the species had been collected historically. The naturally-occurring populations known to exist today are distributed in three centers of concentration: (1) Santa Barbara Canyon, (2) the Carrizo Plain, and (3) the Kreyenhagen Hills in Fresno County. The Santa Barbara Canyon metapopulation occurs on the terraces just west of the Cuyama River and includes approximately 30 acres of occupied habitat. The Carrizo Plain metapopulation is confined to the western side of the Carrizo Plain and encompasses approximately 10 acres of occupied habitat. The Kreyenhagen Hills metapopulation includes 4 small colonies within a small area of rolling hills.

Reproductive Ecology and Demography
Seeds of California jewelflower begin to germinate in the fall, and seedlings may continue to emerge for several months. The seedlings develop into rosettes of leaves during the winter months, after which stems elongate and flower buds appear in February or March. Flowering and seed set may continue as late as May in years of favorable rainfall and temperatures. It is thought that California jewelflower forms a persistent seed bank, but seeds appear to germinate only when exposed to conditions simulating prolonged weathering. Seed dispersal agents are unknown, but may include gravity, seed-eating animals such as giant kangaroo rats, wind, and water. Pollinator-exclusion experiments indicated that insects are necessary for seed set in California jewelflower. Honeybees (*Apis mellifera)* have been observed visiting the flowers, but native insects also would be expected to serve as pollinators. Closely related species of the genus *Thelypodium* were visited by several species of bees *(Bombus* sp., *Apis* sp., and *Xylocopa* sp.) and butterflies (*Pieris* sp.)

Reasons for Decline and Threats to Survival
The primary reason for decline of California jewelflower was habitat conversion to agriculture and urban development. Potential threats to one or more of the remaining populations of California jewelflower include development on private land in the Santa Barbara Canyon area, competition from non-native plants, direct and indirect effects from pesticide and herbicide use for insect control and cropland management, and potential cattle grazing of populations on private lands. The small population size of the California jewelflower also makes it vulnerable to natural catastrophic events such as drought or fire.

Nitrogen deposition enhances non-native species invasions which out-compete native species, including the California jewelflower. In recent years, there is a trend toward an increase in the amount of pesticides applied in the counties where *C. californicus* persists (California Department of Pesticide Regulation 2006); these chemical agents may adversely affect the pollinators of the plant. Attempts to re-establish or establish the California jewelflower have not been successful. Climate change is projected to increase temperatures across California and may result in the asynchrony of flowering and pollinator interactions (Cayan *et al.* 2006), as well as increased risk to the plant from wild fires.

Recovery Status
Based on the lack of protection of sufficient habitat representing the geographic range of the species, the low density and instability of the populations, and the continuation of threats to the species, the California jewelflower is in danger of extinction throughout its known range.

Conservation Needs in the Action Area
Substantial populations of woolly-threads are present within the action area (Westlands Water District, City of Avenal, City of Coalinga), in the Kettleman Hills of Kings County, and in the Jacalitos and Panoche Hills of Fresno County (USBR 2004). The recovery goal for this species is similar to that for other plant species discussed in the Service's 1998 Recovery Plan: to maintain self-sustaining populations in protected areas representative of the former geographic and topographic range of the species and in a variety of appropriate natural communities. The recovery task with the highest priority is to protect existing habitat within the San Joaquin Valley. The Upland Species Recovery Plan identified the need to secure and protect at least one (640 acres) population on the San Joaquin Valley floor (USFWS 1998).

Surveys for California jewelflower and a population census are needed in the the west-side of the southern San Joaquin Valley. Research is needed to determine or understand the effects of grazing, fire, competition from non-native plants, reproduction and demography, identification of pollinators, pesticide effects to pollinators. Seeds of jewelflower need to be collected in order to conserve genetic diversity and allow greenhouse propagation. Linkage areas need to be protected in Tulare, Fresno, Kings, and Kern counties via easements, safe harbor agreements, or other mechanisms. Occupied or unoccupied linkage areas would function as facilitators for pollination and seed dispersal.

San Joaquin Woolly-Threads

Listing
The San Joaquin woolly-threads (*Monolopia congdonii*) was listed as endangered on July 19, 1990 (55 **FR** 29361). Recovery of San Joaquin woolly-threads is discussed in the Recovery Plan for Upland Species of the San Joaquin Valley (Service 1998). It has not been listed by the State of California.

Description
The San Joaquin woolly-threads, a dicot in the family Asteraceae, is an annual herb endemic to the southern San Joaquin Valley and surrounding hills. It has tiny yellow flower heads clustered at the tips of erect to trailing stems covered with tangled hairs. It is readily distinguished from Eatonella, its closest relative, by differences in growth habit, flower and seed morphology, and geographic range.

The San Joaquin woolly-threads grow in annual grasslands or saltbush scrub on alluvial fans, often with sandy soil. It occurs on neutral to subalkaline soils deposited in geologic times by flowing water. On the San Joaquin Valley floor, it typically is found on sandy or sandy loam soils, whereas in the Carrizo Plain, it occurs on silty soils. San Joaquin woolly-threads occupy microhabitats in nonnative grassland, valley saltbush scrub, interior Coast Range saltbush scrub, and upper Sonoran subshrub communities with less than 10 percent shrub cover but in either sparse or dense herbaceous cover. It has been reported from elevations ranging from 200 to 850 feet on the San Joaquin Valley floor and from 2,000 to 2,600 feet in San Luis Obispo and Santa Barbara Counties.

The seeds of San Joaquin woolly-threads may germinate as early as November, but usually germinate in December and January. Flowering generally occurs between late February and early April and may continue into May. Seed production depends on plant size and number of flower heads. In contrast to the more persistent skeletons of Hoover's woolly-star, all trace of San Joaquin woolly-threads plants disappears rapidly after seeds are shed in April or May. Seed dispersal agents are unknown, but may include wind, water, and animals. Seed-dormancy mechanisms are thought to allow the formation of a substantial seed bank in the soil.

Historical and Current Distribution
San Joaquin woolly-threads are endemic to the southern San Joaquin Valley and surrounding hills. Its original range extended from southern Fresno and Tulare Counties (excluding the Tulare lakebed) to the City of Bakersfield and the Cuyama Valley. Occurrences were found in Fresno, Kings, Kern, San Benito, San Luis Obispo, and Santa Barbara counties. San Joaquin woolly-threads currently exist as four metapopulations and several small, isolated populations. The largest metapopulation occurs on the Carrizo Plain, where occupied habitat has been observed to vary from a high of 2,800 acres in a favorable year, to much less in years of lower rainfall. Much smaller metapopulations occur in Kern County near Lost Hills, in the Kettleman Hills of Fresno and Kings Counties, and in the Jacalitos Hills of Fresno County. Isolated occurrences are known from the Panoche Hills in Fresno and San Benito Counties, near the City of Bakersfield, and the Cuyama Valley (San Luis Obispo and Santa Barbara counties).

Essential Habitat Components
San Joaquin woolly-threads occurs in grassland and scrubland habitats. The species generally occupies microhabitats with less than 10 percent shrub cover, although herbaceous cover may be sparse or dense, and cryptogamic crust may or may not be present. San Joaquin woolly-threads occurs on neutral to sub-alkaline soils. On the San Joaquin Valley floor, the species typically is found on sandy or sandy-loam soils, whereas on the Carrizo Plain it occurs on silty soils. The species frequently occurs on sand dunes and sandy ridges as well as along the high-water line of washes and on adjacent terraces.

Reproductive Ecology and Demography
The seeds of San Joaquin woolly-threads may germinate as early as November, but usually germinate in December and January. Flowering generally occurs between late February and early April and may continue into May. Seed production depends on plant size and number of flower heads. In contrast to the more persistent skeletons of Hoover's woolly-star, all trace of San Joaquin woolly-threads plants disappears rapidly after seeds are shed in April or May. Seed dispersal agents are unknown, but may include wind, water, and animals. Seed-dormancy mechanisms are thought to allow the formation of a substantial seed bank in the soil.

Reasons for Decline and Threats to Survival

Intensive agriculture led to the loss of the majority of the occurrences on the floors of the San Joaquin and Cuyama valleys, with other sites being destroyed by urban development in and around Bakersfield and intensive oilfield development between Lokern and Lost Hills. Threats to remaining unprotected populations include heavy grazing (especially by sheep), oil field development, and possibly air pollution. Population and plant size can vary, depending on site and weather conditions. In years of below-average precipitation, few seeds of this species germinate, and those that do typically produce tiny plants.

Recovery Status

The past extirpation of San Joaquin woolly threads from most of its historic range and the current threats to the species continue to endanger its survival and recovery. The threats remain largely as they were when the species was listed in 1990. These threats include loss of habitat to agricultural conversion, urbanization, oil and gas exploration and extraction, water storage and transport infrastructure, and inadequate regulatory mechanisms. The new threats to woolly threads include nitrification of soil which creates optimal conditions for the plant's competitors, and climate change.

The woolly threads populations which occur on public lands do not yet have management plans that achieve the recovery plan's standards; although the BLM-Bakersfield office is making strides toward that goal with a plan expected to be completed in 2010. Other goals in the recovery plan have not been achieved, and in some instances, not initiated, including the development and implementation of an outreach plan, development of economic incentives on private land, land ownership research for large populations in the Kettleman Hills (Fresno and Kings Counties), and protection of two 640 acres preserves. As a result, based on the continuing threats to this species, and lack of progress in achieving the recovery goals set forth in the Upland Species Recovery Plan, San Joaquin woolly threads continues to be in danger of extinction throughout all or a significant portion of its range.

Conservation Needs in the Action Area

Substantial populations of woolly-threads are present within the action area (Westlands Water District, City of Avenal, City of Coalinga), in the Kettleman Hills of Kings County, and in the Jacalitos and Panoche Hills of Fresno County (USBR 2004). The recovery goal for this species is similar to that for other plant species discussed in the Service's 1998 Recovery Plan: to maintain self-sustaining populations in protected areas representative of the former geographic and topographic range of the species and in a variety of appropriate natural communities. The recovery task with the highest priority is to protect existing habitat within the San Joaquin Valley. The Upland Species Recovery Plan identified the need to secure and protect one or more (640 acres) population of woolly threads on the San Joaquin Valley floor (USFWS 1998).

ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of past and ongoing human and natural factors leading to the current status of the species and any critical habitat within the action area. The baseline includes State, tribal, local, and private actions already affecting the species or that will occur at the same time as this consultation. Unrelated Federal actions affecting the same species that have completed formal or informal consultation are also part of the environmental baseline, as are Federal and other actions within the action area that may benefit listed species or critical habitat.

This section provides updates to baseline information relevant to the listed species considered in this consultation. More detailed information regarding species distribution, biology and conservation needs can be found in the Recovery Plan for Upland Species of the San Joaquin Valley, California (USFWS 1998a); Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area (USFWS 1998b); Final and the Draft Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2004); and the Service's 5-Year Reviews for San Joaquin kit fox (USFWS 2010a); Fresno, giant and Tipton kangaroo rats (USFWS 2010b,c,d); blunt-nosed leopard lizard (USFWS 2007c); giant garter snake (USFWS 2006); and California jewelflower (USFWS 2007d).

The environmental baseline for a portion of the action area considered in this Biological Opinion, the surface waters in the Grasslands and San Joaquin River, was recently updated in the Grassland Bypass Project Biological Opinion for 2010 – 2019 (GBP Opinion) (Service File No. 09-F-1036), and is incorporated here by reference. Further, the environmental baseline for the San Joaquin kit fox and the giant garter snake were updated in the GBP Opinion, and as the action area for this IRC consultation is consistent with the action area for the GBP Opinion, these species' baselines are incorporated here by reference as well. The environmental baseline for California least tern in the SLDFR Opinion (Service File No. 06-F-0027) is incorporated in part by reference. In addition, it has been determined by the Service that there is suitable habitat for California least terns in the action area as supported by direct observations of least terns foraging at the sewage ponds at Lemore NAS in 1997 and 1998. While currently, no least tern nesting has been documented within the project area, the action area contains habitat suitable for foraging, resting, movement, and other essential behaviors. Therefore, the Service believes that the California least tern is reasonably certain to occur within the action area because of records of the animal within dispersal distance of the action area and the biology and ecology of the species.

A summary of Reclamation actions in this Biological Opinion action area was compiled in the 2006 Biological Opinion on IRC's (Service File No. 06-F-0070) and is also incorporated here by reference. The environmental baseline includes the ESA consultations completed for the renewal of other long-term water contracts including the DMC Unit (Service File No. 04-I-0707), Friant and Cross Valley Division (01-F-0027), and consultations related to the operation and maintenance activities for Reclamation's South Central California Area Office (Service File No. 04-F-0368). Other unrelated Federal actions affecting the species or their critical habitat that have completed consultation are also included as part of the baseline.

The baseline condition for interim contract renewal assumes that any drainage service provided to the SLU be consistent with the project description and assumptions in the SLDFR Biological Opinion. Any drainage management implemented in a manner not considered in the SLDFR Opinion will need to undergo separate section 7 consultation.

Land use patterns within the SLU

The BA for LTRC for the SLU (USBR 2004), Reclamation estimated that about 14 percent of the SLU's land area remained undeveloped. Approximately 71 percent of undeveloped lands were in the hills surrounding the Pleasant Valley near the City of Coalinga and the Kettleman Hills near the City of Avenal. The remaining 29 percent was in the northern portion of the SLU near Santa Nella and various small parcels throughout the SLU. Approximately 75 to 81 percent of the SLU was estimated to be irrigated farmland, 2.5 percent to be in oil production, and 1.5 percent to be in urban areas, farmsteads, and transportation and conveyance facilities (CDWR 2004, USBR 2004).

The SLU BA estimated that in 2004, about one half of the SLU's irrigated farmland was used for the production of cotton (35 percent) and tomatoes (16 percent). About 11 percent was used for orchards and vineyards, half of which is used for the production of almonds. The remaining farmland was used for a variety of crops, such as alfalfa, asparagus, wheat, melons, corn, grain, and various pasture crops (CDWR 2004; USBR 2004).

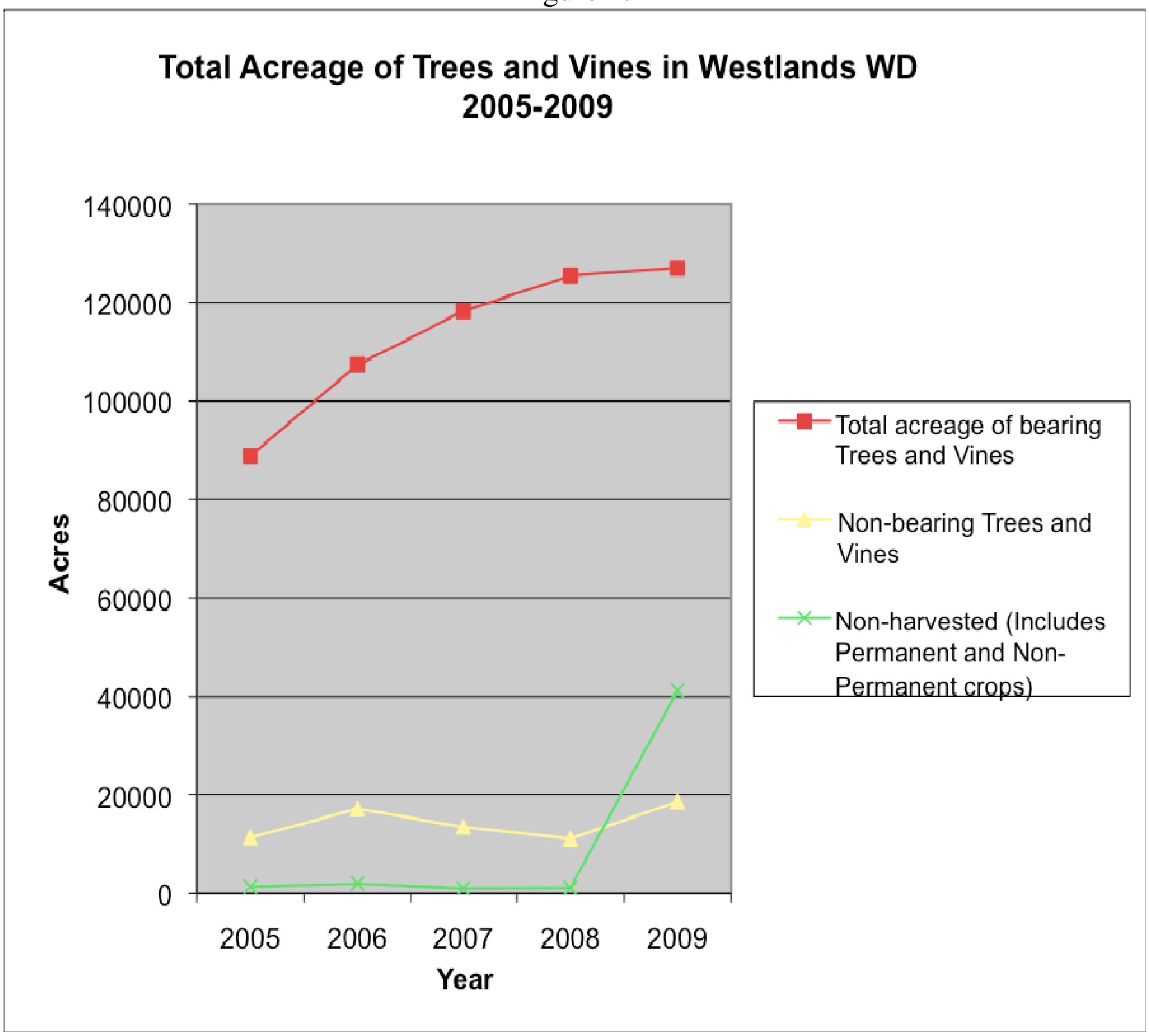
Since the 2004 BA for SLU long term contract renewals, there has been a trend toward an increasing proportion of Westlands WD planted in permanent crops (orchards and vineyards) (Phillips 2006b; Westlands Water District 2004-2009), particularly on the western, non-drainage-impaired portion of the district (Phillips 2006b). Phillips (2006) estimated that acreage of permanent crops in the Fresno County portion of the SLU has increased nearly eightfold between 1977 and 2000 and nearly fourfold between 1994 and 2000. Most of these permanent crops were planted in the western third of Westlands WD. Annual crop reports from Westlands WD from 2005 – 2009 (available at: www.westlandswater.org) indicate that permanent crop acreage has continued to increase since 2005 (Figure 2). Further, although there was a slight decrease in producing nut-bearing trees in 2009, the overall acreage of permanent crops in Westlands WD increased. In 2007 Cypher *et al*. estimated that there were approximately 5,559 acres of suitable habitat and 20,543 acres of moderately suitable sub-optimal habitat currently available for San Joaquin kit fox in the SLDFRE study area (Table 1, Figure 3). Most of the suitable and most of the sub-optimal San Joaquin kit fox habitats identified in 2007 remained between the western boundary of Westlands WD and Interstate 5, within the area likely to be converted to permanent crops. The kit fox is the only listed species addressed in this biological opinion that may at times utilize crop lands to any extent.

Although orchards may provide slightly better permeability for foraging to kit foxes than row crops (Warrick *et al*., 2007), management of orchards to reduce rodent damage (e.g., use of anticoagulant baits (Almond Board of California, 2005)) could make orchards harmful to kit fox. Many of the habitat conversions are outside the control of Reclamation or the contractors.

Municipal and industrial activities in each of the communities that utilize the contract water have resulted in destruction, modification, or degradation of habitat used by San Joaquin kit fox, blunt-nosed leopard lizard, California jewel flower, and San Joaquin wooly-threads (SWRCB 1999). Many, but not all of these activities took place prior to implementation of the ESA in 1973 and prior to the listing of the species considered in this Opinion, and were not subject to the provisions of the ESA. Reclamation (USBR 2004a) identified approximately 34,860 acres of urban or industrial land uses including transportation corridors, industrial areas, farmsteads and urban/residential areas in the SLU. The largest block of this total (25,290 acres) is the industrial – transportation category, which includes the I-5 corridor and other roadways and the oilfields around Avenal and Coalinga, and the remaining lands are the urban area of Avenal, Coalinga, Huron, and the individual farmsteads.

Within the Cities of Avenal and Coalinga, a CEQAnet search of actions between December 2008 and December 2010 revealed that only a few development projects were approved during that time (1 and 3 projects respectively), and that the approved projects appeared to have little or no impact on natural lands. We note that the recently approved project for the City of Avenal was a photovoltaic solar project, a relatively new activity in the area that has the potential to adversely affect habitat of the species addressed in this opinion, with the possible exception of least tern. This particular project was, however, located on agricultural lands.

Figure 2.



(Figure 2 derived from annual crop reports provided by Westland WD at www.westlandswater.org)

Subsurface Drainage Disposal

There are at least 2 evaporation basins in the vicinity of Westlands WD that receive at least some drainage originating from Westlands WD (Stone Land Company and Westlake Farms North). There is a third site at Lemoore NAS that disposes of at least some drainage water originating from Westlands WD with sewage water in an evaporation basin. In addition, one evaporation basin in or near Westlands WD was converted to an integrated on-farm drainage management system that utilizes salt tolerant crops to evaporate and dispose of drainage water from lands in Westlands (Britz) (Pers. comm. A. Toto, Central Valley Regional Water Board, Fresno, CA, 2.17.2010).

The San Luis Drain is approximately 85 miles long. Of that, 28 miles are used by the GBP to convey drainage to Mud Slough North. Approximately 55 miles of the Drain is within Westlands WD and is no longer actively used to convey drainage water. However, this unused portion of the Drain may contain standing water. The source of this water is shallow contaminated groundwater which enters the Drain by means of one way valves that were installed in the Drain to prevent groundwater pressure from compromising the integrity of the canal. The Drain is not fenced, and could be accessible to mosquito abatement district's efforts to plant mosquito fish. The USGS (Presser and Luoma, 2006, Appendix E) quantified the amount of sediment in the full 85 miles of the San Luis Drain as 177,900 cubic yards ranging from 5 to 190 ppm dry weight, with selenium concentrations in water from the Drain in Westlands ranging from 330-430 ppb (from Presser and Barnes 1985). It is unknown what wildlife use the San Luis Drain, or if the Drain is used by federally listed species such as the California least tern. However, the potential is very high for selenium to bioaccumulate in the food chain organisms residing in the Drain.

EFFECTS OF THE ACTION

Effects Overview

This section includes a general overview of the effects to listed species or their habitats that are related to the use of the CVP water supply in the service areas under the proposed 24-month IRCs. It is assumed that all conservation measures and environmental commitments described in the Project Description of this Opinion will be implemented in the manner and schedule described previously in this document. We anticipate that effects will be similar in scope and significance as those analyzed in our recent evaluations of the previous IRCs (Service file nos. 08-F-0538, 06-F-0070, 04-F-0360, 02-F-0070, and 00-F-0056), Grassland Bypass Project (09-F-1036) and in the programmatic biological opinion on implementation of the CVPIA (Service file no. 98-F-0124). Impacts associated with implementation of drainage service for the SLU (including Westlands WD) were considered in the biological opinion on SLDFR (Service file no. 06-F-0027). Any changes to drainage service not considered in the SLDFR Opinion will require separate section 7 consultation.

Conservation measures
Essential to the findings below are Reclamation's past and continuing conservation efforts to recover listed species through the CVPIA (b)(1)(other) and CVP Conservation Program. These programs have provided funding for habitat acquisition and management, surveys, and research

that have contributed to the recovery of numerous listed species that have been adversely affected by the CVP.

Direct Effects

The Service anticipates that there will be no direct effects to listed species associated with the proposed execution of the interim contracts considered in this Biological Opinion for 24 month periods between March 1, 2010, through February 28, 2012, for Westlands WD and March 1, 2011, through February 28, 2013, for the remaining four SLU M&I contractors. O&M of CVP water conveyance facilities, which can be considered interdependent actions, were analyzed under separate consultations as described in the non-jeopardy biological opinions (see **Environmental Baseline**).

The proposed Federal action will continue deliveries of water to these five contractors in the SLU, as well as the portion of the Mercy Springs three-way assignment allocated to Santa Clara Valley WD. No construction of new facilities, installation of new structures, or modification of existing facilities is required or planned. Delivery of Federal water to these six contractors, and from the contractors to the individual water users, will maintain the patterns of land use described above in the **Environmental Baseline**. Execution of the IRC's is the action that allows for the delivery of the Federal CVP water, and thus any effects anticipated would be indirect, rather than direct.

Indirect Effects

Indirect effects are effects caused by or result from the proposed action, will occur later in time, are reasonably certain to occur, and would not occur "but for" the project. We have identified indirect effects of execution of the IRC's below.

Effects of urban development
Continued delivery of CVP water under the M&I contracts (Mendota WMA, City of Avenal, City of Coalinga, City of Huron) sustains the residential, commercial, and industrial activities that occur within the contract service areas of the M&I IRC contractors. These activities would not be sustainable at the same scale, extent, intensity, and duration absent Federal water supplies. However, the CVP supply is the sole or primary reliable or high quality source of municipal water for these IRC contractors; as a result, we would attribute any adverse effects that may occur to the provision of the Federal water supply.

Urban, industrial, or municipal development proposed within areas of natural habitat remaining in the water service area of any of these IRC contractors could destroy, modify, fragment, or degrade habitat of San Joaquin kit fox, blunt-nosed leopard lizard, California jewelflower, or San Joaquin woolly threads. However, based on the kind and extent of development within these cities during the past interim contract period (see **Environmental Baseline**), we do not anticipate a change in the type and extent of development during the 24-month duration of the IRC's. All of these cities are small and are not currently experiencing, nor are they anticipated to experience, significant growth over the next two years based on the current economic situation in California.

Effects of changing cropping patterns
Changes in cropping patterns may adversely affect listed species in several ways. Conversions of native habitat to agricultural use may in many cases occur as a result of, or related to Federal water deliveries, since the groundwater available within the district (the safe yield of groundwater in Westlands WD is 200,000 acre-feet/year) is insufficient to meet the crop water needs (USBR 2009; Westlands WD, 2009). This practice has in the past destroyed, modified, fragmented, or degraded habitat for all of the species addressed in this Opinion (see **Status of the Species** and **Environmental Baseline**). We do not consider it likely that any portion of remaining natural lands in the SLU will be converted to agricultural use during the 2-year IRC based on trends and other information about cropping patterns in the SLU in the recent past (see **Environmental Baseline**), and recent CVP water allocations.

Another way the changes in cropping patterns may adversely affect listed species is through changes in type of crop grown. Effects from these kinds of actions would be limited to San Joaquin kit fox, which is the only one of the listed species addressed in this biological opinion that utilizes cropland to any extent (see **Status of the Species**). We would anticipate trends in conversion of row crops to permanent crops, as discussed in the **Environmental Baseline**, to continue through the 2-year period of the IRC period. Lands with these crops are not always cleared of all herbaceous vegetation, and therefore sometimes may support some prey (primarily ground squirrels, deer mice, and house mice). Also, the open understory of orchards facilitates predator detection by kit foxes. While permanent crop types in SLU (orchards) may be marginally better for San Joaquin kit fox due to their relatively better permeability, the high use of rodenticides associated with orchards to reduce rodent damage (e.g., use of anticoagulant baits (Almond Board of California, 2005)) could harm San Joaquin kit fox.

Pesticide use
Another indirect effect of the use of Federal water authorized under the Proposed IRC contracts is the use of pesticides, including insecticides, acaricides, herbicides, fungicides, and other chemicals, on crops grown benefiting from Federal water. Effects of pesticide use on listed species were addressed in the 2002 and 2008 biological opinion on IRC (Service file nos. 08-F-0538, and 02-F-0070). We anticipate effects of the proposed IRC's to be similar in frequency, intensity, duration, and significance, to those analyzed in the 2008 and 2002 biological opinions and those analyses are incorporated here by reference.

Subsurface Drainage Disposal
As described in the **Environmental Baseline**, there are potentially 3 evaporation basins in the vicinity of Westlands WD that receive at least some drainage originating from Westlands WD. In addition, portions of the San Luis Drain in Westlands WD contain standing water originating from the adjacent shallow groundwater aquifer. Information regarding water quality and food-chain contamination at these evaporation basins or from the San Luis Drain was not made available by Reclamation for this consultation. Therefore, in the absence of data, it is presumed that selenium contamination and adverse effects are likely to occur to a small number of least terns foraging at drainage evaporation ponds receiving at least some drainage water from Westlands WD or from the San Luis Drain. Because of the brief nature of the IRC for Westlands, we make the finding that drainage disposal will adversely affect, but will not

appreciably reduce the likelihood of both the survival and recovery of the California least tern during the three year life of project.

Shallow Contaminated Groundwater in Westlands WD

Giant garter snakes in the Grasslands may be subject to harm as a result of contamination from subsurface movement of shallow groundwater originating in Westlands. Although Westlands WD does not discharge subsurface drainage directly to surface water channels or the San Joaquin River, several recent Reclamation NEPA documents (i.e., [SLDFR FEIS], USBR 2006a; Draft Supplemental EIS SLU Long Term Contract Renewals [SLU DSEIS], USBR 2006b; Broadview Water Contract Assignment Project Draft EA [Broadview DEA], USBR 2004b) have documented there is a hydraulic connection of shallow groundwater contamination originating in Westlands to lands downslope of Westlands that do discharge to surface waters. The SLDFR FEIS included a regional groundwater flow model for the SLDFR project area (includes agricultural lands in the SLU, Delta Mendota Canal Unit, and San Joaquin Exchange Contractors service areas) developed by Hydrofocus Inc. The SLDFR FEIS noted on page 6-26 that, "*Using the groundwater-flow model results, horizontal groundwater velocities were estimated at about 500 feet/year in the upper 50 feet of the saturated zone for the 1-foot/year seepage rate. Therefore, in 44 years groundwater with high salinity and constituent concentrations could travel about 20,000 feet downgradient from the evaporation basins. Results suggested significant water level increases could affect crop root zone salinity within 3,500 feet of the evaporation basins..*." The SLU DSEIS found that, "*The Westlands Subarea has no drainage discharge to the receiving waters of the State, therefore it is not directly affected by the current salinity and boron TMDL which limits discharge into the San Joaquin River. However, these actions have an indirect impact on the hydrology of the Basin owing to regional groundwater flow from Westlands into the Grasslands subarea…"* Further, the Broadview DEA (USBR 2004b) noted on page 4-2 that, "*…the Proposed Action would reduce the quantity of drainage water currently being discharged from the BWD [Broadview WD] to the San Joaquin River by approximately 2,600 acre-feet or 70 percent of water per year (Summers Engineering, 2003). More specifically, by fallowing the BWD lands and not applying CVP water for irrigation, the estimated reduction in drain water discharge from existing conditions (approximately 3,700 acre feet per year [afy]), will be reduced by approximately 1,100 afy. Most of these resulting flows are likely attributable to sub-surface flows originating from up-gradient locations to the south and west…*" and on page 4-12 that, "*Although irrigated agriculture would be discontinued within the BWD, under-land flow of groundwater from up-gradient locations would still contribute to drain water within BWD drainage canals*." In other words, the Broadview DEA estimated that about a third of the subsurface drainage below Broadview WD originated outside and upslope of district boundaries via lateral flow from agricultural lands in the south and west (i.e., Westlands WD).

The SWRCB in their Water Rights Decision 1641 (SWRCB 2000) identified lands within the San Luis Unit contribute to drainage water contamination to the San Joaquin River, "*…the SWRCB finds that the actions of the CVP are the principal cause of the salinity concentrations exceeding the objectives at Vernalis. The salinity problem at Vernalis is the result of saline discharges to the river, principally from irrigated agriculture, combined with low flows in the river due to upstream development. The source of much of the saline discharge to the San Joaquin River is from lands on the west side of the San Joaquin Valley which are irrigated with water provided from the Delta by the CVP, primarily through the Delta-Mendota Canal and the*

San Luis Unit." Oppenheimer and Groeber (2004) in a draft staff report for the Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Salt and Boron Discharges into the Lower San Joaquin River, noted the following with respect to Westlands WD effects to San Joaquin River water quality: *"The Grassland Subarea contains some of most salt-affected lands in the LSJR watershed. This subarea is also the largest contributor of salt to the LSJR (approximately 37% of the LSJR's mean annual salt load). Previous studies indicate that shallow groundwater in the LSJR watershed is of the poorest quality (highest salinity) in the Grassland Subarea (SJVDP, 1990). The Grassland Subarea drains approximately 1,370 square miles on the west side of the LSJR in portions of Merced, Stanislaus, and Fresno Counties. This subarea includes the Mud Slough, Salt Slough, and Los Banos Creek watersheds. The eastern boundary of this subarea is generally formed by the LSJR between the Merced River confluence and the Mendota Dam. The Grassland Subarea extends across the LSJR, into the east side of the San Joaquin Valley, to include the lands within the Columbia Canal Company [and including the Northern Portion of Westlands Water District]."*

In addition, Deverel, in written testimony for the SWRCB Bay-Delta Water Rights Hearing**,** in 1998 described the effect of the shallow drainage problem upslope of the Firebaugh Canal WD and Central California Irrigation District (primarily in Westlands) on drainage conditions within these districts (Deverel 1998). Relevant excerpts are provided below:

> *"I have also been asked if I could quantify the load of salinity and selenium that enters along this boundary by downslope migration compared to the drainage load leaving Firebaugh Canal Water District as an example. Downslope migration does not explain all of the load but a part of it is from this shallow downslope flow, in the range of 20 to 40%...*"
>
> *"…Elevations of groundwater in saturated areas in upslope areas are higher than elevation in lower areas. Although a particular particle of Water will take many years to migrate, in saturated soils pressure is very quickly transmitted to areas of lesser pressure. That is what is happening here. Pressure transmitted from high areas to low areas as an example will cause poor quality Water to show up in surface drain and be counted as load. A particle of poor quality Water may have originated from farming the downslope areas or migrated in the shallow geological features from farming the downslope areas or migrated in the shallow geological features from upslope, but the pressure causes it to rise into the tile drainage and surface drain and flow out."*
>
> *"Pumping decreased substantially during the 1950's and 1960's as surface water was delivered and groundwater water levels rose. This rise in the groundwater levels continues to occur and has caused increases in pressures in downslope areas which have contributed to drainage flows*

A comprehensive analysis of the environmental baseline of the Grassland wetland supply channels (surface waters downstream and downslope of Westlands) and effects of drainwater contamination to giant garter snake is provided in the Biological Opinion on the Third Use Agreement of the GBP (09-F-1036) and is incorporated here by reference. The Service concluded in the GBP Opinion that "*under current baseline conditions, dietary selenium* *concentrations in the South Grasslands still poses a risk to growth, reproduction and survival of giant garter snakes. Further, contamination in the food chain in the North Grasslands, specifically Mud Slough (North) could preclude re-establishment of the snake in the vicinity of this waterway*."

Given the fact that giant garter snakes forage on fish and tadpoles, and these taxa are the most selenium-impacted of the biota sampled in the south Grasslands, it is reasonable to conclude that the giant garter snake is likely adversely affected by selenium in their diet from this area. Among vertebrates, reproductive toxicity is one of the most sensitive endpoints; however birds and fish seem to have substantially lower thresholds for reproductive toxicity than placental mammals (USDOI 1998). Selenium is first and foremost a reproductive toxicant (both a gonadotoxicant and a teratogen); the degree of reproductive damage determines whether populations are adversely affected (Luoma and Presser 2009). It is assumed that for reptiles (such as the giant garter snake) reproductive impairment is among the most sensitive response variables to selenium contamination (USDOI 1998). Therefore, adverse effects to giant garter snakes from dietary exposure to selenium in the aquatic food chain of the south Grasslands are likely to take the form of impaired reproduction.

As established above, drainage contamination from Westlands WD likely contributes to downstream water quality in the Grasslands wetland supply channels. Because of the brief nature of the IRC for Westlands WD, however, the Service concludes that Westlands WD contribution to selenium contamination in the Grasslands wetland supply channels and the San Joaquin River associated with IRC CVP deliveries may adversely affect, but will not appreciably reduce the likelihood of both the survival and recovery of the giant garter snake during the three year life of project.

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 ESA. The discussion of cumulative effects in the 2000 and 2002 biological opinions on IRCs is incorporated by reference.

Many of the indirect effects of the proposed action related to agricultural use of the CVP contract supply are also cumulative effects because not all reasonably foreseeable future activities that adversely affect listed species are solely attributable to the Federal water supply in districts with multiple sources of water. We anticipate cumulative effects in the primarily agricultural water districts over the next two years that are the same as those described above in **Effects of the Action.** We do not expect these effects to be significant based on trends and other information about cropping patterns in the SLU in the recent past (see **Environmental Baseline**), and recent CVP water allocations.

Other cumulative effects we may anticipate include those that result from installation of renewable energy projects. At least one photovoltaic solar project has been proposed in Avenal (see **Environmental Baseline)**, and many more have been proposed in the southern San Joaquin

Valley. These projects may adversely affect San Joaquin kit fox, blunt-nosed leopard lizard, California jewelflower, and San Joaquin wooly-threads by destroying, modifying, degrading, and fragmenting habitat. Photovoltaic solar does not require a water supply.

Summary of Effects

A summary of effects to listed species for Interim Renewal of CVP Contracts for Westlands WD between March 1, 2010, through February 28, 2012, and for the remaining four San Luis Unit M&I contractors between March 1, 2011, through February 28, 2013, is provided in Table 3. below.

Table 3. Summary of Species that May be Affected by SLU Interim Contract Renewals

Species	
San Joaquin kit fox	The currently known species range encompasses all of SLU. On-going urban development and changes in crop type could continue to eliminate suitable habitat within the project area; additional land conversions could occur over the period of the IRC's; however, urban areas in the Cities of Avenal and Huron are not projected to experience significant growth over the period of the IRC's. Known habitat in Coalinga is either situated in areas that are within the FEMA flood zone and off limit to development, or interspersed within the petroleum fields. Effect determination: LTAA but not likely to jeopardize.
California least tern	Likely present in the action area at existing drainage evaporation ponds located within or adjacent to Westlands WD that receive at least some drainage from the District. No new evaporation ponds (not considered in SLDFR) are anticipated during the life of this Interim renewal contract period. Any changes to proposed drainage management, not considered in the SLDFR Opinion will require additional section 7 consultation. Effect determination: LTAA but not likely to jeopardize.
Blunt-nosed leopard lizard	Currently known to occur in Action Area from the Anticline Ridge and Kettleman Hills in the Coalinga and Avenal WD's and in the western areas of the Westlands WD; on-going urban development and changes in crop type continue to eliminate suitable habitat; additional land conversions could occur over the period of the IRC's; however, urban areas in the Cities of Avenal and Huron are not projected to experience significant growth during the duration of the IRC's. Known habitat in Coalinga is either situated in areas that are within the FEMA flood zone and off limit to development, or interspersed within the petroleum fields. Effect determination: LTAA but not likely to jeopardize.
Giant garter snake	In the Westlands WD, with the exception of a heavy rainfall occurrence where floodwater causes sheetflow over district lands, there is no surface discharge of subsurface agricultural drainage within or outside district boundaries. Contaminated shallow groundwater in Westlands WD contributes to drainage contamination downslope and out of the district. Drainage impacts to water quality in surface waters of the Grasslands wetlands, contributes to adverse effects of an already reduced baseline for the snake. These impacts were analyzed in the Grasslands Bypass Project Biological Opinion, 2009. Effect determination: LTAA but not likely to jeopardize.
California jewelflower	Populations are known to occur within the CVP place of use and sphere of influence for the City of Avenal and the City of Coalinga and were present historically within the City of Huron; on-going urban development and changes in crop type continue to eliminate suitable habitat; however, urban areas in the Cities of Avenal, and Huron are not projected to experience significant growth during the duration of the IRC's. Known habitat in Coalinga is either situated in areas that are within the FEMA flood zone and off limit to development, or

	interspersed within the petroleum fields. Effect determination: LTAA but not likely to jeopardize.
San Joaquin woolly-threads	Substantial populations are known to occur within the CVP place of use and sphere of influence for the City of Avenal and the City of Coalinga; on-going urban development and changes in crop type continue to eliminate suitable habitat; however, urban areas in the Cities of Avenal and Huron are not projected to experience significant growth during the duration of the IRC's. Known habitat in Coalinga is either situated in areas that are within the FEMA flood zone and off limit to development, or interspersed within the petroleum fields. Effect determination: LTAA but not likely to jeopardize

CONCLUSION

After reviewing the current status of the San Joaquin kit fox, giant garter snake, California least tern, and blunt-nosed leopard lizard, California jewelflower, and San Joaquin woolly threads, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed is not likely to jeopardize the continued existence of these species.

Our conclusion is based on the conservation measures and anticipated commitments provided in the project description, the short duration of the IRCs, CVP water allocations in the recent past as well as for the year 2010, and that the urban areas in Avenal, Coalinga, and Huron are not expected to experience significant growth during the next two years.

INCIDENTAL TAKE STATEMENT

We can neither anticipate nor quantify the amount or type of incidental take associated with the effects of use of the CVP water supply authorized by renewal of the proposed IRC's that were described in **Effects of the Proposed Action.** We expect that any development projects proposed in these areas that may incidentally take federally listed species, including solar development projects, to obtain incidental take authorization through compliance with either section 7 or section 10(a)(2) of the Act, as appropriate. In addition, farm practices such as pesticide application and type of crop grown are not within the control or authority of Reclamation. As a result, we authorize no incidental take for effects described in **Effects of the Proposed Action**, and propose no reasonable and prudent measures or terms and conditions related to activities that occur within the water service areas of IRC contractors.

CONSERVATION RECOMMENDATIONS

Section 7(a)(l) of the Act directs Federal agencies to utilize their authorities to further the purposes 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. The Service recommends the following to promote the conservation status of the several federally-listed species in the project area:

Implement actions that benefit the recovery needs of the giant garter snake: Reclamation should work with the Service and CDFG to create, enhance and restore additional stable perennial (including summer) wetland habitat for giant garter snakes in the San Joaquin Valley so that they are less vulnerable to reductions in rice production in the vicinity of Grasslands and Mendota Pool. Provision of clean, reliable, level 4 refuge water supplies could provide additional permanent wetland habitat that would benefit giant garter snakes in furtherance of recovery objectives for the species in the San Joaquin Valley. The CVPIA (b)(1)other and the Central Valley Project Conservation Program (CVPCP), conservation grant programs, may be appropriate for such work.

Reclamation should assist the Service in the implementation of recovery actions in the Draft Recovery Plan for the Giant Garter Snake (USFWS 1999). Priority 1 Recovery Actions from these plans include the following:

a. Protect habitat on private lands in the North and South Grasslands for giant garter snakes;
b. Protect habitat on private lands in the Mendota area for giant garter snakes;
c**.** Develop/update and implement management plans for Mendota, China Island, Los Banos, and Volta WAs for giant garter snakes; and

Implement actions that benefit the recovery needs of the San Joaquin kit fox: Reclamation should assist the Service in the implementation of recovery actions in the Recovery Plan for Upland Species in the San Joaquin Valley (USFWS 1998), including pursuing and funding opportunities that expand and connect existing natural land for San Joaquin kit fox in the Mendota area, Fresno County, with the Ciervo-Panoche Natural Area.

Manage retired lands to benefit listed species recovery needs: In accordance with the conservation measure for "strategic land retirement" in the SLDFR biological opinion, Reclamation and/or the Water Authority should work with landowners, in collaboration with the Service and other local resource agencies, to manage retired lands in a manner that maximizes benefits to listed species such as San Joaquin kit fox. This would allow Reclamation to meet its obligation to comply with section 7(a)(2) for both the SLDFR and San Luis Unit long-term contract renewal consultations. These consultations provide a unique opportunity for Reclamation to collaborate in the resolution of a significant resource issue of the southern San Joaquin Valley selenium contaminated drainage, in a way that furthers important resource management goals of both Reclamation and the Service. There is need for evaluation and development of a broad scale landscape mosaic plan for the San Luis Unit and adjacent areas focusing specifically on habitat restoration and endangered species recovery goals. Such a plan could provide guidance to USDOI and Westlands' management efforts on existing retired lands, and guide the Service and Reclamation on evaluation and implementation of future actions in the area. To accomplish this, Reclamation should establish a team of Service and Reclamation staff to negotiate an acceptable land retirement strategy that would address listed species recovery needs.

Optimize SLDFR land retirement with related efforts to maximize benefit to recovery of threatened and endangered species: The Service recommends that Reclamation begin the planning phase for the objectives to further listed species recovery associated with land retirement as soon as possible. The Service further recommends that Reclamation, jointly with the SFWO, convene a drainage technical team under the larger San Joaquin Valley Recovery Team, and invite other interested parties and stakeholders to coordinate and integrate these recovery objectives in a practical manner with other related actions. As discussed in the Environmental Baseline section of this Opinion, an example of an action potentially related to land retirement is encroachment mitigation, a requirement of the SWRCB in their Decision D-1641 (dated March 2000). In D-1641 the SWRCB required in-kind mitigation for encroachment due to the application of CVP water outside the water rights permitted Place of Use for the CVP. As of this date, about 22,000 acres of alkali scrub habitat have yet to be acquired for this mitigation requirement. All of the encroachment of alkali scrub occurred within the San Luis Unit (primarily Westlands) and within the SLDFR project area. The SWRCB D-1641 directed Reclamation to complete this mitigation within ten years of the date of the Decision. Restoration of some of the drainage-impaired retired lands could be used to fulfill this mitigation requirement and could provide habitat that would support listed species such as San Joaquin kit fox.

Adopt a policy that maximizes land retirement (through all appropriate means) on drainage-impaired lands: To avoid and minimize risks and effects to listed species in the San Joaquin Valley, Reclamation should consider retiring from irrigation all drainage impaired lands in the San Luis Unit. This approach would maximize the elimination of drainage at its source and avoid associated adverse effects from drainage contamination in drainage reuse areas, in the Grassland wetland channels, Mud Slough (North) and the San Joaquin River. The Service in the Coordination Act Report for the SLDFR recommended that lands producing drainwater exceeding threshold levels for agricultural toxicants should either be retired from irrigated agriculture or the drainwater be disposed of in a manner that avoids wildlife contact, such as deep-well injection or treatment to render the drainage harmless to the environment (USFWS 2006b).

Expand focus of the SLDFR Mitigation Work Group to include listed species issues.
If USDOI moves forward with implementation of the SLDFR ROD, as recent filings in Federal court would indicate, Reclamation should expand the mitigation work group to address listed species issues of SLDFR planning that has yet be completed. SLDFR issues that have been deferred until a later date include: the preparation of mitigation monitoring and adaptive management plans; full discussion of risks associated with reuse facilities, mitigation and contingency measures; final siting and management planning for project facilities (including mitigation wetlands); and detailed cost estimation and framing of the feasibility analysis.

Ensure a funding source is available to pay for contingencies. Reclamation and the Water Authority should ensure that adequate funding is available for contingencies or adaptive management specific to listed species that arises over the period the GBP Extension is implemented. Such contingencies could include detailed contaminant monitoring to establish risk to San Joaquin kit fox use at reuse areas, or mitigation measures such as fencing of reuse areas or provision of clean wetland compensation habitat for migratory bird impacts at the SJRIP drainage reuse area. Reclamation should estimate and request adequate funding for contingencies that may be needed during the project life in the SLDFR feasibility and budgeting processes. Reclamation should also have contingency funding sources identified (such as acquisition of performance bonds) to enable immediate action to halt adverse effects if stepwise deterrence proves ineffective and prevent prolonged risk to listed species during a reinitiated consultation.

Ensure adequate funding for and quality of water supply for mitigation wetlands.
If USDOI moves forward with implementation of the SLDFR ROD, as recent filings in Federal court would indicate, to maximize benefit to listed species such as giant garter snake, Reclamation should seek allocation of firm, clean, contract water supply for mitigation wetlands. Sources of such water include reverse osmosis treated drainwater, water freed-up by land retirement, or CVP water contract assignments.

Include compliance with 2 µg/L selenium in Grassland wetland water supplies as a GBP performance criterion. As currently envisioned, the GBP project facilities will not be designed to capture and treat drainage generated from: (a) drainage contaminated runoff associated with heavy rainfall events, (b) the DMC sumps and check drains that discharge highly contaminated drainage water into the DMC, (c) and lands to the north of the GDA that still discharge drainage into the Grassland wetland supply channels within the (e.g., Poso and Almond Drain areas). Reclamation should consider including compliance with water quality objectives in the Grasslands wetland channels as a performance criteria. Reclamation should also develop and implement a plan on how to meet selenium objectives in the Grassland wetland supply channels. Compliance with these water quality objectives will likely benefit giant garter snake which forage in these waters.

Monitor and assess the effects of SJRECWA 10-year Transfer Program on water quality and giant garter snake populations in Mud and Salt Sloughs: Reclamation should monitor and assess the effect of reduced flow in Mud and Salt Slough from the SJRECWA 10-Year Transfer program on waterborne selenium concentrations and giant garter snake populations. This is an issue of emerging significance in the environmental baseline for Reclamation actions in this part of the San Joaquin Valley.

Determine effects of selenium and mercury on giant garter snake: Reclamation, together with the Service and other appropriate agencies, should implement a study on the effects of contaminants (specifically selenium and mercury) on giant garter snake surrogate species within the Grassland wetlands, Grassland wetlands supply channels, and Mud Slough (North).

Develop a selenium budget for the Sun Joaquin River, Delta: Reclamation, together with the Service and other appropriate agencies, should complete the studies necessary to develop a selenium budget and to determine the sources, fate and impact of all selenium discharges in the San Joaquin River. This budget would include all presently impaired downstream water bodies used by listed species (e.g., giant garter snake, delta smelt, California clapper rail) including Mud Slough (North), the San Joaquin River, and the North Bay (e.g., Suisun Bay) and Sacramento-San Joaquin Delta.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species and their habitats, the Service request notification of the implementation of any conservation recommendations and, in particular, if and when there are future consultations requests for IRCs and LTCR.

REINITIATION – CLOSING STATEMENT

This concludes formal consultation on the ten IRCs. No further action is needed unless: (1) 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; (2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that is not considered; or (3) a new species is listed or critical habitat designated that may be affected by the action, and (4) discretionary Federal agency involvement or control over the action is maintained (or authorized by law). Reclamation should continue to monitor these actions and review this determination as needed based on the reinitiation criteria.

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 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. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any question regarding the proposed Interim Renewal of Water Service Contracts consultation, please contact Kenneth Sanchez at (916) 414-6620.

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Cypher, Brian. (2008, 2009). Electronic mail from Biologist, Endangered Species Recovery Program, California State University-Stanislaus, Bakersfield, California, to Karen Leyse, Fish and Wildlife Biologist, Recovery Branch, Endangered Species Division, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service, Sacramento, CA. Emails provided information on status of core and satellite population status for the San Joaquin kit fox, providing information on disease prevalence, and providing information on current available habitat.

Erickson, Bill. (2006). Rodenticides Incidents Update: memorandum from B. Erickson, Biologist, to Susan Lewis, Chief, SRRD, EPA, Washington D.C. November 15, 2006.

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Hosea, Robert. (1999). Letter from Principal Investigator, Pesticide Investigations Unit, California Department of Fish and Game, Rancho Cordova, California, to Christine Van Horn Job, Wildlife Biologist, Endangered Species Recovery Program, California State University-Stanislaus, Bakersfield, CA. October 14, 1999

Kinsey, Michael. (2010). Electronic mail transmitting environmental commitment for the project description of the Interim Contract Renewal ESA consultation, from Wildlife Biologist, U.S. Bureau of Reclamation, Fresno, California to Kathy Wood, Assistant Field Supervisor, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, Sacramento, CA.

Lowe, Jason. (2006). Electronic mail from Wildlife Biologist, U.S. Bureau of Land Management, Hollister, California to Joseph Terry, Biologist, San Joaquin Valley Branch, Endangered Species Division, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service, Sacramento, CA.

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Area Manager, Bureau of Reclamation, South Central California Area Office, Fresno, CA

McMillin, Stella. (2008). Electronic message from Stella McMillin, Environmental Scientist, Pesticide Investigations Unit, California Department of Fish and Game, to Karen Leyse of the U.S. Fish and Wildlife Service. September 3, 2008.

Moore, Michael L. (2008). Electronic messages (with attachment) from Associate Wildlife Biologist, California National Guard, Camp Roberts Headquarters, to Karen Leyse, Fish and Wildlife Biologist, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service, Sacramento, CA. June 27 and June 30, 2008.

Mueller, Mark. (2008). Electronic message to Janice Gann, Biologist, CDFG, forwarded to Sheila Larsen, Senior Fish and Wildlife Biologist, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service, Sacramento, CA. September 8, 2008.

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Pau, Nancy. (2002). Memorandum from Nancy Pau, U.S. Fish and Wildlife Service, to Cay Goude, Mike Fris, Vicki Campbell, and Jan Knight: New information affecting the San Joaquin kit fox conservation strategy in the San Joaquin Multi-species and Open Space Plan. February 12, 2002. File: RI E-1 KF PACT.

Saslaw, Larry. (2007). Electronic mail from Field Manager, Bureau of Land Management, Bakersfield, California to Karen Leyse, Recovery Branch, Endangered Species Division, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service, Sacramento, CA.

Vance, Julie. (2006). Electronic mail regarding native habitat being disked in Kings County from Environmental Scientist, Permitting and Regionwide Conservation Planning, California Dept. Fish and Game, Fresno, California, to Susan P. Jones, Chief, San Joaquin Valley Branch, Endangered Species Division, U.S. Fish and Wildlife Service, Sacramento, CA.

Williams, D.F. (1989). Letter to R. Schlorff, CDFG, Sacramento, CA.

Williams, Pam. (2006). Electronic mail from Refuge Biologist, Kern National Wildlife Refuge Complex, Delano, California to Joseph Terry, Biologist, San Joaquin Valley Branch, Endangered Species Division, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service, Sacramento, California.

Williams, Pam. (2007). Electronic mail from Refuge Biologist, Kern National Wildlife Refuge Complex, Delano, California to Joseph Terry, Biologist, San Joaquin Valley Branch, Endangered Species Division, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service, Sacramento, CA.

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Wylie, Glenn, D.(2006) Electronic mail on observations of river otter predation on giant garter snakes from Research Biologist, U.S. Geological Survey, Western Ecological Research Center, Dixon, CA, to Elizabeth Warne, Recovery Biologist, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service, Sacramento, CA.

Personal Communications

Clark, L. (2008). Fort Hunter Liggett Military Reservation, California, provided information on the status of the kit fox at the facility. December 8, 2008.

Coolahan, C. (2009). USDA APHIS State Director, Wildlife Services, Sacramento, CA. Provided information on predator and rodent control materials currently authorized for use by APHIS within the range of the San Joaquin kit fox. January 22, 2009.

Cypher, B. (2008). Researcher/Wildlife Biologist, Endangered Species Recovery Program. California State University-Stanislaus (Bakersfield). Provided information on the recovery strategy for the kit fox, on the fox's status in core and satellite areas, and on research activities to Karen Leyse, Fish and Wildlife Biologist, U.S. Fish and Wildlife, Sacramento Field Office. August 19, 2008, Bakersfield, CA.

Dixon, B. (2009). Environmental Engineer, Occidental of Elk Hills, Inc., Bakersfield, CA. Provided information on management of Occidental oilfield and conservation holdings, and measures to prevent OHV damage to holdings. January 13, 2009.

Golden, N. (2008). USFWS, Division of Environmental Quality, Arlington, VA. Provided information on status of Informal Consultation with the USEPA on Second Generation Anticoagulant Rodenticides.

Gruenhagen, N. (2006). Personal Communication. Bureau of Reclamation, Mid-Pacific South Central California Area Office, Fresno, CA.

Hansen, G. (1991). Consulting Herpetologist, Sacramento, CA.

Hansen, G. (1998). Consulting Herpetologist, Sacramento, CA.

Hansen, E. (2008). Consulting Environmental Biologist, Sacramento, CA. Provided information on population trends, threats, and recommendations for future actions.

Kelly, P. (2000). Endangered Species Recovery Program, Fresno, pers. comm. to P. White, Fish and Wildlife Service, Sacramento, April 6, 2000.

Littlefield, M. (2007). Fish and Wildlife Biologist, USFWS, formerly Lead Fish and Wildlife Biologist for Fort Hunter Liggett and Camp Roberts Military Reserves, Department of Defense.

Moore, M. L. (2008). Provided information on kit fox at Camp Roberts to Karen Leyse, Fish and Wildlife Biologist, SFWO, USFWS, Sacramento, California. June, 2008.

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Roberts, J. (2006). Director, The Natomas Basin Conservancy.

Saslaw, L. (2008, 2009). Field Manager. U.S. Bureau of Land Management. Bakersfield, CA. Provided information on issues pertaining to the kit fox on BLM lands, including Carrizo Plains National Monument. 2007, October 7 and 16, 2008, January 5, 2009, February 4, 2009.

Toto, A.L. (2010). Water Resources Engineer, Central Valley Regional Water Quality Control Board, Fresno, Ca. Provided information pertaining to drainwater evaporation basins in the vicinity of Westlands Water District.

Vance, J. (2007). Wildlife Biologist. California Department of Fish and Game. Fresno, California.

Wylie, G. (2005, 2006). U.S. Geological Survey, Biological Resources Division, Dixon.