Supplemental Responses to CEC Data Requests: Nos. A56 and A211

Amended Application for Certification for HYDROGEN ENERGY CALIFORNIA (08-AFC-8A) Kern County, California

Prepared for:
Hydrogen Energy California LLC

hydrogen energy california

Submitted to:

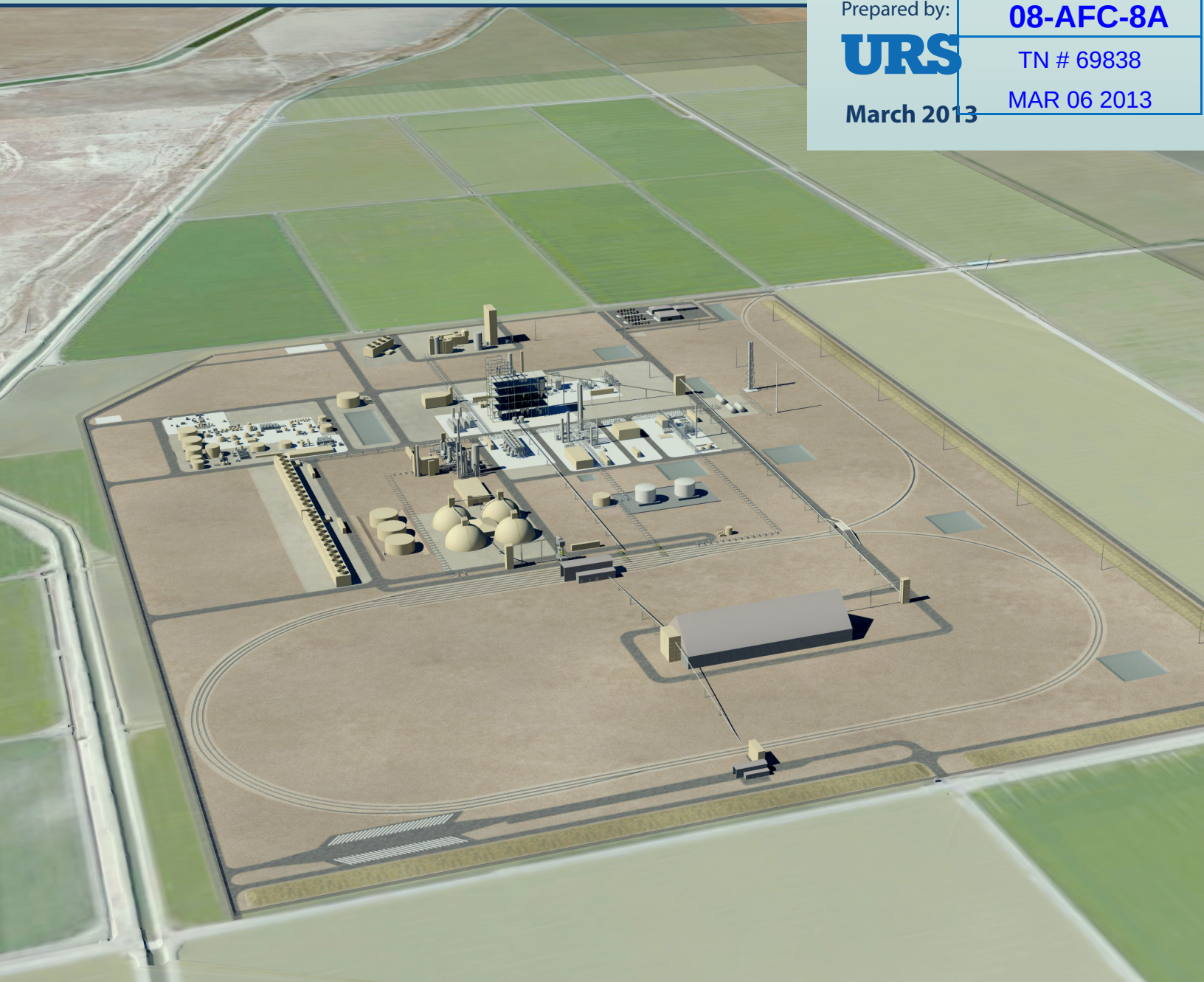
California Energy Commission

U.S Department of Energy

Prepared by:

URS

March 2013



SUPPLEMENTAL RESPONSES TO DATA REQUESTS NOS. A56 and A211
FROM CALIFORNIA ENERGY COMMISSION (CEC)

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LIST OF ACRONYMS AND ABBREVIATIONS USED IN RESPONSES

AFC	Application for Certification
BA	Biological Assessment
BVWSD	Buena Vista Water Storage District
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CEC	California Energy Commission
CEQA	California Environmental Quality Act of 1970
CO_2	carbon dioxide
DOE	Department of Energy
EOR	Enhanced Oil Recovery
HECA	Hydrogen Energy California
MW	megawatt
OEHI	Occidental of Elk Hills, Inc.
PG&E	Pacific Gas & Electric
ROW	right-of-way
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service

Technical Area: Biological Resources
Author: Amy Golden

HABITAT IMPACTS

BACKGROUND

Staff needs to accurately calculate habitat impacts in order to determine species habitat loss and appropriate mitigation acreage. Since the applicant has indicated that the majority of the project's impacts would be temporary and subject to revegetation activities, staff must understand how impact acreages were determined. As mentioned previously, the directional drilling associated with the CO_2 pipeline under the levee, two water canals (West Side Outlet Canal, California Aqueduct), four intersection improvement areas that are impact areas associated with the project and must be included in impact calculations.

DATA REQUEST

A56. Please explain how permanent and temporary impacts were calculated in Table 5.2-6 and whether calculations in this table represent existing acreage or impacted acreage. If this table provides impact calculations, please explain why these calculations differ from the calculations in Table 2-1, Project Description.

SUPPLEMENTAL RESPONSE

A Biological Assessment (BA) for the Hydrogen Energy California (HECA) Project was submitted by DOE to the United States Fish and Wildlife Service (USFWS) on March 1, 2013 (see Attachment A56-1). Revised Table A56-1 (which is the same as Table 6 in the BA) is an updated summary of the permanent and temporary habitat impacts, and supersedes Table 5.2-6 from the 2012 Amended AFC and Table A56-1 previously provided in response to the California Energy Commission (CEC) Data Request A56 submitted in August 2012. Revised Table A56-1 is consistent with Revised Table A211-1; see supplemental response to CEC Data Request A211 provided below.

Revised Table A56-1
Area of Direct Effects to Habitats and Existing Land Use Types within the Action Area (Acres)

	Project Site		Construction Staging Area		Railroad Spur		Railroad Spur Laydown Yard		Natural Gas Pipeline		Process Water Supply Pipeline and BVWSD Well Field		Transmission Line/PG&E Switching Station/ Potable Water Pipeline		OEHI CO_2 Pipeline[2]		OEHI EOR Facilities[2]		Total[5]	
Habitat/ Land Use Types[1]	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**
Alfalfa	–	118.0	59.8	–	1.7	5.3	2.0	–	3.4	–	5.9	1.15	2.8	3.29	–	–	–	–	75.6	127.74
Other Row Crop	–	317.3	20.0	–	3.5	16.2	–	–	9.4	0.23	1.7	–	–	–	–	–	–	–	34.6	333.73
Orchards	–	–	–	–	1.1	4.5	–	–	0.6	–	2	–	0.7	0.01	–	–	–	–	4.4	4.51
Natural/ Ruderal	–	–	–	–	–	–	–	–	3.7	–	–	–	–	–	28.89	0.11	–	63.79	32.59	63.90
Developed/ Disturbed	–	17.7	11.2	–	3.3	12.4	1.0	–	30.1	–	79.5	–	3.7	0.85	–	–	–	–	128.8	30.95
Total	**–**	**453.0**	**91.0**	**–**	**9.6**	**38.4**	**3.0**	**–**	**47.2[3]**	**0.23**	**89.1**	**1.15[4]**	**7.2**	**4.15**	**28.89**	**0.11**	–	**63.79**	**275.99**	**560.83**

Notes:

[1] Areas not designated as crop land or Natural/Ruderal land have been classified as Developed/Disturbed.

[2] Source: Stantec (Stantec Corporation). DOE Data Request – Initial Injection Phase Project Description. Prepared for Occidental of Elk Hills, Inc. December 13, 2012.

[3] The area of temporary habitat disturbance along the portion of the natural gas linear that follows the railroad spur from the Project Site to the interconnection of the railroad with the existing San Joaquin Valley Railroad line is included in the temporary effects for the railroad spur.

[4] The area that would be permanently affected is based on five wells that would occupy approximately 100 feet by 100 feet each. The exact well locations are not known, but the entire area is assumed to be within alfalfa fields.

[5] Total habitat/land use area disturbed during construction is the sum of the temporary disturbance area and the permanent disturbance area.

CO_2 = carbon dioxide

EOR = enhanced oil recovery

OEHI = Occidental of Elk Hills, Incorporated

PG&E = Pacific Gas and Electric Company

ATTACHMENT A56-1
BIOLOGICAL ASSESSMENT

HYDROGEN ENERGY CALIFORNIA
KERN COUNTY, CALIFORNIA

BIOLOGICAL ASSESSMENT

Prepared for:

U.S. Department of Energy
Environmental Compliance Division
National Energy Technology Laboratory
Pittsburgh, PA 15236-0940

On behalf of:

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URS Project Number 28068052

February 2013

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

March 1, 2013

Thomas Leeman
Chief, San Joaquin Valley Division
U.S. Fish and Wildlife Service
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Dear Mr. Leeman:

The U. S. Department of Energy (DOE) is proposing to provide financial assistance to construct the Hydrogen Energy California (HECA) Integrated Gasification Combined-Cycle Polygeneration Project in western Kern County, California. The enclosed biological assessment (BA) evaluates potential effects to endangered and threatened species and designated critical habitats associated with the construction and operation of the HECA Project and the related Occidental of Elk Hills, Inc. (OEHI) Project (the proposed action). A detailed description of the proposed action and the area that would be affected by the proposed action is provided in the BA.

Formal consultation was originally initiated on February 4, 2010 with the transmittal of the draft BA. The enclosed version of the BA has been revised to address comments provided by the USFWS on August 6, 2010 and subsequent project modifications.

Although the DOE is not providing financial assistance to OEHI in connection with the OEHI Project, this BA evaluates the potential effects associated with the OEHI Project during the demonstration period as reasonably foreseeable indirect effects of the proposed agency action.

As described in the enclosed BA (*2 copies*), the proposed action may affect and is likely to adversely affect, the following species that are listed under the Endangered Species Act (ESA):

- Blunt-nosed leopard lizard;
- Giant kangaroo rat;
- Tipton kangaroo rat; and
- San Joaquin kit fox.

However, the proposed action may affect, but is not likely to adversely affect, the following species that is listed as endangered under the federal ESA:

- Buena Vista Lake shrew.

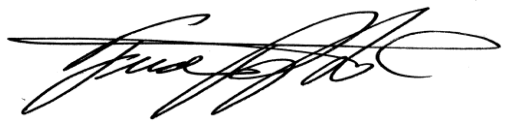
There is no designated critical habitat in the action area, and the proposed action would not affect the designated critical habitat.

3610 Collins Ferry Road, P.O. Box 880, Morgantown, WV 26507
fred.pozzuto@netl.doe.gov • Voice (304) 285-5219 • Fax (304) 285-4403 • www.netl.doe.gov

The current condition and locations of the affected species are described in the BA. Potential effects would include temporary and permanent loss of habitats potentially utilized by blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, and San Joaquin kit fox associated with the proposed action. The construction, operation, and decommissioning of the HECA Project and the OEHI Project will also disturb, and in some limited instances, result in mortality of individuals. Avoidance and minimization measures are proposed or already exist that would reduce potential take of federally listed species and provide long-term beneficial effects. These measures would avoid or minimize the potential for mortality, disturbance, and habitat degradation, as well as, other potential adverse effects on federally listed species. Additional conservation measures would restore and provide permanent protection and enhancement of habitats for federally listed species in the action area. Collectively, when implemented, these measures would avoid jeopardy of the affected species, and improve opportunities for recovery of the species.

DOE requests initiation of formal consultation under Section 7(a)(2) of the ESA. We look forward to working with you towards the successful resolution of this process. Please contact me at (304) 285-5219, or contact HECA's biological consultant, Steve Leach, at (510) 874-3205 regarding this consultation request.

Sincerely,



Fred E. Pozzuto
NEPA Compliance Officer

Enclosure

CEC - Mr. B. Worl

cc w\o enclosure:

URS - Mr. S. Leach
SCS Energy - Ms. M. Mascaro

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List of Acronyms

AB	Assembly Bill
ADT	average daily traffic
AFC	Application for Certification
APLIC	Avian Power Line Interaction Committee
APN	Assessor's Parcel Number
BA	Biological Assessment
bgs	below ground surface
BRMIMP	Biological Resource Mitigation Implementation and Monitoring Plan
BVWSD	Buena Vista Water Storage District
CCPI	Clean Coal Power Initiative Round 3
CD	compact disc
CDFG	California Department of Fish and Game
CEC	California Energy Commission
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CO_2	carbon dioxide
CRP	CO_2 Recovery Plant
CTB	Central Tank Battery
DOE	U.S. Department of Energy
EHOF	Elk Hills Oil Field
EOR	enhanced oil recovery
ESA	Endangered Species Act
GIS	Geographic Information System
HCP	Habitat Conservation Plan
HDD	Horizontal directional drilling
HECA	Hydrogen Energy California
I-5	Interstate 5
KRFCC	Kern River Flood Control Channel
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
OEHI	Occidental of Elk Hills, Incorporated
petcoke	petroleum coke
PG&E	Pacific Gas and Electric Company
Project	HECA power generating facility
RCF	Reinjection Compression Facility
ROW	right-of-way
SR	State Route
syngas	synthesis gas
USC	U.S. Code
URS	URS Corporation
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WKWD	West Kern Water District

EXECUTIVE SUMMARY

Hydrogen Energy California LLC (HECA LLC) is proposing an Integrated Gasification Combined-Cycle polygeneration project (hereafter referred to as the HECA Project). HECA LLC is owned by SCS Energy California LLC. The HECA Project will gasify a 75 percent coal and 25 percent petroleum coke fuel blend to produce synthesis gas (syngas). Syngas produced via gasification will be purified to hydrogen-rich fuel, which will be used to generate low-carbon baseload electricity in a Combined-Cycle Power Block; low-carbon nitrogen-based fertilizer in an integrated Manufacturing Complex; and carbon dioxide (CO_2) for use in enhanced oil recovery (EOR).

The fertilizer and power produced by the HECA Project have a low-carbon footprint, because more than 90 percent of the CO_2 in the syngas is captured and approximately 3 million tons per year of CO_2 is transported via pipeline for use in EOR, which results in simultaneous sequestration (storage) of the CO_2 in a secure geologic formation (HECA, 2012). CO_2 will be transported for use in EOR in the adjacent Elk Hills Oil Field, which is owned and operated by Occidental of Elk Hills, Inc. (OEHI) (hereafter referred to as the OEHI Project). This Biological Assessment (BA) covers both the HECA Project and the OEHI Project during the period of the U.S. Department of Energy (DOE) Demonstration Period, which is explained below.

The DOE is providing financial assistance to the HECA Project under the Clean Coal Power Initiative Round 3 (CCPI) via a cost-sharing agreement with HECA LLC covering project construction and a "Demonstration Period" for the first 2 years of project operations. The DOE's financial assistance for the construction and operation of the HECA Project during the Demonstration Period is referred to herein as the proposed Agency Action. The DOE will analyze potential environmental impacts associated with the proposed Agency Action by preparing an Environmental Impact Statement pursuant to the National Environmental Policy Act (NEPA). The DOE and the California Energy Commission plan to prepare a joint Environmental Impact Statement/Environmental Impact Report equivalent to satisfy both the requirements of NEPA and the California Environmental Quality Act.

Pursuant to the federal Endangered Species Act (ESA), DOE must ensure that "any action authorized, funded, or carried out…is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat. . ." 16 U.S. Code § 1536[a][2]. Although the DOE would not have any regulatory authority over the HECA Project or the OEHI Project, the funding associated with the proposed Agency Action triggers the need for DOE to consult with the U.S. Fish and Wildlife Service pursuant to Section 7 of the ESA regarding potential effects of the proposed Agency Action on endangered or threatened species.

Accordingly, this BA has been prepared to facilitate the Section 7 consultation process. The scope of this BA covers potential effects to endangered and threatened species associated with the construction and operation of the HECA Project and the OEHI Project. Operational effects are evaluated for the 25-year life of the HECA Project, and during the Demonstration Period for the OEHI Project. Although the DOE is not providing financial assistance to OEHI in

connection with the OEHI Project, this BA evaluates the potential effects associated with the OEHI Project during the Demonstration Period as reasonably foreseeable indirect effects of the proposed Agency Action.

Construction, operation, and decommissioning of the HECA Project and the OEHI Project, including associated linears (pipelines, rail spurs, transmission lines, etc.) are likely to adversely affect the following federally listed species:

- Blunt-nosed leopard lizard;
- Giant kangaroo rat;
- Tipton kangaroo rat; and
- San Joaquin kit fox.

The proposed action may affect but is not likely to adversely affect the following species that is listed as endangered under the federal ESA:

- Buena Vista Lake shrew.

These determinations are based on temporary and permanent loss, associated with the proposed action, of habitats potentially used by blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, and San Joaquin kit fox. Construction, operation, and decommissioning of the HECA Project and the OEHI Project will also disturb—and in some limited instances, result in—mortality of individuals. Avoidance and minimization measures are proposed, or already exist, that would reduce potential take of federally listed species and provide long-term beneficial effects. These measures include actions that would avoid or minimize the potential for mortality, disturbance, habitat degradation, and other potential adverse effects on federally listed species. Additional conservation measures would restore and provide permanent protection and enhancement of habitats for federally listed species in the Action Area (defined below). Collectively, when implemented, these measures would avoid jeopardy of the affected species, and improve opportunities for recovery of the species.

1.0 INTRODUCTION

Hydrogen Energy California LLC (HECA LLC) is proposing an Integrated Gasification Combined-Cycle polygeneration project (hereafter referred to as the HECA Project). HECA LLC is owned by SCS Energy California LLC. The HECA Project will gasify a 75 percent coal and 25 percent petroleum coke (petcoke) fuel blend to produce synthesis gas (syngas). Syngas produced via gasification will be purified to hydrogen-rich fuel, which will be used to generate low-carbon baseload electricity in a Combined-Cycle Power Block, low-carbon nitrogen-based fertilizers in an integrated Manufacturing Complex, and carbon dioxide (CO_2) for use in enhanced oil recovery (EOR).

The fertilizers and power produced by the HECA Project have a low-carbon footprint because more than 90 percent of the CO_2 in the syngas is captured and approximately 3 million tons per year of CO_2 is transported via pipeline for use in EOR, which results in simultaneous sequestration (storage) of the CO_2 in a secure geologic formation (HECA, 2012). CO_2 will be transported (via a ±3.4-mile pipeline) for use in EOR in the adjacent Elk Hills Oil Field (EHOF), which is owned and operated by Occidental of Elk Hills, Inc. (OEHI) (hereafter referred to as the OEHI Project). This Biological Assessment (BA) covers both the HECA Project and the OEHI Project during the period of the U.S. Department of Energy (DOE) Demonstration Period, as explained below.

The 453-acre HECA Project Site is approximately 7 miles west of the city of Bakersfield, and approximately 2 miles northwest of the unincorporated community of Tupman in western Kern County, California (Figure 1, Project Location). The HECA Project Site is adjacent to the EHOF (Figure 2, Project Vicinity). HECA has an agreement to purchase the HECA Project Site, as well as an additional 653 acres adjacent to the HECA Project Site, herein referred to as the Controlled Area (Figure 3, Project Site Map). The HECA Project Site and Controlled Area are currently used for farming purposes, including the cultivation of cotton, alfalfa, and onions.

OEHI is proposing to extend the life of the EOR operations at its Elk Hills Unit by using CO_2 to facilitate oil production. A pipeline will be constructed to transport CO_2 from the HECA Project Site to the OEHI Project Site; it will temporarily disturb approximately 28.89 acres and permanently impact approximately 0.11 acre. In addition, the OEHI Project will include construction of a 60.61-acre CO_2 EOR processing facility; and three additional 1.06-acre Satellite Gathering Stations for CO_2 EOR and sequestration. The OEHI Project will also use existing producing and injection wells.

The DOE has proposed providing financial assistance to the HECA Project under the Clean Coal Power Initiative Round 3 (CCPI) via a cost-sharing agreement with HECA LLC, covering project

construction and a "Demonstration Period" for the first 2 years of project operations.[1] The DOE's proposed financial assistance for the construction and 25-year operation of the HECA Project, as well as the construction and operation of the OEHI Project during the Demonstration Period, is referred to herein as the proposed Agency Action. The DOE will analyze potential environmental impacts associated with the proposed Agency Action by preparing an Environmental Impact Statement pursuant to the National Environmental Policy Act (NEPA).[2] The DOE and the California Energy Commission (CEC) plan to prepare a joint Environmental Impact Statement/Environmental Impact Report equivalent to satisfy both the requirements of NEPA and the California Environmental Quality Act.[3]

Pursuant to the federal Endangered Species Act (ESA), DOE must ensure that "any action authorized, funded, or carried out…is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat. . ."[4] Although the DOE would not have any regulatory authority over the HECA Project or the OEHI Project, the funding associated with the proposed Agency Action triggers the need for DOE to consult with the U.S. Fish and Wildlife Service (USFWS) pursuant to Section 7 of the ESA, regarding potential effects of the proposed Agency Action on endangered or threatened species.

Accordingly, this BA has been prepared to facilitate the Section 7 consultation process. The scope of this BA covers potential effects to endangered and threatened species associated with the construction and operation of the HECA Project. Operational effects are evaluated for the

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1 *See* DOE website, Clean Coal Power Initiative Round 3 ("On July 1, 2009, U.S. Department of Energy Secretary Steven Chu announced that projects by Basin Electric Power Cooperative and Hydrogen Energy International HECA LLC had been selected for up to $408 million in funding from the American Recovery and Reinvestment Act.") http://www.fossil.energy.gov/recovery/projects/ccpi.html. The DOE and HECA LLC entered into a Cooperative Agreement effective September 30, 2009. Under this agreement, the DOE has awarded up to $408 million in government sharing of the HECA Project costs associated with project construction and the Demonstration Period. Total HECA Project costs are estimated to be $4 billion; however, more detailed estimates are currently being prepared. *See* DOE website, DOE Signs Cooperative Agreement for New Hydrogen Power Plant, November 6, 2009, http://www.fossil.energy.gov/news/techlines/2009/09077-DOE_Signs_ Cooperative_Agreement.html. The DOE financial assistance under the CCPI program relates to project construction and the Demonstration Period defined by a Cooperative Agreement between HECA LLC and the DOE.

2 *See* DOE, Amended Notice of Intent Modifying the Scope of the Environmental Impact Statement for the Hydrogen Energy California's Integrated Gasification Combined Cycle Project, Kern County, CA, 77 Fed. Reg. 36519 (June 19, 2012).

3 *See* 77 Fed. Reg. 36519, 36520.

4 16 USC § 1536[a][2]. Under the ESA, "[a]ction" is defined as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies" (50 Code of Federal Regulations § 402.02). The "effects of the action" are defined as "direct and indirect effects of an action ... together with the effects of other activities that are interrelated or interdependent with that action" (50 CFR § 402.02). "Interrelated actions" are, in turn, defined by the Services' regulations as "those that are part of a larger action and depend on the larger action for their justification." Interdependent action is defined as "those that have no independent utility apart from the action under consideration" (50 CFR § 402.02). Indirect effects as "those that are caused by the proposed action and are later in time, but still are reasonably certain to occur" (50 CFR § 402.02).

25-year operation of the HECA Project, and for the OEHI Project during the Demonstration Period. Although DOE is not providing financial assistance to OEHI in connection with the OEHI Project, this BA evaluates the potential effects associated with the OEHI Project during the Demonstration Period as reasonably foreseeable indirect effects of the proposed Agency Action.

The EHOF has already been the subject of Section 7 consultation. The EHOF is currently being operated in compliance with a 1995 Biological Opinion (Appendix A) issued by the USFWS, and a related 1997 Memorandum of Understanding (MOU) between OEHI and the California Department of Fish and Game (CDFG) (Appendix B) that has twice been updated, and remains in effect until 2014 (CDFG, 1997; 1999; 2010). The earlier Section 7 consultation was undertaken in connection with the Supplemental Environmental Impact Statement/Program Environmental Impact Report for the federal government's divestment of the EHOF, and that document contemplated CO_2 EOR and associated impacts. Compliance with the 1995 USFWS Biological Opinion and the 1997 CDFG MOU has been documented in annual and semi-annual monitoring reports submitted to USFWS since 1998.

OEHI reinitiated consultations with USFWS and CDFG in 2002 to support a multi-decade Habitat Conservation Plan (HCP) for the EHOF, and anticipates the new HCP being approved by the end of 2013. The new HCP is being negotiated in contemplation of continued operations consistent with the Supplemental Environmental Impact Statement/Program Environmental Impact Report for the federal government's divestment of the EHOF. OEHI reinitiated consultations with USFWS and CDFG to support a 50-year HCP for all production operations at the field, and anticipates that the Biological Opinion and MOU will be replaced by new Section 10 and Section 2081 permits supported by the HCP at some point in the future. However, until that occurs, the Biological Opinion remains in effect indefinitely, and the MOU remains in effect until December 31, 2014.

1.1 PROJECT PURPOSE AND NEED

The DOE proposed Agency Action is to provide limited financial assistance for the development, construction, and demonstration of the HECA Project. DOE has selected the HECA Project through a competitive process under the CCPI program. The Purpose and Need for DOE's proposed Agency Action are to advance the CCPI program by funding projects that have the best chance of achieving the program's objective as established by Congress—the commercialization of clean coal technologies that advance efficiency, environmental performance, and cost competitiveness well beyond the level of technologies that are currently in commercial service. The proposed HECA Project was selected under the CCPI program as one in a portfolio of projects that would represent the most appropriate mix to achieve programmatic objectives and meet legislative requirements.

The HECA Project will be a state-of-the-art facility that will produce electricity and other useful products for California with dramatically lower carbon emissions compared to traditional facilities.

The HECA Project is needed to provide dependable, low-carbon electricity to help meet future power needs, and to help "back up" intermittent renewable power sources, such as wind and solar, to support a reliable power grid. The HECA Project is also needed to provide low-carbon nitrogen-based fertilizers.

According to DOE:

> *The project will be among the cleanest of any commercial solid fuel power plant built or under construction and will significantly exceed the emission reduction targets for 2020 established under the Energy Policy Act of 2005. In addition, emissions from the project plant will be well below the California regulation requiring baseload plants to emit less greenhouse gases than comparably-sized natural gas combined cycle power plants (U.S. Department of Energy, HECA Project Facts, November 2011).*

In addition to DOE's directive to meet emission reduction targets by 2020, California Assembly Bill 32 (AB 32) also has a directive to reduce greenhouse gas emissions to 1990 levels by 2020. AB 32 requires the California Air Resources Board to assign emissions targets to each sector in the California economy, and to develop regulatory and market methods to ensure compliance. These government actions reinforce the timeliness of the HECA Project.

The HECA Project will achieve these important environmental objectives by capturing carbon from its processes and transporting the CO_2 for use in EOR, resulting in permanent sequestration (storage) in secure geologic formations within the earth. A key factor in the siting of the HECA Project is its proximity to EHOF. The EHOF offers an opportunity to beneficially use the CO_2 for EOR. In addition, because of the extensive and long-standing operations at the EHOF, much is known about the subsurface geology, which verifies that it is an ideal location for sequestration. Finally, locating the HECA Project adjacent to the EHOF minimizes the distance the CO_2 must be transported. The proposed Project Site is also close to existing power transmission and natural gas infrastructure, as well as a viable cooling water supply, all of which minimizes the cost and impacts of associated water and natural gas pipelines and electric transmission lines.

DOE recognizes HECA's importance in advancing carbon capture and sequestration:

> *A need exists to further develop carbon management technologies that capture and store or beneficially reuse carbon dioxide (CO_2) that would otherwise be emitted into the atmosphere from coal-based electric power generating facilities. Carbon capture and storage (CCS) technologies offer great potential for reducing CO_2 emissions and mitigating global climate change, while minimizing the economic impacts of the solution. Once demonstrated, the technologies can be readily considered in the commercial market-place by the electric power industry (U.S. Department of Energy, HECA Project Facts, November 2011).*

The HECA Project will provide numerous local, state, regional, national, and global benefits, including the following:

- Promoting energy security by converting abundant and inexpensive solid fuels—petcoke and coal—to clean hydrogen fuel to produce electricity and other useful products.

- Advancing a hydrogen-based transportation system in California by increasing the supply of available hydrogen.

- Improving the reliability of California's electrical grid by generating a nominal 300 megawatts of new, low-carbon baseload electricity—enough electricity to power over 160,000 homes.

- Supporting California's agricultural industries by producing over 1 million tons per year of low-carbon fertilizer.

- Reducing greenhouse gas emissions by capturing approximately 3 million tons of CO_2 per year—equivalent to eliminating 650,000 automobiles from the road—and transporting it for use in EOR, resulting in permanent sequestration.

- Demonstrating the commercial viability of carbon capture and sequestration as a viable method for reducing the carbon footprint of power generation and manufacturing.

- Promoting energy independence by increasing California's production of oil through EOR, extracting an otherwise unrecoverable 5 million barrels of oil each year.

- Improving local groundwater quality and agricultural production by extracting, treating, and using degraded groundwater.

- Providing local jobs to an estimated 2,500 construction workers at peak construction, and to 200 fulltime employees during Project operations.

- Boosting the local and California economy through direct investment and the resulting economic activity and tax revenues in the billions of dollars.

1.2 PURPOSE OF THE BIOLOGICAL ASSESSMENT

This BA documents potential effects of the HECA Project and the OEHI Project on federally listed threatened and endangered species within the Action Area. In addition to construction effects of the proposed facilities, this BA evaluates potential effects during the 25-year operational life of the HECA Project and the 2-year Demonstration Period of the OEHI Project. The Action Area is defined in this BA as the 453-acre HECA Project Site, the 4-acre Pacific Gas and Electric Company (PG&E) switching station, the 1.15–acre water wells, the 93-acre OEHI Project Site, and the construction footprints of the associated linear facilities and adjacent areas that could be directly or indirectly affected by the proposed action (50 Code of Federal Regulations §402.02). Consistent with CEC guidelines and the federal ESA regulations, the Action Area evaluated in this BA is a 1-mile area around the HECA Project Site, a 1,000-foot area adjacent to all associated linear facilities including the CO_2 pipeline, and the OEHI Project

Site. This BA was prepared in accordance with Section 7 of the ESA (16 U.S. Code [USC] 1536 [c]), and follows the standards established in DOE NEPA guidelines.

This BA is organized into eight sections based on the USFWS recommended outline (2008). Section 1 introduces the HECA Project and OEHI Project, HECA Project benefits, as well as the purpose and need for the proposed HECA Project, as detailed above in Section 1.1. Section 2 describes the HECA Project and OEHI Project in more detail. Section 3 describes the environmental setting, including the vegetation communities within the Action Area. Section 4 describes the study methods used to identify the federally listed species that may be affected by the HECA Project and OEHI Project, and describes the life history of these species. Section 5 evaluates the potential adverse effects to these species and associated habitats. Section 6 summarizes the effects to these species and habitat, and includes an effects determination for each species. References are listed in Section 7, and the list of preparers for this BA is provided in Section 8.

The scope of this document is for use by the DOE to support consultation with the USFWS under the ESA. Potential effects on federally listed species are evaluated in accordance with Section 7 of the ESA (16 USC 1536). Criteria used to determine which species were considered for this BA and potential adverse effects to those species from HECA Project and OEHI Project activities are presented in Section 4. In addition, this BA proposes conservation measures to avoid and/or minimize mortality or disturbance to potentially affected species (Section 2).

1.3 SPECIES CONSIDERED IN THIS BIOLOGICAL ASSESSMENT

Federally listed species occurrences and associated habitats in the Action Area are identified based on the results of a literature review, comprehensive background search, and field surveys. A search of four U.S. Geological Survey (USGS) quadrangles in the HECA Project area was conducted (Appendix C); this list was reduced based on habitat and known ranges. The eight species listed as federally endangered or threatened that have the potential to occur within the Action Area are listed in Table 1 (on the following page). These federally listed species are discussed in Sections 4, 5, and 6, and are the subject of this BA. There is no designated Critical Habitat in the Action Area or the vicinity.

1.4 HISTORY OF CONSULTATION

HECA and the DOE have coordinated with the USFWS regarding the HECA Project since 2008. Consultation has included informal discussion, site visits, and formal submittals. A detailed chronology of coordination with the USFWS regarding the HECA Project and the federal Section 7 consultation process is presented below. It should be noted that the original BP/Rio Tinto Project was located in a more sensitive area; any correspondence prior to September 2010 may discuss site conditions and/or impacts that no longer apply, because the project now is being proposed in a different location.

- April 22, 2008, electronic mail from David Kisner (URS Corporation [URS]) to Susan Jones (USFWS) and James Diven (URS) regarding biological aspects in the vicinity of the Project. This discussion related to the former HECA Project Site located in Elk Hills.

Table 1
Federally Listed Species with Potential to Occur within the Action Area

Common Name	Scientific Name	Federal Status
Plants		
California jewel-flower	*Caulanthus californicus*	Endangered
Kern mallow	*Eremalche kernensis*	Endangered
San Joaquin woollythreads	*Monolopia congdonii*	Endangered
Reptiles		
Blunt-nosed leopard lizard	*Gambelia sila*	Endangered
Mammals		
Buena Vista lake shrew	*Sorex ornatus relictus*	Endangered
Giant kangaroo rat	*Dipodomys ingens*	Endangered
Tipton kangaroo rat	*Dipodomys nitratoides nitratoides*	Endangered
San Joaquin kit fox	*Vulpes macrotis mutica*	Endangered

- July 10, 2008, meeting at California CDFG Office in Fresno, California with Julie Vance (CDFG), Susan Jones (USFWS; by telephone), and Peter Cross (USFWS; by telephone). This discussion again involved the former HECA Project Site located in Elk Hills.

- October 14, 2008, Project meeting at CDFG Office in Fresno, California with Julie Vance (CDFG), Susan Jones (USFWS; by telephone), and Peter Cross (USFWS; by telephone). This discussion again involved the former HECA Project Site located in Elk Hills.

- January 29, 2009, phone conversation between Tim Kuhn (USFWS) and David Kisner (URS) regarding BA/Biological Opinion and conservation measures for the current HECA Project Site.

- June 6, 2009, site visit with Tim Kuhn (USFWS) and Julie Vance (CDFG) to review HECA Project linears and biological constraints.

- February 4, 2010, letter from R. Paul Detwiler (DOE) to Tim Kuhn (USFWS), requesting initiation of formal Section 7 consultation for the *Hydrogen Energy International Integrated Gasification Combined Cycle and Carbon Capture and Sequestration Project.*

- February 5, 2010, electronic mail and attached BA transmitted from Dale Shileikis (URS) to Tim Kuhn and Paul Detwiler on behalf of HECA.

- March 30, 2010, phone conversation between Tim Kuhn (USFWS) and David Kisner (URS) regarding BA/Biological Opinion, rare plants, Migratory Bird Treaty Act, and Coles Levee Ecological Reserve.

- April 12, 2010, CEC Data Response and Issue Resolution Workshop in Tupman, California. Public meeting with CEC (Amy Golden), USFWS (Tim Kuhn), and CDFG (Julie Vance) to discuss biological aspects of the proposed HECA Project.

- June 9, 2010, email correspondence from USFWS biologist Tim Kuhn to CEC and CDFG regarding comments on the February 5, 2010 BA for the HECA Project.

- August 6, 2010, comment letter from USFWS biologist Tim Kuhn regarding the February 8, 2010 BA for the HECA Project.

- September 15, 2010, phone conversation between Tim Kuhn (USFWS) and David Kisner (URS) regarding comments on BA, *California Aqueduct Habitat Conservation Plan*, and San Joaquin Kit Fox Recovery Area Geographic Information System (GIS) data layer.

- September 23, 2010, electronic mail transmittal from Tim Kuhn (USFWS) to David Kisner (URS) of San Joaquin Kit Fox Recovery Area GIS layer and *Draft California Aqueduct San Joaquin Field Division Habitat Conservation Plan*.

- November 2, 2010, meeting with Tim Kuhn (USFWS), U.S. Environmental Protection Agency Region IX, DOE, HECA, and URS regarding ESA consultation for the HECA Project.

- January 18, 2012, meeting with Bill Pelle, Thomas Leeman, and Dan Russell from USFWS to discuss Section 7 consultation for the HECA Project. The meeting was organized by DOE to provide an overview of the new HECA Project components for USFWS and review the potential ESA issues. Other attendees included R. Paul Detwiler (DOE), Marisa Mascaro (HECA), George Landman (HECA) and Steve Leach (URS).

- February 6, 2012, meeting at CDFG office in Fresno, California with Julie Vance (CDFG), and Annee Ferranti (CDFG). This discussion involved introducing the new project team and identifying new project components; the new project elements were discussed with regard to the known and potential biological resources in the area.

- October 17, 2012, field meeting with Thomas Leeman from USFWS to discuss Section 7 consultation for the HECA Project. The meeting included a field review of the HECA Project components for USFWS and CDFG and discussion of the potential ESA issues. Other attendees included Julie Vance (CDFG), Amy Golden (CEC), George Landman (HECA), Ed Western (HECA), Jan Novak (URS), David Kisner (URS), and Steve Leach (URS).

2.0 PROJECT DESCRIPTION

The 453-acre HECA Project Site is currently used for active agricultural purposes, including cultivation of cotton, alfalfa, and onions. HECA also has the option to purchase 653 acres adjacent to the HECA Project Site, over which HECA will control access and future land uses. The HECA Project will generate a nominal 300-megawatt output of low-carbon baseload electrical power. The HECA Project will capture more than 90 percent of the CO_2 in the production of the hydrogen fuel, and transport (via pipeline) approximately 3 million tons per year of CO_2 to the EHOF for EOR and sequestration. In addition, the HECA Project will use the hydrogen produced in the gasifier to produce low-carbon nitrogen-based fertilizer in an integrated Manufacturing Complex.

In addition to the Project Site, the HECA Project includes construction and operation of five linear facilities, which include (1) an approximately 2-mile-long electrical transmission line to a new PG&E switching station; (2) an approximately 13-mile-long natural gas interconnection with an existing PG&E natural gas pipeline; (3) an approximately 15-mile-long process water supply pipeline from the Buena Vista Water Storage District (BVWSD); (4) an approximately 1-mile-long potable water supply pipeline from West Kern Water District; and (5) an approximately 5-mile-long industrial railroad spur that will connect to the San Joaquin Valley Rail Road.

The OEHI Project will include construction and operation of three primary EOR components, including (1) an approximately 3.4-mile-long CO_2 Pipeline from HECA to the Elk Hills Oil Field; (2) a CO_2 EOR Processing Facility at the southern terminus of the CO_2 Pipeline; and (3) three Satellite Gathering Stations.

Construction activities associated with each of the HECA and OEHI project components, including avoidance, minimization, and conservation measures, are described below, followed by descriptions of operation and maintenance of the facilities and the project schedule.

2.1 CONSTRUCTION ACTIVITIES

This section describes the construction activities associated with the proposed action. The activities are organized by location.

2.1.1 Power Generating Facility

The 453-acre HECA Project Site is intensively cultivated for the production of alfalfa, cotton, and onions, and has little habitat value for native flora and fauna. In addition, the closest area with habitat value for native flora and fauna is the Kern River Flood Control Channel (KRFCC), approximately 700 feet south of the HECA Project Site. The majority of the 653-acre Controlled Area may remain in active agriculture and act as a buffer between the Project and the KRFCC. The western border of the Tule Elk State Natural Reserve is approximately 1,700 feet to the east of the HECA Project Site.

Construction activities for the HECA Project will occur throughout the 42-month construction period. All construction laydown and parking areas will be within the HECA Project Site and the Controlled Area. Onsite construction activities include clearing and grubbing, grading, hauling, layout of equipment, delivery and handling of materials and supplies, and HECA Project construction and testing operations. The HECA Project Site occurs in an area of relatively flat topography. Site grading will occur as necessary to form level building pads for major process units.

Construction site access will be via Dairy Road for truck deliveries and Adohr Road for construction craft vehicles arriving and departing the site. Initial site preparation will include construction of temporary access roads, parking, laydown areas, office and warehouse facilities, installation of erosion control measures, and other improvements necessary for construction. Erosion control measures will include construction of stormwater retention basins and related site drainage facilities to control runoff within the HECA Project Site boundary. Existing drainage patterns outside the HECA Project Site boundary will remain unchanged, and no runoff from outside the HECA Project Site boundary will flow onto the HECA Project Site.

2.1.2 Electrical Transmission Line

An electrical transmission line will interconnect the HECA Project to PG&E's future switching station. The transmission line will be constructed and owned by HECA up to the point of interconnection. The power generated by the HECA Project will be connected to the existing PG&E system by a single-tower, 230-kilovolt transmission line that will be constructed as part of the HECA Project. This single-circuit line will be connected to a new switchyard at the HECA Project Site.

The proposed electrical transmission line route is approximately 2 miles long to HECA's property boundary, and passes through previously disturbed areas or active agriculture, predominantly pistachio orchards, alfalfa, and cotton. Construction of the line will require installing approximately 26 (15 offsite and 11 onsite) tubular-steel transmission structures and the supporting foundations.

The electrical transmission line route extends east from the HECA Project Site to a new PG&E switching station (adjacent to the existing Midway-Wheeler Ridge transmission lines) as shown on Figure 4, Project Location Details. The new PG&E switching station will be constructed at the eastern terminus of the electrical transmission line, approximately 2 miles east of the HECA Project Site and next to Elk Valley Road. Access to the switching station site would be along an existing unimproved farm road from Morris Road or Elk Valley Road. The electric transmission switching station will be designed, constructed, owned, and operated by PG&E.

The area occupied by the PG&E switching station will be approximately 417 feet by 417 feet. Portions of the site will be excavated to install a grounding grid, underground control and protection cabling, and foundations. It is anticipated that "dead-end" structures to terminate the transmission line from the HECA site would be approximately 30 feet tall near the western end of the switching station site. A similar set(s) of structures at the eastern end of the station for the

incoming lines from Midway and the outgoing lines to Wheeler Ridge would also be required. The height of a two-level structure would be on the order of 50 to 60 feet. The station would also have structures associated with interconnecting buses and cable "drops" to the circuit breakers. The height of these structures would be on the order of 20 to 30 feet.

Approximately 15 steel poles are expected to be required outside of the HECA Project Site. Construction of the interconnection line will consist of installing footings, poles, insular and hardware, and pulling conductor and shield wires. The new transmission line interconnection will be placed in an approximately 100-foot-wide permanent right-of-way (ROW).

Construction of the new 230-kilovolt transmission line interconnection will require approximately 3 months. It will be scheduled for completion and be operational in time for generation testing of the HECA Project. HECA will provide for the transmission line via a Large Generator Interconnection Agreement up to the point of interconnection at the future PG&E switching station.

Upon completion of the linear installation, agricultural uses may be reestablished along the linear route within the 100-foot-wide permanent ROW. Orchards would be limited to 25 feet in height within the permanent ROW.

2.1.3 Natural Gas Supply

A 13-mile natural gas linear will interconnect with a PG&E natural gas pipeline north of the HECA Project Site. The interconnect will consist of one tap off the existing natural gas line, and one metering station at the beginning of the natural gas linear adjacent to a PG&E Inlet. The metering station will be up to 100 feet by 100 feet, and 8 feet tall, surrounded by a chain-link fence. In addition, there will be a metering station at the end of the natural gas linear, on the western side of the HECA Project Site, and a pressure-limiting station on the HECA Project Site. PG&E will construct and own the natural gas pipeline.

The majority of the natural gas linear extends across areas used for active agriculture and existing roadways. However, the natural gas linear is adjacent to several areas with natural habitat value near Interstate 5 (I-5) and at the northern terminus near Magnolia Avenue.

The natural gas linear would require a 50-foot construction ROW and a 25-foot permanent ROW; however, most of the ROW would be in cultivated fields or other disturbed habitat types adjacent to paved and unpaved roads.

Wetland features adjacent to the proposed natural gas linear ROW will be avoided. Non-wetland potential waters of the U.S. within the natural gas pipeline construction limits are degraded, seasonally ponded claypan depressions. If avoidance of non-wetland waters is not feasible, the feature(s) will be temporarily disturbed by the construction activities during installation of the natural gas pipeline, and the site will be restored to pre-construction condition.

Construction of the natural gas pipeline interconnection will involve a variety of crews performing the following typical pipeline construction activities: hauling and stringing the pipe along the route; welding, radiographic inspection, and coating the pipe welds; trenching; lowering the pipe into the trench; backfilling the trench; hydrostatic testing of the pipeline; tying into the existing pipeline; purging the pipeline; and cleaning up and restoring construction areas. Roads and ROWs will be restored to specifications of the involved agencies. Open trenching will be minimized, and trenches will be covered or ramped when left overnight. In areas with habitat value and in agricultural areas, the topsoil from the trenching will be set aside, preserved, and used to cover the excavation.

Construction of the natural gas pipeline interconnection will take approximately 6 months. It will be scheduled to be finished and operational in time to provide test gas to the HECA Project. Construction will occur in accordance with a traffic management plan to minimize impacts to traffic traveling on the affected roadways. Affected areas will be restored to their original state so as to minimize erosion.

2.1.4 Water Supply Pipelines

For process water, the HECA Project will use brackish groundwater supplied by the Buena Vista Water Storage District (BVWSD) via a new 15-mile pipeline. Potable water for drinking and sanitary use will be supplied by West Kern Water District (WKWD), who will construct a new 1-mile pipeline for that purpose. Installation of the process water and potable water pipelines will involve industry standard construction activities for pipelines, including trenching; hauling and stringing of pipe along the routes; welding; radiographic inspection and coating of pipe welds; lowering welded pipe into the trench; hydrostatic testing; and backfilling and restoring the approximate surface grade. Construction of the water pipelines is expected to take approximately 6 months to complete.

Process Water Supply Pipeline

A new 15-mile, 30-inch-diameter pipeline will convey brackish groundwater supplied from the BVWSD to be used for process water by the HECA project. BVWSD will construct and own the process water supply pipeline, and approximately 14.5 miles of the pipeline will be located in an existing BVWSD ROW. The proposed process water pipeline would be constructed entirely within an existing unpaved road, or within areas that are currently actively farmed; therefore, no direct impacts to natural habitats are anticipated. Once the process water is delivered to the HECA Project Site, the brackish water will be treated on site to meet all process and utility water requirements. The process water supply pipeline will be approximately 15 miles in length and will be constructed by BVWSD.

In addition, BVWSD will own, construct, operate, and maintain the well field that will provide brackish groundwater for the HECA Project's process water supply. This well field will be in the northwestern portion of BVWSD's service area within active agricultural fields near the West Side Canal, in the vicinity of Seventh Standard Road, at the northern end of the 15-mile-long process water line. It is currently anticipated that there will be up to five groundwater

extraction wells. Two of these wells will provide operational redundancy. The maximum depth of the wells will be approximately 300 feet below ground surface. The brackish water will be treated at the Project Site to meet all process and utility water requirements. The process water supply pipeline would require a 50-foot construction ROW and a 25-foot permanent ROW.

BVWSD addressed the groundwater extraction wells and the process water supply pipeline in their Draft and Final Environmental Impact Reports for BVWSD's Groundwater Management Program, issued in October 2009 and December 2009, respectively (BVWSD, 2009a; 2009b). The Final Environmental Impact Report for the Groundwater Management Program (State Clearinghouse No. 2009011008) concludes that the wells and the process water pipeline do not result in significant impacts to any federally listed species.

Potable Water Pipeline

For drinking and sanitary use, the HECA Project will use potable water supplied by WKWD. A new 4-inch-diameter potable water line will be constructed, owned, and maintained by HECA LLC.

The potable water line would be approximately 1 mile in length. This pipeline will require a 10-foot construction and permanent ROW that will be placed within the proposed electrical transmission line ROW. Most of the proposed ROW is within or adjacent to existing dirt access roads, or in cultivated fields.

2.1.5 Industrial Railroad Spur

The industrial railroad spur is approximately 5 miles long and will connect the HECA Project Site to the existing San Joaquin Valley Railroad Buttonwillow Branch (formerly called the SP Buttonwillow Branch). Two public at-grade crossings may be required, and several private crossings will be needed for farmers' access to croplands and the irrigation canal. The industrial railroad spur would require a 75-foot construction ROW, 60-foot permanent ROW, and 3-acre rail laydown area.

2.1.6 OEHI Carbon Dioxide Pipeline

An approximately 3.4-mile-long CO_2 12-inch-diameter pipeline will be constructed to transfer the CO_2 from the HECA Project Site to the OEHI CO_2 Processing Facility used by OEHI for injection into deep underground hydrocarbon reservoirs for CO_2 EOR and sequestration. Additional components of the CO_2 pipeline will include metering facilities at the pipeline origin and terminus, a cathodic protection system, and four emergency block valves. Two of the block valves will be automated and two will be manual block valves.

The CO_2 pipeline route originates at the southern portion of the HECA Project Site and will be constructed using a combination of standard open-trench installation and Horizontal Directional Drilling (HDD). One HDD will be approximately 500 feet in length under the levees associated with the West Side/Outlet Canal crossing. A second HDD will be approximately 2,000 feet long,

and will be used to install the pipeline under the KRFCC and the California Aqueduct. On the southern side of the Aqueduct, the pipeline alignment extends southeast and south to the OEHI CO_2 Processing Facility, and parallels existing private roads. OEHI will construct and own the pipeline.

With the exception of HDD crossings where the depth of the CO_2 pipeline may reach 100 feet below grade, the CO_2 Pipeline will be buried approximately 5 feet below grade. Installation of the CO_2 supply pipeline will involve typical construction activities, including trenching; hauling and stringing pipe along routes; welding; radiographic inspection and coating pipe welds; lowering welded pipe into the trench; backfill of the trench; hydrostatic testing of the pipeline; purging the pipeline; and cleanup and restoration of construction areas. Grade cuts will be restored to their original contours, and affected areas will be restored to their original condition to minimize erosion. The pipeline will be protected by cathodic protection, and monitored by independent leak-detection systems.

Construction of the CO_2 pipeline is expected to take approximately 6 months to complete. The CO_2 pipeline would require a 50- to 80-foot construction ROW and a 25-foot permanent ROW.

HDD involves using a drilling rig that will bore a horizontal hole under water crossings. At each of these crossings, a laydown area (or entry/exit pit) has been identified on either side of the water course to accommodate the HDD installation (see Figure 4, Sheet 4, Project Location Details). The temporary disturbance area would be approximately 120 feet by 100 feet for each HDD entry pit; and approximately 75 feet by 100 feet for each HDD exit pit (Stantec, 2012b).

Best management practices for HDD will include silt fencing around the drill sites, energy dissipation devices for discharging water from hydrostatic testing of the pipeline, selecting drilling fluids for environmental compatibility, and removing spent fluids from the areas immediately adjacent to the water bodies for safe disposal and to prevent contamination. In addition, soil erosion control measures will be implemented to prevent runoff and impacts to water quality.

2.1.7 OEHI Carbon Dioxide EOR Processing Facility

The CO_2 from the HECA plant will be received by the CO_2 EOR Processing Facility, which will be located at the southern terminus of the CO_2 Pipeline in the southeastern quarter of Section 27S. The CO_2 EOR Processing Facility will include the Central Tank Battery (CTB), Reinjection Compression Facility (RCF), CO_2 Recovery Plant (CRP), and a Water Treatment Plant. The CO_2 EOR Processing Facility is expected to occupy and permanently disturb an area of 1,200 feet by 2,200 feet (60.61 acres). These dimensions do not include the area of the CO_2 Pipeline or the Satellite Gathering Stations.

Central Tank Battery

The CTB is the primary oil/water separation system for the CO_2 EOR process. The inlet liquid gathering lines from the Satellite Gathering Stations will be manually directed to one of the three

gas separator tanks. The gas from this process will be combined with the gas from the gas separators. The oil and water will be separated, and the oil will be skimmed off and pumped to Section 18G and metered for sale. The partially treated water will be conveyed via pipeline to the existing water treating facilities.

Water Treatment Plant

The oily water from the inlet section of the CTB will be treated to remove oil, solids, and other contaminants from the produced water. The produced water will be pressurized in the injection pumps and sent to the satellites for injection. Low-pressure gas collected from the CTB will be compressed and then routed to the inlet of the RCF and the CRP for processing.

Reinjection Compression Facility

The RCF will be the first portion of the CO_2 treating/recovery facilities to be installed. Produced gas from the Satellite Gathering Stations (see Section 2.1.8) will initially flow to the RCF. At the RCF, the CO_2 gas will be dehydrated, compressed, blended with CO_2 purchased from the HECA Project, and re-injected into a closed-loop system.

CO_2 Recovery Plant

The CRP is the second part of the gas treating/recovery plant. This facility will separate CO_2 from produced hydrocarbon gas and recycle the separated CO_2. The CRP will consist of several processing units for the separation of the CO_2 from the recovered natural gas. The CRP is not expected to be constructed until 2020, and would not be part of the Demonstration Period defined by DOE.

2.1.8 OEHI Satellite Gathering Stations

The Satellite Gathering Stations (satellites, also known as Production/Well-Testing Satellites) will be a series of facilities that will provide primary separation of the oil/water and gas from the production well stream. Initially, three satellites are scheduled to be installed to handle the expected production for the first several years of the field development during the Demonstration Period. Satellites 1, 2, and 3 are each expected to have a permanent surface footprint of 230 by 200 feet. This footprint is included in the total area of the OEHI Project site evaluated in this Biological Assessment.

Each satellite will be equipped with an inlet manifold in which well flow lines associated with that satellite are connected. Flow from each well flow line will be diverted into either the production separator or the test separator via automated manual valves. The production separator is a two-phase separator to handle primary vapor liquid separation of the fluid recovered from the production wells at each satellite. The gases will be separated and routed to the inlet of the RCF. The entire field production pressure will be controlled at the RCF inlet header, and the individual satellites will "float" on that pressure.

Liquid and gas flow rates will be metered for production trending and monitoring. The test separator will be a three-phase, bucket and weir separator to allow for a 24-hour test cycle of each well serviced by that satellite. The oil and water will be controlled by level control, and the gas will be controlled by a back-pressure controller to hold the test separator pressure slightly above that of the associated production separator. Oil, water, and gas from the test separator will be re-combined and directed to the inlet manifold and then to the production separator.

2.2 OPERATION AND MAINTENANCE

This section describes the operation and maintenance of the HECA and OEHI projects.

2.2.1 HECA Project

HECA Project operation and maintenance will occur within the HECA Project Site. The adjacent Controlled Area will remain in active agriculture similar to the existing condition. Access to linears will be limited in nature, and will be along existing access roads or access roads developed during initial installation activity. HECA LLC will own, operate, and maintain the approximately 2-mile transmission line up to the interconnection with a future PG&E switching station. It is anticipated that annual maintenance of the electrical transmission line will be provided for under an agreement between PG&E and the Project. The electrical transmission line is located entirely within areas that are actively farmed or are developed. Most of the maintenance will be routine and can be scheduled during periods when damage to the crops and land can be minimized. Maintenance activities will be conducted by personnel trained to be aware of the presence of sensitive wildlife.

PG&E will own, operate, and maintain the natural gas pipeline. Maintenance of the natural gas pipeline would follow PG&E corporate policies and protocols. Long-term maintenance needs of the natural gas pipeline would be minimal during the 25-year lifespan of the Project; therefore, they are not quantified in this document.

BVWSD will own, operate, and maintain the approximately 15-mile, 30-inch-diameter process water pipeline and associated wells. Annual maintenance of the process water pipeline and associated groundwater wells would be conducted by BVWSD. Maintenance activities of the wells and the pipeline would follow BVWSD corporate policies and protocols. Long-term maintenance needs of the process water pipeline would be minimal during the 25-year lifespan of the Project, and therefore is not quantified in this document.

HECA LLC will own, operate, and maintain the approximately 1-mile potable water pipeline. Maintenance activities of the pipeline would include:

- Annual reconnaissance of the pipeline ROW;
- Annual inspection and exercising (opening and closing for one cycle) of valves, as necessary;
- Annual vegetation removal, re-grading, and application of dirt for the access road after wet periods and pipe work, as necessary; and

- Replacement of pipeline components (lining and coating, valves, and joints), as determined necessary by routine inspection.

Long-term maintenance needs of the potable water pipeline would be minimal during the 25-year lifespan of the HECA Project; therefore, they are not quantified in this document.

HECA LLC currently anticipates that it will own, operate, and maintain the approximately 5-mile railroad spur. Regardless of final ownership of the spur, maintenance activities will consist of routine annual maintenance activities and programmed maintenance conducted on a periodic basis. Annual maintenance activities consist of visual inspections, vegetation control, spot surfacing and lining of rough spots in the track, and adjusting/lubrication of turnouts. In addition, any warning devices at road crossings will be inspected as frequently as monthly.

Programmed major maintenance consists of surfacing and lining the rail line, typically every 3 to 5 years; replacing the rail, potentially once during the life of the HECA Project; and replacing 15 percent of the timber ties on a 10-year cycle. If concrete ties are used, the ties will not need to be replaced. Major maintenance activities will be conducted using on-track equipment. Replaced materials will be removed from the ROW and recycled. Timber ties will be disposed of by incineration, landfill disposal, or other approved disposal options.

2.2.2 OEHI Project

OEHI will own, operate, and maintain the CO_2 pipeline and the related components of the OEHI Project. Maintenance of the CO_2 pipeline and other EOR facilities will follow existing OEHI operational procedures as required by the existing USFWS Biological Opinion (Appendix A) and the related 1997 MOU between OEHI and the CDFG (Appendix B), which has twice been updated and remains in effect until 2014 (CDFG, 1997; 1999; 2010). The EOR facility operations will be similar to the existing facility operations by OEHI at the EHOF. Operations activities include facility inspection and maintenance. Maintenance needs of the CO_2 pipeline and associated EOR facilities would be minimal during the Demonstration Period of the Project; therefore, they are not quantified in this document.

2.3 PROPOSED CONSERVATION MEASURES

This section describes the conservation measures that are included in the HECA Project and the OEHI Project to avoid, minimize, and/or compensate for impacts on listed species.

2.3.1 HECA Project Design Modifications

The HECA Project design has been refined in coordination with the resource agencies and environmental specialists to avoid and minimize impacts on sensitive biological resources to the extent practicable. These measures include relocating the HECA Project Site from the originally proposed location to its current location across the Aqueduct to reduce impacts to the blunt-nosed leopard lizard; and relocating the natural gas pipeline to avoid portions of the Coles Levee Ecosystem Preserve. In addition, the potable water linear and electrical transmission linear were

shortened and relocated to the east of the HECA Project Site, which avoided impacts to 1.9 acres of Allscale Scrub habitat.

The HECA Project also includes general and species-specific measures to avoid and minimize impacts on listed species and their habitat. For potential impacts on listed species that remain after implementation of feasible avoidance and minimization measures, comprehensive compensatory measures through habitat enhancement, establishment, and preservation are included in the Project to offset potential losses of listed species or their habitat. HECA LLC is committed to implementing these measures as part of the Project. These conservation measures are extracted from the Amended Application for Certification (AFC) submitted to the CEC in May 2012, and the corresponding numbers or mitigation measures from the 2012 Amended AFC (e.g., BIO-1, BIO-2, etc.) are provided where applicable.

2.3.2 OEHI Project Design

The proposed CO_2 pipeline crossings of the West Site Canal/Outlet Canal, the KRFCC, and the California Aqueduct will be constructed using HDD to avoid direct and indirect effects to species movement and dispersal at these locations.

OEHI will minimize impacts associated with the OEHI Project by using existing wells and previously disturbed areas to the maximum extent feasible. Avoidance and minimization will also be achieved by minimizing future land disturbance on those portions of the EHOF considered high value on the HCP multi-species map. The OEHI Project will also be implemented in compliance with the 1995 Biological Opinion issued by the USFWS (Appendix A), and a related 1997 MOU between OEHI and the CDFG, as updated (Appendix B). Finally, the OEHI Project will be implemented in compliance with a 50-year HCP for the EHOF, which is currently under development and anticipated to be approved by the end of 2013.

2.3.3 General Avoidance and Minimization Measures

HECA will implement the following general measures to avoid and minimize potential adverse effects to special-status biological resources. The OEHI Project will implement the avoidance and minimization measures in the 1995 Biological Opinion issued by the USFWS and 1997 MOU between OEHI and the CDFG, as amended in 1999 and 2010; and the HCP for the EHOF, when approved.

Biological Resource Mitigation Implementation and Monitoring Plan (BIO-17)

Prior to ground-disturbing activities, HECA will develop a Biological Resource Mitigation Implementation and Monitoring Plan (BRMIMP) in coordination with the CEC, CDFG, and USFWS. The BRMIMP will identify the biological mitigation, monitoring, and compliance measures that will be implemented during construction of the HECA Project. The measures identified in the BRMIMP will address each of the avoidance and minimization measures below, in addition to the terms and conditions of the permits and approvals by the CEC, USFWS, and

CDFG. The BRMIMP will include the qualifications, responsible parties, and schedules for implementing each of the avoidance and minimization measures described below. A draft BRMIMP will be submitted to the CEC, USFWS, and CDFG for review prior to the start of ground-disturbing activities.

Construction Worker Education Program (BIO-7)

A worker education program will be implemented for all HECA Project construction personnel. These personnel will be required to read educational materials and attend an education class given by a qualified biologist. The brochure and class will describe the special-status species that could be encountered, the regulatory protection of the species, and appropriate measures to take upon discovery of a special-status species.

Construction personnel will be instructed to set equipment off the ground when possible to minimize access to small mammals. All work areas will be kept clear of trash and food items to minimize attracting wildlife. Construction techniques to minimize potential adverse impacts will also be presented, such as filling or covering excavations. If excavations are to be left open overnight, ramps will be installed to allow wildlife to escape.

The names and affiliations of all people trained will be documented, and submitted to the CEC, USFWS, and CDFG (see measure BIO-17).

Operations and Maintenance Education Program (BIO-8)

The worker education program will be implemented for HECA Project operations and maintenance personnel. Personnel will be instructed to be alert to and aware of the presence of special-status wildlife. If any special-status wildlife is spotted, activities in the vicinity of the sighting that could impact the species will be halted, and the animal allowed to move away from the activity area.

2.3.4 Special-Status Plant Avoidance, Minimization, and Conservation

The following measures will be implemented to avoid and minimize potential adverse effects to special-status plant species.

Special-Status Plant Pre-Construction Survey (BIO-1)

Qualified biologists will conduct a special-status plant pre-construction survey of the affected areas for the HECA Project and within 200 feet of the affected areas, or to the property boundary if less than 200 feet, and if permission from the adjacent landowner cannot be obtained. Surveys will be conducted according to Protocols for Surveying and Evaluating Impacts to Special-Status Native Plant Populations and Natural Communities (CDFG, 2009). Special-status plants will be identified, counted, and mapped. Populations of special-status plants will be monitored through the course of the year to determine how many mature and bloom. The results of all pre-

construction surveys will be documented, and submitted to the CEC, USFWS, and the CDFG (see conservation measure BIO-17).

Special-Status Plant Avoidance (BIO-2)

If listed plant species are present that will be affected by construction within the HECA Project area, direct impacts to the plants will be avoided, to the greatest extent feasible.

Special-Status Plant Mitigation (BIO-3)

During construction, construction equipment that travels off the Project Site will be cleaned to remove dirt and seeds of noxious weeds. Native plants will be reestablished in areas where construction activities temporarily disturb natural vegetation. Post-construction monitoring will be conducted, and additional control measures such as hand removal, mowing, or herbicide application will be implemented as needed to minimize the establishment of noxious or invasive species (as defined by the California Agricultural Department and/or the California Invasive Plant Council) in areas where natural vegetation was removed during construction.

For permanent impacts to populations of California Native Plant Society (CNPS)-Ranked plant species that cannot be avoided, disturbance will be timed until after available seeds can be collected. These seeds will be properly stored, and then scattered over a suitable area near the parental site just prior to the first rains of the season.

Prior to temporary disturbance of special-status plant occurrences, seeds will be collected and properly stored for replanting after completion of construction. During construction, the topsoil will be salvaged and replaced on site after construction is completed. After work is completed in that area, the topsoil will be replaced and the seeds will be redistributed prior to the first rains of the season.

Both types of the above-mentioned re-seeded areas will be demarcated in the field, mapped, and monitored post-construction for 3 years. If the re-seeded areas have not met the performance criteria established in the BRMIMP after 3 years, additional monitoring will be conducted based on coordination with the resource agencies. Monitoring will be conducted during the early spring to determine whether the target species are present and whether weed species are common. Weeding will occur if weed species appear abundant or are adversely impacting the target species. Weeding will be done in a fashion that will minimize impacts to special-status plant or animal species and other native species, but may include hand-weeding, weed-whacking, or spraying with an agency-approved herbicide.

As part of the BRMIMP, a monitoring report will be submitted by HECA to the CEC and CDFG each year for 3 years that will document the status of each population, weeding efforts that have been undertaken, and suggested work for the next season (see measure BIO-17); these reports will be available to USFWS, if requested.

It is anticipated that these measures will be sufficient to avoid significant impacts to any special-status plant species that may be present.

2.3.5 Special-Status Wildlife Avoidance and Minimization Measures

The following measures will be implemented to avoid and minimize potential adverse effects to special-status wildlife species.

Terrestrial Wildlife Pre-Construction Survey (BIO-4)

Pre-construction surveys will be conducted in affected areas that have potentially suitable habitat for blunt-nosed leopard lizard, San Joaquin kit fox, giant kangaroo rats, and Tipton's kangaroo rats. Surveys will be conducted less than 2 weeks prior to the start of ground disturbance within the affected areas and adjacent habitats within 200 feet of the affected areas, or to the property boundary if less than 200 feet, and permission from the adjacent landowner cannot be obtained. Efforts will include visual surveys for blunt-nosed leopard lizard, San Joaquin kit fox, giant kangaroo, rats and Tipton's kangaroo rats. Visual surveys will also be conducted for Buena Vista Lake shrew in areas within the process water pipeline construction limits that are adjacent to the West Side Canal and the Kern River Flood Control Channel.

All sightings and/or signs of sensitive wildlife will be mapped using a global positioning system device. The results of all pre-construction surveys will be documented, and submitted to the CEC, USFWS, and CDFG (see measure BIO-17).

Site Clearance Prior to Ground Disturbance (BIO-5)

Prior to ground-disturbing activities in undeveloped and uncultivated lands within the HECA Project area, surveys will be conducted to determine whether San Joaquin kit fox, small mammals, or blunt-nosed leopard lizards are present. To ensure that no blunt-nosed leopard lizards are taken during the initial site preparation, each area with potential habitat will be surveyed by a CEC-approved biologist according to the standard protocols for survey timing and ambient temperature. These surveys will occur prior to any ground disturbance. Exclusion fencing will be installed around the perimeter of the work area to ensure that no wildlife re-enters. Exclusion fencing will consist of tin flashing (or other material approved by CDFG and USFWS) that will be buried at least 9 inches underground, and rise at least 2 feet above the ground.

Once the exclusion fencing has been established, the area will be visually surveyed during the day for wildlife, and small mammals will be trapped and relocated (see conservation measure BIO-15) during the night. All surveying and trapping efforts will be conducted in a manner that minimizes collapsing any small mammal burrows. Tracking stations will be used to determine whether there are additional individuals in the area.

The HECA Project construction areas will be surveyed daily for blunt-nosed leopard lizards when soil and air temperatures are within CDFG survey protocol limits. An area will be deemed

clear of any blunt-nosed leopard lizards after there have been no signs or sightings for 5 survey days. If a blunt-nosed leopard lizard is observed within the construction area, the exclusion fencing will be opened to allow the lizard to leave on its own accord. Once the lizard has left the area, the exclusion fencing will be closed and surveyed until there are no signs or sightings of blunt-nosed leopard lizards for 5 consecutive days.

Exclusion fencing will be left in place only for as long as needed to complete the work. For installation of the Project linears, no one area is likely to be closed for more than 6 months. The fencing will be inspected and maintained daily by the approved biologist. If the exclusion fencing is compromised (by wind or other means) and left open, an approved biologist will repair the fencing and determine if the area will need to be re-surveyed and/or re-trapped for wildlife.

To confirm that BIO-5 is successful, ground disturbance will be monitored (see measure BIO-16).

The results of the blunt-nosed lizard surveys and area clearance will be documented, and submitted to the CEC, USFWS, and CDFG (see measure BIO-17).

Predatory Bird Minimization Measures (BIO-6)

Several species of raptors and corvids (such as common ravens, American crows, and red-tailed hawks) are known to prey on blunt-nosed leopard lizards; common ravens are the most abundant potential avian predator in the Action Area. The HECA Project transmission design has been modified to incorporate elements to discourage raven nesting. For example; instead of lattice-style transmission towers, the HECA Project will use a single-pole transmission line design that minimizes potential perches and nesting sites. The proposed single-pole design is consistent with the Avian Power Line Interaction Committee's suggested practices for avian protection on power lines (APLIC, 2006).

To minimize the number of common ravens in the area, no raven will be allowed to nest in the HECA Project transmission towers within 1 mile of known blunt-nosed leopard lizard habitat. Raven nests will be removed by a CEC-approved biologist prior to egg-laying in early spring. For all bird nests removed, documentation will be prepared by HECA and submitted to the CEC, USFWS, and CDFG (see measure BIO-17).

San Joaquin Kit Fox Mitigation (BIO-14)

Disturbance (including any excavation and/or destruction) to all San Joaquin kit fox dens shall be avoided to the maximum extent possible, and shall only occur in accordance with the protocol described in the Standardized Recommendations for Protection of the San Joaquin Kit Fox Prior to or During Ground Disturbance (USFWS, 1999b), or as approved by the wildlife agencies. In essence, the following hierarchy shall be adhered to:

1. Pre-construction surveys shall be conducted by the CEC-approved biologist no less than 14 days and no more than 30 days prior to the beginning of ground disturbance and/or

construction activities or any HECA Project activity likely to impact the San Joaquin kit fox. Surveys shall identify kit fox habitat features on the HECA Project Site, and evaluate use by kit fox; and if possible, assess the potential impacts to the kit fox by the proposed activity. The status of all dens will be determined and mapped, and all appropriate equipment exclusion zones (per den type) will be demarcated in a manner that sufficiently alerts equipment operators of the exclusion zone.

2. Regardless of time of year, no natal kit fox dens will be excavated unless authorized by the Wildlife Agencies. Other den types may be excavated only by agency-approved biologists, and only after occupancy status has been determined. Excavation and/or destruction of dens would then be allowed in accordance with the procedures specified in Standardized Recommendations (USFWS, 1999b), or as approved by the wildlife agencies.

3. All known and natal kit fox dens that are slated for destruction will be replaced. Prior to destruction of an active den, artificial replacement dens will be constructed outside the buffer zone. Replaced dens will be constructed according to protocols set forth by the Wildlife Agencies. The replacement ratio will be 1:1 for non-natal dens. If excavation or destruction is approved by the Wildlife Agencies, replacement ratios will be 2:1 for natal dens.

The results of all den assessments, burrow scoping, and excavation activities will be documented, and submitted to the CEC, USFWS, and CDFG (see measure BIO-17).

Small Mammal Mitigation (BIO-15)

Construction work areas will be surveyed and small mammals will be relocated as necessary prior to any ground disturbance to minimize impacts to small mammals during the initial site preparation; work areas will be cleared in accordance with the *Survey Protocol for the Morro Bay Kangaroo Rat* (USFWS and CDFG, 1996), or as determined in consultation with either CDFG or USFWS. Areas will be secured prior to this effort so that wildlife species cannot re-enter the area (in conjunction with conservation measure BIO-5).

Small mammal trapping and relocation will be conducted for 5 consecutive nights, or until no animals are caught on 2 consecutive nights per area. The small mammal trapping surveys would occur within the construction work areas in potentially suitable habitat (alkali desert scrub, pasture, annual grassland, and barren) that contains evidence of small mammals. Traps will be set according to "sign" (burrows, trails, scat, etc.) and/or in areas of high habitat quality. Small mammal trapping and relocation will be performed by a qualified biologist(s) approved by the CEC with the necessary permits. The results of the small mammal trapping and area clearance will be documented, and submitted to the CEC, USFWS, and CDFG (see Mitigation Measure BIO-17).

2.3.6 Monitoring and Mitigation Reporting

Ground-Disturbance Monitoring for Terrestrial Wildlife (BIO-16)

Construction activities in areas with habitat value for listed species will be monitored by a qualified biologist while the top 18 inches of soil are initially disturbed. The biologist(s) will watch for any special-status animals and will have the authority to stop work if a listed wildlife species is encountered in the construction area. If authorized to remove and/or relocate the species, biologists will relocate the animal to the nearest safe location. If the species cannot be legally relocated, work at that location will be shut down and all personnel will be required to leave the area. The approved biologist will watch the wildlife in question from a distance until the individual has left the area. The results of all construction monitoring will be documented, and submitted to the CEC, USFWS, and CDFG (see Mitigation Measure BIO-17).

Reporting to Agencies (BIO-17)

During construction, a quarterly BRMIMP report will be prepared by HECA and submitted to the CEC, CDFG, and USFWS. The report will be submitted by the 20th of the following month (i.e., the report for May will be submitted by June 20). If the 20th falls on a weekend or holiday, the report will be due the first business day following the 20th. To reduce the use of paper, the BRMIMP may be submitted on compact disc (CD) or electronically, as directed by each agency.

During construction at the HECA Project Site, a CEC-approved biologist will examine active work areas every day prior to the onset of activities to ensure that no special-status species are in the area, and that all wildlife barriers are still in place. Biologists will inform the construction crews when areas are clear, and report significant observations of wildlife to the agencies, as required in the BRMIMP.

2.3.7 Habitat Compensation

HECA LLC will implement the following compensation for temporary and permanent losses of habitats used by special-status species due to construction and operation of the HECA Project. Compensation would include offsite acquisition, preservation, and enhancement of land potentially used by one or more of the affected special-status species.

HECA Project Sensitive Habitat Mitigation (BIO-18)

HECA will compensate for the permanent and temporary loss of habitats potentially used by federally and state-listed species by acquiring credits from the USFWS-approved Kern Water Bank Authority mitigation bank.

HECA LLC will acquire USFWS-approved mitigation credits that meet the habitat and/or species requirements of the federally and state-listed species that would be affected by the proposed action. The compensation proposal consists of the following components:

- Compensation for temporary habitat loss associated with construction of the natural gas pipeline: a total of 8.0 acres (credits) would be acquired to compensate for 3.7 acres of natural vegetation that would be temporarily removed during construction.

- Compensation for permanent habitat loss associated with construction of the Project Site, the railroad spur, the natural gas pipeline, and the PG&E switching station: a total of 47 acres (credits) would be acquired to compensate for the permanent loss of 466 acres of cultivated fields that may be used infrequently by San Joaquin kit fox for movement and migration.

OEHI Project Sensitive Habitat Mitigation

OEHI will provide compensation for the OEHI Project, including the CO_2 pipeline, in accordance with the 1995 USFWS Biological Opinion concerning oil production at Maximum Efficient Rate on Elk Hills Naval Petroleum Reserve (USFWS File # l-1-95-F-102) and the draft HCP currently under review by the USFWS.

2.4 PROJECT SCHEDULE

The anticipated schedule milestones for the Project are as follows:

DOE submits Biological Assessment to USFWS.....March 2013
USFWS finalizes Biological Opinion.....May 2013
Completion of CEC permitting process.....June 2013
Commencement of pre-construction and construction activities.....June 2013
Commencement of truck deliveries and ground disturbance.....August 2013
Completion of construction.....February 2017
Commencement of pre-commissioning and commissioning.....March 2016
Commencement of commercial operation of the Project .....September 2017

3.0 ACTION AREA AND ENVIRONMENTAL SETTING

The following is a discussion of the environmental settings and biological resources currently present in the Action Area, defined in this report as the 453-acre Project Site, the 4-acre PG&E switching station, the OEHI Project Site, and the construction footprints of the associated linear facilities and associated buffers per CEC guidelines (1-mile buffer from the HECA Project Site and 1,000-foot buffer from all associated linear facilities as shown in Figure 5). Information regarding the environmental setting within 35 miles of the HECA Project Site is included when a regional perspective is required.

3.1 PROJECT SETTING

The HECA Project Site is in unincorporated Kern County approximately 2 miles northwest of the unincorporated community of Tupman, and south of Adohr Road. The land use in this portion of Kern County is resource-based oil exploration and production, which provides a large segment of the employment base. Clay mineral extraction also occurs in the area. The 453-acre HECA Project Site is comprised of portions of two agricultural parcels in Section 10 within Township 30 South, Range 24 East.

The HECA Project Site is currently used for farming purposes, including cultivation of cotton, alfalfa, and onions. Land surrounding the HECA Project Site, including the Controlled Area, is also used primarily for farming, particularly the cultivation of alfalfa and cotton. The Outlet Canal, KRFCC, and the California Aqueduct (State Water Project) are 500, 700, and 1,900 feet south of the Project Site, respectively. The western border of the Tule Elk State Natural Reserve is approximately 1,700 feet to the east of the Project Site. The nearest single-family dwellings are approximately 1,400 feet to the east. HECA LLC has an option to purchase the HECA Project Site and Controlled Area.

Land uses in the vicinity of the approximately 13-mile-long natural gas pipeline route are primarily active agricultural land (mainly alfalfa cultivation), disturbed and/or developed areas, and patches of open/undeveloped land (Allscale Scrub).

Land uses in the vicinity of the approximately 15-mile-long process water pipeline are primarily farming (mainly alfalfa, cotton, and wheat cultivation), and orchards (pistachio). Much of the land between the West Side Canal and the KRFCC is Allscale Scrub.

Land uses in the vicinity of the approximately 1-mile-long potable water pipeline consist of previously disturbed habitat and farming (mainly alfalfa, cotton, oat, and wheat cultivation).

Existing land uses in the vicinity of the approximately 2-mile-long electrical transmission line consists of previously disturbed habitat and farming (mainly alfalfa, cotton, oat, and wheat cultivation). The new PG&E switching station at the terminus of the electrical transmission line would occupy approximately 4 acres in a field that is currently cultivated for alfalfa.

The OEHI Project Site consists of approximately 64 acres that will be permanently developed during the Demonstration Period of the project, and approximately 29 acres that will be temporarily disturbed to construct the CO_2 Pipeline. The EHOF is a mix of developed lands used for oil production and undeveloped lands. Land uses in the vicinity of the OEHI Project include farming (mainly alfalfa cultivation), open/undeveloped land (Allscale Scrub; Sawyer, Keeler-Wolf, and Evens, 2009), and resource extraction (oil production). The CO_2 pipeline would cross under the West Side/Outlet Canal, KRFCC, and the California Aqueduct using HDD.

3.1.1 Existing Conservation Lands in the Project Vicinity

Existing conservation lands within 35 miles of the HECA Project Site are listed in Table 2; Figure 5, Existing Natural Resource Conservation Areas, shows those areas within 10 miles, with the exception of the *Elk Hills Unit Draft Habitat Conservation Plan* area, whose boundaries have not yet been published.

Table 2
Existing Natural Resource Conservation Areas near the HECA Project Site

Conservation Area	Approximate Distance (miles)	Direction from HECA Project Site
California Aqueduct San Joaquin Draft Habitat Conservation Plan (developed by Department of Water Resources)	0.3	Southeast
Tule Elk State Reserve	0.3	East
Lokern Ecological Reserve	0.5	South
Occidental of Elk Hills, Inc., Elk Hills Unit Draft Habitat Conservation Plan	1.0	South
Kern Water Bank	1.0	East
Coles Levee Ecosystem Preserve	3.5	Southeast
Buttonwillow Ecological Reserve	6.5	North
Buena Vista Aquatic Recreation Area	7.8	Southeast
Northern Semitropic Ridge Ecological Reserve	22.5	Northwest
Carrizo Plain National Monument	22.7	West
Kern and Pixley National Wildlife Refuges	33.4	Northwest

3.2 CRITICAL HABITAT

Neither the HECA Project nor the OEHI Project would impact any USFWS-designated critical habitat. The nearest critical habitat is for Buena Vista Lake shrew, which is more than 20 miles to the southeast of the HECA Project Site (USFWS 2005).

3.3 ONGOING ACTIVITIES

Numerous ongoing activities in the Action Area may be affecting sensitive habitat, or federally listed plants or wildlife. To the east of the California Aqueduct are areas of active agriculture, active oil and gas extraction, and areas subject to periodic flooding as part of a water-banking system. The EHOF, located south of the California Aqueduct, is one of the most productive oil fields in the western United States, with thousands of existing production wells; it has been in production for decades.

4.0 CONSIDERATION OF FEDERALLY LISTED SPECIES

This section describes the methods used to characterize the HECA Project and OEHI Project's environmental setting and biological resources, and discusses the eight federally listed species with the potential to occur within the Action Area. Giant garter snakes are also included because they historically occupied the Action Area, but are presumed to be extirpated from the area.

4.1 EVALUATION METHODS

The Action Area evaluated for biological resources includes the area within a 1-mile radius of both the 453-acre Project Site and the OEHI Project Site, as well as the area within 1,000 feet of all proposed linear facilities. The proposed linear facilities surveyed by HECA included the process and potable water line corridor, the natural gas pipeline corridor, the railroad spur, the CO_2 pipeline route, and the transmission line route, where access was granted. These surveyed areas are shown on Figure 5, Existing Natural Resource Conservation Areas. In addition to the surveys conducted by HECA, OEHI biologists conducted surveys of the current CO_2 pipeline route and associated facilities in the EHOF.

The impact assessment for biological resources included informal consultation with resource management agencies, literature review, and preliminary field surveys. The literature search included an examination of environmental documents from adjacent and nearby areas, and a review of pertinent maps, scientific literature, and regional biological field guides. Key resources and references include the following:

- Recovery Plan for Upland Species of the San Joaquin Valley, California (USFWS, 1998)
- 2001 Special-status plant species survey results at Elk Hills Oil Field, Kern County, California (Quad Knopf, 2001)
- Supplemental Environmental Information, Occidental of Elk Hills, Inc., CO_2 Enhanced Oil Recovery Project (Stantec, 2012a)
- Modified CO_2 Supply Line Alignment Data Gap Analysis (Stantec, 2012b)
- Endangered Species Program 2011 Annual Report (OEHI, 2012)
- Coles Levee Ecosystem Preserve 2007 Annual Report (Live Oak, 2008a)
- Kern Water Bank Authority Habitat Conservation Plan/Natural Community Conservation Plan 2007 Compliance Report and Management Plan (Kern Water Bank Authority, 2008)
- California Natural Diversity Database (CDFG, 2012a)

A summary of the biological resources surveys performed is provided in Table 3. Qualifications of the biologists who contributed to the BA are provided in Appendix D. Plant species observed during these field surveys are listed in Appendix E, and wildlife species observed are provided in Appendix F. Additional wildlife surveys, including protocol surveys for blunt-nosed leopard lizard, were conducted for the OEHI project components in 2012 (Stantec, 2013).

Table 3
Biological Resources Field Surveys

Resource	Field Surveys Completed	Conducted by URS Biologists(s)
General biology	Habitat assessment, small mammal evaluation, general reconnaissance conducted for the process water linear on April 13 and April 24, 2008	Alex Brown and Julian Valenzuela
General biology	Habitat assessment, small mammal evaluation, general reconnaissance conducted for the CO_2 gas linear route on May 20, 2008	David Kisner
Potential jurisdictional wetlands	Habitat assessment in the vicinity of the CO_2 linear route, conducted on March 5, 6, and 20, 2008 and May 28, 2008	David Kisner and Alyssa Berry
General biology	Habitat assessment of the Project Site on December 30, 2008	David Kisner and Cletis England
General biology	Habitat assessment of the Project Site on January 8 and 9, 2009	Cletis England, Alyssa Berry, Robin Murray, Ronald Cummings, David Compton, and Jessica Birnbaum
Special-status wildlife, and potential jurisdictional wetlands	Rare plant, wildlife, and potential jurisdictional wetlands surveys in the vicinity of the CO_2 linear on March 17, 18, and 26, 2009	David Kisner, Wayne Vogler, Alyssa Berry, and Robin Murray
Special-status plant, wildlife, and potential jurisdictional wetlands	Rare plant, wildlife, and potential jurisdictional wetlands surveys of the Project Site on March 23, 2009	David Kisner and Cletis England
Protocol blunt-nosed leopard lizard surveys and special-status plant and wildlife	April through July 2009 protocol surveys were conducted in areas within or south of the Kern River Flood Control Channel	Wayne Vogler, Kate Eldredge, Alyssa Berry, Cletis England, Robin Murray, Ronald Cummings, Jessica Birnbaum, David Kisner, and Andy Evans
Rare plant survey	April 6 through 9, 2010 Surveys were conducted in the vicinity of the CO_2 linear	David Kisner, Kate Eldredge, and Kelly Kephart
General biology survey	April 5 through 9, 19 through 21, and 28, 2010 Surveys were conducted along the electrical transmission linear	David Kisner, Kate Eldredge, Alyssa Berry, and Kelly Kephart
General biology survey	July 27 and 28, 2010 Surveys were conducted along the natural gas linear alignment	David Kisner, Ronald Cummings, Dave Compton, and Kelly Kephart
Blunt-nosed leopard lizard	Protocol adult and juvenile surveys along natural gas linear: 2010 – August 5 through September 15, 2010 2012 – May, June, July, and August, 2012	2010 – David Kisner, Ronald Cummings, Dave Compton, Kate Eldredge, Jolie Henricks, Melissa Newman, Jane Donaldson, Mark Wilson, and Gilda Barboza 2012 – Level two biologists Chris Julian, David Kisner, and Kate Eldridge; and level one biologists Jamie Deutsch, Kelly Kephart, Johanna Kisner, Melissa Newman, Mike Carbiener, Mike Dempsey, and Jane Donaldson

Table 3
Biological Resources Field Surveys (Continued)

Resource	Field Surveys Completed	Conducted by URS Biologists(s)
Field Reconnaissance for Wetlands and Other Waters	December 7, 2010 Field review of the natural gas linear alignment	David Kisner, Jan Novak
Rare plant survey	March 15, 16, and 17, 2011 The survey was conducted along the natural gas linear alignment	David Kisner, Kelly Kephart, Johanna Kisner, Chris Julian, and Jamie Deutsch
Wetland delineation survey	March 15, 16, and 17, 2011 The survey was conducted along the natural gas linear alignment	David Kisner, Kelly Kephart, Johanna Kisner, Chris Julian, and Jamie Deutsch
Habitat Assessment Surveys/Hawk Winter Nest Structure Survey	February 23, 2012 The survey was conducted along the revised natural gas linear alignment, rail spur, and process water linear alignments	David Kisner and Steve Zembsch
Rare Plant Survey, Wetland Delineation and Habitat Assessment	March 27-30, 2012 The surveys evaluated the entire Action Area, including the Project Site and all Project linears, including the industrial rail spur alignment	Kelly Kephart, Jan Novak, and Jane Donaldson

Per CEC guidelines, a record search was performed for a 5-mile radius of the HECA Project Site, and within 1,000 feet of the HECA Project linears. Federally listed species with the potential to occur within 5 miles of the HECA Project Site or within 1,000 feet of the HECA Project linears were identified from the following data sources:

- USFWS species lists provided for each 7.5-minute USGS quadrangle in the biological resources Action Area (called the East Elk Hills and Tupman quadrangles).A search of all species occurrences in the California Natural Diversity Database (CNDDB) within a 5-mile radius of the Project Site and 1,000 feet of linears (CDFG, 2012a).

- The CNPS Inventory of Rare and Endangered Plants for the East Elk Hills and Tupman quadrangles (CNPS, 2009)

- 2001 Special-status plant species survey results at *Elk Hills Oil Field*, Kern County, California (Quad Knopf, 2001)

- Coles Levee Ecosystem Preserve 2007 Annual Report (Live Oak, 2008a)

- Kern Water Bank Authority Habitat Conservation Plan/Community Conservation Plan 2007 Compliance Report and Management Plan (Kern Water Bank Authority, 2008)

- Occidental Elk Hills Oil Field, Kern County, California Biological Database (2008).

Appendix C identifies all federally listed species with potential to occur within 5 miles of the Action Area. Table 4 shows all federally listed plant species with potential to occur within the Action Area. Table 5 is provided in Section 4.3, and identifies all the federally listed and special-status wildlife species with the potential to occur in the vicinity of the Action Area. These tables summarize the preferred habitats for species with potential to occur in the vicinity of the Action Area. Only species identified on Table 4 and Table 5 with a "low" or greater likelihood of occurrence in Action Area are discussed in more detail in the following sections.

4.2 FEDERALLY LISTED PLANT SPECIES

No federally listed plant species were detected during the 2008, 2009, 2010, 2011, or 2012 surveys conducted by HECA northeast of the California Aqueduct. Multi-year vegetation surveys of the Action Area within the EHOF by OEHI have not documented any federally listed plant species within the OEHI Project Site (Quad Knopf, 2001). Surveys conducted northeast of the California Aqueduct used the protocols set forth in the CDFG Protocols for Surveying and Evaluating Impacts to Special-Status Native Plant Populations and Natural Communities (CDFG, 2009). The surveys were floristic in nature, covered an extensive study area that extended 1,000 feet from the centerline of proposed linears, and reference sites from the Lokern and Lost Hills areas were visited to confirm search images for individual species, and verify that the survey timing coincided with the blooming period for the listed plant species. Figure 6, Federally Listed Plant Species Near the Action Area, shows the species that have been identified near the Action Area; however, no listed plants are within the Action Area.

4.2.1 California Jewel-Flower (*Caulanthus californicus*)

California jewel-flower (listed as federally endangered) is an annual herb that occurs primarily in Fresno, Kern, and Tulare counties. A member of the *Brassicaceae* family, it inhabits chenopod scrub, pinyon and juniper woodlands, and valley and foothill grasslands. Its habitat ranges in elevation from 70 to 1,000 meters. The blooming period is from February to May. The decline of this species is attributable to agriculture, urbanization, energy development, and grazing, and possibly by invasion of non-native plants.

Based on the location of known populations, this species is not expected to be impacted by the HECA Project or the OEHI Project.

4.2.2 Kern Mallow (*Eremalche kernensis*)

Kern mallow (listed as federally endangered) is an annual herb that occurs primarily in Kern and Tulare counties. A member of the *Malvaceae* family, it inhabits chenopod scrub and valley and foothill grasslands. Its habitat ranges in elevation from 70 to 1,000 meters. The blooming period is from March to May. The decline of this species is attributable to conversion of habitat to agricultural use, as well as grazing and oil and gas development.

Table 4
Federally Listed Plant Species with Potential to Occur within 5 Miles of the Action Area

Common Name	Scientific Name	Federal Listing Status[1]	Likelihood of Occurrence in Action Area	Habitat Associations and Flowering/ Greatest Activity Period for Area
California jewel-flower	*Caulanthus californicus*	E	Low Recorded approximately 8 miles south of the Project Site	Chenopod scrub, pinyon and juniper woodlands, valley and foothill grasslands: February-May
Kern mallow	*Eremalche kernensis*	E	Low Recorded near the northern portion of the potable water linear	Chenopod scrub, valley and foothill grasslands: March-May
San Joaquin woollythreads	*Monolopia [Lembertia] congdonii*	E	Moderate Found approximately 2 miles to east of the Project Site	Chenopod scrub, valley and foothill grasslands: February-May
Bakersfield cactus	*Opuntia basilaris* var. *treleasei*	E	Very Low Not recorded in area	Chenopod scrub, cismontane woodland, valley and foothill grassland: April-May

Notes:
[1] E= Endangered

Table 5
Federally Listed or Candidate Wildlife Species with Potential to Occur within 5 Miles of the Action Area

Common Name	Scientific Name	Federal Listing Status	Likelihood of Occurrence in Action Area	Habitat Associations
Reptiles				
Blunt-nosed leopard lizard	*Gambelia sila*	E	Present Observed in 2008 within 1 mile south of the Project Site along the previously proposed CO_2 linear, and in 2010 near the northern terminus of the natural gas linear.	Inhabits sparsely vegetated alkali and desert scrub habitats in areas of low topographic relief. Preferred habitat includes semiarid grasslands, alkali flats, and washes.
Giant garter snake	*Thamnophis gigas*	T	Very Low Last recorded in 1940 within the region. Likely extirpated from Kern County.	Requires adequate water during its active season, herbaceous wetland vegetation as cover, openings in wetland vegetation for basking, and higher elevations for refuge from flood waters during the dormant season. Adapted to irrigation ditches and canals.
Birds				
Western snowy plover	*Charadrius alexandrinus nivosus*	T	Very Low Not found within 5 miles of Project Site.	Breeds above high tide-line on coastal beaches, sand spits, sparsely vegetated dunes, and beaches at creek or river mouths. Western snowy plovers that nest at inland sites are not considered part of the Pacific coast population.
Yellow-billed cuckoo	*Coccyzus americanus*	C	Very Low Poor nesting habitat; migrants may pass through area.	Inhabits open woodlands with clearings and a dense shrub layer. Often frequents woodlands near streams, rivers, or lakes.
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	Very Low Poor nesting habitat; migrants may pass through area.	Breeds in dense riparian habitats along rivers, streams, or other wetlands.
Least Bell's vireo	*Vireo bellii pusillus*	E	Very Low Poor nesting habitat; migrants may pass through area.	Prefers dense, shrubby vegetation, woodlands, scrub oak, coastal chaparral, and mesquite brushlands, often near water in arid regions.

Table 5
Federally Listed or Candidate Wildlife Species with Potential to Occur within 5 Miles of the Action Area (Continued)

Common Name	Scientific Name	Federal Listing Status	Likelihood of Occurrence in Action Area	Habitat Associations
Mammals				
Buena Vista Lake shrew	*Sorex ornatus relictus*	E	Low Habitats in the Action Area are not suitable for this species; no freshwater marsh wetlands or riparian habitats with dense cover in the Action Area.	Inhabits valley freshwater marsh with well-developed ground layer of dead branches, leaf litter, downed logs, exposed cottonwood and willow roots, and high soil moisture.
Giant kangaroo rat	*Dipodomys ingens*	E	High Observed approximately 1 mile south of the Project Site in 1990. Per February 2012 communication with CDFG, this species is expected on the southern side of California Aqueduct, but not likely to occur east of the Aqueduct.	Saltbush scrub and sink scrub communities in the Tulare Lake Basin of the southern San Joaquin Valley. Requires soft, friable soils, which escape seasonal flooding where it will dig burrows in elevated soil mounds at the base of shrubs.
Tipton kangaroo rat	*Dipodomys nitratoides nitratoides*	E	High Previously documented within 1 mile of the Project Site and within the Action Area for the linear Project components.	Valley sink scrub and valley saltbush scrub in the Tulare basin. Sparse top moderate shrub cover is associated with high-density populations. Terrain not subject to flooding is an important factor for permanent occupancy.
San Joaquin kit fox	*Vulpes macrotis mutica*	E	Present Active dens observed in vicinity of CO_2 linear in 2008 and potential tracks/sign observed in KRFCC in 2009.	Chenopod scrub, grasslands, and other habitats. Sometimes forages in agricultural areas.

Notes:
E Federal Endangered T Federal Threatened C Federal Candidate

Based on the location of known populations, this species may be found near the process water pipeline. However, the process water pipeline would be installed within an existing dirt road, and therefore the Kern mallow is not expected to be impacted by the HECA Project or the OEHI Project.

4.2.3 San Joaquin Woollythreads (*Monolopia [Lembertia] congdonii*)

San Joaquin woollythreads (listed as federally endangered) is an annual herb that occurs primarily in Fresno, Kern, and Kings Counties. A member of the *Asteraceae* family, it inhabits chenopod scrub as well as valley and foothill grasslands. Its habitat ranges in elevation from 60 to 800 meters. The blooming period is from February to May. The decline of this species is attributable to agriculture, urbanization, oil and gas development, grazing, trampling, and vehicles.

Based on the location of known populations, this species is not expected to be impacted by the HECA Project or the OEHI Project.

4.3 FEDERALLY LISTED REPTILE SPECIES

Federally listed reptile species with the potential to occur within the Action Area are described below and shown in Table 5. Species with no suitable habitat, and those that have been extirpated in the vicinity of the Action Area, are not discussed further in this document.

4.3.1 Blunt-Nosed Leopard Lizard *(Gambelia sila)*

The blunt-nosed leopard lizard is listed as federally endangered. It inhabits sparsely vegetated alkali and desert scrub habitats. Blunt-nosed leopard lizards are carnivorous. They forage opportunistically on the ground, catching grasshoppers, cicadas, and small lizards, including smaller leopard lizards. They commonly hunt by slowly stalking prey, then rapidly dashing in to capture it.

Leopard lizards typically find shelter by using mammal burrows, shrubs, or structures such as fence posts. Females can create nests by altering unused mammal burrows to form a closed chamber below the soil surface (Tollestrup, 1983). Leopard lizard habitat is characterized by sparsely vegetated scrub and grassland habitats in flat areas. Blunt-nosed leopard lizards hibernate during the winter and are active from late March to late June or July. Metabolic rates and activity are regulated by ambient temperatures. They mate from late April through May and the females usually lay eggs between May and June. The usual clutch size is three eggs, but a clutch can range from two to six. Females usually produce one clutch per year, although occasionally a second is produced. The incubation period is approximately 57 days. Females may breed during their first spring, but males may not breed until they are large enough to secure a territory (Tollestrup, 1982; 1983).

Blunt-nosed leopard lizard populations are located in scattered sites in the San Joaquin Valley and adjacent foothills and are found between elevations of 100 to 2,400 feet (Stebbins, 2003) on

alkali flats, large washes, arroyos, canyons, and low foothills. The decline of this species is primarily attributable to conversion of habitat to agricultural land. Other potential factors in the decline of blunt-nosed leopard lizard populations include predation by ravens.

No blunt-nosed leopard lizards have been observed on the Project Site or within the KRFCC area, portions of which were surveyed in 2008. Figure 7, Blunt-Nosed Leopard Lizard Occurrences Near the Action Area, shows known current blunt-nosed leopard lizard observations and the current understanding of occupied habitat within the Action Area; Figure 7 summarizes the information collected on the OEHI portion of the project over the course of 17 years of data collected for annual reporting requirements. In addition to CNDDB records, blunt-nosed leopard lizards have been observed by URS biologists at several other locations in the vicinity of the proposed HECA Project:

- In August 2008, 20 juvenile blunt-nosed leopard lizards were seen in the course of 1 day on the southwest side of the California Aqueduct, west of the proposed CO_2 pipeline.
- In 2009, a male blunt-nosed leopard lizard was seen approximately 0.2 mile west of the town of Tupman north of the east-west access road.
- In late August 2010, one blunt-nosed leopard lizard was observed approximately 0.4 mile east of the Buttonwillow Ecological Reserve.

The CO_2 pipeline south of the California Aqueduct will be constructed within habitats assumed to be used by blunt-nosed leopard lizard based on known occurrences in the vicinity. Annual surveys of the northern flank of Elk Hills for blunt-nosed leopard lizards have detected this species sporadically since 2000 (OEHI, 2012; Figure 7). Most of the recently documented occurrences of blunt-nosed leopard lizard in the Elk Hills have been on the southwestern side of the hills adjacent to the Buena Vista Valley (OEHI, 2012; Stantec, 2013).

The Kern Water Bank properties are potentially suitable for blunt-nosed leopard lizard, but may not be occupied due to the abundance of grass cover and past management activities (i.e., disking or tilling and periodic flooding). The CNDDB shows records for blunt-nosed leopard lizard on the Tule Elk Reserve approximately 0.5 mile to the south of the proposed alignment from 1990.

Protocol surveys for adults and juveniles were conducted by URS in 2012. The 2012 blunt-nosed leopard lizard surveys were conducted according to the protocols described in the California Department of Fish and Game May 2004 Approved Survey Methodology for the adult blunt-nosed leopard lizard (CDFG, 2004). Five sites along the natural gas and/or rail line shown on Figure 7 were determined to have potential habitat for blunt-nosed leopard lizards. No other habitat suitable for this species is present along the linears that will be constructed by HECA. No blunt-nosed leopard lizards were detected in the Action Area during the 2012 adult and juvenile surveys conducted on the five sites shown on Figure 7.

4.3.2 Giant Garter Snake *(Thamnophis gigas)*

The giant garter snake is a federally threatened species and is one of the largest garter snakes, attaining a total length of at least 63 inches. Females tend to be slightly longer and proportionately heavier than males. Its diet consists of small fish, tadpoles, and frogs. Adequate water during the early spring through mid-autumn to provide food and cover is an essential habitat requirement. During its active season, wetland vegetation such as cattails and bulrushes provide essential cover and foraging habitat; openings alongside waterways facilitate basking. During the dormant season of winter, giant garter snakes require higher elevation uplands for cover and safety from flood water. Throughout the dormant season, giant garter snakes inhabit small mammal burrows that lie above flood elevations. Giant garter snakes breed through March and April, and females give birth to live young from late July through early September. Brood size ranges from 10 to 46 young, with an average brood size of 23. Young immediately disperse into dense cover and absorb their yolk sacs, after which they begin foraging independently. Sexual maturity is reached at an average age of 3 years for males and 5 years for females (Stebbins, 2003).

The giant garter snake lives in agricultural wetlands and other waterways such as irrigation and drainage canals, sloughs, ponds, small lakes, low gradient streams, and adjacent uplands in the Central Valley. Due to the direct loss of natural habitat, the giant garter snake relies heavily on rice fields in the Sacramento Valley, but also uses managed marsh areas in Federal National Wildlife Refuges and State Wildlife Areas. Giant garter snakes are usually absent from larger rivers due to a dearth of suitable habitat and emergent vegetative cover, and from areas with sand, gravel, or rock substrates. Only a few recent sightings of giant garter snakes in the San Joaquin Valley are documented in the CNDDB (CDFG, 2012a).

The species is now apparently extirpated or very rare in most of its former range in the southern San Joaquin Valley. Surveys in the 1970s and 1980s yielded some previously unknown localities and several cases of extirpation or at least severe population declines (USFWS, 1993). The area of occupancy, number of sub-populations, and population size are probably continuing to decline, but the rate of decline is unknown. The decline of this species is primarily attributable to loss and degradation of habitat (USFWS, 1999a). Activities that may degrade habitat include maintenance of flood control and agricultural waterways, weed abatement, rodent control, discharge of contaminants into wetlands and waterways, and overgrazing in wetland or streamside habitats. Factors that may be significant in some areas include predation by and competition with introduced species, parasitism, and road kills (USFWS, 1999a). USFWS (1993) listed threats as habitat loss, flooding (in rice production areas), pollutants, vehicular traffic, livestock grazing, and introduced predators such as house cats and bullfrogs.

No giant garter snakes were observed during the 2008, 2009, 2010, 2011, or 2012 surveys. In addition, based on input from USFWS and CDFG, this species is presumed to be extirpated from the Action Area.

4.4 FEDERALLY LISTED MAMMAL SPECIES

No small mammal trapping was conducted to the northeast of the California Aqueduct during the 2008, 2009, 2010, 2011, or 2012 assessment surveys. Information on the small mammals in the Action Area was gained from other ongoing surveys mentioned above. There is evidence of small mammal activity, including burrows of various sizes, gopher mounds, scat, and tracks within areas of natural vegetation. Potential signs of listed mammals, such as Tipton kangaroo rat (*Dipodomys nitratoides nitratoides)* were seen within the Kern Water Bank properties.

Listed mammal activity on the OEHI property has been monitored over the course of 17 years as part of the ongoing biological monitoring (OEHI, 2012).

4.4.1 Buena Vista Lake Shrew (*Sorex ornatus relictus*)

The Buena Vista Lake shrew is a federally endangered species that inhabits the marshes of the southern San Joaquin Valley. It is a subspecies of the ornate shrew, *S. ornatus ornatus*. Shrews primarily feed on invertebrates, particularly insects. The Buena Vista Lake shrew does not cache food in burrows, and must forage frequently throughout the day and night to maintain its rapid metabolic rate. During the hottest months, activity is mostly confined to cooler periods of the day and night. The reproductive period stretches from late February through September and early October. Females of this species may have from one to eight offspring per litter, though four to six is typical. Nothing is known about the reproductive and mating system of the Buena Vista Lake shrew, but the breeding season may begin in autumn and end with the onset of the dry season in May or June (Williams and Kilburn, 1992).

The Buena Vista Lake shrew formerly occupied the marshlands of the San Joaquin Valley and the Tulare Basin. Its range has diminished due to the loss of lakes and sloughs in the area. It has been recorded from the Kern Lake Preserve area and the Kern National Wildlife Refuge. It occurred in the wetland habitats around the original historic Buena Vista, Tulare, and Kern lakes, and along streams and sloughs throughout the lake basins. Recent captures of shrews at the Kern Lake Preserve were made within a meter of the water line of Gator Pond in the shaded understory of cottonwood-willow riparian habitat, in dense stands of cattails (*Typha* spp.) and bulrushes (*Scirpus* spp.), or occasionally in dense patches of alkali heath (*Frankenia grandifolia*) (Maldonado, 1992; Maldonado et al., 1998). A partial list of plants found at many capture sites is: Fremont cottonwood (*Populus fremontii*), willow (*Salix* spp.), pickleweed (*Salicornia* sp.), alkali heath (*Frankenia grandifolia*), wild-rye (*Elymus* sp.), and Baltic rush (*Juncus balticus*). Many capture sites contain a well-developed ground layer of dead branches, leaf litter, downed logs, exposed cottonwood and willow roots, and high soil moisture. Its current distribution is unknown but is likely to be very restricted due to the loss of habitat. The decline of this species is attributable to loss of habitat due to agricultural conversion (Williams and Kilburn, 1992). Due to lack of study, information about the home range size, breeding territory size, and population densities of the shrew is lacking.

No Buena Vista Lake shrews were seen during the 2008, 2009, 2010, 2011, or 2012 surveys. Established riparian habitat that is potentially suitable for this species is approximately 1 mile

southeast of the HECA Project Site; agricultural waterways which may offer marginal habitat are common within the larger Project Area. There have been observations of this species approximately 3.5 miles southeast of the HECA Project Site in 1999 (CDFG, 2012b). This species is not expected to occur in the HECA Project Site or along any of the linears; however, based on a recent observation of this species in the KRFCC, the USFWS noted during the October 17, 2012, site visit that this species might occur in the vicinity of the process water pipeline, where it is located adjacent to canals or drainage features. These canals or drainage features may offer periodic and temporary dispersal corridors between larger patches of suitable habitat; long-term occupation of the canals and drainage features is not expected due to the lack of sustained habitat, prey, and water levels.

No Buena Vista Lake shrews have been documented in the OEHI Project Site, and no shrews are expected due to the arid habitat and lack of canals, wetlands, or other water features. The proposed CO_2 Pipeline would avoid potential disturbance of the KRFCC by constructing this segment using HDD installation.

4.4.2 Giant Kangaroo Rat *(Dipodomys ingens)*

Giant kangaroo rats are nocturnal rodents that are federally endangered and occur in scattered colonies along the western side of the San Joaquin Valley. They are typically found on fine, sandy loam soils with sparse annual grass and forb vegetation, and marginally found in low-density alkali desert scrub. Their diet primarily consists of seeds, which are cached in burrows (Shaw, 1934) and green vegetation in spring. Level terrain and sandy loam soils are needed for burrowing. Optimal cover consists of areas with almost no shrub overstory, and very few physiographic variations (Grinnell, 1932; Shaw, 1934; Hawbecker, 1951).

Breeding season lasts from January to May, peaking in early spring. Litter size ranges from four to six individuals and young are born and reared in the burrows. Predators include kit foxes, badgers, coyotes, barn owls, rattlesnakes, and gopher snakes. *D. ingens* currently occupies about 2 percent of its former range (CDFG, 1980). The decline of this species is attributable to loss of habitat to cultivation and overgrazing, and the use of rodenticides (CDFG, 1980).

No giant kangaroo rats or precincts were seen during the 2008, 2009, 2010, 2011, or 2012 surveys. Figure 8, Giant Kangaroo Rat Occurrences Near the Action Area, shows all known current giant kangaroo rat observations and the current understanding of occupied habitat within the Action Area. Based on annual monitoring conducted by OEHI, it is assumed that this species may occur within the OEHI Project Site along the CO_2 pipeline, but is not expected to occur farther south within the CO_2 EOR Processing Facility area or satellite development areas.

4.4.3 Tipton Kangaroo Rat (*Dipodomys nitratoides nitratoides*)

The Tipton kangaroo rat is a federally endangered species typically found in arid-land vegetative communities with flat or gently sloping terrain located within the floor of the Tulare Basin in the southern San Joaquin Valley. Tipton kangaroo rats generally occupy grassland with scattered shrubs and desert-shrub associations on friable soils. Burrows are commonly located in slightly

elevated earth, canal embankments, and bases of shrubs and fences where mobile soils gather above the level of surrounding terrain. Soft soils generally support higher densities of Tipton kangaroo rats than other soil types (Williams and Kilburn, 1992). Tipton kangaroo rats require terrain that is not subject to flooding to support a sustainable population. Reproduction occurs in the winter months, with most females giving birth to only two young.

The historical geographic range of Tipton kangaroo rats encompassed over 1.7 million acres of arid land. Their populations occupied the valley floor of the Tulare Basin throughout level or nearly level terrain. Current occurrences are restricted to scattered, isolated areas. In the southern San Joaquin Valley this includes the Kern National Wildlife Refuge, Delano, and other scattered areas within Kern County. Agricultural and residential development and the widespread use of rodenticides are principally responsible for the decline of the species (Williams and Kilburn, 1992).

No Tipton kangaroo rats were seen during the 2008, 2009, 2010, 2011, or 2012 surveys. However, signs of kangaroo rats (burrows, tail drag, foot prints, and scat) were observed within areas with suitable habitat along portions of the natural gas pipeline alignment. A local small mammal expert noted that 2010 had the highest capture rate for Tipton kangaroo rats ever recorded for the area (Warrick, 2010). Tipton kangaroo rats are assumed to be present throughout the Action Area northeast of the aqueduct in areas where suitable habitat is present. Figure 9, Tipton Kangaroo Rat Occurrences Near the Action Area, shows the locations of known Tipton kangaroo rat. Many of these records are very broad and non-specific and/or older than 20 years, but Tipton kangaroo rats could be present throughout the Action Area in areas with suitable habitat.

4.4.4 San Joaquin Kit Fox (*Vulpes macrotis mutica*)

The San Joaquin kit fox is federally listed as an endangered species (USFWS, 1999b). It historically ranged throughout the San Joaquin Valley from Contra Costa County to northern Santa Barbara County. San Joaquin kit foxes remain widely dispersed but have greatly reduced numbers and isolated populations (Williams and Kilburn, 1992). San Joaquin kit foxes primarily live in grassland and to a lesser extent, shrub and agricultural habitats. They predominantly eat rodents, ground squirrels, rabbits, hares, and ground-nesting birds. The pups are born in late winter and early spring, and the male provides most of the food for the female while she is nursing. Kit foxes change dens frequently, often enlarging existing ground squirrel burrows to create new dens. Predation or competitive exclusion of kit foxes may occur in the presence of coyotes, introduced red foxes, domestic dogs, bobcats, and large raptors. Human threats to the San Joaquin kit fox include destruction of habitat, habitat degradation, predator and pest control programs, and accidents caused by proximity to humans such as electrocution, road-kills, and suffocation from accidental burial in dens (Williams and Kilburn, 1992). Finally, natural factors such as drought, flooding, and rabies cause a significant percent of kit fox deaths.

San Joaquin kit foxes could occur throughout the region of the Project Site and linears; however, based on observations of dens, scat, and burrows during surveys from 2008 through 2010, the Elk Hills area southwest of the Kern River Flood Control Channel is likely to be the most

intensively used area within the Action Area (Figure 10, San Joaquin Kit Fox Occurrences Near the Action Area). Very few kit foxes have been recorded northeast of the Kern River Flood Control Channel near the Project Site and linears in the last 20 years, based on CNDDB records (2012a). No active kit fox dens were seen in 2008, 2009, 2010, 2011, or 2012 in areas northeast of the KRFCC; numerous historic burrows were evident along the proposed natural gas pipeline alignment, but none of the burrows showed sign of recent use.

The Kern Water Bank properties have the potential to contain kit fox habitat, because they are open scrub with friable soils for digging burrows, and support a prey base of rodents. However, no burrows were seen that appeared suitable for kit fox, and coyotes were seen in this area periodically; coyotes tend to exclude kit fox from the immediate vicinity.

San Joaquin kit fox have been regularly documented in the northern portion of the OEHI Project Site along the proposed CO_2 pipeline and the CO_2 EOR Processing Facility during the course of the 17 years of monitoring in this area (OEHI, 2012). There have been no documented kit fox in the area surrounding the three satellites.

5.0 EFFECTS ANALYSIS

This section evaluates the potential effects of the proposed HECA Project and OEHI Project on federally listed species. The effects analysis addresses the federally listed plant and wildlife species described in the previous sections. Potential effects are evaluated based on the area of direct habitat disturbance (direct effect) and additional indirect effects, as defined below. This section also addresses potential cumulative effects.

5.1 DEFINITION OF EFFECTS

Potential effects of the proposed action are characterized in this section using the following terms:

- Direct effects are the immediate effects of a proposed action on a federally listed species or its habitat.
- Indirect effects are defined as "those effects that are caused by or would result from the proposed action and are later in time, but are still reasonably certain to occur" (USFWS/NMFS, 1998).
- Cumulative effects are defined as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation" (USFWS, 1998).

Potential effects are also characterized as either temporary or permanent in duration. Effects that would be restored to pre-construction elevations within 1 calendar year, and are not subject to active project-related disturbance are identified as temporary effects; effects that cannot be restored to pre-construction conditions within 1 calendar year or are subject to active project-related disturbance are characterized as permanent.

5.2 HABITAT DISTURBANCE

This section summarizes potential habitat disturbance that would be associated with the HECA Project and the OEHI Project. This summary focuses on habitats that are potentially used by federally listed species. Potential habitat disturbance would include permanent conversion to other habitat types (e.g., developed) and temporary removal of habitats during construction.

The HECA Project and OEHI Project would affect habitat that supports or has the potential to support federally listed wildlife species. The estimated direct impacts to habitats potentially used by federally listed species are quantified in Table 6. Construction of the natural gas and CO_2 pipelines would directly impact Natural/Ruderal (Allscale Scrub) habitat that is known to support breeding, foraging, and dispersal of federally listed species listed in the direct effects discussion below. The proposed OEHI CO_2 EOR facilities would affect habitat that has moderate multispecies habitat value in the draft Elk Hills HCP (HCP Section 5, Figure 5.1) (Stantec, 2012a). Therefore, Table 6 includes the OEHI EOR impacts under the Natural/Ruderal habitat category, based on the Demonstration Period project information provided by OEHI (Stantec, 2012c). Habitats within the HECA Project

Table 6
Area of Direct Effects to Habitats and Existing Land Use Types within the Action Area

	Project Site		Construction Staging Area		Railroad Spur		Railroad Spur Laydown Yard		Natural Gas Pipeline		Process Water Supply Pipeline and BVWSD Well Field		Transmission Line/PG&E Switching Station/ Potable Water Pipeline		OEHI CO_2 Pipeline[2]		OEHI EOR Facilities[2]		Total	
Habitat/ Land Use Types[1]	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**	**Temporary**	**Permanent**
Alfalfa	–	118.0	59.8	–	1.7	5.3	2.0	–	3.4	–	5.9	1.15	2.8	3.29	–	–	–	–	75.6	127.74
Other Row Crop	–	317.3	20.0	–	3.5	16.2	–	–	9.4	0.23	1.7	–	–	–	–	–	–	–	34.6	333.73
Orchards	–	–	–	–	1.1	4.5	–	–	0.6	–	2	–	0.7	0.01	–	–	–	–	4.4	4.51
Natural/ Ruderal	–	–	–	–	–	–	–	–	3.7	–	–	–	–	–	28.89	0.11	–	63.79	32.59	63.90
Developed/ Disturbed	–	17.7	11.2	–	3.3	12.4	1.0	–	30.1	–	79.5	–	3.7	0.85	–	–	–	–	128.8	30.95
Total	**–**	**453.0**	**91.0**	**–**	**9.6**	**38.4**	**3.0**	**–**	**47.2[3]**	**0.23**	**89.1**	**1.15[4]**	**7.2**	**4.15**	**28.89**	**0.11**	**–**	**63.79**	**275.99**	**560.83**

Notes:

1 Areas not designated as crop land or Natural/Ruderal land have been classified as Developed/Disturbed.
2 Source: DOE Data Request – Initial Injection Phase Project Description (Stantec, 2012c).
3 The area of temporary habitat disturbance along the portion of the natural gas linear that follows the railroad spur from the Project Site to the interconnection of the railroad with the existing San Joaquin Valley Railroad line is included in the temporary effects for the railroad spur.
4 The area that would be permanently affected is based on five wells that would occupy approximately 100 feet by 100 feet each. The exact well locations are not known, but the entire area is assumed to be within alfalfa fields.

CO_2 = carbon dioxide
EOR = enhanced oil recovery
OEHI = Occidental of Elk Hills, Incorporated
PG&E = Pacific Gas and Electric Company

Site, process water pipeline route, and electrical transmission line route are not likely to be used by blunt-nosed leopard lizards or kangaroo rats; however, these areas may offer limited foraging opportunities and dispersal corridors for the San Joaquin kit fox.

One of the constraints associated with the OEHI Project EOR facilities is the presence of existing conservation lands, including the CDFG Lokern Ecological Reserve and other areas. The HECA and OEHI project linears have been aligned to avoid impacts to existing conservation areas and biologically significant areas.

5.2.1 Direct Effects

Direct effects are identified as either permanent or temporary, depending on the duration of disturbance. Permanent disturbance is defined as a disturbance of the substrate that results in paving or development of the surface that will not eventually revert back to natural habitat with value for plants and wildlife. A temporary disturbance implies a physical impact to an area for less than one season, and that the value of the habitat can typically be reestablished within 2 years of disturbance.

Natural habitat types within the Action Area include Allscale Scrub, which includes small patches of Allscale, Riparian Scrub, and open areas dominated by non-native grasses and fiddleneck (*Amsinckia* sp.) (Sawyer, Keeler-Wolf, and Evens, 2009). This document refers to this habitat as Natural/Ruderal habitat. The HECA Project would temporarily and/or permanently remove the following habitats:

- Agricultural lands
- Natural/Ruderal Habitat (Allscale Scrub)

Temporary and permanent direct effects to agricultural lands are not likely to adversely affect blunt-nosed leopard lizards or Tipton or giant kangaroo rats. However, agricultural lands are occasionally used by San Joaquin kit fox for movement and migration. The HECA Project would permanently remove agricultural lands that are cultivated for alfalfa, cotton, and onions. Permanent development of 435 acres of cultivated lands within the HECA Project Site, the 1.15-acre water wells, and the 4-acre PG&E switching station is assumed to have a minimal direct effect on the San Joaquin kit fox population in the region, due to the current land use practices and the distance (approximately 1 mile) from more suitable habitats in the Elk Hills area.

Construction of portions of the CO_2 and natural gas pipelines would affect Allscale Scrub that is potentially used by blunt-nosed leopard lizard, giant kangaroo rat, and San Joaquin kit fox. Approximately 3.7 acres of Natural/Ruderal habitat would be temporarily disturbed during construction of the natural gas pipeline. The OEHI Project would permanently impact 63.79 acres and temporarily impact 28.89 acres within the EHOF (Stantec, 2012a; Stantec, 2012b; and Stantec, 2012c). All of the OEHI temporary effects would be associated with the CO_2 pipeline construction, which would permanently impact approximately 0.11 acre. However, a significant portion of the EOR facilities will be located in areas of the EHOF where disturbance

has already occurred, and OEHI will design project components to use existing disturbed acreage to the maximum extent feasible.

5.2.2 Indirect Effects

The proposed action could indirectly affect adjacent habitats for listed species. Indirect effects could include increased emissions of air pollutants, nitrogen deposition, erosion, dust from construction vehicles, and introduction of invasive or noxious species.

The increased emissions from the construction activities are not expected to significantly affect agricultural or natural habitats. The emissions from the construction vehicles would occur over the course of the 42-month construction schedule and are not anticipated to significantly impact the region's air quality or the vegetation and wildlife in the Action Area. The emissions from the HECA Project include emissions from the plant's heat recovery steam generator stack and cooling tower facilities. The emissions will meet regional air quality standards, and will not result in an impact to the surrounding federally listed plants or wildlife.

Erosion will be controlled by implementing the Storm Water Pollution Prevention Plan and an erosion protection plan.

Dust associated with construction will be controlled by wetting dry, friable soils in the construction area. Periodic wetting of the access routes may also prove necessary depending on the wind and weather patterns.

Ground-disturbing construction activities could potentially introduce or facilitate the establishment of noxious or invasive species. HECA LLC will implement the conservation measures described in Section 2.3 to minimize this impact. OEHI will continue to implement the terms and conditions of the 1995 USFWS Biological Opinion and the 1997 CDFG MOU that are intended to minimize potential effects on listed species.

5.3 FEDERALLY LISTED PLANT SPECIES

No federally listed plant species were detected during the 2008, 2009, 2010, 2011, or 2012 plant surveys, and no federally listed plants are expected to be directly affected by the HECA Project or OEHI Project. The federally listed California jewel-flower, Kern mallow, and San Joaquin woollythreads are known to occur in the region, but are absent from the Action Area. Surveys along the natural gas pipeline are currently being conducted by HECA; however, based on site visits and existing data, no federally listed plants are expected in this area. If any federally listed plant species are found along the natural gas pipeline, the USFWS will be informed immediately and the population will be avoided by rerouting the pipeline, and/or reducing the construction corridor (see conservation measure BIO-3). Additional information will be provided to USFWS following the completion of the surveys.

5.4 FEDERALLY LISTED REPTILE SPECIES

5.4.1 Blunt-Nosed Leopard Lizard

Blunt-nosed leopard lizards were detected within the Elk Hills portion of the Action Area during the 2008 and 2009 surveys. One individual was also detected east of the Buttonwillow Ecological Reserve during the 2010 surveys of the natural gas linear; no blunt-nosed leopard lizards were detected during protocol adult and juvenile surveys completed in 2012 within the five areas of potentially suitable habitat along the natural gas pipeline (Figure 7). Based on these survey results and the distribution of other documented occurrences, blunt-nosed leopard lizards are only expected, if at all, in the flatter portions of the CO_2 pipeline within the Elk Hills area. Potential direct and indirect effects to the blunt-nosed leopard lizard are evaluated below.

Direct Effects

Blunt-nosed leopard lizards have the potential to be directly affected by habitat removal, vehicle strikes, or entrapment in open trenches or within a burrow during the installation and maintenance of the associated pipelines. However, implementation of the proposed conservation measures would substantially minimize potential direct impacts to blunt-nosed leopard lizards during construction, operation, and maintenance. These measures would avoid take of individuals, which is prohibited under the California Fish and Game Code.

Indirect Effects

Indirect effects to blunt-nosed leopard lizards may include:

- Temporary disturbance due to noise from construction and operation activities and human presence.
- A temporary reduction in natural food sources as a result of habitat disturbance.
- Predators attracted to construction-related food or trash in the area may prey on blunt-nosed leopard lizards.
- Construction, maintenance, and operational activities associated with roads and various facilities may result in the disturbance of blunt-nosed leopard lizards.

5.4.2 Giant Garter Snake

No giant garter snakes were observed during the 2008, 2009, 2010, 2011, or 2012 surveys within the Action Area. This species is presumed to be extirpated from the Action Area.

5.5 FEDERALLY LISTED MAMMAL SPECIES

5.5.1 Buena Vista Lake Shrew

No Buena Vista Lake shrews were detected during the 2008, 2009, 2010, 2011, or 2012 surveys. This species is not expected to be present in the Action Area, based on the absence of suitable habitats and the distance from known occurrences; however, due to the unpredictable nature of

this species, and to the length of the process water alignment, the USFWS requested that HECA evaluate potential for take of this species.

Direct Effects

Buena Vista Lake shrews have the potential to be directly affected by habitat removal, vehicle strikes, or entrapment in open trenches or within a burrow during the installation and maintenance of the associated pipelines. However, implementation of the proposed conservation measures would substantially minimize potential direct impacts to Buena Vista Lake shrews during construction, operation, and maintenance. These measures would avoid mortality of individuals.

Indirect Effects

Indirect effects to Buena Vista Lake shrews may include:

- Temporary disturbance due to noise from construction and operation activities and human presence.
- A temporary reduction in natural food sources as a result of habitat disturbance.
- Predators attracted to construction-related food or trash in the area may prey on Buena Vista Lake shrews.
- Construction, maintenance, and operational activities associated with roads and various facilities may result in the disturbance of Buena Vista Lake shrews.

5.5.2 Giant Kangaroo Rat

Based on range generalizations and known occurrences (refer to Figure 8), giant kangaroo rats presumably could be present along the Elk Hills portions of the CO_2 pipeline. Based on habitat preferences, more individuals would be expected within the flatter portions of the alignment, although there are only records for the steeper topographic portions of the Elk Hills area.

Direct Effects

Giant kangaroo rats have the potential to be directly affected by temporary habitat removal, vehicle strikes, or entrapment in open trenches or within a burrow during the installation and maintenance of the CO_2 pipeline. Potential direct effects will be minimized by implementation of the avoidance and minimization measures in the 1995 Biological Opinion issued by the USFWS and 1997 MOU between Oxy and the California CDFG as updated, and the HCP for the EHOF, when approved.

Indirect Effects

Indirect effects to giant kangaroo rats may include the following:

- Temporary disturbance of individual animals caused by noise associated with Project activities and human presence;

- Temporary reduction in natural food sources as a result of habitat disturbance; and

- Increased predation due to night lighting from the HECA Project Site, which would make kangaroo rats more visible to predators, and may interfere with the kangaroo rat's foraging ability.

5.5.3 Tipton Kangaroo Rat

Based on range generalizations and previously documented occurrences, Tipton kangaroo rats are presumed to be present where habitat is potentially suitable for this species, including several segments of the natural gas pipeline (Figure 9). This species is not expected to be present south of the California Aqueduct along the CO_2 pipeline route based on discussions with CDFG (Vance, 2012).

Direct Effects

Tipton kangaroo rats have the potential to be directly affected by temporary habitat removal, vehicle strikes, or entrapment in open trenches or burrows during the installation and maintenance of the natural gas pipeline. Implementation of the trapping, relocation, worker education program, and speed limits would minimize these potential direct effects. Direct impacts to Tipton kangaroo rats are not expected to affect more than 10 individuals over the life of the HECA Project.

Indirect Effects

Indirect effects to Tipton kangaroo rats may include the following:

- Temporary disturbance from noise associated with construction and operation activities and human presence;

- Reduced availability of natural food sources as a result of habitat disturbance; and

- Increased predation because night lighting from the HECA Project may make the Tipton kangaroo rats more visible to predators, and may interfere with the kangaroo rat's foraging ability.

5.5.4 San Joaquin Kit Fox

Potential direct and indirect effects to San Joaquin kit foxes are evaluated in this section. San Joaquin kit fox are known to occur in the Elk Hills area about 1 mile south of the HECA Project Site (Figure 10). This species has also been occasionally observed in agricultural areas in the HECA Project Site and the Controlled Area, as well as the construction areas of the various linear facilities.

Direct Effects

Construction of the HECA Project and OEHI Project could directly affect San Joaquin kit foxes in the region. Direct effects could include temporary and permanent habitat loss, vehicle strikes, and entrapment in open trenches or within burrows during the installation and maintenance of the natural gas, process water, and CO_2 pipelines. In addition, portions of the HECA Project would be within the Western Kern County Core recovery area identified in the Recovery Plan for Upland Species of the San Joaquin Valley (USFWS, 1998).

The USFWS Recovery Plan identifies several kit fox recovery areas in the Action Area, including:

- Western Kern County Core
- Antelope Plain/Semitropic Kern Satellite
- Urban Bakersfield Satellite

The HECA Project Site is adjacent to the northeastern edge of the Western Kern County Core recovery area. In addition, portions of the proposed CO_2 linear, electrical transmission lines, and process water pipeline are within this area (Figure 11 and Table 7). The HECA Project would temporarily disturb or remove habitats in these areas that are already degraded by existing activities (i.e., dirt roads, active agriculture, and canals), and are not likely to provide habitat for breeding or denning kit foxes. These areas are also not high-quality habitat for kangaroo rats, because kit foxes appear to be strongly linked ecologically to kangaroo rats (Cypher, 2006).

Table 7
Overlap of Project Components and the San Joaquin Kit Fox
Western Kern County Core Recovery Area

HECA Project Component	Area (Acres) within the Western Kern County Core Recovery Area
HECA Project Site	7.0[1]
Carbon Dioxide Pipeline	28.9
Process Water Pipeline	42.2[2]
Total	**78.2**

Notes:

[1] Acreage is actively farmed and is poor habitat for the San Joaquin kit fox.
[2] Acreage is included in the HECA Project Site area, is actively farmed, and is poor habitat for the San Joaquin kit fox.

The HECA Project Site and other permanent project components are actively farmed and are unlikely to provide foraging or movement habitat for San Joaquin kit fox. Although the HECA Project Site is approximately 1 mile from the margin of the Elk Hills area, the likelihood that kit fox would be present in this area is reduced by the presence of the California Aqueduct, roads, and other existing physical barriers, in addition to human activity associated with cultivated fields. Therefore, permanent loss of 435 acres at the HECA Project Site, 26 acres for the new railroad spur, 0.23 acre for the new natural gas pipeline, 1.15 acre for the BVWSD well field, and 4 acres at the PG&E switching station would have a minimal direct effect on San Joaquin kit fox in the region, because this species is not likely to regularly use the affected fields.

Approximately half of the Western Kern County Core recovery area that would be impacted by the CO_2 pipeline is high-quality habitat potentially used for denning, foraging, and dispersal of San Joaquin kit fox. The other half is less suitable for denning, foraging, and dispersal due to the steep topography of the Elk Hills and the level of existing disturbance to the area. The portion of the Western Kern County Core recovery area impacted by the process water pipeline is generally poor habitat for denning, foraging, and dispersal due to the level of disturbance (i.e., graded dirt roads, agricultural canals, and actively farmed lands) and proximity to other types of human disturbance (i.e., dumping, target shooting, and spraying).

Traffic associated with construction and operations would pass through portions of habitat for the Western Kern County Core recovery area, the Antelope Plain/Semitropic/Kern and Urban Bakersfield Satellite recovery area, and potential habitat linkages along I-5 and State Route 46 (Figure 11). The existing average daily traffic (ADT) and the HECA Project-related increase to the ADT were evaluated for the road segments inside of the San Joaquin kit fox recovery areas (Table 8). Most of the increases in traffic during construction were minimal, with the exception of the increase in traffic on Tupman Road and Stockdale Highway. Operation-related traffic includes the workforce for the HECA Project, the delivery of coal and petcoke, and shipping of some products. Petcoke deliveries are included in the operation-related traffic impacts because the trucks delivering the fuel pass through portions of the Antelope Plain/Semitropic/Kern and Urban Bakersfield Satellite Population. Coal will be delivered by truck or by rail; therefore, the potential increase in truck traffic for coal delivery is addressed in the mortality calculations because it represents the most conservative estimate of potential impacts.

The existing mortality of San Joaquin kit fox in the western Bakersfield area was determined through the 6-year study *Urban Roads and the Endangered San Joaquin Kit Fox* by Bjurlin, Cypher, Wingert, and Van Horn Job (2005). Existing, construction, and operations traffic levels were determined using Section 5.10 of the Amended AFC (Hydrogen Energy California, 2012) and Caltrans traffic estimates. Based on known mortality rates and traffic levels, the HECA Project-related mortality of San Joaquin kit fox is estimated at approximately 39 foxes over the course of 25 years (Table 9). This is a conservatively high estimate because the time of day during which the increased traffic would be on the road was not considered in the estimate; most HECA Project-related traffic would be on the roads during daylight hours when kit fox are less likely to be present. Kit foxes tend to travel during the evenings, at night, or near dawn.

The combination of potential traffic-related impacts summarized above and other potential habitat impacts to San Joaquin kit fox identified in this section is estimated to affect fewer than 39 individuals over the 25-year life of the HECA Project.

Indirect Effects

San Joaquin kit foxes inhabiting the Action Area and surrounding vicinity are likely to be subject to indirect effects, including:

- The temporary and permanent loss of kit fox foraging, pupping, and movement corridor habitat.
- Temporary harassment from noise associated with construction and operation activities and human presence.
- A temporary reduction in natural food sources as a result of habitat disturbance.
- Construction, maintenance, and operational activities associated with roads and various facilities may result in the disturbance of nearby San Joaquin kit foxes.
- Night lighting from the HECA Project Site may make kit foxes more visible to predators, and may interfere with the kit fox's foraging ability.

Table 8
Existing and HECA Project-Related Traffic Estimates within the San Joaquin Kit Fox Recovery Area

Roadway	Current ADT [1]	Construction		Operations[2]		Product Deliveries[3]	
		Current + Project ADT	Project Increase	Current + Project ADT	Project Increase	Current + Project ADT	Project Increase
I-5 (north of SR 46)	30,500	30,759	0.8%	30,876	1.2%	30,702	0.7%
I-5 (south of SR 119)	30,000	30,396	1.3%	30,416	1.4%	30,226	0.8%
Tupman Road (Tupman Town)[4]	490	1,474	200.8%	614	25.3%	490	0.0%
SR 119 (Bakersfield – east of I-5)	6,800	7,554	11.1%	6,918	1.7%	6,822	0.3%
SR 119 (Taft – west of Tupman Road)	11,800	11,924	1.1%	11,816	0.1%	11,800	0.0%
Stockdale Highway (west of I-5)[4]	2,520	3,683	46.2%	3,504	39.0%	4,321	71.5%
SR 46 (west of I-5)	10,000	10,136	1.4%	10,000	0.0%	10,000	0.0%

Notes:
[1] Unless otherwise stated, ADT values were obtained from Caltrans 2010 Traffic Data.
[2] HECA Project employees or by product trucks only.
[3] Petcoke and coal delivery to the HECA Project Site by truck only. (Does not include employees or product trucks.)
[4] Calculated from 2012 peak hour counts assuming that PM peak hour equates to 10% of ADT.

ADT = average daily traffic
SR = State Route

Table 9
HECA Project Construction and Operations Traffic Impact to San Joaquin Kit Fox

Roadways	Length (miles)	San Joaquin kit fox Recovery Area	Type	Baseline take (fox/yr/mi)	Baseline annual take (fox/year)	Project vehicles (% increase)	Project Take (fox/yr)	Cumulative Take (fox/yr)
Construction								
I-5 (north of SR 46)	14.00	Antelope Plain/ Semitropic/Kern	Satellite	0.01[1]	0.14	0.8	0.00	0.14
I-5 (south of SR 119)	5.65	Western Kern County	Core	0.03[1]	0.17	1.3	0.00	0.17
Tupman Road (Tupman Town)	5.41	Western Kern County	Core	0.14[2]	0.76	200.8	1.53	2.29
SR 119 (Bakersfield – east of I-5)	4.28	Western Kern County	Core	0.07	0.30	11.1	0.00	0.30
SR 119 (Taft – west of Tupman Road)	13.22	Western Kern County	Core	0.02[1]	0.26	1.1	0.00	0.26
Stockdale Highway (west of I-5)	5.09	Urban Bakersfield	Satellite	0.20[1]	1.02	46.2	0.47	1.49
SR 46 (west of I-5)	10.5	Antelope Plain/ Semitropic/Kern	Satellite	0.06[4]	0.63	1.4	0.01	0.64
SR 46 (west of I-5)	6.75	Link	Link	0.03[4]	0.20	1.4	0.00	0.20
SR 46 (west of I-5)	10.18	Link	Link	0.03[4]	0.30	1.4	0.00	0.30
Subtotal				0.59	3.78		2.01	5.79
Construction-related take over 3 years							**6.03**	

Table 9
HECA Project Construction and Operations Traffic Impact to San Joaquin Kit Fox

Roadways	Length (miles)	San Joaquin kit fox Recovery Area	Type	Baseline take (fox/yr/mi)	Baseline annual take (fox/year)	Project vehicles (% increase)	Project Take (fox/yr)	Cumulative Take (fox/yr)
Operations								
I-5 (north of SR 46)	14.00	Antelope Plain/ Semitropic/Kern	Satellite	0.01[1]	0.14	1.2	0.00	0.14
I-5 (south of SR 119)	5.65	Western Kern County	Core	0.03[1]	0.17	1.4	0.00	0.17
Tupman Road (Tupman Town)	5.41	Western Kern County	Core	0.14[2]	0.76	25.3	0.19	0.95
SR 119 (Bakersfield – east of I-5)	4.28	Western Kern County	Core	0.07	0.30	1.7	0.01	0.31
SR 119 (Taft – west of Tupman Road)	13.22	Western Kern County	Core	0.02[1]	0.26	0.1	0.00	0.26
Stockdale Highway (west of I-5)	5.09	Urban Bakersfield	Satellite	0.20[1]	1.02	39.0	0.40	1.42
Subtotal				0.40	2.65			3.25
Operations-related take over 25 years							**15.00**	

Table 9
HECA Project Construction and Operations Traffic Impact to San Joaquin Kit Fox (Continued)

Roadways	Length (miles)	San Joaquin kit fox Recovery Area	Type	Baseline take (fox/yr/mi)	Baseline annual take (fox/year)	Project vehicles (% increase)	Project Take (fox/yr)	Cumulative Take (fox/yr)
Product Delivery								
I-5 (north of SR 46)	14	Antelope Plain/ Semitropic/Kern	Satellite	0.01[1]	0.14	0.7	0.00	0.14
I-5 (south of SR 119)	5.65	Western Kern County	Core	0.03[1]	0.17	0.8	0.00	0.17
SR 119 (Bakersfield – east of I-5)	4.28	Western Kern County	Core	0.07	0.30	0.3	0.00	0.30
Stockdale Highway (west of I-5)	5.09	Urban Bakersfield	Satellite	0.2	1.02	71.5	0.73	1.75
Subtotal				0.31	1.63		0.73	2.36
Coal/Petcoke-related take over 25 years[4]							**18.25**	
Total Project-related take over 25 years							**39.28**	

Notes:

[1] Mortality calculated from data presented in: esrp.csustan.edu/publications/pdf/esrp_urbanroad_sjkf.pdf.
[2] Mortality estimated based on road type described in: esrp.csustan.edu/publications/pdf/esrp_urbanroad_sjkf.pdf.
[3] Baseline take for SR 46 was estimated based on home range size from http://humboldt-dspace.calstate.edu/xmlui/bitstream/handle/2148/36/Frost.pdf?sequence=1 compared to "urban" kit fox. Link populations were assumed to be half of the satellite population.
[4] Traffic-related impacts associated with operation and product deliveries would be reduced if coal is transported to the project site using the proposed rail spur.

I-5 = Interstate 5
SR = State Route

5.6 CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, local, or private projects that are reasonably certain to occur in the Action Area. Future federal projects that are unrelated to the proposed action are not considered in this section because they would require separate consultation pursuant to Section 7 of the ESA (16 USC § 1536).

Only one potential non-federal proposed project occurs within the Action Area (Table 10). This project is an application for a conditional use permit to establish a 1,061-acre dairy complex, consisting of a 121-acre dairy, a 739-acre liquid waste disposal/spreading site, and a 201-acre solid waste disposal/spreading site) at Palm Ranch. Based on aerial topography, this area appears to be an existing agricultural field. Depending on the current agricultural practices at the site, conversion of habitat could potentially contribute to the loss of movement and migration habitat for the San Joaquin kit fox. If patches of alkali and scrub habitats are present within the site, habitat conversion could contribute to the loss of burrowing or denning habitat for the blunt-nosed leopard lizard, Tipton kangaroo rat, and giant kangaroo rat. Agricultural land, which may include small isolated marginal blocks of native vegetation, is marginal habitat for these species. Marginal agricultural habitats are less likely to support these species than higher quality habitats such as the Elk Hills and the Kern River floodplain. However, the loss of 1,061 acres of agricultural habitat in conjunction with the proposed action would result in substantial cumulative effects to federally listed species under USFWS jurisdiction.

Table 10 also presents potential non-federal projects that could occur within the larger vicinity of the proposed action. Most of the projects are at least 5 miles from the Action Area and are clustered around existing highway and road corridors in areas that appear to be used for agricultural, residential, commercial, and industrial purposes. Many of the projects are separated from the Action Area by I-5 and Highway 43, and by large blocks of agricultural land uses. A few of the proposed projects are located south of the Action Area either in the Elk Hills or just east of the Action Area. These projects appear to be located in areas of higher quality habitats (e.g., native vegetation) than the projects in the urban or agricultural areas; they also appear not to have significant dispersal barriers between them and the Action Area, aside from the California Aqueduct, which bisects the Action Area. Therefore, these projects could contribute to the incremental cumulative loss of habitat for the San Joaquin kit fox, blunt-nosed leopard lizard, Tipton kangaroo rat, and Giant kangaroo rat.

All of the potential non-federal projects in the vicinity of the Action Area will be required to comply with state and local regulatory requirements that also protect federally listed wildlife and plant species. Effects from these projects are expected to be mitigated through the regulatory pathways that would reduce the cumulative effects on federally listed species; however, the HECA Project and OEHI Project would contribute to a cumulatively adverse effect to the federally listed species, as identified in this biological assessment.

Table 10
Proposed Projects, Which May Lack a Federal-Nexus, Within the Vicinity of the Proposed Action

Case ID	Project Location	APN	Applicant	Case Type	Request	Acres	Use Type
Within Action Area							
10212	Adjacent to the North and West of the Project Site	159-030-06; 159-070-03; 159-130-11; 159-020-16	Dykstra Dairies/ David Albers	CUP	Conditional Use Permit to Establish a 1,061-Acre Dairy (121-Acre Dairy, 739 Acres of Liquid Waste Disposal/Spreading, and 201 Acres for Solid Waste Disposal/Spreading) (Palm Ranch)	1,061	Agriculture
At Least 5 Miles from Action Area and/or separated by major highways or agricultural blocks that reduce the potential for use or movement by federally listed species.							
9952; 9953	7626 Superior Road	104-012-15	Cooper, Michael and Cheryl/D and D	ZCC; EXCLUSION	Zoning Change/Amendment From Exclusive Agriculture (A) to Natural Resource 5 Gross Acre Minimum Lot Size [NR(5)] District; Exclusion From Agricultural Preserve	10	Industrial
10660	Southeast Corner of 7th Standard Road and Brandt Road	463-030-12	Affentranger, Franz (Pine Dairy)	CUP	Conditional Use Permit to Establish a 589.35-Acre Dairy and 1,973.28-Acre Crop Area (Pine Dairy)	2,563.63	Agriculture
12698	Tracy Avenue, Buttonwillow	103-080-44	Rio Bravo Vista/ Mcintosh and Associates	PD	Precise Development for 'La Quinta' Hotel	6.5	Commercial
12766	345 Driver Road	104-291-52	Petro Ready Mix/ Pete Pedroza	PD	Precise Development for Concrete Batch Plant	78.18	Industrial

Notes:

APN	Assessor's Parcel Number
CUP	Conditional Use Permit
Exclusion	Exclusion from Agricultural Preserve
PD	Precise Development
ZCC	Zoning Change/Amendment

6.0 CONCLUSION AND DETERMINATION OF EFFECTS

This section presents determinations of the potential effects of the HECA Project and OEHI Project on federally listed species, based on the effects analysis discussed in Section 5.

6.1 FEDERALLY LISTED PLANT SPECIES

The proposed action would have **no effect** on plant species that are listed or proposed for federal listing. No federally threatened or endangered plant species or plant species proposed for listing were observed in the Action Area during 2008, 2009, 2010, 2011, or 2012 plant surveys. BIO-2 would require avoidance of any listed plant species, to the greatest extent feasible.

6.2 FEDERALLY LISTED REPTILE SPECIES

6.2.1 Blunt-Nosed Leopard Lizard

Implementation of the proposed action **may affect, and is likely to adversely affect** the blunt-nosed leopard lizard. Blunt-nosed leopard lizards have been observed along the CO_2 pipeline alignment, and would be addressed as part of the OEHI Project. Under California law, no mortality is allowed for this fully protected species. For the HECA Project, the avoidance and conservation measures BIO-4, BIO-5, BIO-6, BIO-8, BIO-15, and BIO-17 described in Section 2.3 would avoid mortality and reduce other direct effects on the blunt-nosed leopard lizard, including habitat loss or degradation. For the portions of the project within the EHOF, the avoidance measures in the 1995 Biological Opinion issued by the USFWS and 1997 MOU between Oxy and the California CDFG as updated, and the HCP for the EHOF, when approved, would avoid mortality and reduce other direct effects on the blunt-nosed leopard lizard.

The HECA Project would temporarily remove up to 3.7 acres of natural/ruderal habitat that does not appear to be occupied by the blunt-nosed leopard lizard, based on 2012 protocol surveys. The OEHI Project activities would temporarily remove up to 28.89 acres of habitat and permanently remove up to 63.90 acres of habitat potentially used by the blunt-nosed leopard lizard. Habitat compensation is proposed as described by conservation measure BIO-18 (HECA Project), and in accordance with the 1995 USFWS Biological Opinion (USFWS File # l-1-95-F-102) and draft HCP currently under review by the USFWS (OEHI Project), which will benefit this species to offset the loss of habitat.

6.3 FEDERALLY LISTED MAMMAL SPECIES

6.3.1 Buena Vista Lake Shrew

The proposed action **may affect, but is not likely to adversely affect** the Buena Vista Lake shrew. No Buena Vista Lake shrews were observed in the Action Area during 2008, 2009, 2010, 2011, or 2012 surveys; however, this species is presumed to be present because Buena Vista Lake shrews have been previously documented in the greater biological region. Potential effects could include temporary loss of habitat during construction, and mortality of individuals caused

by construction activities. The avoidance and conservation measures BIO-4, BIO-7, BIO-8, BIO-15, and BIO-16 described in Section 2.3 would substantially reduce the potential for direct effects on the Buena Vista Lake shrews. Also, habitat compensation, as described by conservation measure BIO-18, will provide additional benefits for long-term survival and recovery of the Buena Vista Lake shrew.

6.3.2 Giant Kangaroo Rat

The proposed action **may affect, and is likely to adversely affect** the giant kangaroo rat. No giant kangaroo rats were observed in the Action Area during 2008, 2009, 2010, 2011, or 2012 surveys; however, this species is presumed to be present because giant kangaroo rats have been previously documented in the Elk Hills region that would be crossed by the CO_2 pipeline. Potential effects could include temporary loss of habitat during construction, and mortality of individuals caused by construction activities. The OEHI Project actions would temporarily remove up to 28.89 acres and permanently remove approximately 63.90 acres of habitat potentially occupied by giant kangaroo rat. These 93 acres overlap entirely with the acreage already identified for blunt-nosed leopard lizard above. The avoidance and conservation measures BIO-4, BIO-7, BIO-8, BIO-15, and BIO-16 described in Section 2.3 would substantially reduce the potential for direct effects on the giant kangaroo rats for the portions of the CO_2 pipeline not within the EHOF. For the portions of the pipeline within the EHOF, the avoidance measures in the 1995 Biological Opinion issued by the USFWS and 1997 MOU between Oxy and the California CDFG as updated, and the HCP for the EHOF, when approved, would substantially reduce the potential for direct effects on the giant kangaroo rats. Also, habitat compensation, as described by conservation measure BIO-18 (HECA Project), and the 1995 USFWS Biological Opinion (USFWS File # l-1-95-F-102) and draft HCP currently under review by the USFWS (OEHI Project), will provide additional benefits for long-term survival and recovery of the giant kangaroo rat.

6.3.3 Tipton Kangaroo Rat

The proposed action **may affect, and is likely to adversely affect** the Tipton kangaroo rat. No Tipton kangaroo rats were observed in the Action Area during 2008, 2009, 2010, 2011, and 2012 surveys; however, based on existing information in the CNDDB and personal communications with local experts, Tipton kangaroo rats are presumed to be present in some areas along the natural gas pipeline. Potential effects could include temporary loss of habitat during construction, and mortality of individuals caused by construction activities. The proposed action would temporarily remove up to 3.7 acres of habitat potentially occupied by Tipton kangaroo rat. In addition, the OEHI Project actions would temporarily remove up to 28.89 acres and permanently remove approximately 63.90 acres of habitat potentially occupied by Tipton kangaroo rat. This is the same area identified for blunt-nosed leopard lizard above. The avoidance and conservation measures BIO-4, BIO-7, BIO-8, BIO-14, BIO-12, and BIO-15 described in Section 2.3 would substantially reduce the potential for direct effects on the Tipton kangaroo rats, which were known to occur in the region, for the HECA Project and the portion of the CO_2 pipeline not within the EHOF. For the portions of the project within the EHOF, the avoidance measures in the 1995 Biological Opinion issued by the USFWS and 1997 MOU

between Oxy and the California CDFG as amended, and the HCP for the EHOF, when approved, would substantially reduce the potential for direct effects on the Tipton kangaroo rats. Also, habitat compensation, as described by conservation measure BIO-18 (HECA Project), and the 1995 USFWS Biological Opinion (USFWS File # l-1-95-F-102) and draft HCP currently under review by the USFWS (OEHI Project),will provide additional benefits for long-term survival and recovery of the Tipton kangaroo rat.

6.3.4 San Joaquin Kit Fox

The proposed action **may affect, and is likely to adversely affect** the San Joaquin kit fox. San Joaquin kit fox signs were observed during surveys in the Elk Hills area (southwest of the Kern River Flood Control Channel) between 2008 and 2010. Based on these observations and other existing information reviewed for this BA, San Joaquin kit fox are presumed to be present along the CO_2 pipeline (OEHI, 2012). Based on field observations and habitat characteristics, kit fox are substantially less likely to be present along the natural gas pipeline alignment, electrical transmission line, or at the Project Site. Potential effects could include temporary loss of habitat during construction, permanent loss of low-quality migration/movement habitat at the HECA Project Site, and mortality of individuals caused by construction activities and HECA Project operations. The OEHI Project actions would temporarily remove up to 28.89 acres and permanently remove approximately 0.11 acre of habitats that provide all constituent elements (breeding, foraging, and migration) required by San Joaquin kit fox. These 29 acres overlap entirely with the acreage already identified for blunt-nosed leopard lizard above. These impacts would occur only in the CO_2 pipeline construction limits in the Elk Hills area. The Natural/ Ruderal (Allscale Scrub) habitats elsewhere in the HECA Project area are less likely to provide habitat for breeding and foraging kit foxes.

Based on the conservative traffic model described in Section 5.5.4, construction and operation traffic could result in mortality of approximately 39 kit foxes over the course of the 25-year HECA Project lifespan. This mortality would be spread over an area of approximately 3,000 square miles, so the impact to any one population would be minimal on an annual basis. The avoidance and conservation measures BIO-4, BIO-7, and BIO-13 described in Section 2.3 would substantially reduce the potential for direct effects on the San Joaquin kit fox from the HECA Project and portion of the CO_2 pipeline not within the EHOF. For the portions of the pipeline within the EHOF, the avoidance measures in the 1995 Biological Opinion issued by the USFWS and 1997 MOU between Oxy and the California CDFG as updated, would minimize or avoid direct effects on the San Joaquin Kit Fox. Also, habitat compensation, as described by conservation measure BIO-18 (HECA Project), and the 1995 USFWS Biological Opinion (USFWS File # l-1-95-F-102) and the draft HCP currently under review by the USFWS (OEHI Project), will improve recovery and survival of the kit fox populations in the region by establishing additional permanent conservation areas, and implementing land management activities that will facilitate better regional protection for habitats used by this species. Additional land management activities that may be implemented on existing conservation lands include control of non-native species, limiting off-road vehicle access, and installation of fencing to reduce trespass and trash disposal.

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Reviewer:	Steve Leach, Senior Biologist

FIGURES

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PROJECT LOCATION

Biological Assessment
February 2013 — Hydrogen Energy California (HECA)
28068052 — Kern County, California

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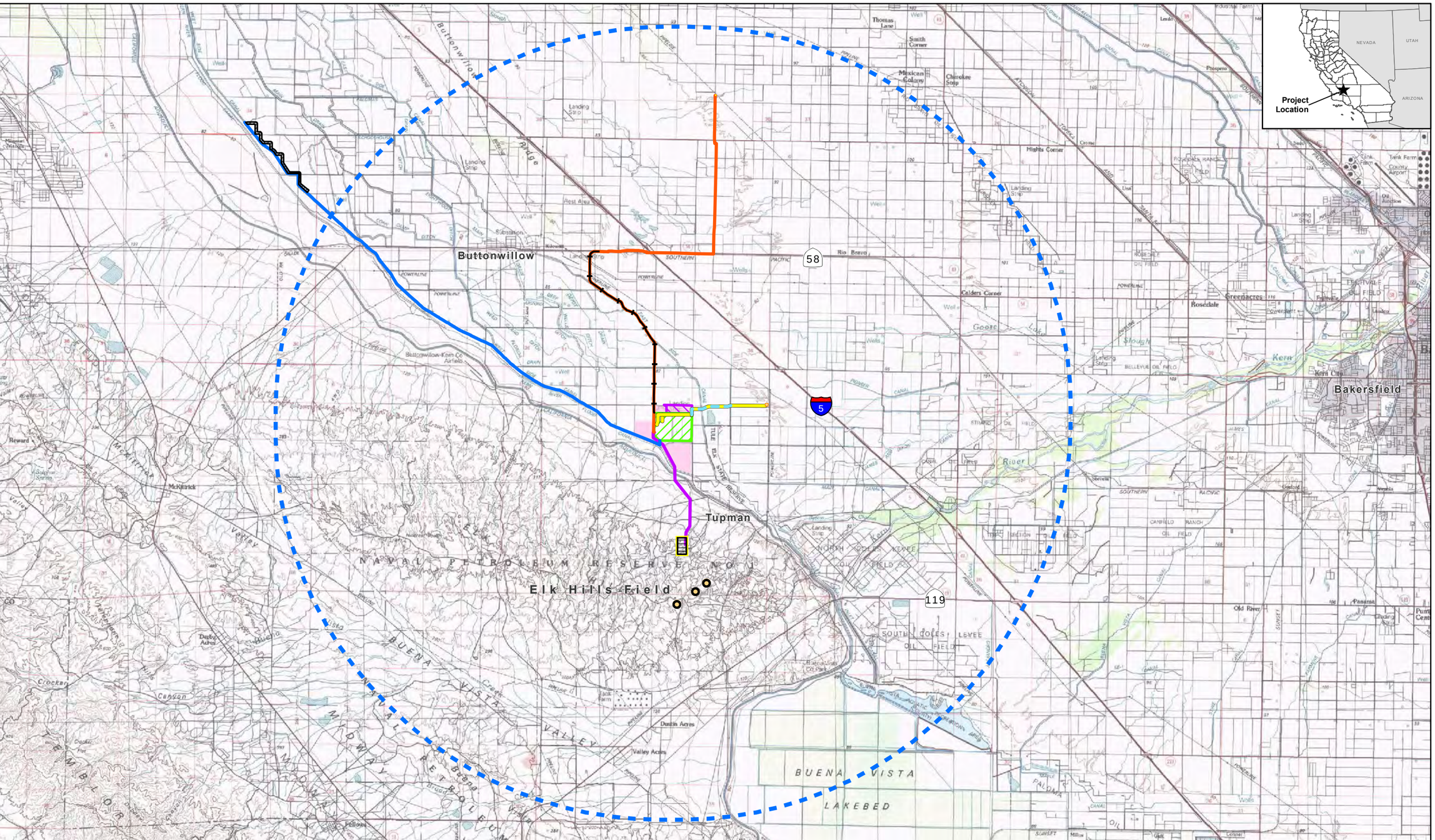
FIGURE 1



PROJECT VICINITY

Biological Assessment
Hydrogen Energy California (HECA)
Kern County, California

February 2013
28068052

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FIGURE 2

Sources: USGS (30'x60' quads: Taft 1982, Delano 1982). Created using TOPO!, ©2006 National Geographic Maps, All Rights Reserved. HECA Project Team (Biological Data, 2009)

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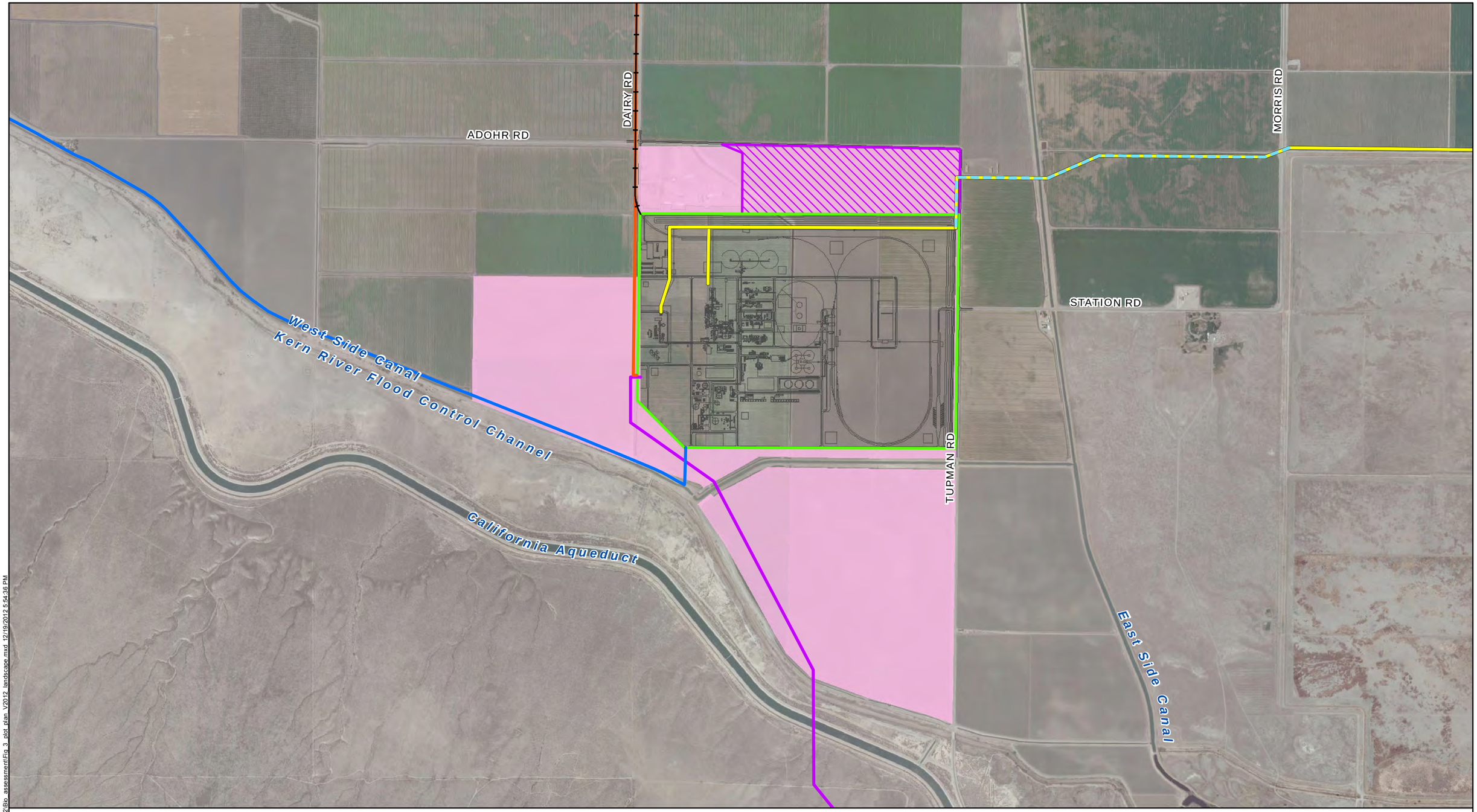

Project Site
Construction Staging Area
Controlled Area

Carbon Dioxide
Natural Gas
Potable Water
Process Water
Railroad
Transmission

N

0 750 1,500 Feet

Source: Aerial Photo, Digital Globe, 2008.

PROJECT SITE MAP

Biological Assessment
February 2013 Hydrogen Energy California (HECA)
28068052 Kern County, California

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FIGURE 3

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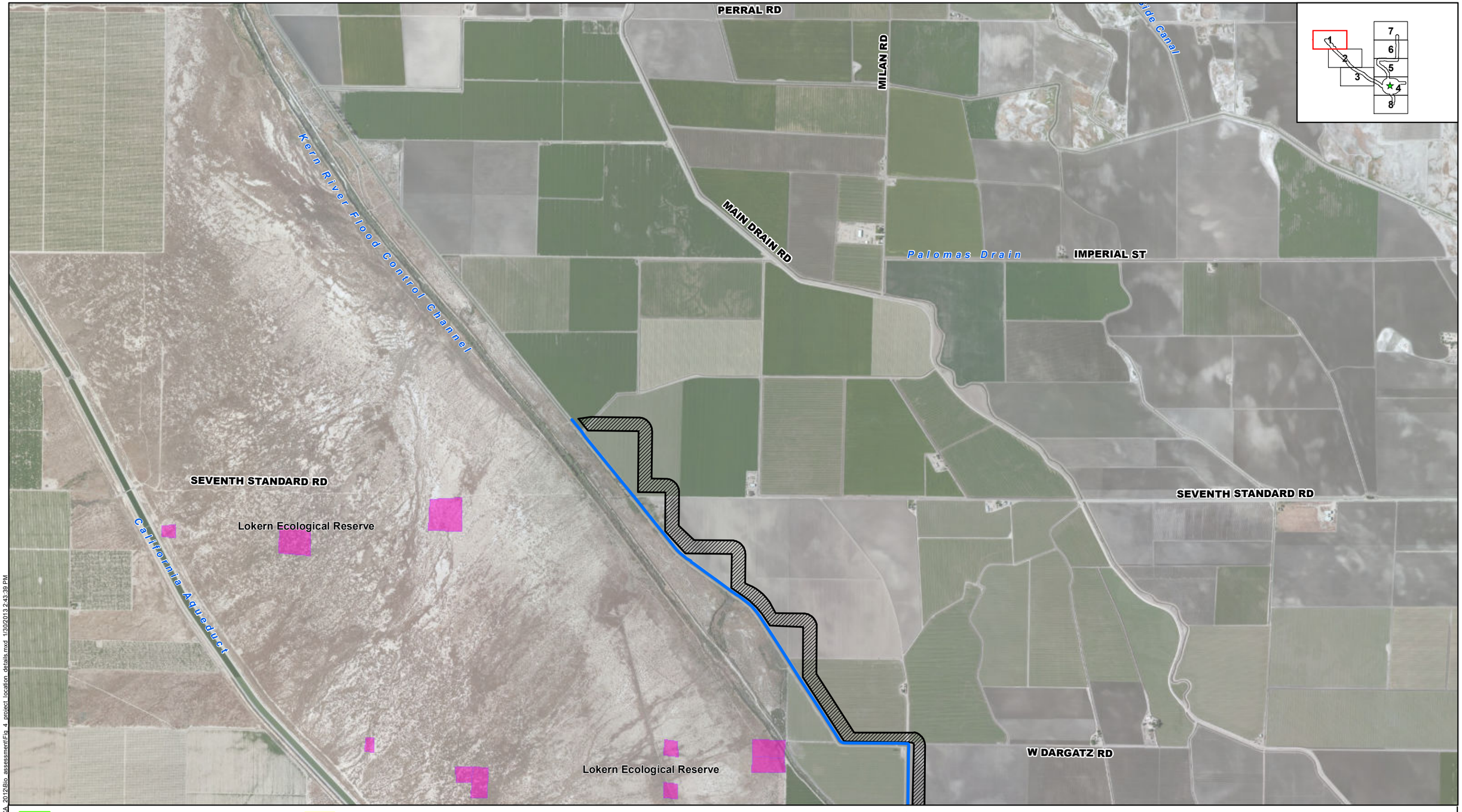

Project Site
Construction Staging Area
Controlled Area
BVWSD Well Field
Elk Hills Conservation Area

Carbon Dioxide
Natural Gas
Potable Water
Process Water
Railroad
Transmission

Proposed Natural Gas Valve Station
Rail Laydown Yard
HDD Entry/Exit Pits
Electrical Switching Station

OEHI CO2 EOR Project
EOR Processing Facility
EOR Satellite Gathering Station

Note:
HDD = Horizontal Directional Drilling

N
0 1,000 2,000 Feet

Source: Aerial Imagery, Bing Maps Hybrid, 2010

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PROJECT LOCATION DETAILS

February 2013
28068052

Biological Assessment
Hydrogen Energy California (HECA)
Kern County, California

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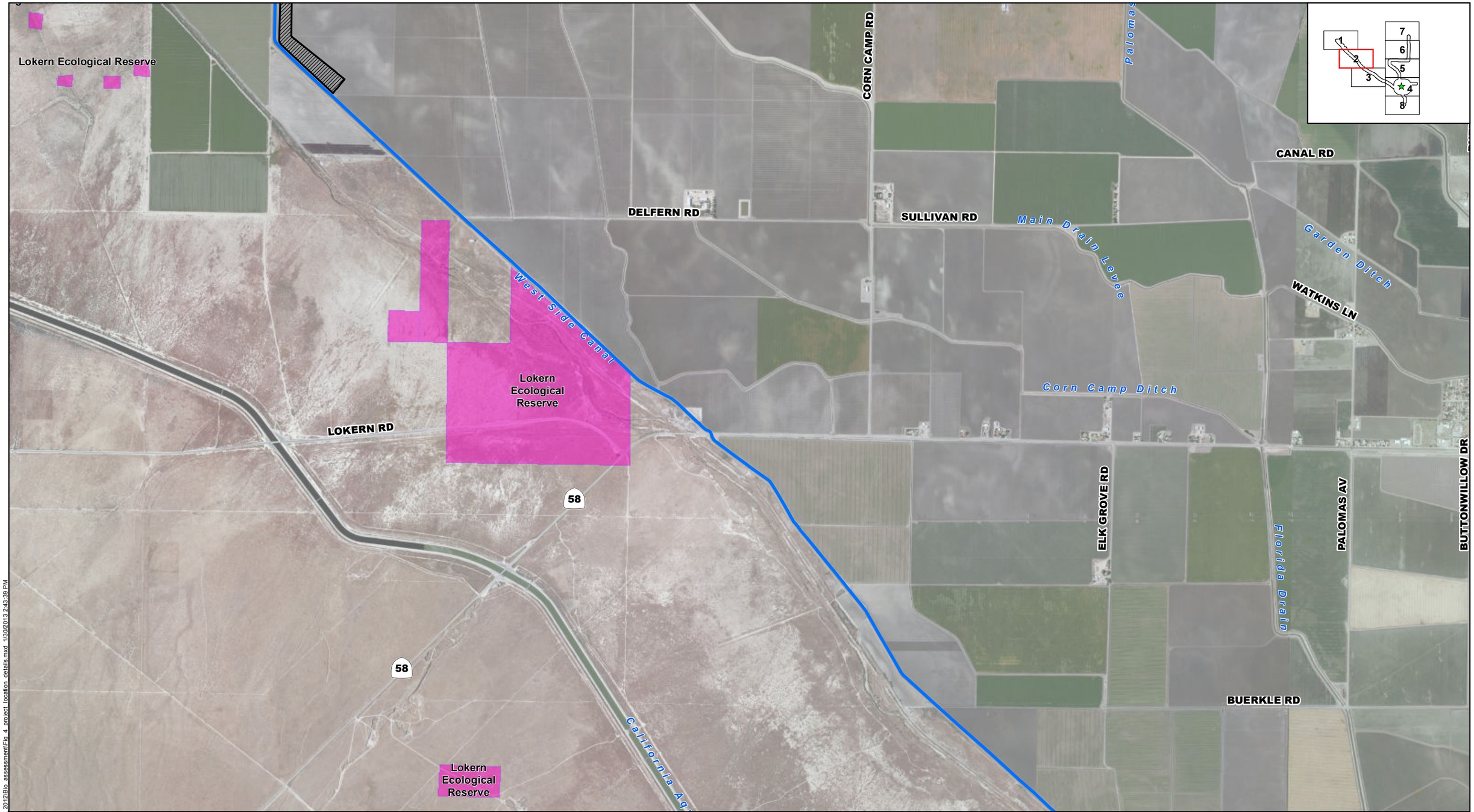
FIGURE 4 (1)



Project Site
Construction Staging Area
Controlled Area
BVWSD Well Field
Elk Hills Conservation Area

Carbon Dioxide
Natural Gas
Potable Water
Process Water
Railroad
Transmission

Proposed Natural Gas Valve Station
Rail Laydown Yard
HDD Entry/Exit Pits
Electrical Switching Station

OEHI CO2 EOR Project
EOR Processing Facility
EOR Satellite Gathering Station

Note:
HDD = Horizontal Directional Drilling

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Source: Aerial Imagery, Bing Maps Hybrid, 2010

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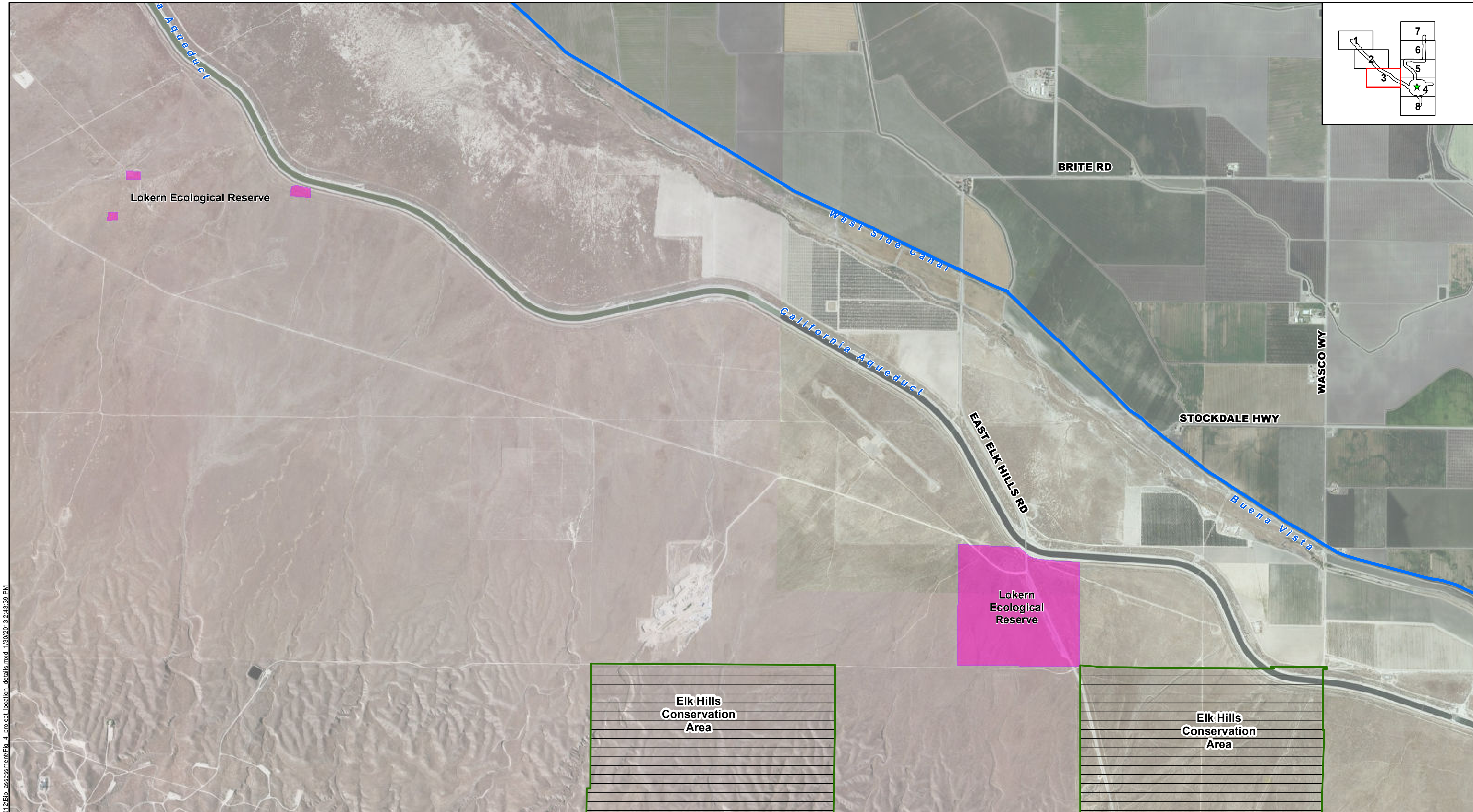
PROJECT LOCATION DETAILS

February 2013
28068052

Biological Assessment
Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 4 (2)



- Project Site
- Construction Staging Area
- Controlled Area
- BVWSD Well Field
- Elk Hills Conservation Area
- Carbon Dioxide
- Natural Gas
- Potable Water
- Process Water
- Railroad
- Transmission
- Proposed Natural Gas Valve Station
- Rail Laydown Yard
- HDD Entry/Exit Pits
- Electrical Switching Station

OEHI CO2 EOR Project
- EOR Processing Facility
- EOR Satellite Gathering Station

Note:
HDD = Horizontal Directional Drilling

N

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PROJECT LOCATION DETAILS

February 2013
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Biological Assessment
Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 4 (3)

Source: Aerial Imagery, Bing Maps Hybrid, 2010

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STOCKDALE HWY

ADOHR RD

DAIRY RD

MORRIS RD

ELK VALLE

STATION RD

TUPMAN RD

Kern River Flood Control Channel

West Side Canal

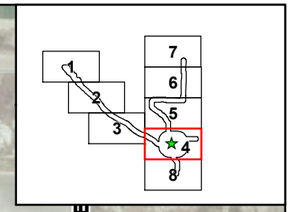
East Side Canal

Main Canal

Elk Hills Conservation Area

Lokern Ecological Reserve

Tule Elk Reserve



Project Site
Construction Staging Area
Controlled Area
BVWSD Well Field
Elk Hills Conservation Area

Carbon Dioxide
Natural Gas
Potable Water
Process Water
Railroad
Transmission

Proposed Natural Gas Valve Station
Rail Laydown Yard
HDD Entry/Exit Pits
Electrical Switching Station

OEHI CO2 EOR Project
EOR Processing Facility
EOR Satellite Gathering Station

Note:
HDD = Horizontal Directional Drilling

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Source: Aerial Imagery, Bing Maps Hybrid, 2010

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PROJECT LOCATION DETAILS

Biological Assessment
Hydrogen Energy California (HECA)
Kern County, California

February 2013
28068052

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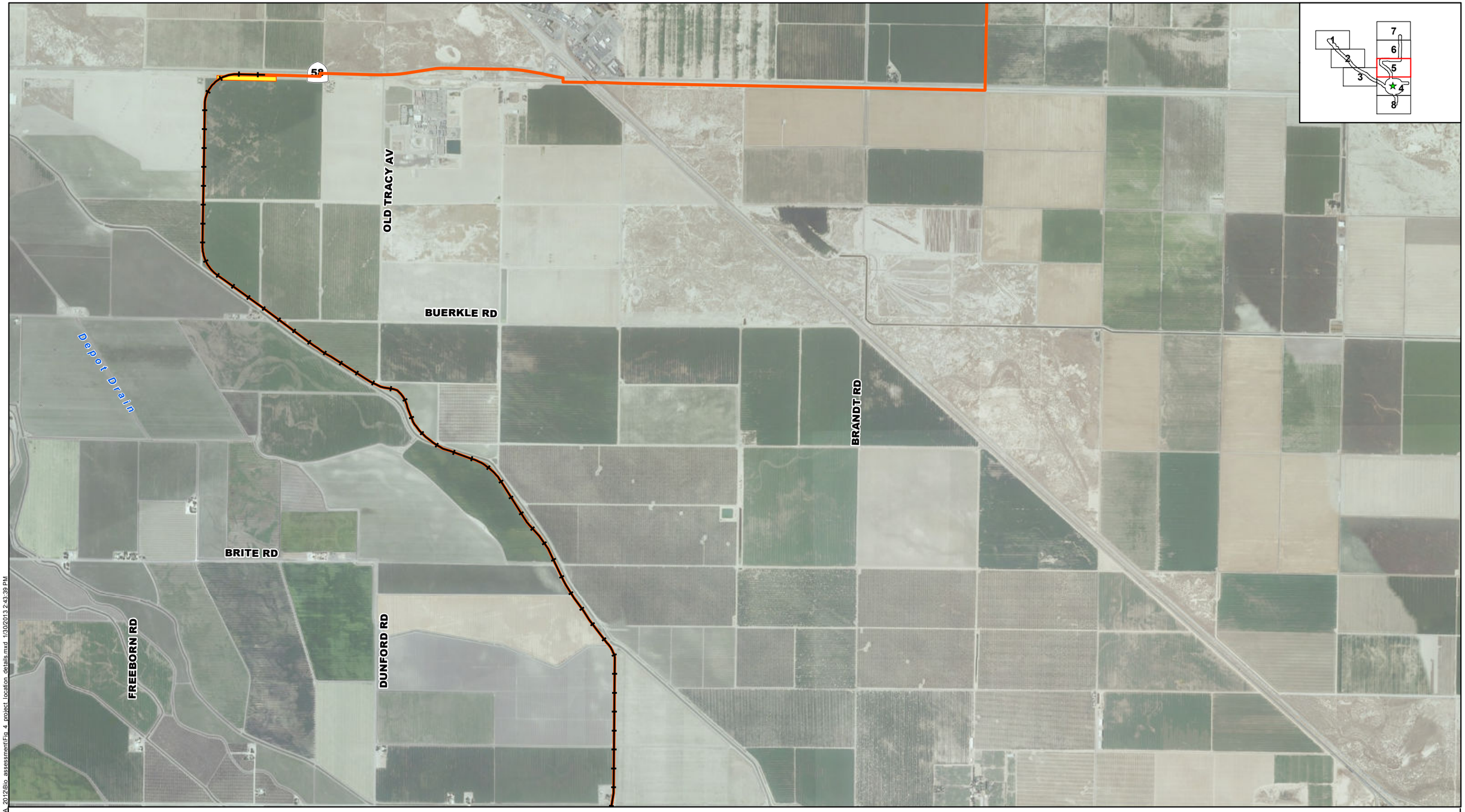
FIGURE 4 (4)



Project Site
Construction Staging Area
Controlled Area
BVWSD Well Field
Elk Hills Conservation Area

Carbon Dioxide
Natural Gas
Potable Water
Process Water
Railroad
Transmission

Proposed Natural Gas Valve Station
Rail Laydown Yard
HDD Entry/Exit Pits
Electrical Switching Station

OEHI CO2 EOR Project
EOR Processing Facility
EOR Satellite Gathering Station

Note:
HDD = Horizontal Directional Drilling

N

0 1,000 2,000 Feet

Source: Aerial Imagery, Bing Maps Hybrid, 2010

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PROJECT LOCATION DETAILS

February 2013
28068052

Biological Assessment
Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 4 (5)

JUMPER AV

SEVENTH STANDARD RD

MAGNOLIA AVE

Buttonwillow
Ecological
Reserve

ROB RD

BRANDT RD

TRACY AV

SULLIVAN RD

SULLIVAN RD

5

1 2 3 4 5 6 7 8

Project Site
Construction Staging Area
Controlled Area
BVWSD Well Field
Elk Hills Conservation Area

Carbon Dioxide
Natural Gas
Potable Water
Process Water
Railroad
Transmission

Proposed Natural Gas Valve Station
Rail Laydown Yard
HDD Entry/Exit Pits
Electrical Switching Station

OEHI CO2 EOR Project
EOR Processing Facility
EOR Satellite Gathering Station

Note:
HDD = Horizontal Directional Drilling

N

0 1,000 2,000 Feet

Source: Aerial Imagery, Bing Maps Hybrid, 2010

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PROJECT LOCATION DETAILS

February 2013
28068052

Biological Assessment
Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 4 (6)

JUMPER AV

SCOFIELD AV

RIVERSIDE ST

LEONARD AV

MAGNOLIA AV

PALM AV

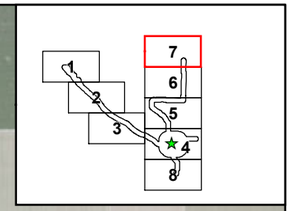
WILDWOOD RD

Buttonwillow Ecological Reserve

Buttonwillow Ecological Reserve

Buttonwillow Ecological Reserve

Proposed Natural Gas Valve Station



Project Site
Construction Staging Area
Controlled Area
BVWSD Well Field
Elk Hills Conservation Area

Carbon Dioxide
Natural Gas
Potable Water
Process Water
Railroad
Transmission

Proposed Natural Gas Valve Station
Rail Laydown Yard
HDD Entry/Exit Pits
Electrical Switching Station

OEHI CO2 EOR Project
EOR Processing Facility
EOR Satellite Gathering Station

Note:
HDD = Horizontal Directional Drilling

N

0 1,000 2,000 Feet

Source: Aerial Imagery, Bing Maps Hybrid, 2010

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PROJECT LOCATION DETAILS

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Hydrogen Energy California (HECA)
Kern County, California

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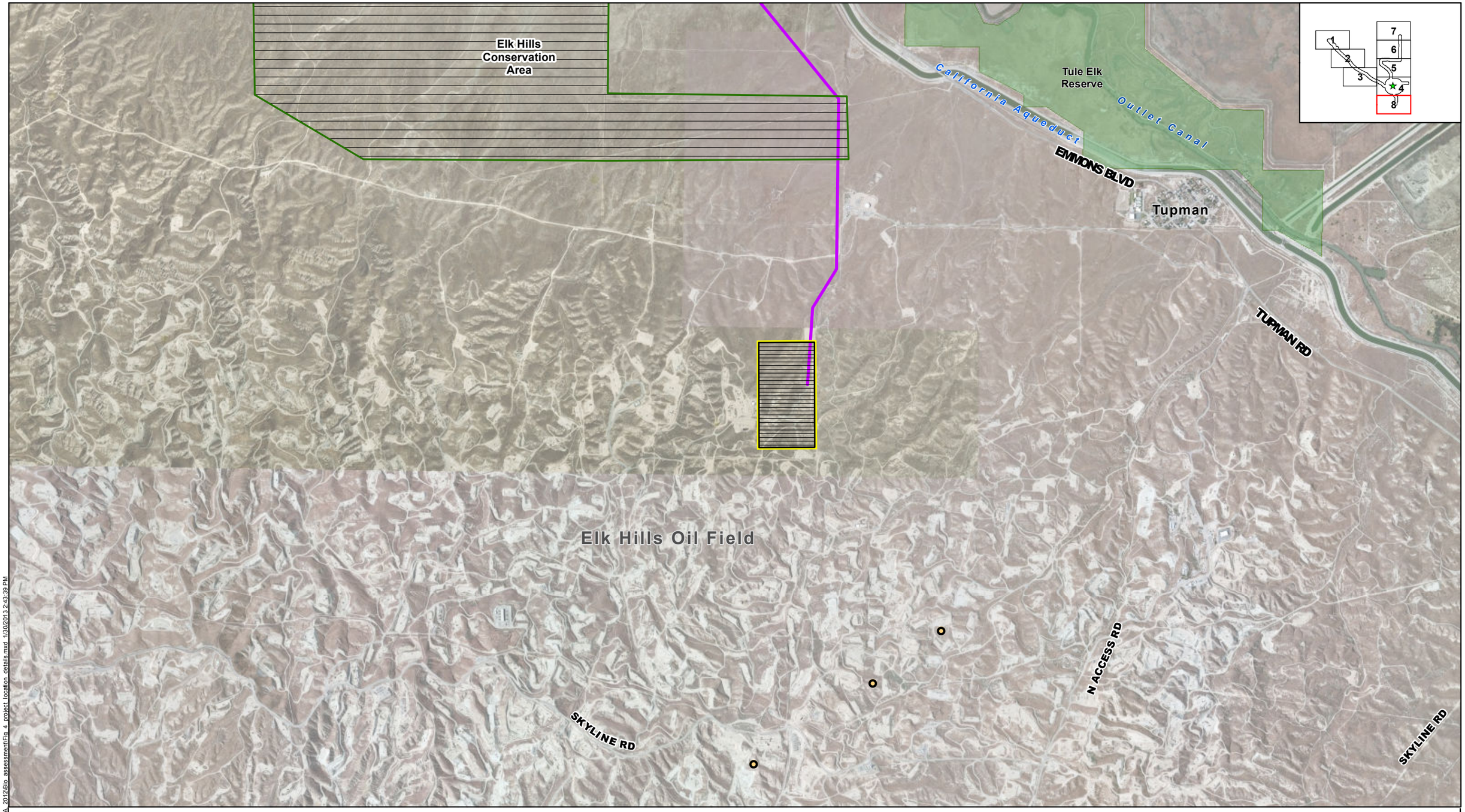
FIGURE 4 (7)



Project Site
Construction Staging Area
Controlled Area
BVWSD Well Field
Elk Hills Conservation Area

Carbon Dioxide
Natural Gas
Potable Water
Process Water
Railroad
Transmission

Proposed Natural Gas Valve Station
Rail Laydown Yard
HDD Entry/Exit Pits
Electrical Switching Station

OEHI CO2 EOR Project
EOR Processing Facility
EOR Satellite Gathering Station

Note:
HDD = Horizontal Directional Drilling

N

0 1,000 2,000 Feet

Source: Aerial Imagery, Bing Maps Hybrid, 2010

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PROJECT LOCATION DETAILS

Biological Assessment
Hydrogen Energy California (HECA)
Kern County, California

February 2013
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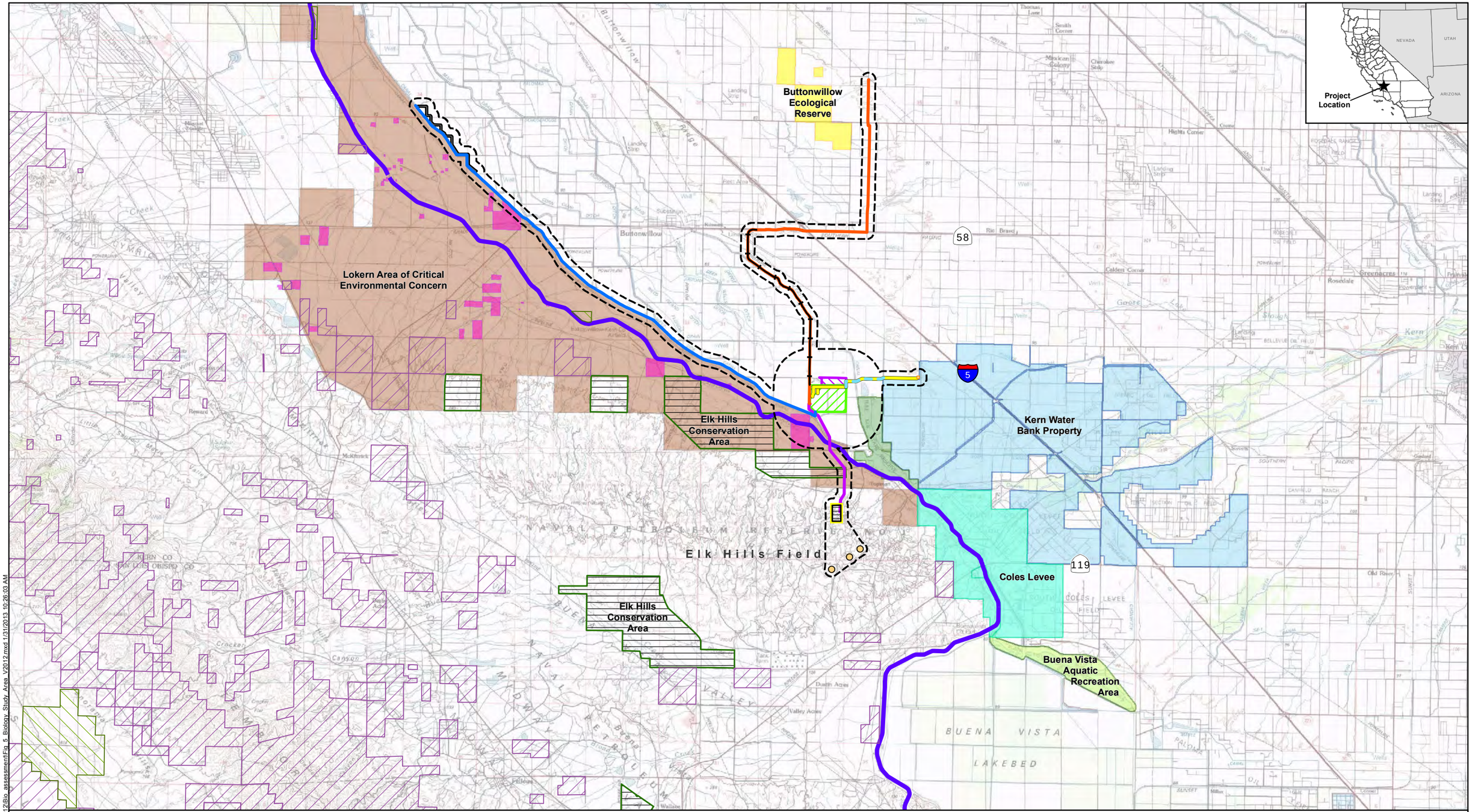
FIGURE 4 (8)



Project Site
Construction Staging Area
Action Area
Elk Hills Conservation Area
Electrical Switching Station

Carbon Dioxide
Natural Gas
Potable Water
Process Water
Railroad
Transmission

Buena Vista Aquatic Recreation Area
Kern Water Bank Property
Coles Levee
Lokern Area of Critical Environmental Concern
Tule Elk State Natural Reserve

Buttonwillow Ecological Reserve
Lokern Ecological Reserve
California Aqueduct San Joaquin Field Division Draft Habitat Conservation Plan (Approximate Extent)
Bureau of Land Management
Other Public Land

OEHI CO2 EOR Project
EOR Processing Facility
EOR Satellite Gathering Station

N

0 1.25 2.5 MILES

Sources: USGS (30'x60' quads: Taft 1982, Delano 1982). Created using TOPO!, ©2006 National Geographic Maps, All Rights Reserved. HECA Project Team (Biological Data, 2009)

[cd:\U:\GIS\HECA\Projects\HECA_2012\Bio_assessment\Fig_5_Biology_Study_Area_V2012.mxd 1/31/2013 10:26:03 AM]

EXISTING NATURAL RESOURCE CONSERVATION AREAS

Biological Assessment
Hydrogen Energy California (HECA)
Kern County, California

February 2013
28068052

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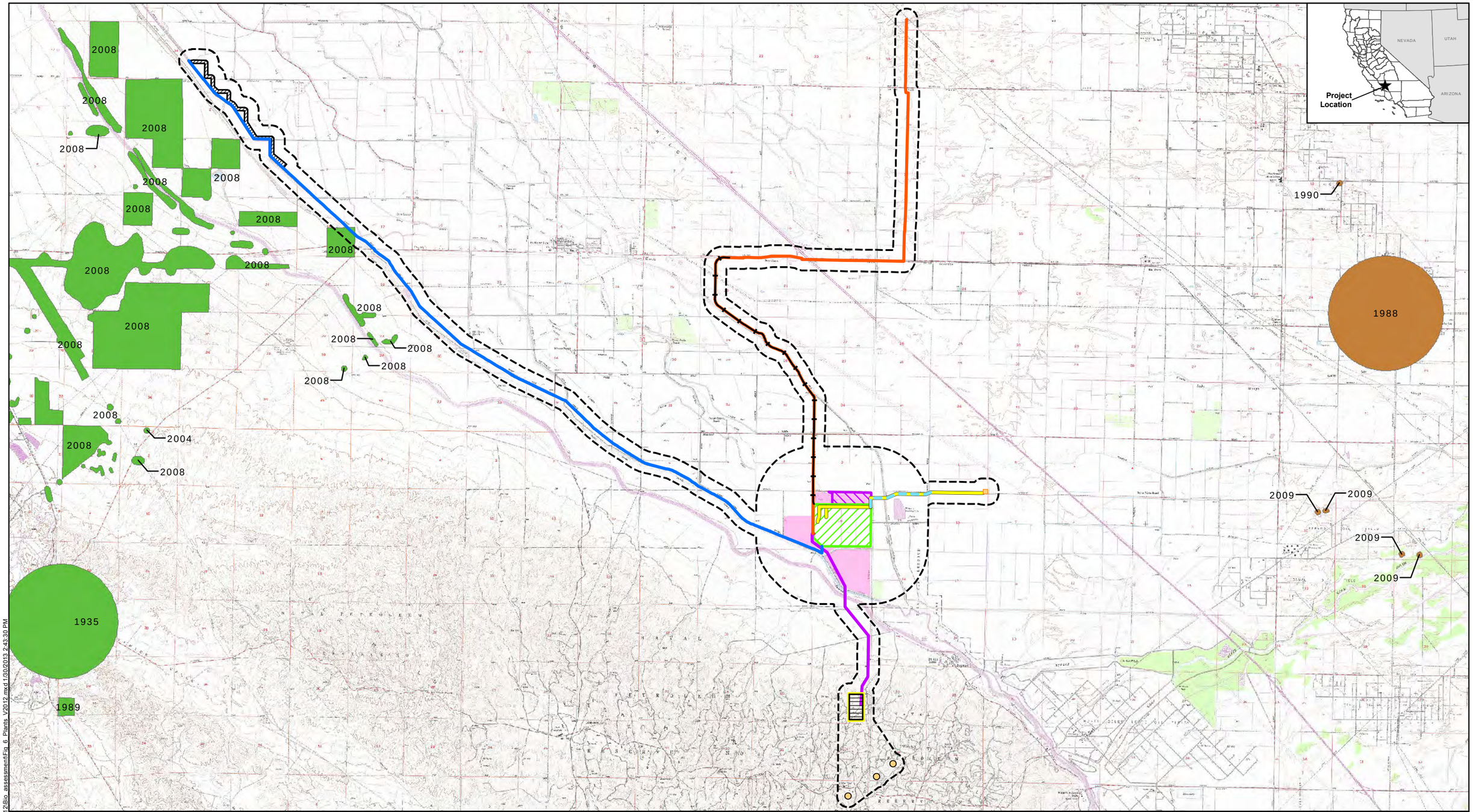
FIGURE 5



Project Site
Construction Staging Area
Controlled Area
BVWSD Well Field
Electrical Switching Station

Carbon Dioxide
Natural Gas
Potable Water
Process Water
Railroad
Transmission

San Joaquin Woollythreads
Kern Mallow

OEHI CO2 EOR Project
EOR Processing Facility
EOR Satellite Gathering Station

Note:
No known occurrences of California jewel-flower or Bakersfield cactus in area covered by this map.

N
0 0.75 1.5 MILES

Source: USGS 7.5-minute quadrangles: Buttonwillow, published 1973 (rev 1976), East Elk Hills, published 1973 (rev 1977), Lokern, published 1973 (rev 1976), Tupman, published 1973 (rev 1977), West Elk Hills, published 1973 (rev 1976); Species data, CNDDB, April 2012.

FEDERALLY LISTED PLANT SPECIES NEAR THE ACTION AREA

Biological Assessment
Hydrogen Energy California (HECA)
Kern County, California

February 2013
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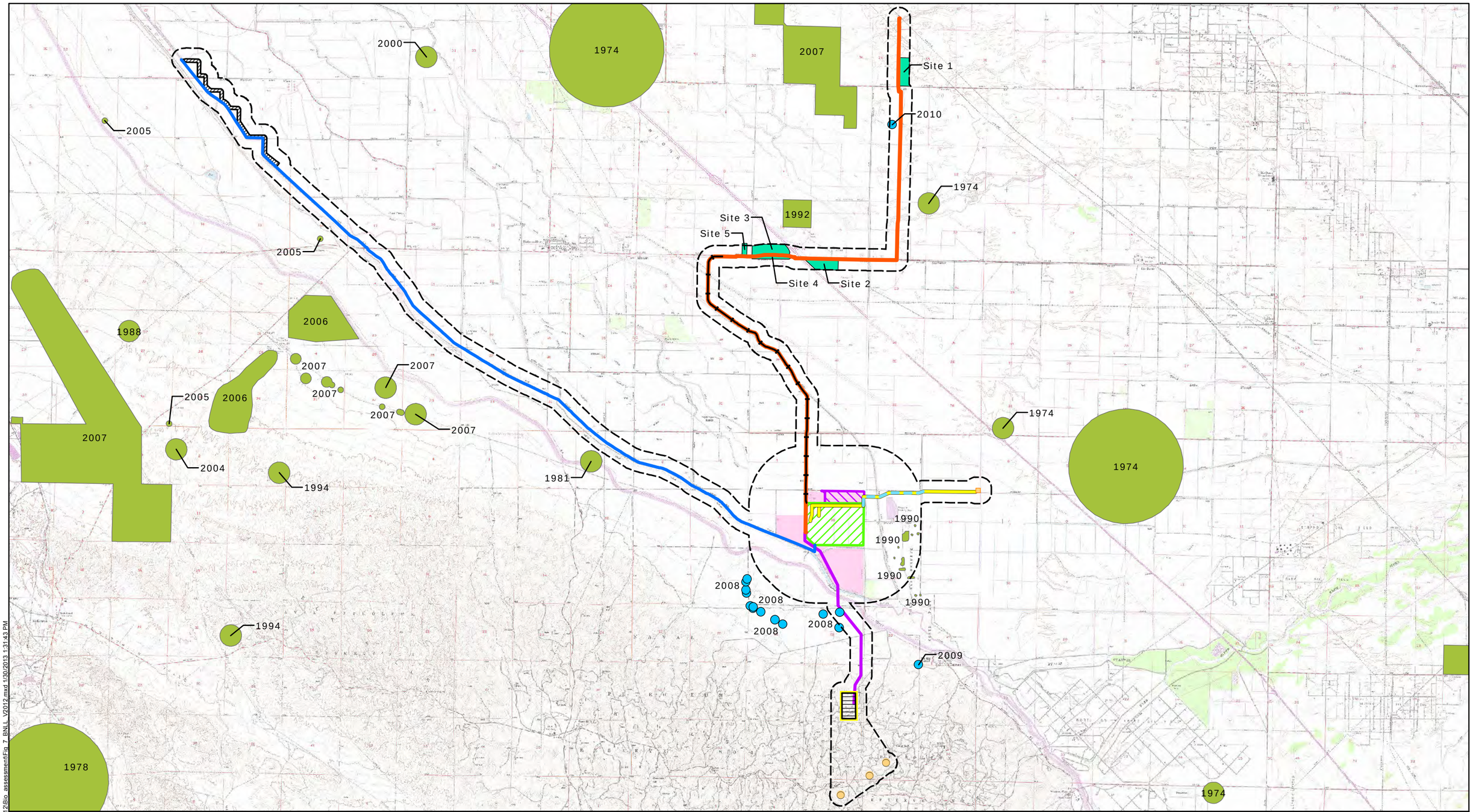
FIGURE 6

Icd U:\GIS\HECA\Projects\HECA_2012\Bio_assessment\Fig_6_Plants_V2012.mxd 1/30/2013 2:43:30 PM



Project Site
Construction Staging Area
Controlled Area
Action Area
BVWSD Well Field
Electrical Switching Station

BNLL - CNDDB records
2012 Survey Area
BNLL - URS observation

Carbon Dioxide
Natural Gas
Potable Water
Process Water
Railroad
Transmission

OEHI CO2 EOR Project
EOR Processing Facility
EOR Satellite Gathering Station

N
0 0.75 1.5 MILES

Source: USGS 7.5-minute quadrangles: Buttonwillow, published 1973 (rev 1976), East Elk Hills, published 1973 (rev 1977), Lokern, published 1973 (rev 1976), Tupman, published 1973 (rev 1977), West Elk Hills, published 1973 (rev 1976); Species data, CNDDB, 2012.

BLUNT-NOSED LEOPARD LIZARD OCCURRENCES NEAR THE ACTION AREA

Biological Assessment
Hydrogen Energy California (HECA)
Kern County, California

February 2013
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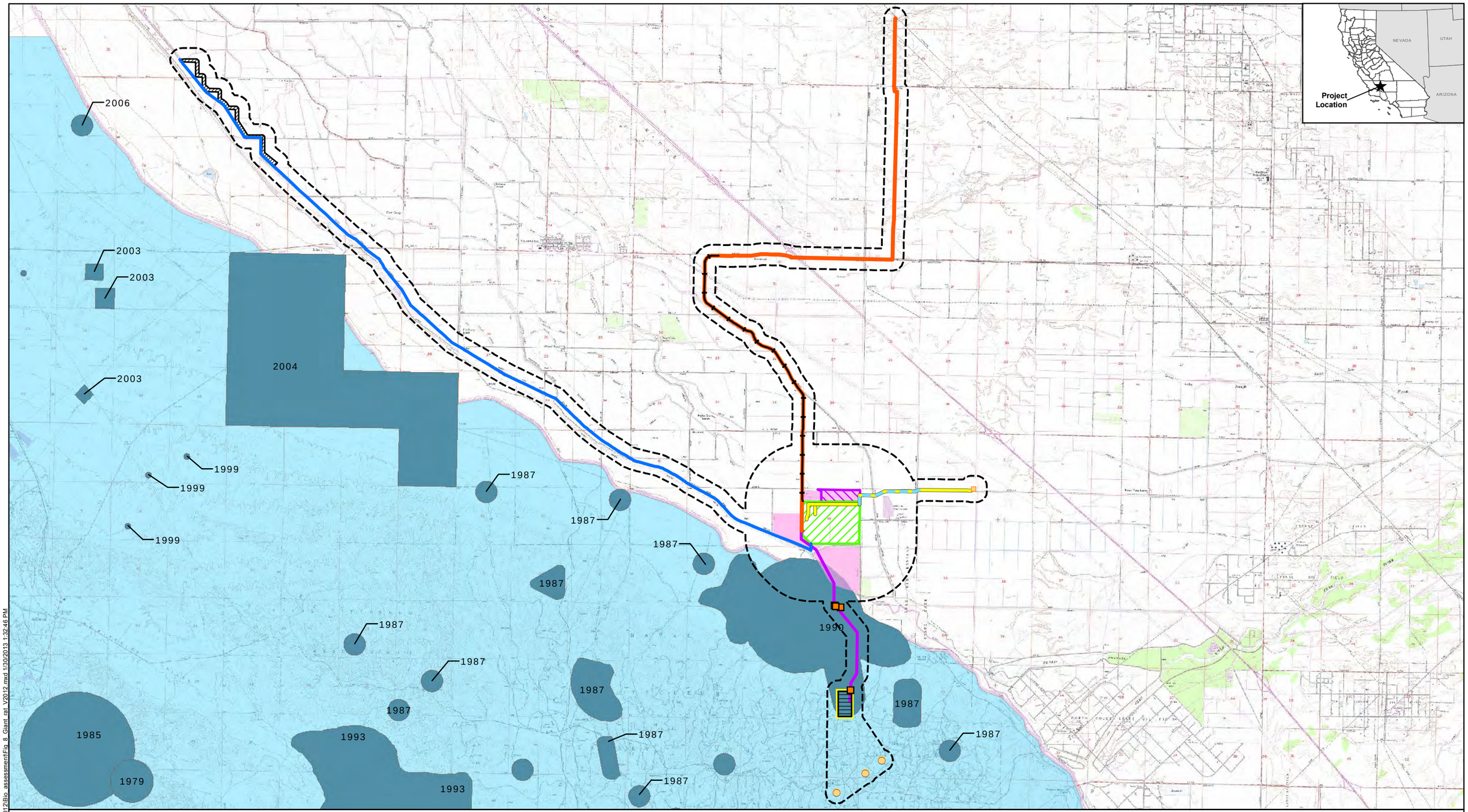
FIGURE 7

J:\cd\U\GIS\HECA\Projects\HECA_2012\Bio assessment\Fig_7_BNLL_V2012.mxd 1/30/2013 1:31:43 PM



[cd:\GIS\HECA\Projects\HECA_2012\Bio_assessment\Fig_8_Giant_rat_V2012.mxd 1/30/2013 1:32:46 PM]

Source: USGS 7.5-minute quadrangles: Buttonwillow, published 1973 (rev 1976), East Elk Hills, published 1973 (rev 1977), Lokern, published 1973 (rev 1976), Tupman, published 1973 (rev 1977), West Elk Hills, published 1973 (rev 1976); Species data, CNDDB, April 2012; Stantec. 2013. 2012 Special-Status Species Surveys for Initial CO2 Injection Phase. OEHI. January 8.

GIANT KANGAROO RAT OCCURRENCES NEAR THE ACTION AREA

Biological Assessment
Hydrogen Energy California (HECA)
Kern County, California

February 2013
28068052

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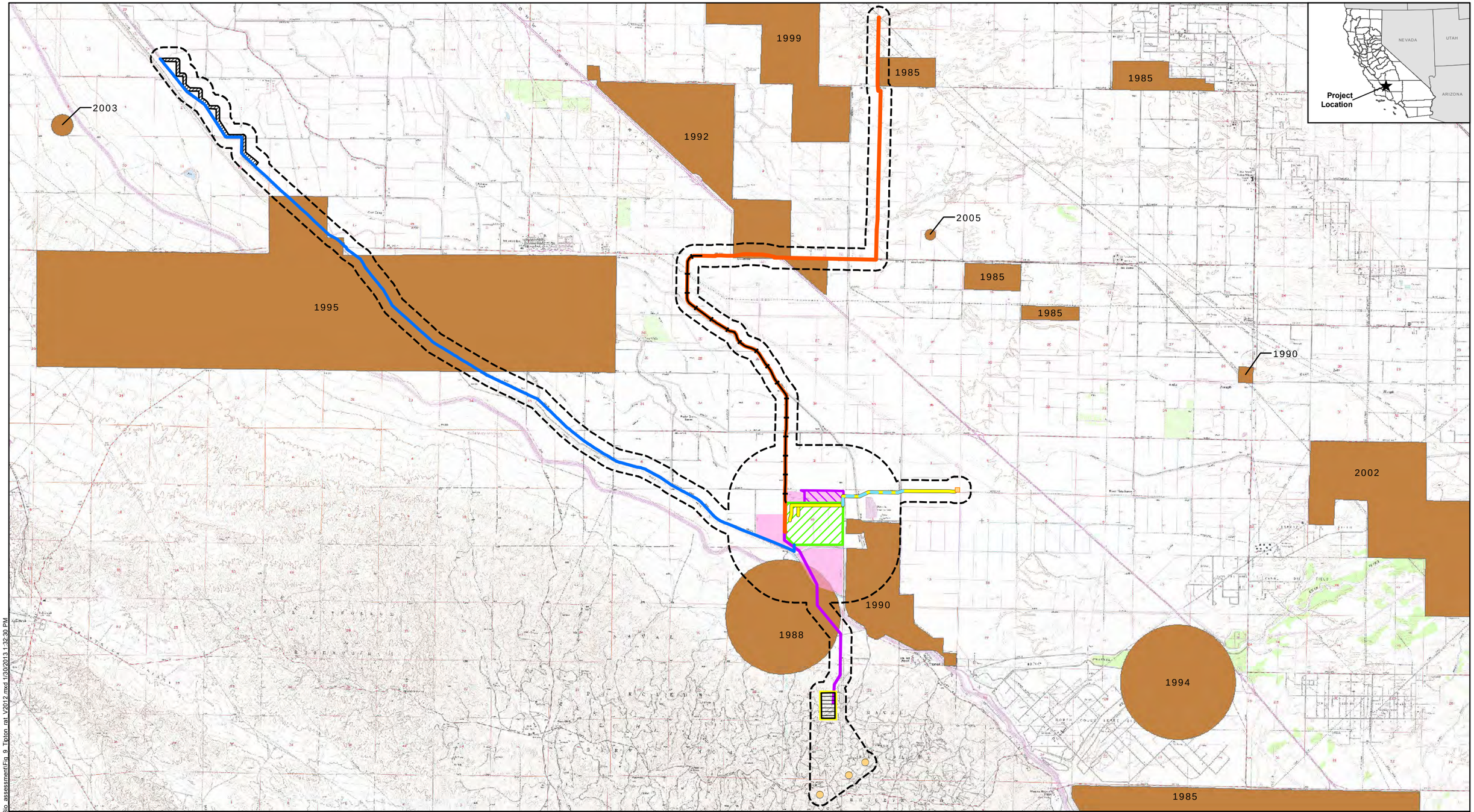
FIGURE 8



Project Site
Construction Staging Area
Controlled Area
BVWSD Well Field
Electrical Switching Station

Carbon Dioxide
Natural Gas
Potable Water
Process Water
Railroad
Transmission

Tipton Kangaroo Rat (CNDDB Records)

OEHI CO2 EOR Project
EOR Processing Facility
EOR Satellite Gathering Station

N

0 0.75 1.5 MILES

Source: USGS 7.5-minute quadrangles: Buttonwillow, published 1973 (rev 1976), East Elk Hills, published 1973 (rev 1977), Lokern, published 1973 (rev 1976), Tupman, published 1973 (rev 1977), West Elk Hills, published 1973 (rev 1976); Species data, CNDDB, April 2012.

U:\GIS\HECA\Projects\HECA_2012\Bio_assessment\Fig_9_Tipton_rat_V2012.mxd 1/30/2013 1:32:30 PM

TIPTON KANGAROO RAT OCCURRENCES NEAR THE ACTION AREA

February 2013
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Biological Assessment
Hydrogen Energy California (HECA)
Kern County, California

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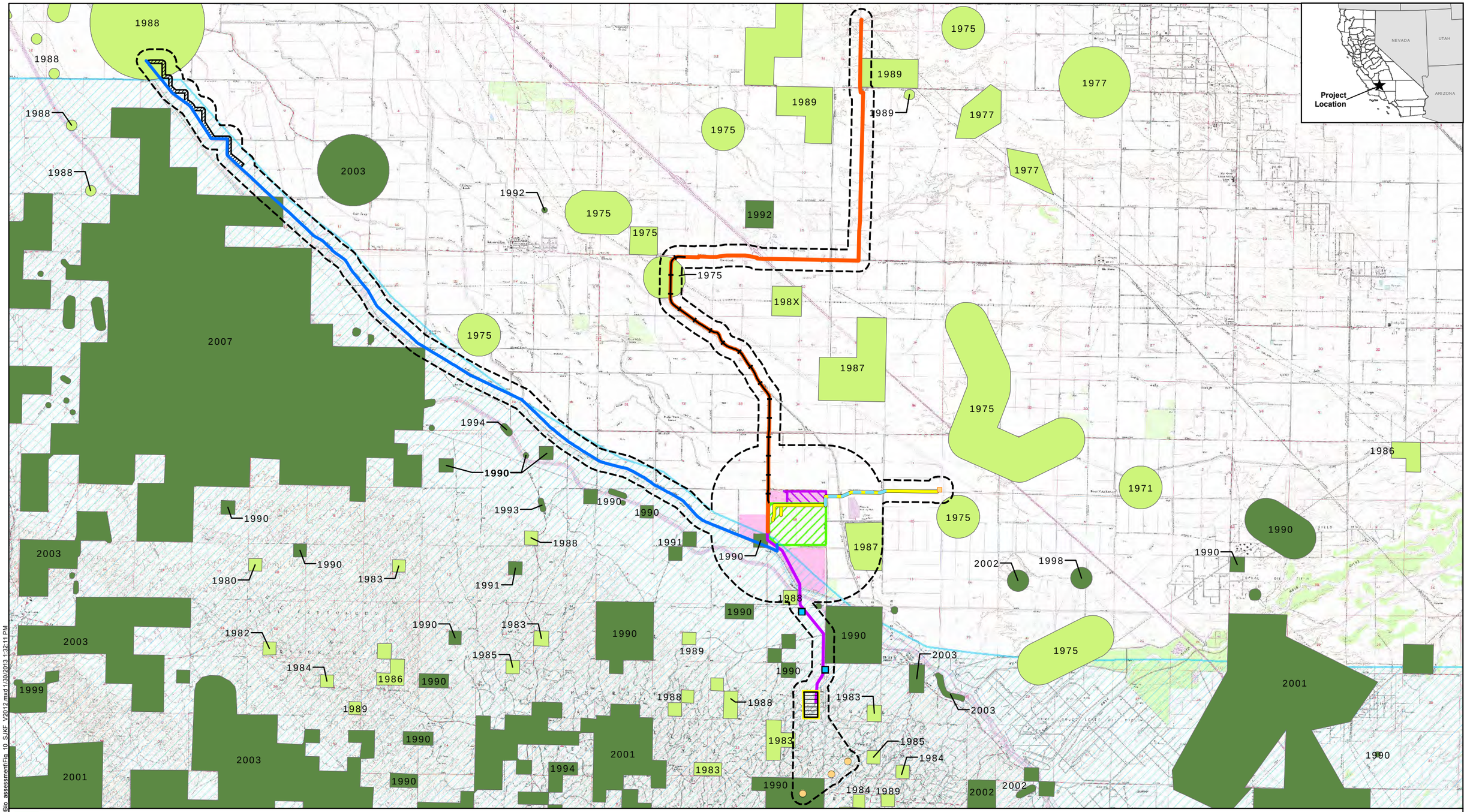
FIGURE 9



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SAN JOAQUIN KIT FOX OCCURRENCES NEAR THE ACTION AREA

February 2013
28068052

Biological Assessment
Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 10

Source: USGS 7.5-minute quadrangles: Buttonwillow, published 1973 (rev 1976), East Elk Hills, published 1973 (rev 1977), Lokern, published 1973 (rev 1976), Tupman, published 1973 (rev 1977), West Elk Hills, published 1973 (rev 1976); Species data, CNDDB, 2012; Stantec. 2013. 2012 Special-Status Species Surveys for Initial CO2 Injection Phase. OEHI. January 8.

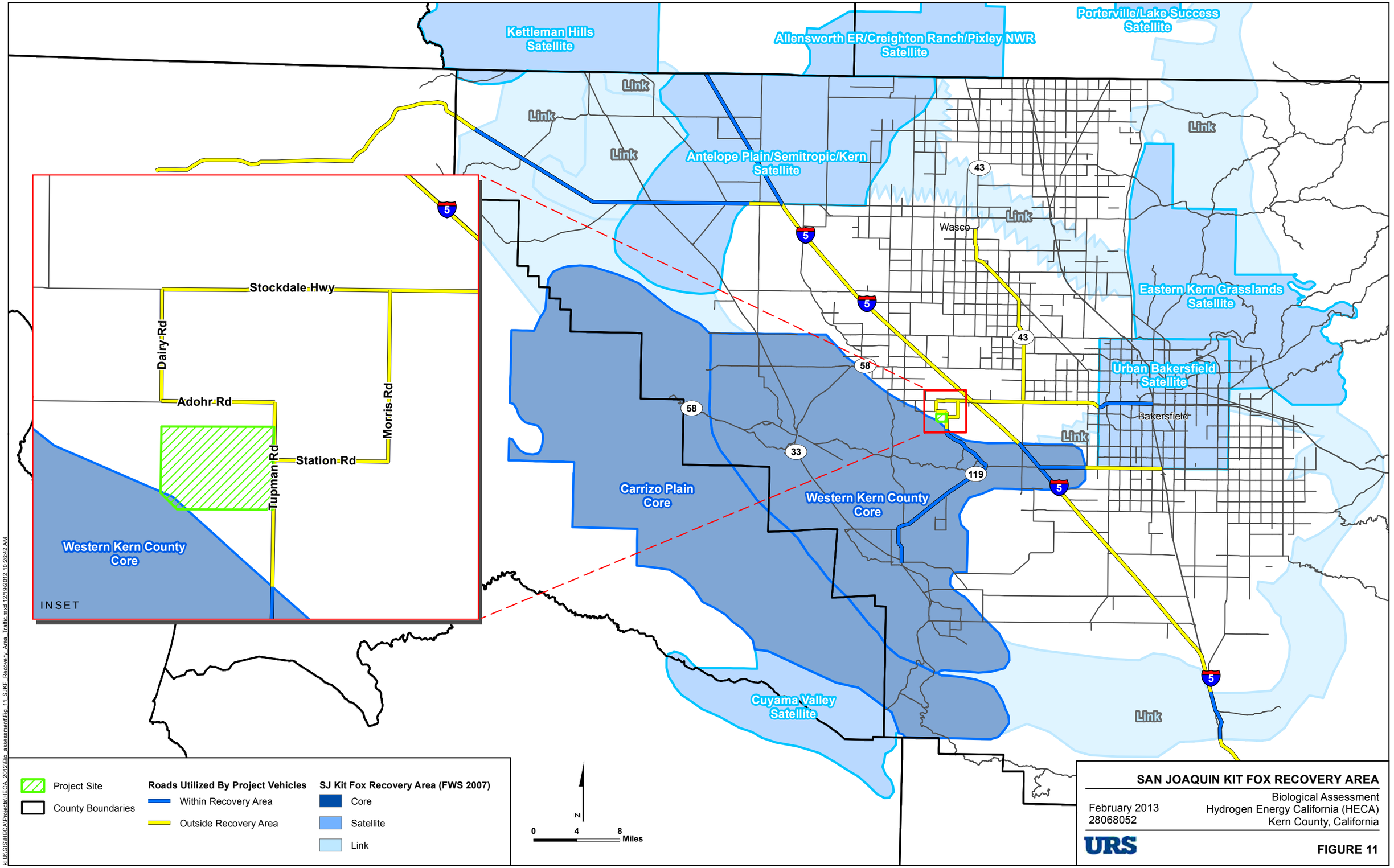
Kettleman Hills Satellite
Allensworth ER/Creighton Ranch/Pixley NWR Satellite
Porterville/Lake Success Satellite
Link
Link
Link
Link
Link
Link
Antelope Plain/Semitropic/Kern Satellite
Wasco
Eastern Kern Grasslands Satellite
Urban Bakersfield Satellite
Bakersfield
Carrizo Plain Core
Western Kern County Core
Western Kern County Core
Cuyama Valley Satellite
Link
5
43
58
33
119
Stockdale Hwy
Dairy Rd
Adohr Rd
Morris Rd
Tupman Rd
Station Rd
INSET
Project Site
County Boundaries
Roads Utilized By Project Vehicles
Within Recovery Area
Outside Recovery Area
SJ Kit Fox Recovery Area (FWS 2007)
Core
Satellite
Link
N
0
4
8
Miles
SAN JOAQUIN KIT FOX RECOVERY AREA
Biological Assessment
Hydrogen Energy California (HECA)
Kern County, California
February 2013
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FIGURE 11
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APPENDIX A

USFWS 1995 BIOLOGICAL OPINION FOR OEHI OPERATIONS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

IN REPLY REFER TO:

In Reply Refer To:
1-1-95-F-102

November 8, 1995

Mr. Danny A. Hogan, Director
U.S. Department of Energy
Naval Petroleum Reserves in California
P.O. Box 11
Tupman, California 93276

Subject: Reinitiation of Formal Consultation Concerning Oil Production at Maximum Efficient Rate on Elk Hills Naval Petroleum Reserve, Kern County, California

Dear Mr. Hogan:

This responds to your October 9, 1991, request for reinitiation of formal consultation pursuant to section 7(a) of the Endangered Species Act of 1973, as amended (Act), on a proposal by the U.S. Department of Energy (DOE or the Department) to continue oil production activities at Maximum Efficient Rate (MER) on Elk Hills Naval Petroleum Reserve (NPR-1 or the Reserve), Kern County, California. At issue are effects of proposed MER production on the federally endangered San Joaquin kit fox (*Vulpes macrotis mutica*), blunt-nosed leopard lizard (*Gambelia silus*), giant kangaroo rat (*Dipodomys ingens*), Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), Kern mallow (*Eremalche kernensis*), and San Joaquin wooly-threads (*Lembertia congdonii*), and the federally threatened Hoover's woolly-star (*Eriastrum hooveri*). Your request for formal consultation was received by this office on October 15, 1991. The U.S. Fish and Wildlife Service (Service) provided a draft biological opinion to DOE on May 28, 1993. Formal comments from DOE on the draft opinion were received on December 8, 1994. Subsequent meetings between representatives from the Service, DOE and Chevron U.S.A. (Chevron) were held on February 8, March 3, April 20, and May 18, 1995, to discuss the content of the biological opinion.

The Service addressed effects on federally listed species of MER production activities on NPR-1 in two prior biological opinions dated February 1, 1980 (Case No. 1-1-80-F-2) and December 16, 1987 (Case No. 1-1-80-F-2R). The 1980 biological opinion concluded that MER oil production on NPR-1 may jeopardize the continued existence of the San Joaquin kit fox and blunt-nosed leopard lizard, but included six reasonable and prudent alternatives that, if implemented, would allow MER production to continue. The Department agreed to implement these alternatives and to complete a future consultation to evaluate their success in minimizing adverse effects of MER production on federally listed species.

The subsequent 1987 biological opinion concluded that MER production on NPR-1 would not jeopardize the continued existence of the San Joaquin kit fox, blunt-nosed leopard lizard, Tipton kangaroo rat and giant kangaroo rat--which was listed as federally endangered in 1988. This conclusion was based, in part, on development and implementation by DOE of a comprehensive mitigation program designed to minimize adverse effects of MER production on federally listed species. In addition to this program, the 1987 opinion required the Department to implement several reasonable and prudent measures, including replacement of endangered species habitat lost as a result of project related actions.

The 1987 biological opinion also cited the Department's intent to develop a Supplemental Environmental Impact Statement (SEIS) concerning future oil production activities on NPR-1. The intent to develop such an update resulted from planning activities conducted concurrently with the 1987 consultation that determined that future oil development activities on NPR-1 could exceed some environmental impacts projected in the Department's original EIS completed in 1979 (DOE 1979). Accordingly, the Department published a Notice of Intent to prepare a supplemental EIS on NPR-1 activities in the **Federal Register** on April 4, 1988, completed a draft supplemental EIS (DSEIS) in May, 1992 (DOE 1992), and a final supplemental EIS (FSEIS) in July, 1993 (DOE 1993).

It is this supplemental EIS, together with Federal listing of several plant species--the Hoover's woolly-star, San Joaquin wooly-threads, and Kern mallow on July 19, 1990--that necessitates reinitiation of formal consultation and preparation of this revised biological opinion.

This biological opinion is based on the DSEIS (DOE 1992); the FSEIS (DOE 1993); a biological assessment prepared for currently proposed activities on NPR-1 (DOE 1991); several other reports (see Literature Cited section); meetings and discussions between the Service, Department, Chevron, and Energy Advisory Services, Inc.(EASI), the Department's biological contractor (formerly EG&G Energy Measurements); and information in our files.

BIOLOGICAL OPINION

Description of the Proposed Action

Elk Hills Naval Petroleum Reserve (or Naval Petroleum Reserve No. 1) was established in 1912 for national defense purposes, but was largely maintained in reserve shut-in status until 1976. Because of oil shortages in the early 1970's, Congress passed the Naval Petroleum Reserve Production Act in 1976, which provided for oil production on NPR-1 at the "Maximum Efficient Rate." Maximum Efficient Rate under this statute was defined as the maximum rate that optimizes both economic return and hydrocarbon recovery. The proposed action addressed in this biological opinion is continuing MER production on NPR-1 in compliance with the Naval Petroleum Production Act and as described in the DSEIS (DOE 1992).

NPR-1 consists of approximately 47,409 acres about 25 miles southwest of Bakersfield, California. Of this, 37,049 acres (78 percent) are administered by the Department of Energy; the balance of 10,360 acres (22 percent) is owned by Chevron (DOE 1992). To the south of and partially contiguous with NPR-1 lies Buena Vista Hills Oil Field which encompasses Naval Petroleum Reserve (NPR-2). Of approximately 30,000 acres comprising NPR-2, DOE administers about 10,000 acres and the balance is owned by private oil companies. The government's share of NPR-2 has been developed under lease by private oil companies since the 1920's. Together, NPR-1 and NPR-2 constitute what is known as the Naval Petroleum Reserves in California (NPRC).

Topographically, Elk Hills consists of a ridge about 16 miles long by six miles wide that runs east to west in the southern San Joaquin Valley. NPR-1 is surrounded on three sides by oil and gas fields and agricultural lands. On the north side, NPR-1 is immediately contiguous with a large area (approximately 30,000 acres) of relatively undisturbed endangered species habitat known as the Lokern Road area. Vegetation on NPR-1 consists primarily of saltbush scrub and grassland habitats.

Elk Hills is the seventh largest oil field in the United States (DOE 1991). It is a highly profitable field, cumulative net government revenues exclusive of Chevron's share from 1976 to 1990 totalling $11.6 billion (DOE 1992).

Hydrocarbon products recovered or produced on NPR-1 include crude oil, natural gas, and natural gas liquids including propane, butane, and natural gasoline. Of estimated original recoverable oil reserves on NPR-1, 860 million barrels have been produced--630 as the result of MER production since 1976 (DOE 1992). Oil production on NPR-1 peaked in 1981 at approximately 180,000 barrels per day and averaged approximately 74,000 barrels per day in Fiscal Year 1991 (DOE 1992). The Department estimates that oil production on NPR-1 could continue to be profitable until 2010 to 2025, perhaps longer (DOE 1992).

Existing Facilities

Existing operational facilities on NPR-1 include the following (DOE 1991): (1) 1,253 active wells (production, water source, gas injection, waterflood injection, wastewater disposal injection, and steam injection); (2) 1,055 existing wells that are shut-in (idle) or abandoned; (3) approximately 2,500 miles of pipelines and 1,000 miles of roads; (4) one crude oil tank farm; (5) 121 tank settings; (6) five LACT (lease automatic custody transfer) facilities used to separate oil from water and transfer oil to Chevron and Department purchasers; (7) 45 product storage tanks; (8) four gas-processing plants used to separate natural gas liquid products from natural gas; (9) five wastewater disposal facilities; (10) two gas injection plants; (11) 11 gas compression plants; (12) one steam injection facility used for thermally enhanced oil recovery; (13) several emergency wastewater sumps and two landfill facilities; (14) three building complexes for offices, maintenance, and storage; and (15) a variety of other supporting systems and infrastructure.

The majority of waste materials generated on NPR-1 are non-hazardous and include produced water, spent drilling fluids, and solid wastes such as paper, construction debris, and garbage (DOE 1991). Hazardous materials utilized or generated on NPR-1 include used oil, lubricants, and batteries; herbicides and pesticides; and solvent wastes (DOE 1991). Most produced water is re-injected on-site into subsurface formations; drilling fluids are placed into on-site land areas located in Sections 10G and 27R (the land area in Section 10G is temporarily idle). A hazardous waste facility in Section 27R was formally closed in 1992. Hazardous wastes are removed to off-site disposal facilities or are recycled (DOE 1991).

Despite careful handling, spills of oil or other chemicals occasionally occur on NPR-1. Since 1989, these have been handled in accordance with a Spill Prevention Control and Countermeasure Plan (BPOI 1989), which provides for an emergency response team, cleanup procedures, and documentation. Nonetheless, an unquantified number of acres on NPR-1 has been affected by such spills since 1976 and the Department currently is cleaning up approximately 64 sites known to have been contaminated by chromium, arsenic, and other materials (all 64 of these sites already have been remediated) (DOE 1991).

Activities necessary to achieve and maintain MER production on NPR-1 were first described in the original project EIS (DOE 1979). These activities have resulted in the construction of numerous oil production, processing, and storage facilities, associated infrastructure, and administrative facilities on NPR-1 since 1976 (see Environmental Baseline section). Because of evolving conditions, however, including better technical understanding of oil and gas reservoirs beneath NPR-1, the Department now proposes several new facilities believed to be necessary to maintain MER production through the 1990's and into the next century. These are described in the FSEIS (DOE 1993) and are summarized below. The Service completed a biological opinion in 1987 (File No. 1-1-80F-2R) that covers all of the on-going activities at NPR-1.

To maintain hydrocarbon production on NPR-1 at Maximum Efficient Rate, the Department proposes to conduct the following ongoing activities (DOE 1992) (those not pertaining to biological issues are omitted).

(1) Production at MER, estimated in the Long Range Plan to be approximately 99,000 bbl/day of oil in FY 1990, declining to approximately 72,000 bbl/day in FY 1995; 365 million ft/day of gas in FY 1990, increasing to 417 million ft/day in FY 1995; and 654,000 gal/day of natural gas liquid products in FY 1990, increasing to 768,000 gal/day in FY 1995;

(2) Drilling, redrilling or deepening approximately 382 existing wells (including 148 for the steamflood operation described below), performance of approximately 2,663 remedial jobs on existing wells, and abandonment of approximately 1,080 existing wells.

(3) Investigating, remediating, or otherwise managing numerous old and inactive waste sites.

(4) Activities to permit third parties to construct, operate, and maintain pipeline projects, geophysical surveys, and other projects on NPR-1 lands. Approximately 3-4 third-party projects are anticipated per year.

(5) A program to initiate revegetation on approximately 1,045 acres of previously disturbed lands no longer needed for production operations.

(6) Continued maintenance of the NPR-1 perimeter firebreak. This activity was addressed in prior biological opinions dated June 3, 1987 (Case No. 1-1-87-F-40), August 20, 1991 (Case No. 1-1-91-F-18), June 16, 1992 [Case No. 1-1-91-F-18(R)], and April 27, 1993 [Case No. 1-1-91-F-18(R2)].

In addition, the Department proposes to initiate the following <u>new</u> activities to maintain MER production on NPR-1 (DOE 1992).

(1) Construction and operation of a phased multi-year steamflood operation consisting of 148 wells on an approximately 500-acre area (referred to as the SOZ Steam Flood Project). This project represents an expansion of a 59-acre pilot steamflood project initiated in 1987 and addressed under a prior biological opinion (Case No. 1-1-85-F-22).

(2) Construction and operation of an additional waste water treatment facility.

(3) Construction and operation of a 5-acre butane isomerization facility.

(4) Construction and operation of a fourth gas compression and processing facility.

(5) Construction and operation of facilities to increase gas compression capacity for gas-lift and gas injection projects, and to increase waterflooding capacity.

To mitigate for adverse effects on federally listed species of ongoing and new MER production activities on NPR-1, DOE proposes to implement the following mitigation commitments as part of the proposed action. This program consists of the following components.

Mitigation Commitments

<u>Conservation Area</u>

Within three years of the date of this opinion, the Department shall place into protected status 7,075 acres of undisturbed endangered species habitat within, or adjacent to, NPR-1, and if appropriate NPR-2, preferably along the north side of NPR-1 adjacent to the Lokern Road area. This will be subject to agreement between the Service and the Department on a management agreement which would identify precise acreage amount, location, and management details

related to the conservation area. If this cannot be accomplished within 3 years, the Department agrees to reinitiate consultation if the Service is not satisfied with the progress that is being made. Such habitat shall be protected against major development activities in perpetuity through a management agreement or other appropriate document executed by and between the Director, NPRC and State Supervisor, FWS. The Department shall enter into written, legally binding agreement with the Service and other affected parties concerning the manner in which compensation lands shall be managed. This conservation area would satisfy any present or future requirements for compensating for the impacts described in the proposed action.

Prior to finalization of any land protection mechanism as required under this mitigation commitment, the Department shall submit for the Service's review the following information: (I) a description of lands selected for protection; (ii) the manner in which they would be protected; (iii) Department commitments with respect to how such lands would be managed, if necessary; and (iv) other information as deemed appropriate by the Department or Service. Finalization of the protection program shall not occur until written approval is obtained from the Service that the protection program is acceptable in all pertinent respects. The Service is available to assist the Department in selecting suitable NPR-1 lands for protection and for other assistance as necessary.

Wildlife Management Plan

This Plan was developed in 1987 to mitigate the effects of routine NPR-1 operation on endangered species and other wildlife; it requires or encourages the following: (I) conducting pre-activity surveys prior to surface disturbing activities; (ii) revegetation of disturbed areas; (iii) monitoring endangered species populations; (iv) controlling coyote populations as appropriate; (v) implementing operating guidelines; (vi) studying conservation and habitat restoration techniques; (vii) developing information and education programs for NPR-1 employees and contractors; and (viii) participating in endangered species recovery programs (O'Farrell and Scrivner 1987). Some activities conducted under the Wildlife Management Plan are discussed further below.

Endangered Species Research and Monitoring Program

In 1979 DOE initiated an endangered species monitoring program on NPR-1 and hired EG&G Energy Measurements, Inc. (EG&G) as its sole biological consultant. In part, EG&G was tasked with implementing reasonable and prudent alternative no. 1 in the Service's 1980 biological opinion--which required an evaluation of effects of oil field development on NPR-1, "basic research" on endangered species including collection of "baseline population and distributional" data, and development of methods to "increase carrying capacity" and "promote the conservation" of endangered species on NPR-1.

Since 1979 EASI has conducted extensive endangered species activities on behalf of the Department and has become an integral component of DOE's overall program on NPR-1 and NPR-2. From approximately 1979 to 1980, EASI conducted site-wide surveys on the Reserves to inventory endangered species populations (Thom Kato, EG&G, pers. comm.). From approximately 1980 to 1987, EASI gathered extensive data concerning kit fox distribution, abundance, mortality factors, and reproductive success within "developed" and "undeveloped" habitats on the Reserves (see Project Effects section). These data were reported in numerous topical reports prepared in 1986 and 1987 and in a biological assessment prepared in support of the 1987 formal consultation and biological opinion.

Operationally, EASI's role on the Reserves is currently divided into seven program "elements" (Thom Kato, EG&G, pers. comm.). These are (1) endangered

species monitoring, including monitoring of kit foxes, lagomorphs, small mammals, coyotes, and other federally listed species; (2) pre-activity surveys on NPR-1; (3) habitat reclamation and management (discussed below); (4) research and development (discussed below); (5) general program assistance, including section 7 consultation support; (6) assistance with third party projects on NPR-1 and NPR-2; and (7) endangered species support activities on NPR-2. An eighth program element previously included through approximately 1990--investigation of relationships between oil field materials and practices and wildlife--was placed as a task in the research and development element in Fiscal Year 1992, evidently because most tasks associated with this element either have been completed or deferred.

Under Element 4--research and development--EASI has conducted or proposed to conduct a variety of projects that are either independent of or indirectly related to other program tasks. Justification for these "research" studies derives in large part from language in the Service's prior biological opinions requiring or recommending, for example, development of methods to "increase carrying capacity" on NPR-1 (1980 opinion) and to conduct artificial kit fox den studies (1987 opinion). Projects conducted or ongoing under this element include, but are not limited to, a kit fox supplemental feeding study, a kit fox relocation project, a giant kangaroo rat habitat reclamation study, and a burn area re-seeding study. Projects proposed but not conducted to date include a kit fox artificial den study and a study of Bakersfield kit foxes associated with the relocation project (William Lehman, USFWS, pers. comm.).

NPRC has proposed an adjustment in the overall scope of its endangered species program from one that has been dedicated to gaining understanding (data collection, monitoring, research and studies) to one that for the most part is limited to reasonable avoidance, habitat reclamation, and habitat conservation, including the establishment of the on-site conservation area.

Monitoring would continue to be conducted in accordance with current scopes based on the following frequencies: Kit foxes would continue to be monitored annually through fiscal year 1996 (NPR-1, NPR-2, abundance, capture and tagging, prey and predators, i.e., lagomorphs, small mammals, coyotes and bobcats, diseases, sources and rates of mortality, and reproductive success). Absent a convincing scientific basis, after that kit fox abundance only would be monitored every 5 years. The abundance of all other protected species would be monitored annually through fiscal year 1999, and every 5 years thereafter.

NPRC proposes that no new data collection, research, or study activities would be initiated. Such activities currently in progress, however, would be completed, including a comprehensive effort that is in progress to integrate and document all data collected and all research/study information, analyses, and conclusions. The Service recognizes NPRC has conducted a great deal of valuable research of the sensitive species of Elk Hills. However, studies (particularly on the conservation area) should continue to gather information on endangered species management and range-wide recovery. Efforts can include habitat manipulations that will sustain and enhance the habitat quality on NPR-1; monitoring populations of listed and candidate species; beet leafhopper control and it's effect on blunt-nosed leopard lizards; etc. Ultimately, these studies should be designed to facilitate on-site endangered species conservation with an emphasis of range-wide recovery needs. The Department and the Service have agreed to address the issue of research/studies as part of the conservation area management agreement.

In late 1988, the DOE established an interagency committee to assist DOE and Chevron by providing additional perspectives on its endangered species programs on NPR-1 and NPR-2. Known informally as the Elk Hills Endangered Species Advisory Committee, this group is composed of representatives from DOE, Bechtel Petroleum Operations, Inc. (DOE's Unit Operator), EASI, Chevron,

the Service, California Department of Fish and Game, the California Energy Commission, the Bureau of Land Management, Enterprise Advisory Services, Inc., and the San Joaquin Valley Endangered Species Recovery Planning Program. The committee meets four times per year.

Habitat Reclamation and Compensation

Both prior biological opinions concerning MER production on NPR-1 discussed in detail the issue of habitat losses, resulting from MER production, and compensation for such losses. A reasonable and prudent measure in the 1980 opinion required DOE to "prepare a Master Plan for the restoration of disturbed habitat on NPR-1." The terms and conditions within the 1987 opinion required the Department to (1) complete an inventory of previously disturbed parcels at NPR-1 that could be rehabilitated to offset habitat loss associated with project activities, and (2) to develop a 10-year program to restore on-site disturbed acreage equivalent to that lost as a result of project activities.

Pursuant to these requirements, the Department in 1988 completed detailed disturbance mapping of NPR-1 based on current aerial photography, and in 1985 initiated a habitat reclamation program on NPR-1 and NPR-2. Through FY 1993, 899 acres of previously disturbed acres on NPR-1 had been replanted (EG&G 1995). While this represents all lands available for reclamation (i.e., lands that are abandoned and meet all reclamation criteria), the Department has estimated an additional 363 acres on NPR-1 will be available for abandonment and reclamation, through 1998 (DOE 1994). This would yield a total of 1,262 acres revegetated as a result of the Department's reclamation program through 1998. In addition, approximately 920 acres of disturbed lands on NPR-1 have revegetated naturally (DOE 1991).

The issue of how the Department's habitat reclamation program relates to its overall obligation to compensate for habitat losses on NPR-1 resulted in considerable discussion during the current consultation. Based on the requirement within the 1987 opinion to restore "equivalent on-site acreage" DOE questioned whether its habitat reclamation program alone was not sufficient to compensate for MER related disturbances, provided equivalent acreage was revegetated. However, for the following reasons the Service did not consider habitat reclamation alone to be adequate. First, the 1987 biological opinion states that equivalent on-site acreage should be restored "at a minimum.". Second, both prior opinions also mention other compensation methods, including zoning for no development, purchase of off-site habitats, and contribution of funds. Third, "equivalent" reclamation (at a 1:1 ratio) would not be consistent with San Joaquin Valley compensation policy as developed by the Service and California Department of Fish and Game through numerous prior projects--which typically requires a 3:1 compensation ratio for permanent habitat impacts and a 1.1:1 ratio for temporary impacts in saltbush scrub habitats. Finally, in previous projects, revegetation of disturbances resulting from a project typically is not credited to the compensation obligation for that project but is considered a separate mitigation measure.

On the other hand, the Service recognizes that DOE has in good faith expended considerable effort and expense on its habitat reclamation program based in part on the Service's recommendations and requirements. Because of this, the Service has worked with the DOE to develop a compensation program for NPR-1 that would utilize standard compensation policies, recognize the Department's reclamation efforts, and encourage continuation of such efforts.

Studies near completion demonstrate that in some cases reclamation projects are no more effective than natural revegetation for habitat restoration. In situations where natural revegetation is effective, NPRC would limit reclamation to only those activities needed to stabilize soils while natural revegetation is occurring. Procedures for reclamation would be developed in

collaboration with the Service and other professionals as appropriate. Otherwise, habitat reclamation and success monitoring would continue in a manner similar to current procedures. Existing disturbances would be reclaimed as they are identified as no longer being needed for oil field operations.

The resulting program is based on the following assumptions: (1) because MER development has primarily been considered a single integrated project under this and prior biological opinions, and not as a series of separate projects, the habitat compensation obligation for MER development should apply retro-actively to 1976 for the unfulfilled portion of habitat reclamation obligations stemming from the 1987 biological opinion; (2) that habitat disturbances resulting from MER development should be compensated at the same rate as other San Joaquin Valley habitat losses; (3) that habitat disturbances on NPR-1 that have recovered naturally should not count as credits toward DOE's compensation obligation, since they are fortuitous and not the result of its reclamation program; and (4) that all acres revegetated or planned for revegetation under the DOE's reclamation program should be credited toward its compensation obligation, even though many reclaimed areas were disturbed after MER development began. The latter assumption is also based on the fact that the Department's reclamation program is a relatively large-scale, systematic effort being applied to a wide variety of disturbances on NPR-1. We therefore regard it as a programmatic effort rather than merely a project effort.

Finally, to satisfy DOE's compensation obligation, the Service and Department have discussed conceptually the possibility of placing portions of NPR-1 into protected status for the primary purpose of endangered species management. The Service considers this a suitable strategy because significant areas of NPR-1 are relatively undisturbed (especially along its periphery); and because NPR-1 and undisturbed portions of NPR-2 are contiguous with other important native habitats, including the Buena Vista Valley and the Lokern Road area.

Based on the above discussion, the Department has agreed in principle to compensate for habitat losses associated with MER development on NPR-1 by placing into protected status a total of 7,075 acres of undisturbed lands on NPR-1 and NPR-2. This figure is based on estimated temporary disturbance of 318 acres and estimated permanent disturbance of 2,525 acres resulting from MER development, utilizing agreed-upon compensation ratios and minus all acres revegetated or planned for revegetation under DOE's reclamation program established pursuant to the 1987 biological opinion: i.e., 318 temporary acres X 1.1 = 350 acres; 2,525 permanent acres X 2 or 3 = 5,965 acres; 350 + 5,965 = 6,315 total compensation acres + 691 acres of temporary disturbance for third party projects (691 x 1.1 = 760); 6,315 + 760 = 7,075 (DOE 1995). The derivation of temporary versus permanent disturbances is explained in the Project Effects section below.

Plant Mitigation Commitments

To protect federally listed plants and plant species of concern on NPR-1, the Department also has agreed to the following measures.

(1) The Department will complete one comprehensive floristic survey of NPR-1 for all State and Federal endangered, threatened, candidate, and special concern species in the areas of NPR-1 where this kind of a survey has not already been completed. The Department agrees to complete the survey by the end of the fourth growing season, subject to adequate precipitation following permit issuance. Within 60 days of permit issuance, NPRC will provide a written scope of work for the survey to the Service for review, comment, and approval. The scope of the surveys will be developed informally in collaboration with Service personnel from the outset. The scope will address such things as priorities, precipitation criteria, reporting requirements, and schedules. Service comments and approval on

the scope are to be provided to NPRC within 60 days. Within 6 months following the completion of each year's survey, the Department will complete a topical report covering the results and findings for that year's survey, including mapping. Within 6 months following the completion of the last year's survey, the Department will complete a topical report covering the results and findings for the four year survey.

(2) With the exception of Hoover's woolly-star, the Department will initiate a separate section 7 consultation for any project that would disturb habitat known to have federally threatened or endangered plants.

(3) To minimize adverse effects of oil and gas production on Hoover's woolly-star, the Department will implement the following protective measures:

a. The Department will conduct preactivity surveys for Hoover's woolly-star for all projects and to make every reasonable effort to conduct them during the Hoover's woolly-star's growing season.

b. If Hoover's woolly-star is known or thought to be in a project area, every reasonable effort will be made to avoid them by relocating and/or reconfiguring the project.

c. If it becomes necessary to locate a project in an area where Hoover's woolly-star is known or thought to be present, every reasonable effort will be made to wait until after seed set before beginning ground disturbances. When disturbances occur after seed set, 2 to 4 inches of topsoil will be conserved and respread within one year, if possible, within appropriate Hoover's woolly-star habitat at a site that is being revegetated outside the conservation area. If it is not possible to meet the 1-year time frame, the topsoil shall be stockpiled and respread within appropriate habitat outside the conservation area as soon as possible.

d. It will not be necessary to protect Hoover's woolly-star that has become reestablished in previously disturbed areas.

(4) The Department will include Hoover's woolly-star habitat in the conservation area.

(5) The Department will use locally obtained native seed for revegetation to the extent commercially available at competitive prices.

(6) The Department will ensure that the habitat of the four oil neststraw (*Stylocline citroleum*) populations known to exist in Sections 10R, 12R, and 17S, is not developed.

Species Account/Environmental Baseline

San Joaquin Kit Fox. The endangered San Joaquin kit fox historically was distributed within an 8,700-square mile in central California from the vicinity of Tracy in the upper San Joaquin Valley south to the general vicinity of Bakersfield. Intensive agriculture, urbanization, and other land-modifying actions have eliminated extensive portions of habitat and are the most significant causes of this species' endangerment. The coyote and the introduced red fox compete for food resources with the smaller kit fox, and are suspected of preying upon kit foxes as well. Predation, competition, poisoning, and road kills contribute substantially to the vulnerability of this species. Kit foxes currently are limited to remaining grassland, saltbush, open woodland, and alkali sink valley floor habitats, and similar habitats located along bordering foothills and adjacent valleys and plains.

Although in the southern San Joaquin Valley, they appear to make extensive use of habitat fragments in an urbanizing environment.

Giant Kangaroo Rat. The giant kangaroo rat was distributed historically from southern Merced County, south through the San Joaquin Valley, to southwestern Kern County and northern Santa Barbara County. Preferred habitat is native annual grasslands with sparse vegetation, good drainage, fine loamy soils, and slope of less than 10 percent. Significant populations survive only in a few areas of remaining habitat, including the Pahoche Hills, Cuyama Valley, Carrizo and Elkhorn Plains and the Lokern area.

Kangaroo rats typically inhabit areas of open ground which tends to facilitate their mode of locomotion. Such areas include rangeland, wildlands, and farmlands that have not been recently cultivated or disced. Kangaroo rats can repopulate formerly cultivated areas from adjoining occupied habitat.

Blunt-Nosed Leopard Lizard. 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. 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 foothills grasslands vegetational communities.

Adult lizards often seek safety in burrows, while immature lizards use rock piles, trash piles, and brush. The lizards use burrows constructed by mammals, such as kangaroo rats, for overwintering and aestivation. The habitat of the lizard has been significantly reduced, degraded, and fragmented by agricultural development, petroleum and mineral extraction, livestock grazing, pesticide application, and off-road vehicle use. 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 Coast Range. The 1985 revised recovery plan (FWS 1985) identified habitat essential for the survival and recovery of the species, priority habitat areas, and areas that could be restored to habitat.

Tipton Kangaroo Rat. The Tipton kangaroo rat inhabits saltbush scrub and alkali sink scrub communities in the Tulare Lake Basin of the southern San Joaquin Valley. They currently inhabit approximately 4 percent of their historic range. Tipton kangaroo rats commonly dig burrows on elevated ground which is not subject to flooding. However, areas which are flooded in winter and spring are occasionally colonized during the dry season. The preferred location for Tipton kangaroo rat burrows typically involves alluvial fans and floodplains and includes fine, highly alkaline sands and, to a lesser degree, alkaline sandy loams. In addition, they generally burrow around the bases of woody shrubs. One of the smallest kangaroo rats, the subspecies is often found in areas also occupied by the larger Heermann's kangaroo rat.

Hoover's woolly-star. Surveys have shown that Hoover's woolly-star populations range from the upper Cuyama Valley near Ventucopa, Santa Barbara County, northward to the Panoche Hills in San Benito County, a distance of approximately 140 miles. Hoover's woolly-star occurs in 42 USGS 7 ½ - minute quadrangles within Kings, Kern, San Luis Obispo, Santa Barbara, San Benito, and Fresno counties. Hoover's woolly-star occurrences primarily are located within four areas. The four areas from largest to smallest are: (1) the Kettleman Hills area, (2) the Carrizo Plain-Elkhorn Plain-Temblor Range-Caliente Mountains-Cuyama Valley-Sierra Madre Mountains area, (3) the Lokern-Elk Hills-Buena Vista Hills-Coles Levee-Maricopa-Taft area, and (4) the Antelope Plain-Lost Hills-Semitropic area. Additional, more isolated populations occur throughout the region. An intra-agency draft recovery plan has been developed for Hoover's woolly-star.

Kern Mallow. Kern mallow was first described as *Eremalche kernesis* (Wolf 1938). The most recent treatments (Bates 1992, 1993) assign Kern mallow the name *Eremalche parryi* (Greene) Greene ssp. *parryi*. Bates' treatment of Kern mallow, which includes both white- and purple-flowered gynodioecious plants, has not widely been accepted by the scientific community. Due to the debate within the scientific community over the newest treatment, the Service intends to undertake a status review to solicit available scientific information on which to base a determination of the appropriate taxonomic circumscription of Kern mallow. In the interim, the Service shall continue to consider the listed entity to be *E. kernensis* C.B. Wolf, which was the circumscription used when Kern mallow was listed in 1990. The endangered Kern mallow is a small annual herb of the mallow family 2 to 4-inches in height primarily with white flowers (USFWS 1989). Kern mallow is restricted to the eastern base of the Temblor Range, occurring from the vicinity of McKittrick to near Buttonwillow within valley saltbush scrub in Kern County (Taylor and Davilla 1986). The species is threatened by oil and gas development, transmission line maintenance or expansion, agricultural conversion, overgrazing by livestock, exotic plant competition, and off-road vehicle use. An intra-agency draft recovery plan has been developed for Kern mallow.

San Joaquin wooly-threads. The endangered San Joaquin wooly-threads is a small annual herb of the sunflower family and is endemic to the San Joaquin Valley of California. Its white-wooly stems, only three inches long, often trail along the ground. Flowers are about 1/4-inch in diameter, lack ray flowers, and have a yellow center. San Joaquin wooly-threads once ranged throughout the floor of the San Joaquin Valley from western Fresno County and eastern Tulare County south to the foothills of the Tehachapi Mountains, reaching into San Benito County on the northwestern part of its range following the rain shadow of the South Coast Ranges (Taylor, 1989). Little is known of the habitat preferences of San Joaquin wooly-threads. It appears to favor non-alkaline soils of sandy or silty sand texture and an arid climatic regime (Taylor, 1989). Much of the habitat for San Joaquin wooly-threads has been eliminated by conversion of annual grassland sites to agriculture. An intra-agency draft recovery plan has been developed for San Joaquin wooly-threads.

Endangered Species Surveys/Status

In 1979, when the Department began its endangered species program on NPR-1, kit foxes were numerous and widely distributed within the Reserve. In 1984, kit fox dens were observed on all but two sections (DOE 1991). However, since 1979 the kit fox population on the NPR-1 "study area" has declined from a high of 144 animals in the winter of 1981-1982 to a low of just 12 animals in the winter of 1991-1992. In addition, kit foxes have disappeared from the central upland portions of NPR-1--where most oil development has occurred--and now appear to be confined to the flatter peripheries of NPR-1. This decline and the status of kit foxes on NPR-1 is discussed in detail in the Project Effects section. However, Elk Hills continues to be very important for the long-term survival and recovery of the San Joaquin kit fox.

Distribution of other federally listed species on NPR-1 typically is more restricted than that of kit foxes. From 1979 to 1987, a total of only 136 blunt-nosed leopard lizards were observed in only 28 of NPR-1's 74 sections (DOE 1991). Leopard lizards typically are found in washes and areas of low relief around the periphery of the Reserve, especially in the Buena Vista Valley along the NPR-1/NPR-2 border; however, leopard lizards also have been observed in six sections in the NPR-1 central uplands. Recorded leopard lizard densities on NPR-1 vary from 0.16 to 0.24 individuals per acre (DOE 1991).

Giant kangaroo rat burrow systems have been observed in 30 sections of NPR-1 (DOE 1991). Like the leopard lizard, the majority of these burrow systems

occur in the Buena Vista Valley, though a few burrows also have been observed in the central uplands. In recent surveys, however, many of these burrow systems have been found to be inactive, possibly because of drought conditions from 1987 to 1991. Giant kangaroo rat burrows on NPR-1 were observed at elevations ranging from 316 to 1,510 feet.

The California Aqueduct is cited in Williams (1985) as the approximate line between the ranges of the Tipton kangaroo rat and the short-nosed kangaroo rat (*Dipodomys nitratoides brevinasus*). Consequently, Tipton kangaroo rat distribution on NPR-1 is confined to those small portions of the Reserve east of the aqueduct. During a three-night trapping census conducted in 1988, six to 12 Tipton kangaroo rats were captured per night in this area (DOE 1991).

Initial field surveys for the Hoover's wooly-star and other federally listed plants were conducted on NPR-1 in spring 1988 (EG&G 1988, DOE 1991). A total of 28 Hoover's wooly-star populations were observed, primarily restricted to alluvial fans along the lower flanks of the Reserve in Sections 4B, 10B, 12G, 7R, 8R, 10R, 12R, 13R, 32R, 17S, 18S, 20S, 21S, 22S, 23S, and 26S (DOE 1991). Further surveys were conducted in 1991 and additional wooly-star populations were observed in Sections 3B, 12B, 13B, 1G, 10G, 25S, 27S, 30S, 31S, and 14Z (EG&G unpublished data). Hoover's wooly-star populations on NPR-1 tend to occur in areas where other vegetation is sparse such as washes and formerly disturbed sites (e.g., the NPR-1 firebreak and abandoned roadways). Four populations were found at or above 1,000 feet in elevation (EG&G 1993).

The Kern mallow, San Joaquin wooly-threads, and California jewelflower (*Caulanthus californicus*) were not observed during these surveys. However, apparently suitable habitat for Kern mallow was observed in the northwestern portion of NPR-1 (Sections 12Z, 13Z, and 14Z), and the species likely exists here in low numbers or may become established within the foreseeable future (DOE 1991). Potential habitat for San Joaquin wooly-threads also was observed along the northern flanks of NPR-1, but these habitats may be suboptimal because of the dense cover of red brome present (DOE 1991). Based on these data the Service concludes that the Kern mallow and San Joaquin wooly-threads may be present within NPR-1 and may be affected by proposed project activities within the remaining life of the NPR-1 oil field. Suitable habitat for the California jewelflower probably does not exist on NPR-1 (DOE 1991).

Effects of the Proposed Action on Listed Species

Adverse effects of continued MER production on NPR-1 on the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Kern mallow, San Joaquin wooly-threads, and Hoover's woolly-star may result from numerous sources. During construction activities, individual animals may be directly injured or killed by vehicle strikes resulting from construction related traffic, through inadvertent crushing or entombment in collapsed dens or burrows, or through entrapment in construction related holes or trenches. Also during construction, individual mallow, wooly-threads, or woolly-star populations may be crushed or damaged by vehicle traffic or destroyed by grading, pipeline trenching, and related disturbances. Seedbanks of these plants also may be buried or otherwise destroyed. Other forms of death or injury to federally listed species may result from wildfires inadvertently ignited during welding operations, contact with oil spills, sumps, and inundation of animals during release of hydrostatic pipeline test water.

Individual kit foxes, leopard lizards, kangaroo rats, and plant populations also may be subject to harm and mortality during routine day-to-day operations on NPR-1. Factors contributing to such harm and mortality include routine vehicle traffic, routine grading associated with well drilling and access road construction, oil spills, contamination by commonly used oil field chemicals, habitat degradation (discussed below), and other routine operations.

In addition, individual kit foxes, leopard lizards, and kangaroo rats may be subject to harassment during NPR-1 construction and other activities resulting from increased levels of human disturbance, destruction or excavation of dens and burrows, entrapment in open pipes and construction related trenches, and other factors. Some animals may escape direct injury during such activities but become displaced into adjacent areas. These animals may be vulnerable to increased predation, exposure, and stress through disorientation and loss of shelter.

To date, effects discussed above have been substantially minimized by the Department's endangered species mitigation program. A key component of this program is the practice of conducting preactivity surveys prior to all surface disturbing activities. Preactivity surveys are conducted according to "Operational guidelines for conducting endangered species preactivity surveys on Naval Petroleum Reserve #1, Kern County, California" (Kato and O'Farrell, 1987). Based on available data, the Service concludes that DOE has done a good job of implementing its preactivity survey program (EG&G 1992). In 1980, 74 percent of all NPR-1 projects were conducted without preactivity surveys, while in 1984 and 1985 all projects conducted on NPR-1 were preceded by surveys (Kato 1986). Pre-construction surveys continue to be implemented on NPR-1 on a regular basis (Thom Kato, EG&G, pers. comm.). However, some problems exist in ensuring that recommendations resulting from such surveys actually are implemented. For example, in Fiscal Year 1991 recommendations were not implemented in 22 of 175 projects (12.6%) for which preactivity surveys were conducted, and recommendations were not followed in 3 of 90 surveys (3.3%) in Fiscal Year 1992. The instances noted above where the recommendations were not followed did not result in take of endangered species.

Since the December 1987 Biological Opinion, the number of deaths that occurred as a result of DOE/NPRC activities included 2 kit foxes and 2 blunt-nosed leopard lizards. Twenty-four giant kangaroo rat burrows were disked in 1988 during firebreak maintenance but the actual number of individuals killed was not determined. From a historical perspective, a total of 49 San Joaquin kit foxes, 7 blunt-nosed leopard lizards, and 72 giant kangaroo rats have been reported killed or injured as a result of the factors discussed above since 1980. (EG&G unpublished data). Of these, 11 San Joaquin kit foxes, 2 blunt-nosed leopard lizards, and 6 giant kangaroo rats have been killed or injured as a result of the Departments's endangered species research program. No Tipton kangaroo rats are known to have been killed or injured during MER activities on NPR-1.

Based on radio-collar data, 291 kit foxes were recovered dead on NPR-1 from 1980 to 1988. Of these, cause of death for 29.9 percent was classified as predation (primarily by coyotes), 24.7 percent as probable predation, 10.0 percent as vehicle strikes, and 3.1 percent as other causes (DOE 1991). Cause of death for 32.3 percent of kit foxes recovered could not be determined. Excluding these foxes, 80.7 percent of foxes for which cause of death could be determined were killed by predation, 14.7 percent by vehicle strikes, and 4.6 percent by other causes (DOE 1991). Mortality sources other than predation and vehicles included disease, shooting, drowning, and burying.

Following is a detailed discussion of the effects of past and proposed future MER activities on NPR-1 on the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, federally listed plants, and their habitats (USFWS 1987).

San Joaquin Kit Fox

DOE/NPRC has studied the San Joaquin kit fox population on NPR-1 intensively since 1980 on a 28,480-acre area encompassing the southern half of the Reserve and 2,880 acres in adjacent Buena Vista Valley known as the NPR-1 study area.

The NPR-1 study area contains 16,640 acres defined as "developed" habitat and 11,840 acres defined as "undeveloped" habitat; a square mile containing more than 15 percent of developed land (oil wells, roads, etc.) is defined as developed, and a square mile containing 15 percent or less of developed land is defined as undeveloped (DOE 1991). The areas (developed or undeveloped) are largely contiguous; the range of percent developed in the areas considered was 0.5% to 46.3%; and some sections were divided into half-sections when the developed and undeveloped areas were delineated. Studies conducted by EASI on NPR-1 have included monitoring of kit fox population size, reproductive success, diet, mortality factors, movement patterns, and den characteristics. In part, their purpose has been to determine effects of MER related oil development on the resident kit fox population.

Between 1981 and 1991, EASI has estimated the San Joaquin kit fox population on the NPR-1 study area and on NPR-2 (beginning in 1983) twice annually based on intensive trapping sessions and capture-recapture data (once annually since Fiscal Year 1992). In 1988, trapping sessions were extended to include the entire civil boundaries of NPR-1 in an effort to detect differences in kit fox abundance or distribution between the study area and the Reserve as a whole.

During the period since detailed studies began (1980), the minimum known kit fox population within the NPR-1 study area declined from a high of 165 foxes in the winter of 1981-1982 to 44 foxes in the winter of 1985-1986 (DOE 1991). Similarly, the minimum known population size declined from a high of 167 foxes in the summer of 1982 to 55 foxes in summer 1985 (DOE 1991). The population appeared to stabilize at 40 to 50 kit foxes through approximately 1990, but recent evidence suggests the population has again declined. In winter 1991 the minimum population size was as low as 12 in the NPR-1 study area, but has increased to 40 in 1993 (EG&G unpublished data).

This San Joaquin kit fox population decline on NPR-1 was discussed at length in the Service's 1987 biological opinion and remains a subject of concern. It has been discussed in the biological assessment (DOE 1991), DSEIS (DOE 1992), numerous Elk Hills Endangered Species Advisory Committee meetings, as well as other documents and forums. However, the exact cause of the decline has proven difficult to determine.

Several factors have been considered in attempting to explain this decline, including: (1) the effects of MER development; (2) the endangered species research program; (3) effects of an extended drought in California; and (4) other natural or human-caused factors. In addition, this decline may reflect a general decline in the species due to rangewide habitat degradation.

MER Development. As required under the Service's 1980 biological opinion, the Department attempted to determine the effects of MER development on kit foxes through studies conducted by EASI from 1980 through 1986. Based on these studies, EASI and DOE concluded that the NPR-1 kit fox decline has occurred at similar rates in developed and undeveloped habitats (DOE 1991). This conclusion in turn suggests that MER development has not affected the NPR-1 kit fox population in a significant manner.

However, several factors suggest that these conclusions may not be accurate. First, the kit fox population on NPR-2--where little oil development occurred compared to NPR-1 during the same time period--has declined significantly less than on NPR-1. The NPR-2 kit fox population numbered 177 animals in the summer of 1983 and 113 in the summer of 1989 (EG&G unpublished data). Based on winter data, the NPR-2 kit fox population appears even more stable compared to NPR-1 (119 foxes in the winter of 1983-1984 and 131 in the winter of 1988-1989) (DOE unpublished data). Recent kit fox trapping data presented in the draft FY93 annual progress report shows that kit fox abundance differed between NPR-1 and NPR-2, but that they exhibited similar trends. In addition,

the 1993 minimum population size has increased on NPR-2 to 108 foxes, just as on NPR-1.

Second, circumstantial evidence suggests that the kit fox decline on NPR-1 has been greater in the central upland portions of the Reserve, where most oil development has occurred, than in the flatter lands along its periphery, which are relatively undeveloped. This change in distribution is demonstrated by the fact that few foxes have been captured in the central uplands in recent years, where they were relatively numerous in the early 1980's. By far most kit foxes currently are captured in the flatter undeveloped periphery of the Reserve (Thom Kato, EG&G, pers. comm.). The Department has concluded that kit foxes are presently found on their preferred habitat on NPR-1.

Several factors with respect to MER development can probably be eliminated as causing the kit fox decline on NPR-1. First, it is unlikely that den loss has contributed significantly to the decline. Between 1980 and 1986, only 5 known kit fox dens were destroyed inadvertently as a result of the MER production and another 20 were intentionally excavated to avoid burial of resident foxes (DOE 1991). However, these losses appear to be relatively insignificant since during the same period approximately 946 dens were known to be utilized by kit foxes (Berry et al. 1987).

Contamination of kit foxes by heavy metals commonly associated with oil fields also appears to be minimal. Kit fox hair samples collected from kit foxes on NPR-1 developed lands, NPR-1 undeveloped lands, NPR-2, Camp Roberts, and the Elkhorn Plain were analyzed by Oak Ridge National Laboratory in Oak Ridge, Tennessee (Suter et. al. 1992). Results indicated that kit foxes on NPR-1 exhibited little evidence of contamination by the elements studied, including arsenic, barium, vanadium, chromate, or uranium. Although a few foxes showed high tissue concentrations of some elements, most levels were associated with background soil concentrations or were highest in undeveloped reference sites. Heavy metal concentrations evidently were not great enough to account for the kit fox decline on NPR-1.

The Endangered Species Research Program. The intensive kit fox research and monitoring program conducted on NPR-1 by EASI has occasionally been cited as a possible contributor to the NPR-1 kit fox decline (e.g., O'Neil and Greer 1988). Throughout the life of the program, approximately two thousand kit foxes have been captured and 486 foxes have been radio collared (Thom Kato, EG&G, pers. comm.). All foxes captured, whether collared or not, have been equipped with individually numbered ear tags. Research factors possibly contributing to the kit fox decline include lowering of kit fox survivorship as a result of wearing radio collars, spread of disease through trapping and handling, and loss of kit foxes to research accidents.

At the Service's request, DOE/NPRC considerably expanded their studies of the effects of EASI's radio-collar program on kit foxes in 1992. Utilizing EASI data from 1980 to 1992, DOE/NPRC evaluated effects of radio collars on numerous parameters, including collar to body weight ratio, collar design (heavy or light), survival period, and recapture interval, again comparing radio collared kit foxes to kit foxes with ear tags only. With one exception, no differences in survivorship were observed between radio-collared and ear-tagged foxes. Based on these results, and with reference to the large data set and thoroughness of EASI's study, the Service concludes that EASI's kit fox radio collar program has not significantly contributed to the kit fox decline on NPR-1.

However, DOE/NPRC found that kit fox pups radio collared prior to the month of July tended to survive for shorter periods than pups collared after July (EG&G unpublished data). This result probably has not significantly affected kit fox status on NPR-1 but may have important implications in how kit fox radio collar programs are managed on NPR-1 and elsewhere.

Effects of the Drought. By the early 1990's, endangered species populations throughout the San Joaquin Valley were exhibiting declines likely associated with California's five-year drought that lasted from 1987 to 1992. For example, surveys conducted on NPR-1 in 1991 found that most previously active giant kangaroo rat precincts were no longer occupied (EG&G, unpublished data). Similar giant kangaroo rat declines were observed in the Carrizo Plain (Dan Williams pers. comm.), and leopard lizards reportedly did not reproduce in the Carrizo Plain and elsewhere in 1991 (Dave Germano pers. comm.). Similarly, little kit fox reproduction was observed on NPR-1 in 1991 (EG&G, unpublished data). This harsh five-year drought has often been cited as a primary or contributing factor in the kit fox decline on NPR-1. The principal result of the drought thought to affect kit foxes was reduction in availability of prey species (typically, small mammals and lagomorphs).

Since 1983, EASI has conducted a bi-annual census of lagomorphs on NPR-1 and NPR-2, and, like the kit fox, lagomorphs have declined significantly on both Reserves (DOE 1991). On NPR-1, lagomorphs also were censused during road counts from 1980 to 1983 and declined annually over this period. Similarly, the California Department of Fish and Game (CDFG) has conducted two annual spotlighting routes near NPR-1 (the "Taft" and "McKittrick" routes) in which both kit foxes and lagomorphs have been censused since approximately 1970 (CDFG unpublished data). Results of CDFG data also indicate significantly declining lagomorph numbers along these routes, together with a decline in kit fox numbers that appears to strongly "mimic" the pattern of lagomorph decline. These data suggest that a decline in prey availability caused by the drought may be a primary contributor to the kit fox decline on NPR-1.

However, based on other available data this conclusion cannot be considered certain. For example, the lagomorph and kit fox decline on NPR-1 began prior to 1987, when the five-year drought began; while on NPR-2, where the kit fox decline has been less pronounced, lagomorph densities did not begin to decline until 1987, when the drought began (DOE 1991). Furthermore, in an analysis of EG&G data (kit fox numbers versus lagomorph numbers) on NPR-1 and NPR-2 conducted in 1991, the General Accounting Office (GAO) found that between 1984 and 1989 the estimated number of lagomorphs per kit fox was higher on NPR-1 than on NPR-2 (GAO unpublished data). This suggests that prey availability alone can not account for the perceived differences between kit fox numbers on NPR-1 and NPR-2, and that some other factor or factors may have contributed to apparently differential kit fox declines on the two Reserves.

CDFG data suggest another pattern with respect to fluctuating kit fox numbers. According to the graph of these data (DOE 1991), in 1970 kit fox and lagomorph numbers appear to have been declining from earlier highs in the late 1960's. Their numbers then appear to have remained relatively low from approximately 1972 to 1979, when they began to incline sharply to highs in the early 1980's that were unequaled within the study period. The early 1980's is precisely when EASI began its systematic counts of kit foxes and lagomorphs on NPR-1 and NPR-2.

This suggests that EASI initiated its kit fox census on NPR-1 and NPR-2 when lagomorph numbers were at an unusual high, resulting from natural cyclic fluctuations or to some other factor such as rainfall. This in turn suggests that (1) kit fox numbers were unusually high in 1979 or 1980, when EASI census activities began (likely due to high lagomorph numbers), (2) that this high represented a cyclic fluctuation rather than average kit fox carrying capacity on NPR-1, and (3) that the initiation of intensive MER activities on NPR-1 and the observed kit fox decline on the Reserve was coincidental, not causally related (Harris et al 1987).

Other Natural Factors Other factors possibly contributing to the NPR-1 kit fox decline include coyote predation and disease. Since 1980, coyotes have been responsible for most known kit fox mortalities on NPR-1 (80.7 percent of

all dead foxes for which a cause of death could be determined) (DOE 1991). However, based on other studies this appears to be the normal interaction between kit foxes and the larger, more aggressive coyote (e.g., Linda Spiegel, CEC, pers. comm.); and EASI data indicate that coyote numbers on NPR-1 declined contemporaneously with kit fox numbers. Though coyote predation may have exacerbated kit fox problems originally caused by other factors, no data we reviewed suggest that kit fox-coyote interactions can account for the kit fox decline on NPR-1. The significance of coyote predation in kit fox populations is published in articles such as O'Farrell (1984, 1987), and Standley et al. (1992).

In 1981, 1982, and 1984, the kit fox population on NPR-1 was studied for the presence of disease by analyzing kit fox blood serum for the presence of 10 infectious pathogens (DOE 1991). Despite the occurrence of antibodies for canine parvovirus, tularemia, canine distemper, and canine hepatitus in kit fox blood samples, little clinical evidence of disease has been noted in the NPR-1 kit fox population (DOE 1991). Disease can therefore be largely ruled out in explaining the observed kit fox decline on NPR-1.

Summary The above discussion illustrates that the relationship between kit foxes, oil development, and other environmental factors on NPR-1 is complex. In short, it is difficult to ascribe the San Joaquin kit fox decline on NPR-1 conclusively to any single factor.

Nevertheless, several observations seem important. First, lagomorph and kit fox numbers appear to have declined jointly-(if differentially)-throughout the general area, not just on NPR-1. Second, although the disappearance of kit foxes from the central upland portions of NPR-1 has been pronounced and contemporaneous with intensive oil developments-suggesting a direct relationship-CDFG data suggest that kit fox presence in the central uplands in the early 1980's may have been the result of unusually optimal conditions at that time. If this is true, then kit foxes may not normally occupy this portion of NPR-1 because of natural factors (e.g. relatively steep terrain), and this area may have been the first to be abandoned when environmental conditions deteriorated--possibly, at least in part, because of the drought. On the other hand, oil development in the central uplands may have contributed to the adverse conditions-(already marginal because of natural factors)-that eventually caused kit foxes to abandon the area. In this respect, the Service considers EASI data suggesting that kit fox declines have been equivalent in developed and undeveloped habitats on NPR-1 to be inconclusive.

Third, the fact that kit fox declines on NPR-2 have been less severe than fox declines on NPR-1 may be significant and is difficult to explain. Several differences between the two Reserves that may account for this fact have been cited--(e.g., intensive oil development on NPR-1 and overall gentler topography on NPR-2), but here again results are inconclusive.

Based on existing data, the only factors that probably can be ruled out as causing or significantly contributing to the NPR-1 kit fox decline is coyote predation, disease, oil field chemicals, and the endangered species research program. Conversely, it seems likely that the decline may have resulted from a combination of the other effects discussed-(e.g., the drought, natural cyclic fluctuations, oil field developments, and naturally marginal conditions in the central uplands of the Reserve). Continued monitoring of the kit fox population on NPR-1 in the immediate future, especially in light of the end of the drought in the winter of 1992-1993, will be critically important in better understanding the respective roles of the factors discussed above in the NPR-1 kit fox decline.

Based on the above discussion, the Service concludes as follows with respect to the San Joaquin kit fox: (1) that MER oil production probably is not solely responsible for the kit fox decline on NPR-1 but likely has been a

contributing factor; (2) that intensive oil developments in the NPR-1 central uplands likely has contributed to the disappearance of the kit fox from this portion of the Reserve; (3) that proposed new developments in the central uplands, such as the larger facilities as described in the DSEIS (DOE 1992), SEIS (DOE 1993), will contribute to continuing habitat losses and adverse effects in this area and may inhibit effective future use of this area by kit foxes; and (4) that the latter effect is not likely to jeopardize the continued existence of the species because the central uplands probably represents, on average, marginal kit fox habitat except in optimal conditions, and provided that DOE implement the mitigation commitments described on pages 4 to 7 above.

Giant and Tipton Kangaroo Rats

Specific effects to giant kangaroo rats potentially resulting from continuing MER production on NPR-1 include: (1) Destruction of giant kangaroo rat burrow systems during construction of proposed facilities in Townships G, R, and S and by third-party pipelines; (2) removal of food sources (grasses and seeds) during construction activities; (3) alteration of soil conditions-e.g., soil compaction-making it more difficult for kangaroo rats to construct burrows; (4) accidental oil spills or wastewater discharge; (5) disturbance; and (6) accidental death or injury during EASI's trapping and research activities (DOE 1991). In 1986, for example, 12 kangaroo rats (species not identified) were killed when a DOE lessee discharged wastewater into a natural drainage adjacent to NPR-1. Furthermore, O'Farrell et al. (1987) reported that 73 percent of all giant kangaroo burrow systems on NPR-1 occurred at least 150 feet away from well pads, and numerous well pads may be constructed in known giant kangaroo rat habitats in Sections 6-7G, 14R, 20R, 25R, 28R, 26-27S, and 36S during continuing MER production.

However, construction of the larger facilities currently proposed-(e.g., the fourth gas plant, butane facility, and cogeneration plant)-is not expected to affect known giant kangaroo rat populations, and pre-construction surveys and flexibility in well pad location should minimize impacts to giant kangaroo rats elsewhere (DOE 1991). Furthermore, the majority of these wells would be constructed in the central upland portions of NPR-1 where giant kangaroo rats are relatively uncommon. Third-party pipelines-expected to disturb a total of 101 acres-may directly affect some giant kangaroo rat habitat in the Buena Vista Valley and other peripheral areas on the Reserve.

The Tipton kangaroo rat, which is present only in Section 23S east of the California Aqueduct, should not be affected by any planned DOE activities on NPR-1 because no development is planned in that area.

Blunt-nosed Leopard Lizard

Specific effects of continuing NPR-1 activities on blunt-nosed leopard lizards are expected to be similar to those cited above for giant kangaroo rats. In addition, leopard lizards are vulnerable to entrapment in well cellars, and, because they inhabit washes and are vulnerable to accidental wastewater discharges and oil spills. Both such forms of leopard lizard mortality have been documented either on or adjacent to NPR-1 in the 1980's (DOE 1991). In 1992, an aestivating leopard lizard was inadvertently unearthed during gravel mining on NPR-1 but this lizard was unharmed and was returned to its habitat (EG&G unpublished data). Other forms of potential leopard lizard effects on NPR-1 include vehicle strikes and destruction of small mammal burrows during construction activities and third-party projects such as seismic surveys and pipelines.

However, most construction of relatively large new facilities will occur in the central upland portions of the Reserve where little leopard lizard habitat exists, and pre-construction surveys and flexibility in well location should

minimize leopard lizard effects during DOE and third-party projects elsewhere on the Reserve.

Hoover's Woolly-star and Other Federally Listed Plants

The overall effects of the programmatic on listed, proposed, candidates, or sensitive plants cannot fully be assessed at this time because inventory information is incomplete and not always properly timed. Although some intensive surveys have been conducted, they have not always been floristic. Potential effects of proposed project activities on Hoover's woolly-star include (1) destruction of plants and plant habitats during grading, trenching and other construction activities, (2) crushing of individual plants and plant populations during off-road vehicle use and seismic surveys, (3) inundation of plant populations resulting from oil spills or hydrostatic water releases, (4) destruction of plant populations resulting from man-caused fires, and (5) dust from vehicular traffic that can reduce plant productivity. No known populations of Kern mallow or San Joaquin wooly-threads currently exist on NPR-1. However, similar adverse effects to these species might occur as a result of MER activities should they later be found or become established on NPR-1.

Adverse effects to federally listed plants would be minimized because (1) most proposed new activities would occur in the NPR-1 central uplands where Kern mallow and San Joaquin wooly-threads populations are not likely to exist, (2) NPRC agrees to initiate a separate section 7 consultation for any project that would disturb habitat known to have federally threatened or endangered plants other than Hoover's woolly-star, (3) populations of Hoover's woolly-star would be avoided to the maximum extent practicable, as described on pages 8 and 9 above, and (4) where plant populations are not avoidable, DOE would implement other mitigation measures such as stockpiling of topsoil.

Habitat Disturbance

As of June 1988, an estimated 6,467 acres of native habitat originally existing on NPR-1 have been disturbed either permanently or temporarily as a result of oil development activities since the 1920's (DOE 1993). Of these, an estimated 3,227 acres have been disturbed since the inception of MER production in 1976 (DOE 1993).

The Department estimates that habitat disturbance on NPR-1 resulting from proposed new facilities between 1989 and 2025 will total 878 acres (DOE 1991), which includes 5 acres that were disturbed for a water well project covered by a separate consultation (File No. 1-1-92-F-39). This will result from proposed work on 382 wells (579 acres), gas operations expansion (15 acres), and construction of the cogeneration facility (3 acres), the butane isomerization facility (5 acres), steam generators for the SOZ Steam Flood Project (210 acres), gas compression facilities (10 acres), gas injection facilities (4 acres), and pipeline replacement and maintenance activities (50 acres) (DOE 1993). Of this, 750 acres would be affected by 1998.

Adding past MER disturbances to anticipated future disturbances yields total estimated habitat disturbance on NPR-1 resulting from DOE activities through the life of MER production (1976-2025), or 4,105 acres (3,227 + 878 = 4,105). In addition, non-Federal third party pipeline projects are expected to disturb 691 acres through the year 2025 (DOE 1991). Because the Department has indicated its willingness to consider these as DOE disturbance for the purpose of this consultation (Jim Killen, DOE, pers. comm.), total disturbance resulting from DOE and related activities during MER production is 4,796 acres.

In addition, 547 acres within the NPR-1 civil boundaries have been disturbed in the past by activities not constructed or undertaken by the Department.

These include 133 acres disturbed by the California Aqueduct, 45 acres occupied by the town of Taft, and 369 acres of agricultural lands not owned by DOE (EG&G unpublished data). An estimated 79 acres have been disturbed since 1988 as a result of third party projects on NPR-1 (DOE 1991). However, these disturbances are either the result of non-DOE projects or are addressed and mitigated under separate biological opinions. Finally, third party seismic surveys are expected to result in minor temporary disturbances of 3,390 acres through 2025 (DOE 1991).

Estimated temporary disturbance on NPR-1 resulting from past MER development totals 432 acres, while estimated permanent disturbance totals 2,795 acres. Estimated temporary disturbance resulting from proposed new activities totals 50 acres, and estimated permanent disturbance totals 828 acres. Temporary disturbance throughout the life of MER development (1976-2025) totals 482 acres and permanent disturbance totals 3,623 acres (DOE 1995).

Cumulative Effects

Cumulative effects are those impacts of future State and private actions that are reasonably certain to occur. Future Federal actions will be subject to the consultation requirements established in section 7 of the Act and, therefore, are not considered cumulative to the proposed action.

Our agency is aware of other projects currently under review by State, county, and local authorities where biological surveys have documented the occurrence of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Hoover's woolly-star, Kern mallow, and San Joaquin wooly-threads. These projects include urban, mineral, and energy development, and flood control and reservoir construction.

However, we do not anticipate that the project under evaluation in this biological opinion, considered together with other non-Federal actions, would appreciably reduce the likelihood of survival and recovery of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Hoover's woolly-star, Kern mallow, or San Joaquin wooly-threads.

Conclusion

After reviewing the current status of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Kern mallow, San Joaquin wooly-threads and the Hoover's woolly-star; the environmental baseline for the action area; the effects of the action and the cumulative effects; it is the Service's biological opinion that the proposed continuation of the oil development program on NPR-1 at Maximum Efficient Rate, as implemented, is not likely to jeopardize the continued existence of these species. No critical habitat has been designated for these species, therefore, none will be affected. This conclusion is based on (1) continuing implementation by DOE of its mitigation commitments, and (2) the fact that most proposed future MER-related disturbances would occur in the central upland portions of NPR-1 where few populations of threatened and endangered species currently exist.

INCIDENTAL TAKE STATEMENT

Sections 4(d) and 9 of the Endangered Species Act prohibit any taking (i.e., to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct) of listed fish and wildlife species without special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly

disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant. Under the terms of sections 7(b)(4) and 7(o)(2), taking that is incidental to and not a intended as part of the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

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

Sections 7(b)(4) and 7(o)(2) of the Act do not apply to the incidental take of listed plant species. However, protection of listed plants is provided to the extent that the Act requires a Federal permit for removal or reduction to possession of endangered plants from areas under Federal jurisdiction, or for any act that would remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any regulation of any State or in the course of any violation of a State criminal trespass law.

San Joaquin kit foxes, blunt-nosed leopard lizards, giant kangaroo rats, and Tipton kangaroo rats may be taken incidentally during continued MER production and proposed construction of new facilities on NPR-1. Project actions that may result in the mortality, harm, or harassment of these species have been previously discussed in this biological opinion. Mitigation measures proposed by the Department will substantially reduce but not eliminate the potential for incidental taking of these species during proposed NPR-1 activities.

Amount of Extent of Take

Based on information provided in the project biological assessment (DOE 1991), information on past incidental takings on NPR-1 provided by EASI, information in our files, and through prior consultations, the Service anticipates that the following numbers of kit foxes, leopard lizards, and kangaroo rats may be subject to harm or mortality during proposed NPR-1 project activities through the year 2025:

1. Ninety (90) San Joaquin kit foxes (3/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

2. Two hundred and ten (210) blunt-nosed leopard lizards (7/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

3. Nine hundred (900) giant kangaroo rats (30/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

4. Thirty (30) Tipton kangaroo rats (1/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

The number of animals subject to incidental take must not exceed the annual amounts stated above, and the total for 30 years is cumulative only.

The number of San Joaquin kit foxes, blunt-nosed leopard lizards, giant kangaroo rats and Tipton kangaroo rats subject to harassment from noise, vibrations, and capture or excavation of dens and burrows cannot be estimated because the number of individuals of these species within potential project areas is unknown. Therefore, the Service anticipates harassment of all individuals of these federally listed species inhabiting areas where project activities would occur provided that such harassment: (1) Is the result of bona fide project activities; (2) is inadvertent or for the express purpose of removing individual animals from construction areas to safe locations; and 3) that all terms and conditions specified below are fully implemented.

Effect of the Take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species discussed.

Reasonable and Prudent Measures

The Service states that the following reasonable and prudent measures are necessary and appropriate to minimize the potential for incidental take of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, and Tipton kangaroo rat authorized by this biological opinion.

1. The potential for harm or mortality to federally listed wildlife species and their habitats resulting from project related activities shall be minimized.

2. The potential for inadvertent entrapment of federally listed wildlife species during construction activities shall be minimized.

3. Compliance with the reasonable and prudent measures, terms and conditions, reporting requirements, and reinitiation requirements contained in this biological opinion shall be ensured.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the Department must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

The terms and conditions specify measures considered necessary by the Service or modify mitigation commitments proposed by the Department. Unless otherwise indicated, all terms and conditions described shall be implemented by the Department at each project site. Where terms and conditions vary from or contradict mitigation commitments as proposed in this or any previous document, specifications in these terms and conditions shall apply.

1. The potential for harm or mortality to federally listed wildlife shall be minimized by implementing the following procedures:

   (a) The Department shall continue to conduct pre-activity surveys prior to all surface disturbing activities on NPR-1. Any change in preactivity surveys would have to be approved by the Service, and may involve reinitiation of consultation.

   (b) Biological monitors (see attachment 1), shall be present, or readily available, on NPR-1 construction sites during all critical construction activities occurring within or adjacent to sensitive endangered species habitat as identified during pre-activity surveys. Examples of activities for which such monitors may be

present include surveys or flagging necessary to determine and delineate specific construction areas, pipeline alignments, and location of access routes and storage areas; grading and trenching activities; checking of pipes, pipeline trench segments, and similar structures for entrapped wildlife; backfilling pipeline trench segments; den and burrow excavations; and other activities as determined by monitoring biologists to be necessary.

(c) The areas disturbed by construction related activities and routine day-to-day operation on NPR-1 shall be minimized to the maximum extent practicable. All NPRC and Contractor vehicles shall be confined to existing roads or to project areas which have received a preactivity survey.

(d) All spills of oil, liquids contaminated by oil, hazardous materials within NPR-1 shall be cleaned up in a manner consistent with the NPR-1 Spill Prevention, Control and Countermeasure Plan.

(e) Speed limits in all construction areas shall not exceed 25 mph.

(f) A litter control program shall be implemented during project activities. This program shall include daily collection of trash, especially that which is food-related, disposal in covered receptacles, and regular removal from project sites.

(g) Construction activities (but not drilling, operations, maintenance, or any other activities) between dusk and dawn shall be minimized.

(h) Personnel performing pre-activity surveys, wildlife handling, kit fox den excavations, and monitoring activities are to be qualified to perform these duties as described by Attachment 1. One supervisory biologist as a training officer who will be given responsibility over all trainees, with full authority to deny or grant trainees the ability to perform permitted activities. This will provide some level of consistency regarding qualifications and employee certification.

2. The potential for inadvertent entrapment of federally listed wildlife species during construction activities shall be minimized by implementing the following procedures:

(a) The Department shall make every reasonable effort to avoid damage or destruction of San Joaquin kit fox dens, giant and Tipton kangaroo rat burrows, and burrows potentially utilized by blunt-nosed leopard lizards during proposed MER activities on NPR-1. Such avoidance measures may include minor re-location of project facilities and minimization of construction impacts to the least possible area.

(b) Known San Joaquin kit fox dens shall not be damaged or destroyed by project related actions unless written or verbal concurrence is obtained from the Service's Sacramento Field Office prior to such effects. If concurrence cannot reasonably be obtained in a timely manner (e.g., on weekends), destruction of known kit fox dens may proceed only if qualified personnel determine that the den cannot reasonably be avoided and if the Service is verbally notified as soon as possible after the fact. Any known kit fox den that must be destroyed shall first be monitored for three consecutive nights by qualified personnel to ensure that it is not occupied by kit foxes, and then shall be excavated by or under the direct supervision of qualified personnel and backfilled to preclude later use by kit foxes. Destruction of all known kit fox dens shall be documented in the annual report.

Potential San Joaquin kit fox dens may be excavated without prior notification to the Service, provided that qualified personnel have determined that the den is not a known kit fox den. Alternately, excavation of potential kit fox dens need not be conducted prior to construction activities, provided that no evidence of kit fox use of such dens is observed after three consecutive nights of monitoring, and that construction operations over such dens occur no more than 24 hours after such dens are last determined to be unoccupied. In the event the Service modifies the procedures for monitoring dens prior to excavation, NPRC shall adopt the revised procedures, so as to be in compliance with this term and condition.

(c) San Joaquin kit foxes, blunt-nosed leopard lizards, and giant and Tipton kangaroo rats may from time to time be captured and relocated from construction sites, provided (i) that burrows of these animals cannot reasonably be avoided during construction activities; (ii) that associated conditions and actions deemed appropriate by the Service are satisfied; (iii) that verbal or written approval from the Sacramento Field Office is obtained prior to any such capture and removal; and (iv) that any person or persons conducting capture and relocation activities possess an appropriate scientific collecting permit issued by the Service or are otherwise qualified to conduct such activities, as determined by the Service in writing.

(d) At the end of each day during all major NPR-1 construction projects, all open pipeline trench segments and other steep-walled holes or trenches greater than two feet deep shall either be covered with plywood or similar materials, or shall be equipped with escape ramps constructed of wooden planks, earth fill, or similar materials and spaced no further than one-quarter mile apart. Projects to which this term and condition applies include the same as those described in term and condition 3(a).

(3) If entrapped wildlife is observed, said wildlife shall only be removed by qualified personnel (see Attachment 1).

3. Compliance with the reasonable and prudent measures, terms and conditions, reporting requirements, and reinitiation requirements contained in this biological opinion shall be ensured by:

(a) Prior to the sale of NPR-1, the Department shall initiate and complete a subsequent section 7 consultation as to this Federal action; and the reasonable and prudent measures and terms and conditions shall be adhered to by the subsequent owner until a section 10(a)(1)(B) permit and a CDFG 2081 permit are issued for their actions. In addition, as part of the subsequent section 7 consultation, the Department shall enter into a Conservation Agreement with the Service if the conservation area has not been established.

(b) Within 90 calendar days following the end of each fiscal year, the Department shall submit to the Service's Sacramento Field Office a brief annual report detailing the following information: (i) A summary of all major construction activities undertaken the previous year; (ii) dates that such construction occurred and the number of habitat acres permanently or temporarily disturbed; (iii) pertinent information concerning the Department's success in meeting project mitigation measures; (iv) an explanation of failure to meet such measures, if any; (v) known project effects on federally listed species, including an estimate of the number of kit fox dens and giant kangaroo rat burrows destroyed, including a general estimate of other small mammal burrows impacted, if any; (vi) known

occurrences of incidental take of listed species, if any; (vii) habitat reclamation efforts undertaken that year, if any; (viii) results of ongoing monitoring of habitats reclaimed in previous year; (ix) an estimate of habitat acres reclaimed to date; and (x) other pertinent information. The term "major construction activity" in this term and condition shall apply to the proposed gas plant, cogeneration plant, butane isomerization facility, all underground pipelines, and any other facility resulting in permanent disturbance of more than 3 acres at a time, or temporary disturbance of more than 5 acres at a time.

(c) If requested, upon completion of any proposed construction project, or at any reasonable time deemed appropriate by the Service, the Department or its contractors shall accompany Service personnel on site inspection tours of construction sites or other locations, as requested, to review project impacts to endangered species and their habitats.

(d) Unless otherwise authorized by the Service in writing, all terms and conditions within this biological opinion shall apply to all third party projects permitted by the Department on NPR-1.

Reviewing Requirement

The reasonable and prudent measures, with implementing terms and conditions, are designed to minimize incidental take that might otherwise result from project activities. If, during proposed project actions, the amount or extent of incidental take of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, or Tipton kangaroo rat is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. The Department must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Reporting Requirement

The Service is to be notified in writing within three working days of the accidental death or injury of a San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat or Tipton kangaroo rat or of the finding of any dead or injured kit fox, leopard lizard, or kangaroo rat, during project related actions. Notification must include the date, time and location of the incident or of the finding of a dead or injured animal, and any other pertinent information. The Service contact for this information is the Assistant Field Supervisor for Endangered Species at (916) 979-2725. To determine disposition of dead or injured San Joaquin kit foxes, blunt-nosed leopard lizards, or giant kangaroo rats, the California Department of Fish and Game, Region 4 Office, Fresno should be contacted (209/222-3761).

CONSERVATION RECOMMENDATIONS

Sections 2(c) and 7(a)(1) of the Act direct 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 and the ecosystems upon which they depend. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. Therefore, the Service recommends the following additional actions to protect federally listed species and their habitats during proposed continuing MER activities at NPR-1:

(1) The Department should consider placing into conservation status all lands outside of the primary production and conservation areas for the benefit of listed species. These lands could be subject to oil development activities, however, the quality of the habitat should be maintained.

(2) The Department should consider, in the event of the sale of NPR-1, selling only the sub-surface mineral rights. The surface ownership should be retained by the Federal government for the long-term survival and recovery of the listed species that occupy NPR-1.

(3) The Department should direct EASI to continue monitoring of kit fox and lagomorph population trends and rainfall patterns on NPR-1 and NPR-2. This information and information obtained from CDFG survey routes, should be utilized to further clarify the relative importance of factors potentially affecting kit fox distribution and abundance on NPR-1. In accordance with the concluding paragraph below, the Department should reinitiate consultation concerning MER activities on NPR-1 should any such new information suggest that MER production is resulting in effects to San Joaquin kit foxes not considered in this opinion, or that the conclusions in this opinion with respect to effects of MER production on kit foxes is incorrect or inadequate.

(4) The Department should direct EASI to increase monitoring of population trends on NPR-1 of other federally listed species-(i.e., the blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Kern mallow, Hoover's woolly-star, and San Joaquin wooly-threads). The Department should reinitiate consultation concerning MER activities on NPR-1 should any new information suggest that MER production is resulting in effects on these species not considered in this opinion or that the conclusions in this opinion with respect to effects of MER production on these species is incorrect or inadequate.

(5) The Department should contribute funds to be utilized for research projects on federally listed San Joaquin Valley species conducted either on NPR-1 but by researchers other than EASI, or off NPR-1 in adjacent, nearby, or other San Joaquin Valley locations. The rationale for this recommendation is as follows.

First, NPR-1 is a highly lucrative oil field, generating average net revenues of approximately $750 million per year. Second, NPR-1 occupies a key location in the configuration of remaining San Joaquin Valley habitats in Kern County (near or adjacent to the Lokern Road area, Buena Vista Valley, and others) and DOE activities on NPR-1 have resulted in temporary or permanent disturbance to over 6,000 acres of endangered species habitat within this area--by any measure a significant effect. Third, over 3,500 acres of habitat disturbance on NPR-1 resulted from Federal activities conducted prior to the onset of MER development and no mitigation for the effect has been required under this or previous biological opinions. Fourth, in the Service's view, restricting DOE research funds non-competitively to a single group (EASI) does not result in the greatest benefit to affected endangered species. Finally, as a Federal agency, the Department has significant responsibilities under section 7(a)(1) of the Act to utilize its authorities in carrying out endangered species programs.

Based on these considerations, the Service recommends that DOE contribute a sum of approximately $100,000 per year through the life of the NPR-1 oil field, or until federally listed species affected by DOE activities are delisted, whichever comes first, to a suitable interest-bearing account to be administered by the Service for research and management of such species.

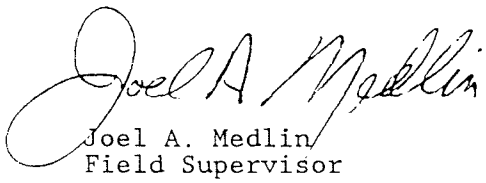
In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on proposed continuing MER production on NPR-1. 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 action that may affect federally listed species in a manner or to an extent not considered in this opinion; (3) the project is substantially modified in a manner that causes an effect to listed species that was not considered in this opinion; and/or (4) a new species is listed or critical habitat is determined that may be affected by the action.

We appreciate the cooperation of the Department, Chevron, and EASI throughout this consultation process. Please contact Jody Brown or Peter Cross of my staff at (916) 979-2728 if you have questions or information concerning this biological opinion with respect to federally listed wildlife species, and Kirsten Tarp at (916) 979-2120 if you have questions or information with respect to federally listed plants.

Sincerely,



Joel A. Medlin
Field Supervisor

Attachment

cc: ARD-ES, Portland, OR
Ms. Sandra Morey, CDFG Sacramento, CA
Regional Manager, CDFG, Fresno, CA
Mr. Jim Killen, U.S. Department of Energy, Tupman, CA
Mr. Brian Cypher, EASI Energy Advisory Services, Inc., Tupman, CA
Ms. Linda Spiegel, California Energy Commission, Sacramento, CA
Dr. Daniel F. Williams, SJVESRPP, Fresno, CA

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ATTACHMENT 1

DEFINITION OF QUALIFIED PERSONNEL
(FOR KIT FOX DEN EXCAVATION/REMOVAL OF ENTRAPPED WILDLIFE, PREACTIVITY SURVEYS AND MONITORING ACTIVITIES ONLY)

Kit Fox Den Excavation, Removal of Entrapped Wildlife, Preactivity Surveys

Personnel are to have either a 4-year degree in biology, or a related field, from an accredited college or university, plus 30 days of full time on-the-job training at NPRC performing preactivity surveys with another qualified person; or 2 years of field, or field related, experience working in an endangered species program on a full time basis, plus 90 days of full time on-the-job training at NPRC performing preactivity surveys with another qualified person. Training is to be carried out under the supervision of and be certified by a NPRC supervising biologist. The supervising biologist is to have a 4-year degree in biology, or a related field, from an accredited college or university, plus a combination of advanced education and field experience qualifying that person to work in the NPRC endangered species program both as a biologist and as a supervisor.

Training is to include:

* Identifying protected and candidate species known to occur on or adjacent to NPRC;

* Life history of protected and candidate species know to occur on or adjacent to NPRC;

* Topical Report 110282-2178 "Operational Guidelines for Conducting Preactivity Surveys on Naval Petroleum Reserve No. 1" and its supplements; the current NPR-1 site wide Biological Assessments and Biological Opinions for NPR-1 and NPR-2; FWS's Standard Recommendations for Protection of protected species occurring on or adjacent to NPRC; and sections 9 and 10 of the Endangered Species Act.

* The video titles "Protecting Endangered Species on NPR-1".

Demonstrating the ability to successfully conduct preactivity surveys is to be the basis for certification by the supervising biologist. Included in this is the knowledge to know when to ask for assistance from the supervising biologist.

Monitoring

For the purposes of monitoring activities occurring within or adjacent to endangered species habitat, monitors are considered to qualified upon:

1) Successfully completing an 8 hour training course. Training is to be carried out under the supervision of and be certified by a NPRC supervising biologist. The supervising biologist is to have a 4-year degree in biology, or a related field, from an accredited college or university, plus a combination of advanced education and field experience qualifying that person to work in the NPRC endangered species program both as a biologist and as a supervisor.

Training is to include:

* Identifying protected and candidate species known to occur on or adjacent of NPRC;

* Life history of protected and candidate species known to occur on or adjacent to NPRC;

* Topical Report 110282-2178 "Operational Guidelines for Conducting Preactivity Surveys on Naval Petroleum Reserve No. 1" and its supplements; the current NPR-1 site wide Biological Assessments and Biological Opinions for NPR-1 and NPR-2; FWS's Standard Recommendations for Protection of protected species occurring on or adjacent to NPRC; and sections 9 and 10 of the Endangered Species Act.

* The video titled "Protecting Endangered Species on NPR-1.

2) Completing the following reviews with preactivity survey personnel and the lead person in charge of the project:

* Construction project boundaries;

* Areas demarcated to avoid disturbing endangered species or their habitat;

* Specific measures identified during the preactivity survey to avoid impacts to endangered species;

* Project scope and schedule;

* Designated points of contact and phone numbers.

Demonstrating the ability to successfully conduct monitoring is to be the basis for certification by the supervising biologist. Included in this is the knowledge to know when to ask for assistance from the person who conducted the preactivity survey, or from the supervising biologist.

APPENDIX B

CDFG 1997 MOU WITH OEHI OPERATIONS

CALIFORNIA ENDANGERED SPECIES ACT

MEMORANDUM OF UNDERSTANDING

AND TAKE AUTHORIZATION

By and Between

OCCIDENTAL OF ELK HILLS, INC.

and

THE CALIFORNIA DEPARTMENT OF FISH AND GAME

regarding

NAVAL PETROLEUM RESERVE - 1
(ELK HILLS)

CALIFORNIA ENDANGERED SPECIES ACT MEMORANDUM OF UNDERSTANDING AND TAKE AUTHORIZATION

by and between

OCCIDENTAL OF ELK HILLS, INC.

and

THE CALIFORNIA DEPARTMENT OF FISH AND GAME

regarding

NAVAL PETROLEUM RESERVE - 1 (ELK HILLS)

This California Endangered Species Act Memorandum of Understanding ("CESA MOU") is made and entered into by and between Occidental of Elk Hills, Inc., a Delaware corporation ("Occidental"), in its individual capacity and its capacity as the Elk Hills Unit Operator, and the California Department of Fish and Game (the "Department"), collectively "the Parties."

Occidental proposes to undertake a project that may cause the take of species of wildlife protected by the California Endangered Species Act, California Fish and Game Code §2050, *et seq.* ("CESA"). The Project is the subject of a federal Biological Opinion issued pursuant to a Federal Endangered Species Act, Section 7 consultation between the United States Fish and Wildlife Service ("USFWS") and the Department of Energy (Exhibit 1). In conjunction with the federal Biological Opinion, this CESA MOU prescribes management measures for the species that are to be incorporated into the Project. The management measures are designed to avoid, minimize, and mitigate adverse impacts to the species and to ensure that the Project will not destroy or adversely modify habitat essential to the species' continued existence. If the management measures are duly implemented, the Project can be completed in compliance with CESA. This CESA MOU will become effective upon execution by the Department and Occidental, and will cover all actions also covered by the Biological Opinion, provided that it shall also be revocable by Occidental in its sole discretion and without any cost or liability in the event that Occidental fails to acquire the United States' interest in the Elk Hills Unit from the Department of Energy and assume unit operator status for the Project.

AGREEMENT

The Parties agree to the following recitals of fact, definitions, terms, conditions, and other provisions:

1.0 DEFINITIONS

The following definitions shall govern interpretation of this CESA MOU:

1.1 *"Wildlife"* means all wild animals, birds, plants, fish, amphibians, and related ecological communities, including the habitat upon which the wildlife depends for its continued viability, as provided in Fish and Game Code §711.2.

1.2 *"Take"* means to hunt, pursue, catch, capture, or kill an individual of a listed species, or to attempt any such act. *"Take"* includes any act that is the proximate cause of the death of an individual of a listed species or any act a natural and probable consequence of which is the death of any individual of a listed species.

1.3 *"Management measure"* means any action deemed necessary by the Department to sustain a species within a natural ecological system. *"Management measures"* include legal, biological and administrative measures.

1.4 *"Elk Hills Unit"* means the real property located near Tupman, Kern County, California previously known as Naval Petroleum Reserve - 1 ("NPR-1"), the sale of the United States' interest in which is defined in Public Law 104-106 and is expected to occur at the Closing.

1.5 *"Elk Hills Unit Operator"* means the entity responsible for the operation and management of petroleum product recovery and related activities at the Elk Hills Unit on its own behalf and on behalf of other Elk Hills Unit participants. Upon its acquisition of the United States' interest in the Elk Hills Unit at the Closing, Occidental will become the Elk Hills Unit Operator.

1.5 *"Closing"* means the date on which the sale of the United States' interest in the Elk Hills Unit to Occidental becomes effective.

1.6 *"Biological Opinion"* means that biological opinion issued by the USFWS entitled "Reinitiation of Formal Consultation Concerning Oil Production at Maximum Efficient Rate on Elk Hills Naval Petroleum Reserve, Kern County," dated November 8, 1995.

2.0 RECITALS

2.1 The wildlife species identified on Exhibit 2 (the "Covered Species") have been listed pursuant to the CESA as either endangered or threatened, or are species of concern, and are known to exist at or in the vicinity of the Project, which consists of Occidental's acquisition,

operation and management of the Elk Hills Unit and continued oil and gas exploration, extraction, production, development, transport, processing and related activities at the Elk Hills Unit (collectively the "Project"). Life history information concerning the Covered Species is contained in Exhibit 3, which consists of relevant portions of the Draft Recovery Plan for Upland Species of the San Joaquin Valley, California, published in 1997 by Region 1 of the United States Fish and Wildlife Service. Occidental proposes to avoid, minimize and mitigate adverse impacts to the Covered Species that may result from the Project and has requested Take Authorization for the Covered Species from the Department, pursuant to Fish and Game Code §2081.

2.2 The Department is trustee for the fish and wildlife resources of the State of California and has jurisdiction over the conservation, protection, and management of fish, wildlife and native plants, and the habitat necessary for biologically sustainable populations thereof, pursuant to Fish and Game Code §1802. Under the objectives and policies of CESA, it is the Department's goal to conserve, protect, restore, and enhance the Covered Species and the Covered Species' habitat.

2.3 The Parties acknowledge that Occidental will not acquire the United States' interest in the Elk Hills Unit until the Closing, which is anticipated by the Parties to occur approximately February 2, 1998, but that Occidental has received a grant of option from the United States to acquire such interest sufficient to warrant issuance of this CESA MOU. The Parties are entering into this CESA MOU in anticipation of the Closing.

2.4 This CESA MOU is the result of a cooperative effort by the Parties to ensure that the Project may proceed as proposed to the extent it is consistent with CESA.

3.0 PROJECT DESCRIPTION

The description of the Project contained in the federal Biological Opinion (also described in Section 2.1 above) is hereby incorporated into this CESA MOU. Pursuant to the terms of the Biological Opinion (pages 19-20), the Project includes the temporary and permanent surface habitat disturbance of the Elk Hills Unit for continued oil and gas exploration, extraction, production, development, transport, processing and related activities, consisting of the following approximate totals: 3,240 acres of historic, pre-1976 permanent disturbance, 547 acres of disturbance unrelated to petroleum recovery operations, 482 acres of actual and future post-1976 temporary disturbance, 3,623 acres of actual and future post-1976 permanent disturbance, 691 acres of post-1976 pipeline disturbance, and 3,390 acres of minor post-1976 seismic survey disturbances. The parties estimate that approximately 50 acres of temporary and 828 acres of permanent disturbance remain under those totals. This estimate of remaining future surface habitat disturbance will be verified by existing surface area disturbance calculations to be completed within ninety (90) days after the Closing.

4.0 IMPACTS TO COVERED SPECIES

4.1 The Project will result in the temporary and permanent loss of potential habitat for the Covered Species as described in the federal Biological Opinion. Individuals of the

Covered Species that are displaced by the Project may escape direct injury, but will have to compete for food and living space in adjacent areas. Relocated individuals will be more vulnerable to disease, predation, and accidental death. Disturbance of the existing habitat will temporarily reduce the prey base and/or foraging area for individuals residing in the Project vicinity.

4.2 The Project's impacts on certain of the Covered Species are described in the federal Biological Opinion and are hereby incorporated into this CESA MOU.

4.3 Impacts to the San Joaquin Antelope Squirrel, western burrowing owl, and oil neststraw are not addressed specifically as such in the federal Biological Opinion. However, project impacts to these species are included in the federal Biological Opinion by implication, in that the habitat occupied or potentially occupied by them within the project area are generally contained within the habitat occupied by the other Covered Species, and the impacts of the project on them are consistent with the impacts to the other Covered Species.

5.0 TAKE AUTHORIZATION

Subject to the terms and conditions of the federal Biological Opinion and of this CESA MOU, specifically including this provision of the CESA MOU and pursuant to Section 2081 of the Fish and Game Code, the Department authorizes any take of Covered Species that is incidental to the Project as described in Section 3.0. Non-incidental take of the Covered Species by Elk Hills Unit Operator or on Elk Hills Unit Operator's behalf by its employees, contractors or designated agents that is deliberate or that otherwise results from an act by Elk Hills Unit Operator or on Elk Hills Unit Operator's behalf by its employees, contractors or designated agents outside the scope of the Project as defined in Section 3.0 is not authorized. The State Fully Protected blunt-nosed leopard lizard is known to occur on the Elk Hills Unit. Direct take of this species is not authorized by the Department at this time, despite its inclusion as a Covered Species. Implementation of take avoidance measures required by the federal Biological Opinion will avoid direct take of blunt-nosed leopard lizard and is authorized.

5.1 Department Notification and Approval.

Wherever the federal Biological Opinion requires that Elk Hills Unit Operator inform, notify, or obtain the approval of the USFWS, Elk Hills Unit Operator shall also inform, notify, or obtain the approval of the Department, if the information, notification, or approval concerns the Covered Species. Where the Department's approval is required, the Department shall abide by the schedule or time constraint, if any, imposed on the USFWS for providing its approval.

5.2 Project Representative.

At least thirty (30) days before the Closing, Elk Hills Unit Operator shall designate a representative responsible for communications with the Department, and for overseeing compliance with this CESA MOU and the attached federal Biological Opinion. The

Department shall be informed, in writing, of the representative's name, business address and telephone number, and shall be notified in writing if a substitute representative is designated.

5.3 Employee Orientation.

Elk Hills Unit Operator shall conduct an orientation program for all persons who will work on-site during construction. The program shall consist of a brief presentation from a person knowledgeable about the biology of the Covered Species and the terms of this CESA MOU and the federal Biological Opinion. The education program shall include a discussion of the biology of the Covered Species, the habitat needs of these species, their status under CESA, and the Management Measures in the federal Biological Opinion and this CESA MOU. A fact sheet containing this information shall also be prepared and distributed. Upon completion of the orientation, employees shall sign a form stating that they attended the program and understand all Management Measures. These forms shall be filed at Elk Hills Unit Operator's offices and shall be made available to the Department on request.

5.4 Notification Regarding Dead, Injured or Entrapped Animals.

If Elk Hills Unit Operator or any of its employees, contractors or designated agents kills or injures an individual of a Covered Species at the Elk Hills Unit, or finds any such animal dead, injured, or entrapped at the Elk Hills Unit, Elk Hills Unit Operator shall as soon as practicable (but in no event later than the first business day 24 hours after the Representative has knowledge of such death or injury) notify the Department by telephone. All reasonable efforts shall be made to allow any entrapped animals to escape. Any dead or injured animal discovered by Elk Hills Unit Operator or its contractors or designated agents at the Elk Hills Unit shall be turned over to the Department in a manner reasonably requested by the Department (or to USFWS consistent with the Biological Opinion), and a written report detailing the date, time, location and general description of the circumstances under which it was found must be submitted to the Department no later than three (3) business days after the Representative has knowledge of such death or injury.

5.5 Access to Project Site/Compliance Reports.

Elk Hills Unit Operator shall allow Department representatives access to the Project site, accompanied by the Representative, to monitor compliance with the terms and conditions of this CESA MOU, subject to any reasonable access restrictions requested by Elk Hills Unit Operator. A copy of the annual compliance report as required by the federal Biological Opinion will be provided to the Department, and will be augmented to include information regarding the San Joaquin Antelope Squirrel consistent with the information required for the other Covered Species.

5.6 Implementation of On-Going Wildlife Management Plan Components

Elk Hills Unit Operator shall continue to implement the on-going program components of the Wildlife Management Plan as described in the federal Biological Opinion.

Elk Hills Unit Operator will provide a description of the on-going program components for Department approval within thirty (30) days following the Closing.

5.7 Inventory of Disturbances

Elk Hills Unit Operator shall provide a baseline inventory of surface disturbances to the Department within ninety (90) days following the Closing, shall confer with the Department and the USFWS regarding the accuracy and adequacy of this inventory, and shall provide revisions as necessary.

5.8 Summary of On-Going Surface Disturbance

Elk Hills Unit Operator shall provide an annual summary of surface disturbances and reclamation to the Department within the first quarters of 1999 and 2000, unless this requirement is superseded by the requirements of the proposed long-term wildlife habitat and management plan cited in paragraph 6 below

5.9 Preparation of Permanent Wildlife Habitat and Management Plan

Elk Hills Unit Operator shall prepare a wildlife habitat and management plan for the Elk Hills Unit in consultation with the Department and USFWS and subject to Department approval. A draft plan shall be submitted to the Department for review no later than the end of the second quarter of 1998, and a final plan including supporting plans, agreements, and other elements, shall be prepared for Department approval by November 9, 1998.

5.10 Habitat Reserve

Consistent with the federal Biological Opinion, Elk Hills Unit Operator shall place into protected status at least 7,075 acres of Habitat Management lands on or adjacent to the Elk Hills Unit, at locations approved by the Department, and shall provide a suitable management plan and adequate funding for long-term management of those lands, subject to Department requirements. The Department may extend or revise this requirement to facilitate the transition from this interim CESA MOU to a proposed long-term wildlife habitat and management plan, and/or potential federal section 10(a) permit.

5.11 Additional Management Measures

Occidental shall comply with those Conservation Measures identified in Exhibit 4, if any, for the species that are not specifically provided for in the federal Biological Opinion.

5.12 Security for Faithful Performance

Within thirty (30) days following the Closing, Occidental shall provide to the Department a Conditional Standby Letter of Credit in the face amount of Seven Hundred Fifty

Thousand Dollars ($750,000.00), as security for Occidental's faithful performance of its obligations under Section 5.10 above.

6.0 DEPARTMENT FINDINGS

The Department finds that: (a) neither the Project nor this CESA MOU will result in jeopardy to the continued existence of the Covered Species if the terms and conditions of the federal Biological Opinion and this CESA MOU are fully implemented and adhered to, (b) through the identification and protection of conservation areas as specified in the federal Biological Opinion, the Covered Species may be afforded protection from further degradation, (c) the take authorized by this CESA MOU is incidental to an otherwise lawful activity, (d) the impacts of the authorized take pursuant to the federal Biological Opinion and this CESA MOU will be minimized and fully mitigated through adherence to the terms and conditions of the Biological Opinion and this CESA MOU, and (e) the Biological Opinion is consistent with CESA.

7.0 DEFAULT

In the event Elk Hills Unit Operator defaults on any of its material obligations under the federal Biological Opinion and this CESA MOU, the Department shall have all rights and all remedies available at law or in equity, including specific performance and injunction.

8.0 NOTICE

All notices and other communications required or permitted by this CESA MOU shall be in writing. Such writing shall be delivered personally, by courier, by telecopy, or by first-class or certified mail, return receipt requested. All default notices shall be sent certified mail, return receipt requested. Notices or transmittals shall be deemed delivered upon the earlier of actual receipt or three days after posting by certified mail, if delivered to the following addresses:

Elk Hills Unit Operator	Occidental of Elk Hills, Inc. 1200 Discovery Drive Box 12021 Bakersfield, CA 93389-2021 ATTN: Dennis L. Newman Environmental Manager
and to	Occidental of Elk Hills, Inc. 1200 Discovery Drive Box 12021 Bakersfield, CA 93389-2021 ATTN: General Counsel

DEPARTMENT	GENERAL COUNSEL Legal Affairs Division California Department of Fish and Game 1416 Ninth Street, Twelfth Floor Sacramento, California 95814
REGION	Regional Manager California Department of Fish and Game 1234 East Shaw Avenue Fresno, CA 93720 Attn: Dr. Jeffrey R. Single.

9.0 ASSIGNMENT

Any sale or assignment of this CESA MOU or any of the rights or obligations hereunder is void absent the written consent of the Department, which shall not be withheld or delayed without good reason; provided, however, that no consent shall be required for assignment or pledge made by Elk Hills Unit Operator (a) to any company that shall succeed by purchase, merger or consolidation to the stock, assets or properties of Elk Hills Unit Operator; or (b) as security for a debt under the provision of any mortgage, deed of trust, indenture, bank credit agreement, or similar instrument or pursuant to an exercise of remedies under any such security; and provided, further, that no consent shall be required for a transfer of an undivided interest in all or a part of Elk Hills Unit Operator's interest in this CESA MOU in conjunction with transfer of a corresponding interest in the Elk Hills Unit, so long as Elk Hills Unit Operator remains the operator of the Elk Hills Unit and is liable for performance of the duties and responsibilites of the Elk Hills Unit Operator pursuant to the CESA MOU.

10.0 ENTIRE AGREEMENT

This CESA MOU comprises the entire agreement and understanding between the Parties concerning the Project. This CESA MOU supersedes all prior and contemporaneous agreements, representation or understandings whether oral or written.

11.0 GOVERNING LAW

This CESA MOU shall be governed by the laws of the State of California. The Parties agree to attempt in good faith to resolve any dispute pursuant to this CESA MOU or the terms and conditions hereof through non-binding mediation prior to instituting litigation, except in exigent circumstances. If the dispute has not been resolved by mediation within fourteen (14) days of the Parties first meeting with the mediator, then either Party may seek to resolve the dispute by filing an action in the state or federal courts of California. Actual or threatened breach of this CESA MOU may be prohibited or restrained by a court of competent jurisdiction, subject to generally applicable requirements for injunctive relief.

12.0 BENEFIT OF CESA MOU

This CESA MOU is solely for the benefit of the Parties and the People of the State of California by and through the Department.

13.0 FURTHER ACTIONS

From time to time, the Parties shall by mutual agreement execute such instruments and other documents, and take such other actions, as may be reasonably necessary to carry out the terms of this CESA MOU. This CESA MOU cannot be amended or modified in any way except by a written instrument executed by the Parties. Any proposal for amendment or modification must be duly delivered for review and approval by the Director of the Department and by Elk Hills Unit Operator.

14.0 TERMINATION

This CESA MOU may be terminated by the Department after thirty (30) days written notice to Elk Hills Unit Operator in the event of any material default by Elk Hills Unit Operator of its obligations hereunder or under the Biological Opinion, which default Elk Hills Unit Operator has failed to cure after reasonable notice and opportunity to cure. Additionally, this CESA MOU shall terminate without further action by any Party on December 31, 1999, unless otherwise extended in writing executed by all Parties.

15.0 DISCLAIMER

This CESA MOU contains the Department's requirements for the Project pursuant to CESA; barring material unforeseen circumstances, the Department shall not request additional mitigation or avoidance measures for the Project under authority of CESA. Elk Hills Unit Operator understands and recognizes that this CESA MOU does not constitute or imply compliance with applicable state or federal laws and regulations, other than CESA, and does not create an entitlement under other applicable laws and regulations to proceed with the Project.

16.0 EFFECTIVE DATE

This CESA MOU shall be immediately effective upon the later to occur of execution by the Parties or the Closing.

17.0 COUNTERPARTS

This CESA MOU may be executed in counterparts, in which case each executed counterpart shall be deemed an original.

18.0 EXHIBITS

This CESA MOU includes and incorporates the following:

EXHIBIT 1: FEDERAL BIOLOGICAL OPINION

EXHIBIT 2: COVERED SPECIES

EXHIBIT 3: LIFE HISTORIES

EXHIBIT 4: ADDITIONAL CONSERVATION MEASURES

IN WITNESS WHEREOF, THE PARTIES HERETO HAVE EXECUTED THIS MOU TO BE IN EFFECT AS OF THE DATE LAST WRITTEN BELOW.

OCCIDENTAL OF ELK HILLS, INC., a Delaware corporation

By: Don Romine Date: Dec 22, 1997
Don Romine, General Manager

CALIFORNIA DEPARTMENT OF FISH AND GAME

By:_____ Date:_____
C.F. RAYSBROOK, Interim Director

APPROVED AS TO FORM:

By:_____ Date:_____
CRAIG MANSON, General Counsel

18.0 EXHIBITS

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OCCIDENTAL OF ELK HILLS, INC., a Delaware corporation

By:_____ Date: _____
Don Romine, General Manager

CALIFORNIA DEPARTMENT OF FISH AND GAME

By: Jacqueline E. Schafer Date: 12-29-97
JACQUELINE E. SCHAFER, Director

APPROVED AS TO FORM:

By: _____ Date: 12-24-97
CRAIG MANSON, General Counsel

EXHIBIT 1

FEDERAL BIOLOGICAL OPINION

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

In Reply Refer To:
1-1-95-F-102

November 8, 1995

Mr. Danny A. Hogan, Director
U.S. Department of Energy
Naval Petroleum Reserves in California
P.O. Box 11
Tupman, California 93276

Subject: Reinitiation of Formal Consultation Concerning Oil Production at Maximum Efficient Rate on Elk Hills Naval Petroleum Reserve, Kern County, California

Dear Mr. Hogan:

This responds to your October 9, 1991, request for reinitiation of formal consultation pursuant to section 7(a) of the Endangered Species Act of 1973, as amended (Act), on a proposal by the U.S. Department of Energy (DOE or the Department) to continue oil production activities at Maximum Efficient Rate (MER) on Elk Hills Naval Petroleum Reserve (NPR-1 or the Reserve), Kern County, California. At issue are effects of proposed MER production on the federally endangered San Joaquin kit fox *(Vulpes macrotis* mutica), blunt-nosed leopard lizard *(Gambelia silus)*, giant kangaroo rat *(Dipodomys ingens)*, Tipton kangaroo rat *(Dipodomys nitratoides nitratoides)*, Kern mallow *(Eremalche kernensis)*, and San Joaquin wooly-threads *(Lembertia congdonii)*, and the federally threatened Hoover's woolly-star *(Eriastrum* hooveri). Your request for formal consultation was received by this office on October 15, 1991. The U.S. Fish and Wildlife Service (Service) provided a draft biological opinion to DOE on May 28, 1993. Formal comments from DOE on the draft opinion were received on December 8, 1994. Subsequent meetings between representatives from the Service, DOE and Chevron U.S.A. (Chevron) were held on February 8, March 3, April 20, and May 18, 1995, to discuss the content of the biological opinion.

The Service addressed effects on federally listed species of MER production activities on NPR-1 in two prior biological opinions dated February 1, 1980 (Case No. 1-1-80-F-2) and December 16, 1987 (Case No. 1-1-80-F-2R). The 1980 biological opinion concluded that MER oil production on NPR-1 may jeopardize the continued existence of the San Joaquin kit fox and blunt-nosed leopard lizard, but included six reasonable and prudent alternatives that, if implemented, would allow MER production to continue. The Department agreed to implement these alternatives and to complete a future consultation to evaluate their success in minimizing adverse effects of MER production on federally listed species.

The subsequent 1987 biological opinion concluded that MER production on NPR-1 would not jeopardize the continued existence of the San Joaquin kit fox, blunt-nosed leopard lizard, Tipton kangaroo rat and giant kangaroo rat--which was listed as federally endangered in 1988. This conclusion was based, in part, on development and implementation by DOE of a comprehensive mitigation program designed to minimize adverse effects of MER production on federally listed species. In addition to this program, the 1987 opinion required the Department to implement several reasonable and prudent measures, including replacement of endangered species habitat lost as a result of project related actions.

The 1987 biological opinion also cited the Department's intent to develop a Supplemental Environmental Impact Statement (SEIS) concerning future oil production activities on NPR-1. The intent to develop such an update resulted from planning activities conducted concurrently with the 1987 consultation that determined that future oil development activities on NPR-1 could exceed some environmental impacts projected in the Department's original EIS completed in 1979 (DOE 1979). Accordingly, the Department published a Notice of Intent to prepare a supplemental ETS on NPR-1 activities in the Federal Register on April 4, 1988, completed a draft supplemental ETS (DSEIS) in May, 1992 (DOE 1992), and a final supplemental EIS (FSEIS) in July, 1993 (DOE 1993).

It is this supplemental EIS, together with Federal listing of several plant species--the Hoover's woolly-star, San Joaquin wooly-threads, and Kern mallow on July 19, 1990--that necessitates reinitiation of formal consultation and preparation of this revised biological opinion.

This biological opinion is based on the DSEIS (DOE 1992); the FSEIS (DOE 1993); a biological assessment prepared for currently proposed activities on NPR-1 (DOE 1991); several other reports (see Literature Cited section); meetings and discussions between the Service, Department, Chevron, and Energy Advisory Services, Inc. (EASI), the Department's biological contractor (formerly EG&C Energy Measurements); and information in our files.

BIOLOGICAL OPINION

Description of the Proposed Action

Elk Hills Naval Petroleum Reserve (or Naval Petroleum Reserve No. 1) was established in 1912 for national defense purposes, but was largely maintained in reserve shut-in status until 1976. Because of oil shortages in the early 1970's, Congress passed the Naval Petroleum Reserve Production Act in 1976, which provided for oil production on NPR-1 at the "Maximum Efficient Rate." Maximum Efficient Rate under this statute was defined as the maximum rate that optimizes both economic return and hydrocarbon recovery. The proposed action addressed in this biological opinion is continuing MER production on NPR-1 in compliance with the Naval Petroleum Production Act and as described in the DSEIS (DOE 1992)

NPR-1 consists of approximately 47,409 acres about 25 miles southwest of Bakersfield, California. Of this, 37,049 acres (78 percent) are administered by the Department of Energy; the balance of 10,360 acres (22 percent) is owned by Chevron (DOE 1992). To the south of and partially contiguous with NPR-1 lies Buena Vista Hills Oil Field which encompasses Naval Petroleum Reserve (NPR-2). Of approximately 30,000 acres comprising NPR-2, DOE administers about 10,000 acres and the balance is owned by private oil companies. The government's share of NPR-2 has been developed under lease by private oil companies since the 1920's. Together, NPR-1 and NPR-2 constitute what is known as the Naval Petroleum Reserves in California (NPRC).

Topographically, Elk Hills consists of a ridge about 16 miles long by six miles wide that runs east to west in the southern San Joaquin Valley. NPR-1 is surrounded on three sides by oil and gas fields and agricultural lands. On the north side, NPR-1 is immediately contiguous with a large area (approximately 30,000 acres) of relatively undisturbed endangered species habitat known as the Lokern Road area. Vegetation on NPR-1 consists primarily of saltbush scrub and grassland habitats.

Elk Hills is the seventh largest oil field in the United States (DOE 1991). It is a highly profitable field, cumulative net government revenues exclusive of Chevron's share from 1976 to 1990 totalling $11.6 billion (DOE 1992).

Hydrocarbon products recovered or produced on NPR-1 include crude oil, natural gas, and natural gas liquids including propane, butane, and natural gasoline. Of estimated original recoverable oil reserves on NPR-1, 860 million barrels have been produced--630 as the result of MER production since 1976 (DOE 1992). Oil production on NPR-1 peaked in 1981 at approximately 180,000 barrels per day and averaged approximately 74,000 barrels per day in Fiscal Year 1991 (DOE 1992). The Department estimates that oil production on NPR-1 could continue to be profitable until 2010 to 2025, perhaps longer (DOE 1992).

Existing Facilities

Existing operational facilities on NPR-1 include the following (DOE 1991): (1) 1,253 active wells (production, water source, gas injection, waterflood injection, wastewater disposal injection, and steam injection); (2) 1,055 existing wells that are shut-in (idle) or abandoned; (3) approximately 2,500 miles of pipelines and 1,000 miles of roads; (4) one crude oil tank farm; (5) 121 tank settings; (6) five LACT (lease automatic custody transfer) facilities used to separate oil from water and transfer oil to Chevron and Department purchasers; (7) 45 product storage tanks; (8) four gas-processing plants used to separate natural gas liquid products from natural gas; (9) five wastewater disposal facilities; (10) two gas injection plants; (11) 11 gas compression plants; (12) one steam injection facility used for thermally enhanced oil recovery; (13) several emergency wastewater sumps and two landfill facilities; (14) three building complexes for offices, maintenance, and storage; and (15) a variety of other supporting systems and infrastructure.

The majority of waste materials generated on NPR-1 are non-hazardous and include produced water, spent drilling fluids, and solid wastes such as paper, construction debris, and garbage (DOE 1991). Hazardous materials utilized or generated on NPR-1 include used oil, lubricants, and batteries; herbicides and pesticides; and solvent wastes (DOE 1991). Host produced water is re-injected on-site into subsurface formations; drilling fluids are placed into on-site land areas located in Sections 10G and 27R (the land area in Section 10G is temporarily idle). A hazardous waste facility in Section 27R was formally closed in 1992. Hazardous wastes are removed to off-site disposal facilities or are recycled (DOE 1991).

Despite careful handling, spills of oil or other chemicals occasionally occur on NPR-1. Since 1989, these have been handled in accordance with a Spill Prevention Control and Countermeasure Plan (BPOI 1989), which provides for an emergency response team, cleanup procedures, and documentation. Nonetheless, an unquantified number of acres on NPR-1 has been affected by such spills since 1976 and the Department currently is cleaning up approximately 64 sites known to have been contaminated by chromium, arsenic, and other materials (all 64 of these sites already have been remediated) (DOE 1991).

Activities necessary to achieve and maintain MER production on NPR-1 were first described in the original project EIS (DOE 1979). These activities have resulted in the construction of numerous oil production, processing, and storage facilities, associated infrastructure, and administrative facilities on NPR-1 since 1976 (see Environmental Baseline section). Because of evolving conditions, however, including better technical understanding of oil and gas reservoirs beneath NPR-1, the Department now proposes several new facilities believed to be necessary to maintain MER production through the 1990's and into the next century. These are described in the ESEIS (DOE 1993) and are summarized below. The Service completed a biological opinion in 1987 (File No. 1-1-80F-2R) that covers all of the on-going activities at NPR-1.

To maintain hydrocarbon production on NPR-1 at Maximum Efficient Rate, the Department proposes to conduct the following ongoing activities (DOE 1992) (those not pertaining to biological issues are omitted).

(1) Production at MER, estimated in the Long Range Plan to be approximately 99,000 bbl/day of oil in FY 1990, declining to approximately 72,000 bbl/day in FY 1995; 365 million ft/day of gas in FY 1990, increasing to 417 million ft/day in FY 1995; and 654,000 gal/day of natural gas liquid products in FY 1990, increasing to 768,000 gal/day in FY 1995;

(2) Drilling, redrilling or deepening approximately 382 existing wells (including 148 for the steamflood operation described below), performance of approximately 2,663 remedial jobs on existing wells, and abandonment of approximately 1,080 existing wells.

(3) Investigating, remediating, or otherwise managing numerous old and inactive waste sites.

(4) Activities to permit third parties to construct, operate, and maintain pipeline projects, geophysical surveys, and other projects on NPR-1 lands. Approximately 3-4 third-party projects are anticipated per year.

(5) A program to initiate revegetation on approximately 1,045 acres of previously disturbed lands no longer needed for production operations.

(6) Continued maintenance of the NPR-1 perimeter firebreak. This activity was addressed in prior biological opinions dated June 3, 1987 (Case No. 1-1-87-F-40), August 20, 1991 (Case No. 1-1-91-F-18), June 16, 1992 [Case No. 1-1-91-F-18(R)], and April 27, 1993 [Case No. 1-1-91-F-18(R2)].

In addition, the Department proposes to initiate the following new activities to maintain MER production on NPR-1 (DOE 1992).

(1) Construction and operation of a phased multi-year steamflood operation consisting of 148 wells on an approximately 500-acre area (referred to as the SOZ Steam Flood Project). This project represents an expansion of a 59-acre pilot steamflood project initiated in 1987 and addressed under a prior biological opinion (Case No. 1-1-85-F-22).

(2) Construction and operation of an additional waste water treatment facility.

(3) Construction and operation of a 5-acre butane isomerization facility.

(4) Construction and operation of a fourth gas compression and processing facility.

(5) Construction and operation of facilities to increase gas compression capacity for gas-lift and gas injection projects, and to increase waterflooding capacity.

To mitigate for adverse effects on federally listed species of ongoing and new MER production activities on NPR-1, DOE proposes to implement the following mitigation commitments as part of the proposed action. This program consists of the following components.

Mitigation Commitments

Conservation Area

Within three years of the date of this opinion, the Department shall place into protected status 7,075 acres of undisturbed endangered species habitat within, or adjacent to, NPR-1, and if appropriate NPR-2, preferably along the north side of NPR-1 adjacent to the Lokern Road area. This will be subject to agreement between the Service and the Department on a management agreement which would identify precise acreage amount, location, and management details

related to the conservation area. If this cannot be accomplished within 3 years, the Department agrees to reinitiate consultation if the Service is not satisfied with the progress that is being made. Such habitat shall be protected against major development activities in perpetuity through a management agreement or other appropriate document executed by and between the Director, NPRC and State Supervisor, FWS. The Department shall enter into written, legally binding agreement with the Service and other affected parties concerning the manner in which compensation lands shall be managed. This conservation area would satisfy any present or future requirements for compensating for the impacts described in the proposed action.

Prior to finalization of any land protection mechanism as required under this mitigation commitment, the Department shall submit for the Service's review the following information: (I) a description of lands selected for protection; (ii) the manner in which they would be protected; (iii) Department commitments with respect to how such lands would be managed, if necessary; and (iv) other information as deemed appropriate by the Department or Service. Finalization of the protection program shall not occur until written approval is obtained from the Service that the protection program is acceptable in all pertinent respects. The Service is available to assist the Department in selecting suitable NPR-1 lands for protection and for other assistance as necessary.

Wildlife Management Plan

This Plan was developed in 1987 to mitigate the effects of routine NPR-1 operation on endangered species and other wildlife; it requires or encourages the following: (I) conducting pre-activity surveys prior to surface disturbing activities; (ii) revegetation of disturbed areas; (iii) monitoring endangered species populations; (iv) controlling coyote populations as appropriate; (v) implementing operating guidelines; (vi) studying conservation and habitat restoration techniques; (vii) developing information and education programs for NPR-1 employees and contractors; and (viii) participating in endangered species recovery programs (O'Farrell and Scrivner 1987). Some activities conducted under the Wildlife Management Plan are discussed further below.

Endangered Species Research and Monitorina Program

In 1979 DOE initiated an endangered species monitoring program on NPR-1 and hired EG&G Energy Measurements, Inc. (EG&G) as its sole biological consultant. In part, EG&C was tasked with implementing reasonable and prudent alternative no. 1 in the Service's 1980 biological opinion--which required an evaluation of effects of oil field development on NPR-1, "basic research" on endangered species including collection of "baseline population and distributional" data, and development of methods to "increase carrying capacity" and "promote the conservation" of endangered species on NPR-1.

Since 1979 EASI has conducted extensive endangered species activities on behalf of the Department and has become an integral component of DOE's overall program on NPR-1 and NPR-2. From approximately 1979 to 1980, EAST conducted site-wide surveys on the Reserves to inventory endangered species populations (Thom Kato, EG&G, pers. comm.). From approximately 1980 to 1987, EASI gathered extensive data concerning kit fox distribution, abundance, mortality factors, and reproductive success within "developed" and "undeveloped" habitats on the Reserves (see Project Effects section). These data were reported in numerous topical reports prepared in 1986 and 1987 and in a biological assessment prepared in support of the 1987 formal consultation and biological opinion.

Operationally, EASI's role on the Reserves is currently divided into seven program "elements" (Thom Kato, EG&G, pers. comm.). These are (1) endangered

species monitoring, including monitoring of kit foxes, lagomorphs, small mammals, coyotes, and other federally listed species; (2) pre-activity surveys on NPR-1; (3) habitat reclamation and management (discussed below); (4) research and development (discussed below); (5) general program assistance, including section 7 consultation support; (6) assistance with third party projects on NPR-1 and NPR-2; and (7) endangered species support activities on NPR-2. An eighth program element previously included through approximately 1990--investigation of relationships between oil field materials and practices and wildlife--was placed as a task in the research and development element in Fiscal Year 1992, evidently because most tasks associated with this element either have been completed or deferred.

Under Element 4--research and development--EASI has conducted or proposed to conduct a variety of projects that are either independent of or indirectly related to other program tasks. Justification for these "research" studies derives in large part from language in the Service's prior biological opinions requiring or recommending, for example, development of methods to "increase carrying capacity" on NPR-1 (1980 opinion) and to conduct artificial kit fox den studies (1987 opinion). Projects conducted or ongoing under this element include, but are not limited to, a kit fox supplemental feeding study, a kit fox relocation project, a giant kangaroo rat habitat reclamation study, and a burn area re-seeding study. Projects proposed but not conducted to date include a kit fox artificial den study and a study of Bakersfield kit foxes associated with the relocation project (William Lehman, USFWS, pers. comm.).

NPRC has proposed an adjustment in the overall scope of its endangered species program from one that has been dedicated to gaining understanding (data collection, monitoring, research and studies) to one that for the most part is limited to reasonable avoidance, habitat reclamation, and habitat conservation, including the establishment of the on-site conservation area.

Monitoring would continue to be conducted in accordance with current scopes based on the following frequencies: Kit foxes would continue to be monitored annually through fiscal year 1996 (NPR-1, NPR-2, abundance, capture and tagging, prey and predators, i.e., lagomorphs, small mammals, coyotes and bobcats, diseases, sources and rates of mortality, and reproductive success). Absent a convincing scientific basis, after that kit fox abundance only would be monitored every 5 years. The abundance of all other protected species would be monitored annually through fiscal year 1999, and every 5 years thereafter.

NPRC proposes that no new data collection, research, or study activities would be initiated. Such activities currently in progress, however, would be completed, including a comprehensive effort that is in progress to integrate and document all data collected and all research/study information, analyses, and conclusions. The Service recognizes NPRC has conducted a great deal of valuable research of the sensitive species of Elk Hills. However, studies (particularly on the conservation area) should continue to gather information on endangered species management and range-wide recovery. Efforts can include habitat manipulations that will sustain and enhance the habitat quality on NPR-1; monitoring populations of listed and candidate species; beet leafhopper control and it's effect on blunt-nosed leopard lizards; etc. Ultimately, these studies should be designed to facilitate on-site endangered species conservation with an emphasis of range-wide recovery needs. The Department and the Service have agreed to address the issue of research/studies as part of the conservation area management agreement.

In late 1988, the DOE established an interagency committee to assist DOE and Chevron by providing additional perspectives on its endangered species programs on NPR-1 and NPR-2. Known informally as the Elk Hills Endangered Species Advisory Committee, this group is composed of representatives from DOE, Bechtel Petroleum Operations, Inc. (DOE's Unit Operator), EASI, Chevron,

the Service, California Department of Fish and Came, the California Energy Commission, the Bureau of Land Management, Enterprise Advisory Services, Inc., and the San Joaquin Valley Endangered Species Recovery Planning Program. The committee meets four times per year.

Habitat Reclamation and Compensation

Both prior biological opinions concerning MER production on NPR-1 discussed in detail the issue of habitat losses, resulting from MER production, and compensation for such losses. A reasonable and prudent measure in the 1980 opinion required DOE to "prepare a Master Plan for the restoration of disturbed habitat on NPR-1." The terms and conditions within the 1987 opinion required the Department to (1) complete an inventory of previously disturbed parcels at NPR-1 that could be rehabilitated to offset habitat loss associated with project activities, and (2) to develop a 10-year program to restore on-site disturbed acreage equivalent to that lost as a result of project activities.

Pursuant to these requirements, the Department in 1988 completed detailed disturbance mapping of NPR-1 based on current aerial photography, and in 1985 initiated a habitat reclamation program on NPR-1 and NPR-2. Through FY 1993, 899 acres of previously disturbed acres on NPR-1 had been replanted (EG&G 1995). While this represents all lands available for reclamation (i.e., lands that are abandoned and meet all reclamation criteria), the Department has estimated an additional 363 acres on NPR-1 will be available for abandonment and reclamation, through 1998 (DOE 1994). This would yield a total of 1,262 acres revegetated as a result of the Department's reclamation program through 1998. In addition, approximately 920 acres of disturbed lands on NPR-1 have revegetated naturally (DOE 1991).

The issue of how the Department's habitat reclamation program relates to its overall obligation to compensate for habitat losses on NPR-1 resulted in considerable discussion during the current consultation. Based on the requirement within the 1987 opinion to restore "equivalent on-site acreage" DOE questioned whether its habitat reclamation program alone was not sufficient to compensate for MER related disturbances, provided equivalent acreage was revegetated. However, for the following reasons the Service did not consider habitat reclamation alone to be adequate. First, the 1987 biological opinion states that equivalent on-site acreage should be restored "at a minimum". Second, both prior opinions also mention other compensation methods, including zoning for no development, purchase of off-site habitats and contribution of funds. Third, "equivalent" reclamation (at a 1:1 ratio) would not be consistent with San Joaquin Valley compensation policy as developed by the Service and California Department of Fish and Game through numerous prior projects--which typically requires a 3:1 compensation ratio for permanent habitat impacts and a 1.1:1 ratio for temporary impacts in saltbush scrub habitats. Finally, in previous projects, revegetation of disturbances resulting from a project typically is not credited to the compensation obligation for that project but is considered a separate mitigation measure.

On the other hand, the Service recognizes that DOE has in good faith expended considerable effort and expense on its habitat reclamation program based in part on the Service's recommendations and requirements. Because of this, the Service has worked with the DOE to develop a compensation program for NPR-1 that would utilize standard compensation policies, recognize the Department's reclamation efforts, and encourage continuation of such efforts.

Studies near completion demonstrate that in some cases reclamation projects are no more effective than natural revegetation for habitat restoration. In situations where natural revegetation is effective, NPRC would limit reclamation to only those activities needed to stabilize soils while natural revegetation is occurring. Procedures for reclamation would be developed in

collaboration with the Service and other professionals as appropriate. Otherwise, habitat reclamation and success monitoring would continue in a manner similar to current procedures. Existing disturbances would be reclaimed as they are identified as no longer being needed for oil field operations.

The resulting program is based on the following assumptions: (1) because MER development has primarily been considered a single integrated project under this and prior biological opinions, and not as a series of separate projects, the habitat compensation obligation for MER development should apply retro-actively to 1976 for the unfulfilled portion of habitat reclamation obligations stemming from the 1987 biological opinion; (2) that habitat disturbances resulting from MER development should be compensated at the same rate as other San Joaquin Valley habitat losses; (3) that habitat disturbances on NPR-1 that have recovered naturally should not count as credits toward DOE's compensation obligation, since they are fortuitous and not the result of its reclamation program; and (4) that all acres revegetated or planned for revegetation under the DOE's reclamation program should be credited toward its compensation obligation, even though many reclaimed areas were disturbed after MER development began. The latter assumption is also based on the fact that the Department's reclamation program is a relatively large-scale, systematic effort being applied to a wide variety of disturbances on NPR-1. We therefore regard it as a programmatic effort rather than merely a project effort.

Finally, to satisfy DOE's compensation obligation, the Service and Department have discussed conceptually the possibility of placing portions of NPR-1 into protected status for the primary purpose of endangered species management. The Service considers this a suitable strategy because significant areas of NPR-1 are relatively undisturbed (especially along its periphery); and because NPR-1 and undisturbed portions of NPR-2 are contiguous with other important native habitats, including the Buena Vista Valley and the Lokern Road area.

Based on the above discussion, the Department has agreed in principle to compensate for habitat losses associated with MER development on NPR-1 by placing into protected status a total of 7,075 acres of undisturbed lands on NPR-1 and NPR-2. This figure is based on estimated temporary disturbance of 318 acres and estimated permanent disturbance of 2,525 acres resulting from MER development, utilizing agreed-upon compensation ratios and minus all acres revegetated or planned for revegetation under DOE's reclamation program established pursuant to the 1987 biological opinion: i.e., 318 temporary acres X 1.1 = 350 acres; 2,525 permanent acres X 2 or 3 = 5,965 acres; 350 + 5,965 = 6,315 total compensation acres + 691 acres of temporary disturbance for third party projects (691 x 1.1 = 760); 6,315 + 760 = 7,075 (DOE 1995). The derivation of temporary versus permanent disturbances is explained in the Project Effects section below.

Plant Mitigation Commitments

To protect federally listed plants and plant species of concern on NPR-1, the Department also has agreed to the following measures.

(1) The Department will complete one comprehensive floristic survey of NPR-1 for all State and Federal endangered, threatened, candidate, and special concern species in the areas of NPR-1 where this kind of a survey has not already been completed. The Department agrees to complete the survey by the end of the fourth growing season, subject to adequate precipitation following permit issuance. Within 60 days of permit issuance, NPRC will provide a written scope of work for the survey to the Service for review comment, and approval. The scope of the surveys will be developed informally in collaboration with Service personnel from the outset. The scope will address such things as priorities, precipitation criteria, reporting requirements, and schedules. Service comments and approval on

the scope are to be provided to NPRC within 60 days. Within 6 months following the completion of each year's survey, the Department will complete a topical report covering the results and findings for that year's survey, including mapping. Within 6 months following the completion of the last year's survey, the Department will complete a topical report covering the results and findings for the four year survey.

(2) With the exception of Hoover's woolly-star, the Department will initiate a separate section 7 consultation for any project that would disturb habitat known to have federally threatened or endangered plants.

(3) To minimize adverse effects of oil and gas production on Hoover's woolly-star, the Department will implement the following protective measures:

a. The Department will conduct preactivity surveys for Hoover's woolly-star for all projects and to make every reasonable effort to conduct them during the Hoover's woolly-star's growing season.

b. If Hoover's woolly-star is known or thought to be in a project area, every reasonable effort will be made to avoid them by relocating and/or reconfiguring the project.

c. If it becomes necessary to locate a project in an area where Hoover's woolly -star is known or thought to be present, every reasonable effort will be made to wait until after seed set before beginning ground disturbances. When disturbances occur after seed set, 2 to 4 inches of topsoil will be conserved and respread within one year, if possible, within appropriate Hoover's woolly-star habitat at a site that is being revegetated outside the conservation area. If it is not possible to meet the 1-year time frame, the topsoil shall be stockpiled and respread within appropriate habitat outside the conservation area as soon as possible.

d. It will not be necessary to protect Hoover's woolly-star that has become reestablished in previously disturbed areas.

(4) The Department will include Hoover's woolly-star habitat in the conservation area.

(5) The Department will use locally obtained native seed for revegetation to the extent commercially available at competitive prices.

(6) The Department will ensure that the habitat of the four oil neststraw *(Stylocline citroleum)* populations known to exist in Sections 10R, 12R, and 17S, is not developed.

Species Account/Environmental Baseline

San Joaquin Kit Fox. The endangered San Joaquin kit fox historically was distributed within an 8,700-square mile in central California from the vicinity of Tracy in the upper San Joaquin Valley south to the general vicinity of Bakersfield. Intensive agriculture, urbanization, and other land-modifying actions have eliminated extensive portions of habitat and are the most significant causes of this species' endangerment. The coyote and the introduced red fox compete for food resources with the smaller kit fox, and are suspected of preying upon kit foxes as well. Predation, competition, poisoning, and road kills contribute substantially to the vulnerability of this species. Kit foxes currently are limited to remaining grassland, saltbush, open woodland, and alkali sink valley floor habitats, and similar habitats located along bordering foothills and adjacent valleys and plains.

Although in the southern San Joaquin Valley, they appear to make extensive use of habitat fragments in an urbanizing environment.

Giant Kangaroo Rat. The giant kangaroo rat was distributed historically from southern Merced County, south through the San Joaquin Valley, to southwestern Kern County and northern Santa Barbara County. Preferred habitat is native annual grasslands with sparse vegetation, good drainage, fine loamy soils, and slope of less than 10 percent. Significant populations survive only in a few areas of remaining habitat, including the Pahoche Hills, Cuyama Valley, Carrizo and Elkhorn Plains and the Lokern area.

Kangaroo rats typically inhabit areas of open ground which tends to facilitate their mode of locomotion. Such areas include rangeland, wildlands, and farmlands that have not been recently cultivated or disced. Kangaroo rats can repopulate formerly cultivated areas from adjoining occupied habitat.

Blunt-Nosed Leonard Lizard. 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. 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 foothills grasslands vegetational communities.

Adult lizards often seek safety in burrows, while immature lizards use rock piles, trash piles, and brush. The lizards use burrows constructed by mammals, such as kangaroo rats, for overwintering and aestivation. The habitat of the lizard has been significantly reduced, degraded, and fragmented by agricultural development, petroleum and mineral extraction, livestock grazing, pesticide application, and off-road vehicle use. 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 Coast Range. The 1985 revised recovery plan (FWS 1985) identified habitat essential for the survival and recovery of the species, priority habitat areas, and areas that could be restored to habitat.

Tipton Kangaroo Rat. The Tipton kangaroo rat inhabits saltbush scrub and alkali sink scrub communities in the Tulare Lake Basin of the southern San Joaquin Valley. They currently inhabit approximately 4 percent of their historic range. Tipton kangaroo rats commonly dig burrows on elevated ground which is not subject to flooding. However, areas which are flooded in winter and spring are occasionally colonized during the dry season. The preferred location for Tipton kangaroo rat burrows typically involves alluvial fans and floodplains and includes fine, highly alkaline sands and, to a lesser degree, alkaline sandy loams. In addition, they generally burrow around the bases of woody shrubs. One of the smallest kangaroo rats, the subspecies is often found in areas also occupied by the larger Heermann's kangaroo rat.

Hoover's woolly-star. Surveys have shown that Hoover's woolly-star populations range from the upper Cuyama Valley near Ventucopa, Santa Barbara County, northward to the Panoche Hills in San Benito County, a distance of approximately 140 miles. Hoover's woolly-star occurs in 42 USGS 7 ½ minute quadrangles within Kings, Kern, San Luis Obispo, Santa Barbara, San Benito, and Fresno counties. Hoover's woolly-star occurrences primarily are located within four areas. The four areas from largest to smallest are: (1) the Kettleman Hills area, (2) the Carrizo Plain-Elkhorn Plain-Temblor Range-Caliente Mountains-Cuyama Valley-Sierra Madre Mountains area, (3) the Lokern-Elk Hills-Buena Vista Hills-Coles Levee-Maricopa-Taft area, and (4) the Antelope Plain-Lost Hills-Semitropic area. Additional, more isolated populations occur throughout the region. An intra-agency draft recovery plan has been developed for Hoover's woolly-star.

Kern Mallow. Kern mallow was first described as *Eremalche kernesis* (Wolf 1938). The most recent treatments (Bates 1992, 1993) assign Kern mallow the name *Eremalche parryi* (Greene) Greene ssp. *parryi*. Bates' treatment of Kern mallow, which includes both white- and purple-flowered gynodioecious plants, has not widely been accepted by the scientific community. Due to the debate within the scientific community over the newest treatment, the Service intends to undertake a status review to solicit available scientific information on which to base a determination of the appropriate taxonomic circumscription of Kern mallow. In the interim, the Service shall continue to consider the listed entity to be *E. kernensis* C.B. Wolf, which was the circumscription used when Kern mallow was listed in 1990. The endangered Kern mallow is a small annual herb of the mallow family 2 to 4-inches in height primarily with white flowers (USFWS 1989). Kern mallow is restricted to the eastern base of the Temblor Range, occurring from the vicinity of McKittrick to near Buttonwillow within valley saltbush scrub in Kern County (Taylor and Davilla 1986). The species is threatened by oil and gas development, transmission line maintenance or expansion, agricultural conversion, overgrazing by livestock, exotic plant competition, and off-road vehicle use. An intra-agency draft recovery plan has been developed for Kern mallow.

San Joaquin wooly-threads. The endangered San Joaquin wooly-threads is a small annual herb of the sunflower family and is endemic to the San Joaquin Valley of California. Its white-wooly stems, only three inches long, often trail along the ground. Flowers are about. 1/4-inch in diameter, lack ray flowers, and have a yellow center. San Joaquin wooly-threads once ranged throughout the floor of the San Joaquin Valley from western Fresno County and eastern Tulare County south to the foothills of the Tehachapi Mountains, reaching into San Benito County on the northwestern part of its range following the rain shadow of the South Coast Ranges (Taylor, 1989). Little is known of the habitat preferences of San Joaquin wooly-threads. It appears to favor non-alkaline soils of sandy or silty sand texture and an arid climatic regime (Taylor, 1989). Much of the habitat for San Joaquin wooly-threads has been eliminated by conversion of annual grassland sites to agriculture. An intra-agency draft recovery plan has been developed for San Joaquin wooly-threads.

Endangered Species Surveys/Status

In 1979, when the Department began its endangered species program on NPR-1, kit foxes were numerous and widely distributed within the Reserve. In 1984, kit fox dens were observed on all but two sections (DOE 1991). However, since 1979 the kit fox population on the NPR-1 "study area" has declined from a high of 144 animals in the winter of 1981-1982 to a low of just 12 animals in the winter of 1991-1992. In addition, kit foxes have disappeared from the central upland portions of NPR-1--where most oil development has occurred--and now appear to be confined to the flatter peripheries of NPR-1. This decline and the status of kit foxes on NPR-1 is discussed in detail in the Project Effects section. However, Elk Hills continues to be very important for the long-term survival and recovery of the San Joaquin kit fox.

Distribution of other federally listed species on NPR-1 typically is more restricted than that of kit foxes. From 1979 to 1987, a total of only 136 blunt-nosed leopard lizards were observed in only 28 of NPR-1's 74 sections (DOE 1991). Leopard lizards typically are found in washes and areas of low relief around the periphery of the Reserve, especially in the Buena Vista Valley along the NPR-1/NPR-2 border; however, leopard lizards also have been observed in six sections in the NPR-1 central uplands. Recorded leopard lizard densities on NPR-1 vary from 0.16 to 0.24 individuals per acre (DOE 1991).

Giant kangaroo rat burrow systems have been observed in 30 sections of NPR-1 (DOE 1991). Like the leopard lizard, the majority of these burrow systems

occur in the Buena Vista Valley, though a few burrows also have been observed in the central uplands. In recent surveys, however, many of these burrow systems have been found to be inactive, possibly because of drought conditions from 1987 to 1991. Giant kangaroo rat burrows on NPR-1 were observed at elevations ranging from 316 to 1,510 feet.

The California Aqueduct is cited in Williams (1985) as the approximate line between the ranges of the Tipton kangaroo rat and the short-nosed kangaroo rat *(Dipodomys nitratoides brevinasus)*. Consequently, Tipton kangaroo rat distribution on NPR-1 is confined to those small portions of the Reserve east of the aqueduct. During a three-night trapping census conducted in 1988, six to 12 Tipton kangaroo rats were captured per night in this area (DOE 1991).

Initial field surveys for the Hoover's wooly-star and other federally listed plants were conducted on NPR-1 in spring 1988 (EG&G 1988, DOE 1991). A total of 28 Hoover's wooly-star populations were observed, primarily restricted to alluvial fans along the lower flanks of the Reserve in Sections 4B, 10B, 12G, 7R, 8R, 10R, 12R, 13R, 32R, 17S, 18S, 20S, 21S, 22S, 23S, and 26S (DOE 1991). Further surveys were conducted in 1991 and additional wooly-star populations were observed in Sections 3B, 12B, 13B, 1G, 10G, 25S, 27S, 30S, 31S, and 14Z (EG&G unpublished data). Hoover's wooly-star populations on NPR-1 tend to occur in areas where other vegetation is sparse such as washes and formerly disturbed sites (e.g., the NPR-1 firebreak and abandoned roadways). Four populations were found at or above 1,000 feet in elevation (EG&G 1993).

The Kern mallow, San Joaquin wooly-threads, and California jewelflower *(Caulanthus californicus)* were not observed during these surveys. However, apparently suitable habitat for Kern mallow was observed in the northwestern portion of NPR-1 (Sections 12Z, 13Z, and 14Z), and the species likely exists here in low numbers or may become established within the foreseeable future (DOE 1991). Potential habitat for San Joaquin wooly-threads also was observed along the northern flanks of NPR-1, but these habitats may be suboptimal because of the dense cover of red brome present (DOE 1991). Based on these data the Service concludes that the Kern mallow and San Joaquin wooly-threads may be present within NPR-1 and may be affected by proposed project activities within the remaining life of the NPR-1 oil field. Suitable habitat for the California jewelflower probably does not exist on NPR-1 (DOE 1991).

Effects of the Proposed Action on Listed Species

Adverse effects of continued MER production on NPR-1 on the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Kern mallow, San Joaquin wooly-threads, and Hoover's woolly-star may result from numerous sources. During construction activities, individual animals may be directly injured or killed by vehicle strikes resulting from construction related traffic, through inadvertent crushing or entombment in collapsed dens or burrows, or through entrapment in construction related holes or trenches. Also during construction, individual mallow, wooly-threads, or woolly-star populations may be crushed or damaged by vehicle traffic or destroyed by grading, pipeline trenching, and related disturbances. Seedbanks of these plants also may be buried or otherwise destroyed. Other forms of death or injury to federally listed species may result from wildfires inadvertently ignited during welding operations, contact with oil spills, sumps, and inundation of animals during release of hydrostatic pipeline test water.

Individual kit foxes, leopard lizards, kangaroo rats, and plant populations also may be subject to harm and mortality during routine day-to-day operations on NPR-1. Factors contributing to such harm and mortality include routine vehicle traffic, routine grading associated with well drilling and access road construction, oil spills, contamination by commonly used oil field chemicals, habitat degradation (discussed below), and other routine operations.

In addition, individual kit foxes, leopard lizards, and kangaroo rats may be subject to harassment during NPR-1 construction and other activities resulting from increased levels of human disturbance, destruction or excavation of dens and burrows, entrapment in open pipes and construction related trenches, and other factors. Some animals may escape direct injury during such activities but become displaced into adjacent areas. These animals may be vulnerable to increased predation, exposure, and stress through disorientation and loss of shelter.

To date, effects discussed above have been substantially minimized by the Department's endangered species mitigation program. A key component of this program is the practice of conducting preactivity surveys prior to all surface disturbing activities. Preactivity surveys are conducted according to "Operational guidelines for conducting endangered species preactivity surveys on Naval Petroleum Reserve #1, Kern County, California" (Kato and O'Farrell, 1987). Based on available data, the Service concludes that DOE has done a good job of implementing its preactivity survey program (EG&G 1992). In 1980, 74 percent of all NPR-1 projects were conducted without preactivity surveys, while in 1984 and 1985 all projects conducted on NPR-1 were preceded by surveys (Kato 1986). Pre-construction surveys continue to be implemented on NPR-1 on a regular basis (Thom Kato, EG&G, pers. comm.). However, some problems exist in ensuring that recommendations resulting from such surveys actually are implemented. For example, in Fiscal Year 1991 recommendations were not implemented in 22 of 175 projects (12.6%) for which preactivity surveys were conducted, and recommendations were not followed in 3 of 90 surveys (3.3%) in Fiscal Year 1992. The instances noted above where the recommendations were not followed did not result in take of endangered species.

Since the December 1987 Biological Opinion, the number of deaths that occurred as a result of DOE/NPRC activities included 2 kit foxes and 2 blunt-nosed leopard lizards. Twenty-four giant kangaroo rat burrows were disked in 1988 during firebreak maintenance but the actual number of individuals killed was not determined. From a historical perspective, a total of 49 San Joaquin kit foxes, 7 blunt-nosed leopard lizards, and 72 giant kangaroo rats have been reported killed or injured as a result of the factors discussed above since 1980. (EG&G unpublished data). Of these, 11 San Joaquin kit foxes, 2 blunt-nosed leopard lizards, and 6 giant kangaroo rats have been killed or injured as a result of the Department's endangered species research program. No Tipton kangaroo rats are known to have been killed or injured during HER activities on NPR-1.

Based on radio-collar data, 291 kit foxes were recovered dead on NPR-1 from 1980 to 1988. Of these, cause of death for 29.9 percent was classified as predation (primarily by coyotes), 24.7 percent as probable predation, 10.0 percent as vehicle strikes, and 3.1 percent as other causes (DOE 1991). Cause of death for 32.3 percent of kit foxes recovered could not be determined. Excluding these foxes, 80.7 percent of foxes for which cause of death could be determined were killed by predation, 14.7 percent by vehicle strikes, and 4.6 percent by other causes (DOE 1991). Mortality sources other than predation and vehicles included disease, shootings drowning, and burying.

Following is a detailed discussion of the effects of past and proposed future MER activities on NPR-1 on the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, federally listed plants, and their habitats (USFWS 1987).

San Joaquin Kit Fox

DOE/NPRC has studied the San Joaquin kit fox population on NPR-1 intensively since 1980 on a 28,480-acre area encompassing the southern half of the Reserve and 2,880 acres in adjacent Buena Vista Valley known as the NPR-1 study area.

The NPR-1 study area contains 16,640 acres defined as "developed" habitat and 11,840 acres defined as "undeveloped" habitat; a square mile containing more than 15 percent of developed land (oil wells, roads, etc.) is defined as developed, and a square mile containing 15 percent or less of developed land is defined as undeveloped (DOE 1991). The areas (developed or undeveloped) are largely contiguous; the range of percent developed in the areas considered was 0.5% to 46.3%; and some sections were divided into half-sections when the developed and undeveloped areas were delineated. Studies conducted by EASI on NPR-1 have included monitoring of kit fox population size, reproductive success, diet, mortality factors, movement patterns, and den characteristics. In part, their purpose has been to determine effects of MER related oil development on the resident kit fox population.

Between 1981 and 1991, EASI has estimated the San Joaquin kit fox population on the NPR-1 study area and on NPR-2 (beginning in 1983) twice annually based on intensive trapping sessions and capture-recapture data (once annually since Fiscal Year 1992). In 1988, trapping sessions were extended to include the entire civil boundaries of NPR-1 in an effort to detect differences in kit fox abundance or distribution between the study area and the Reserve as a whole.

During the period since detailed studies began (1980), the minimum known kit fox population within the NPR-1 study area declined from a high of 165 foxes in the winter of 1981-1982 to 44 foxes in the winter of 1985-1986 (DOE 1991). Similarly, the minimum known population size declined from a high of 167 foxes in the summer of 1982 to 55 foxes in summer 1985 (DOE 1991). The population appeared to stabilize at 40 to 50 kit foxes through approximately 1990, but recent evidence suggests the population has again declined. In winter 1991 the minimum population size was as low as 12 in the NPR-1 study area, but has increased to 40 in 1993 (EG&C unpublished data).

This San Joaquin kit fox population decline on NPR-1 was discussed at length in the Service's 1987 biological opinion and remains a subject of concern. It has been discussed in the biological assessment (DOE 1991), DSEIS (DOE 1992), numerous Elk Hills Endangered Species Advisory Committee meetings, as well as other documents and forums. However, the exact cause of the decline has proven difficult to determine.

Several factors have been considered in attempting to explain this decline, including: (1) the effects of MER development; (2) the endangered species research program; (3) effects of an extended drought in California; and (4) other natural or human-caused factors. In addition, this decline may reflect a general decline in the species due to range-wide habitat degradation.

MER Development. As required under the Service's 1980 biological opinion, the Department attempted to determine the effects of MER development on kit foxes through studies conducted by EASI from 1980 through 1986. Based on these studies, EASI and DOE concluded that the NPR-1 kit fox decline has occurred at similar rates in developed and undeveloped habitats (DOE 1991). This conclusion in turn suggests that MER development has not affected the NPR-1 kit fox population in a significant manner.

However, several factors suggest that these conclusions may not be accurate. First, the kit fox population on NPR-2--where little oil development occurred compared to NPR-1 during the same time period--has declined significantly less than on NPR-1. The NPR-2 kit fox population numbered 177 animals in the summer of 1983 and 113 in the summer of 1989 (EG&C unpublished data). Based on winter data, the NPR-2 kit fox population appears even more stable compared to NPR-1 (119 foxes in the winter of 1983-1984 and 131 in the winter of 1988-1989) (DOE unpublished data). Recent kit fox trapping data presented in the draft FY93 annual progress report shows that kit fox abundance differed between NPR-1 and NPR-2, but that they exhibited similar trends. In addition,

the 1993 minimum population size has increased on NPR-2 to 108 foxes, just as on NPR-1.

Second, circumstantial evidence suggests that the kit fox decline on NPR-1 has been greater in the central upland portions of the Reserve, where most oil development has occurred, than in the flatter lands along its periphery, which are relatively undeveloped. This change in distribution is demonstrated by the fact that few foxes have been captured in the central uplands in recent years, where they were relatively numerous in the early 1980's. By far most kit foxes currently are captured in the flatter undeveloped periphery of the Reserve (Thom Kato, EG&G, pers. comm.). The Department has concluded that kit foxes are presently found on their preferred habitat on NPR-1.

Several factors with respect to MER development can probably be eliminated as causing the kit fox decline on NPR-1. First, it is unlikely that den loss has contributed significantly to the decline. Between 1980 and 1986, only 5 known kit fox dens were destroyed inadvertently as a result of the MER production and another 20 were intentionally excavated to avoid burial of resident foxes (DOE 1991). However, these losses appear to be relatively insignificant since during the same period approximately 946 dens were known to be utilized by kit foxes (Berry et al. 1987).

Contamination of kit foxes by heavy metals commonly associated with oil fields also appears to be minimal. Kit fox hair samples collected from kit foxes on NPR-1 developed lands, NPR-1 undeveloped lands, NPR-2, Camp Roberts, and the Elkhorn Plain were analyzed by Oak Ridge National Laboratory in Oak Ridge, Tennessee (Suter et. al. 1992). Results indicated that kit foxes on NPR-1 exhibited little evidence of contamination by the elements studied, including arsenic, barium, vanadium, chromate, or uranium. Although a few foxes showed high tissue concentrations of some elements, most levels were associated with background soil concentrations or were highest in undeveloped reference sites. Heavy metal concentrations evidently were not great enough to account for the kit fox decline on NPR-1.

The Endangered Species Research Program. The intensive kit fox research and monitoring program conducted on NPR-1 by EASI has occasionally been cited as a possible contributor to the NPR-1 kit fox decline (e.g. O'Neil and Greer 1988). Throughout the life of the program, approximately two thousand kit foxes have been captured and 486 foxes have been radio collared (Thom Kato, EG&G, pers. comm.). All foxes captured, whether collared or not, have been equipped with individually numbered ear tags. Research factors possibly contributing to the kit fox decline include lowering of kit fox survivorship as a result of wearing radio collars, spread of disease through trapping and handling, and loss of kit foxes to research accidents.

At the Service's request, DOE/NPRC considerably expanded their studies of the effects of EASI's radio-collar program on kit foxes in 1992. Utilizing EAST data from 1980 to 1992, DOE/NPRC evaluated effects of radio collars on numerous parameters, including collar to body weight ratio, collar design (heavy or light), survival period, and recapture interval, again comparing radio collared kit foxes to kit foxes with ear tags only. With one exception, no differences in survivorship were observed between radio-collared and ear-tagged foxes. Based on these results, and with reference to the large data set and thoroughness of EASI's study, the Service concludes that EASI's kit fox radio collar program has not significantly contributed to the kit fox decline on NPR-1.

However, DOE/NPRC found that kit fox pups radio collared prior to the month of July tended to survive for shorter periods than pups collared after July (EG&C unpublished data). This result probably has not significantly affected kit fox status on NPR-1 but may have important implications in how kit fox radio collar programs are managed on NPR-1 and elsewhere.

Effects of the Drought. By the early 1990's, endangered species populations throughout the San Joaquin Valley were exhibiting declines likely associated with California's five-year drought that lasted from 1987 to 1992. For example, surveys conducted on NPR-1 in 1991 found that most previously active giant kangaroo rat precincts were no longer occupied (EG&G, unpublished data). Similar giant kangaroo rat declines were observed in the Carrizo Plain (Dan Williams pers. comm.), and leopard lizards reportedly did not reproduce in the Carrizo Plain and elsewhere in 1991 (Dave Germano pers. comm.). Similarly, little kit fox reproduction was observed on NPR-1 in 1991 (EG&G, unpublished data). This harsh five-year drought has often been cited as a primary or contributing factor in the kit fox decline on NPR-1. The principal result of the drought thought to affect kit foxes was reduction in availability of prey species (typically, small mammals and lagomorphs).

Since 1983, EASI has conducted a bi-annual census of lagomorphs on NPR-1 and NPR-2, and, like the kit fox, lagomorphs have declined significantly on both Reserves (DOE 1991). On NPR-1, lagomarphs also were censused during road counts from 1980 to 1983 and declined annually over this period. Similarly, the California Department of Fish and Game (CDFG) has conducted two annual spotlighting routes near NPR-1 (the "Taft" and "McKittrick" routes) in which both kit foxes and lagomorphs have been censused since approximately 1970 (CDFG unpublished data). Results of CDFG data also indicate significantly declining lagomorph numbers along these routes, together with a decline in kit fox numbers that appears to strongly "mimic" the pattern of lagomorph decline. These data suggest that a decline in prey availability caused by the drought may be a primary contributor to the kit fox decline on NPR-1.

However, based on other available data this conclusion cannot be considered certain. For example, the lagomorph and kit fox decline on NPR-1 began prior to 1987, when the five-year drought began; while on NPR-2, where the kit fox decline has been less pronounced, lagomorph densities did not begin to decline until 1987, when the drought began (DOE 1991). Furthermore, in an analysis of EG&G data (kit fox numbers versus lagomorph numbers) on NPR-1 and NPR-2 conducted in 1991, the General Accounting Office (GAO) found that between 1984 and 1989 the estimated number of lagomorph per kit fox was higher on NPR-1 than on NPR-2 (GAO unpublished data). This suggests that prey availability alone can not account for the perceived differences between kit fox numbers on NPR-1 and NPR-2, and that some other factor or factors may have contributed to apparently differential kit fox declines on the two Reserves.

CDFG data suggest another pattern with respect to fluctuating kit fox numbers. According to the graph of these data (DOE 1991), in 1970 kit fox and lagomorph numbers appear to have been declining from earlier highs in the late 1960's. Their numbers then appear to have remained relatively low from approximately 1972 to 1979, when they began to incline sharply to highs in the early 1980's that were unequaled within the study period .The early 1980's is precisely when EASI began its systematic counts of kit foxes and lagomorphs on NPR-1 and NPR-2.

This suggests that EASI initiated its kit fox census on NPR-1 and NPR-2 when lagomorph numbers were at an unusual high, resulting from natural cyclic fluctuations or to some other factor such as rainfall. This in turn suggests that (1) kit fox numbers were unusually high in 1979 or 1980, when EASI census activities began (likely due to high lagomorph numbers), (2) that this high represented a cyclic fluctuation rather than average kit fox carrying capacity on NPR-1, and (3) that the initiation of intensive MER activities on NPR-1 and the observed kit fox decline on the Reserve was coincidental, not causally related (Harris et al 1987).

Other Natural Factors Other factors possibly contributing to the NPR-1 kit fox decline include coyote predation and disease. Since 1980, coyotes have been responsible for most known kit fox mortalities on NPR-1 (80.7 percent of

all dead foxes for which a cause of death could be determined) (DOE 1991). However, based on other studies this appears to be the normal interaction between kit foxes and the larger, more aggressive coyote (e.g., Linda Spiegel, CEC, pers. comm.); and EASI data indicate that coyote numbers on NPR-1 declined contemporaneously with kit fox numbers. Though coyote predation may have exacerbated kit fox problems originally caused by other factors, no data we reviewed suggest that kit fox-coyote interactions can account for the kit fox decline on NPR-1. The significance of coyote predation in kit fox populations is published in articles such as O'Farrell (1984, 1987), and Standley et al. (1992).

In 1981, 1982, and 1984, the kit fox population on NPR-1 was studied for the presence of disease by analyzing kit fox blood serum for the presence of 10 infectious pathogens (DOE 1991). Despite the occurrence of antibodies for canine parvovirus, tularemia, canine distemper, and canine hepatitis in kit fox blood samples, little clinical evidence of disease has been noted in the NPR-1 kit fox population (DOE 1991). Disease can therefore be largely ruled out in explaining the observed kit fox decline on NPR-1.

Summary The above discussion illustrates that the relationship between kit foxes, oil development, and other environmental factors on NPR-1 is complex. In short, it is difficult to ascribe the San Joaquin kit fox decline on NPR-1 conclusively to any single factor.

Nevertheless, several observations seem important. First, lagomorph and kit fox numbers appear to have declined jointly-(if differentially)-throughout the general area, not just on NPR-1. Second, although the disappearance of kit foxes from the central upland portions of NPR-1 has been pronounced and contemporaneous with intensive oil developments-suggesting a direct relationship-CDFG data suggest that kit fox presence in the central uplands in the early 1980's may have been the result of unusually optimal conditions at that time. If this is true, then kit foxes may not normally occupy this portion of NPR-1 because of natural factors (e.g. relatively steep terrain), and this area may have been the first to be abandoned when environmental conditions deteriorated--possibly, at least in part, because of the drought. On the other hand, oil development in the central uplands may have contributed to the adverse conditions-(already marginal because of natural factors)-that eventually caused kit foxes to abandon the area. In this respect, the Service considers EASI data suggesting that kit fox declines have been equivalent in developed and undeveloped habitats on NPR-1 to be inconclusive.

Third, the fact that kit fox declines on NPR-2 have been less severe than fox declines on NPR-1 may be significant and is difficult to explain. Several differences between the two Reserves that may account for this fact have been cited--(e.g., intensive oil development on NPR-1 and overall gentler topography on NPR-2), but here again results are inconclusive.

Based on existing data, the only factors that probably can be ruled out as causing or significantly contributing to the NPR-1 kit fox decline is coyote predation, disease, oil field chemicals, and the endangered species research program. Conversely, it seems likely that the decline may have resulted from a combination of the other effects discussed-(e.g., the drought, natural cyclic fluctuations, oil field developments, and naturally marginal conditions in the central uplands of the Reserve). Continued monitoring of the kit fox population on NPR-1 in the immediate future, especially in light of the end of the drought in the winter of 1992-1993, will be critically important in better understanding the respective roles of the factors discussed above in the NPR-1 kit fox decline.

Based on the above discussion, the Service concludes as follows with respect to the San Joaquin kit fox: (1) that MER oil production probably is not solely responsible for the kit fox decline on NPR-1 but likely has been a

contributing factor; (2) that intensive oil developments in the NPR-1 central uplands likely has contributed to the disappearance of the kit fox from this portion of the Reserve; (3) that proposed new developments in the central uplands, such as the larger facilities as described in the DSEIS (DOE 1992), SEIS (DOE 1993), will contribute to continuing habitat losses and adverse effects in this area and may inhibit effective future use of this area by kit foxes; and (4) that the latter effect is not likely to jeopardize the continued existence of the species because the central uplands probably represents, on average, marginal kit fox habitat except in optimal conditions, and provided that DOE implement the mitigation commitments described on pages 4 to 7 above.

Giant and Tipton Kangaroo Rats

Specific effects to giant kangaroo rats potentially resulting from continuing MER production on NPR-1 include: (1) Destruction of giant kangaroo rat burrow systems during construction of proposed facilities in Townships G, R, and S and by third-party pipelines; (2) removal of food sources (grasses and seeds) during construction activities; (3) alteration of soil conditions-e.g., soil compaction-making it more difficult for kangaroo rats to construct burrows; (4) accidental oil spills or wastewater discharge; (5) disturbance; and (6) accidental death or injury during EASI's trapping and research activities (DOE 1991). In 1986, for example, 12 kangaroo rats (species not identified) were killed when a DOE lessee discharged wastewater into a natural drainage adjacent to NPR-1. Furthermore, O'Farrell et al. (1987) reported that 73 percent of all giant kangaroo burrow systems on NPR-1 occurred at least 150 feet away from well pads, and numerous well pads may be constructed in known giant kangaroo rat habitats in Sections 6-7G, 14R, 20R, 25R, 28R, 26-27S, and 365 during continuing MER production.

However, construction of the larger facilities currently proposed-(e.g., the fourth gas plant, butane facility, and cogeneration plant)-is not expected to affect known giant kangaroo rat populations, and pre-construction surveys and flexibility in well pad location should minimize impacts to giant kangaroo rats elsewhere (DOE 1991). Furthermore, the majority of these wells would be constructed in the central upland portions of NPR-1 where giant kangaroo rats are relatively uncommon. Third-party pipelines-expected to disturb a total of 101 acres-may directly affect some giant kangaroo rat habitat in the Buena Vista Valley and other peripheral areas on the Reserve.

The Tipton kangaroo rat, which is present only in Section 23S east of the California Aqueduct, should not be affected by any planned DOE activities on NPR-1 because no development is planned in that area.

Blunt-nosed Leopard Lizard

Specific effects of continuing NPR-1 activities on blunt-nosed leopard lizards are expected to be similar to those cited above for giant kangaroo rats. In addition, leopard lizards are vulnerable to entrapment in well cellars, and, because they inhabit washes and are vulnerable to accidental wastewater discharges and oil spills. Both such forms of leopard lizard mortality have been documented either on or adjacent to NPR-1 in the 1980's (DOE 1991). In 1992, an aestivating leopard lizard was inadvertently unearthed during gravel mining on NPR-1 but this lizard was unharmed and was returned to its habitat (EG&G unpublished data). Other forms of potential leopard lizard effects on NPR-1 include vehicle strikes and destruction of small mammal burrows during construction activities and third-party projects such as seismic surveys and pipelines.

However, most construction of relatively large new facilities will occur in the central upland portions of the Reserve where little leopard lizard habitat exists, and pre-construction surveys and flexibility in well location should

minimize leopard lizard effects during DOE and third-party projects elsewhere on the Reserve.

Hoover's Woolly-star and Other Federally Listed Plants

The overall effects of the programmatic on listed, proposed, candidates, or sensitive plants cannot fully be assessed at this time because inventory information is incomplete and not always properly timed. Although some intensive surveys have been conducted, they have not always been floristic. Potential effects of proposed project activities on Hoover's woolly-star include (1) destruction of plants and plant habitats during grading, trenching and other construction activities, (2) crushing of individual plants and plant populations during off-road vehicle use and seismic surveys, (3) inundation of plant populations resulting from oil spills or hydrostatic water releases, (4) destruction of plant populations resulting from man-caused fires, and (5) dust from vehicular traffic that can reduce plant productivity. No known populations of Kern mallow or San Joaquin wooly-threads currently exist on NPR-1. However, similar adverse effects to these species might occur as a result of MER activities should they later be found or become established on NPR-1.

Adverse effects to federally listed plants would be minimized because (1) most proposed new activities would occur in the NPR-1 central uplands where Kern mallow and San Joaquin wooly-threads populations are not likely to exist, (2) NPRC agrees to initiate a separate section 7 consultation for any project that would disturb habitat known to have federally threatened or endangered plants other than Hoover's woolly-star, (3) populations of Hoover's woolly-star would be avoided to the maximum extent practicable, as described on pages 8 and 9 above, and (4) where plant populations are not avoidable, DOE would implement other mitigation measures such as stockpiling of topsoil.

Habitat Disturbance

As of June 1988, an estimated 6,467 acres of native habitat originally existing on NPR-1 have been disturbed either permanently or temporarily as a result of oil development activities since the 1920's (DOE 1993). Of these, an estimated 3,227 acres have been disturbed since the inception of MER production in 1976 (DOE 1993).

The Department estimates that habitat disturbance on NPR-1 resulting from proposed new facilities between 1989 and 2025 will total 878 acres (DOE 1991), which includes 5 acres that were disturbed for a water well project covered by a separate consultation (File No. 1-1-92-F-39). This will result from proposed work on 382 wells (579 acres), gas operations expansion (15 acres), and construction of the cogeneration facility (3 acres), the butane isomerization facility (5 acres), steam generators for the SOZ Steam Flood Project (210 acres), gas compression facilities (10 acres), gas injection facilities (4 acres), and pipeline replacement and maintenance activities (50 acres) (DOE 1993). Of this, 750 acres would be affected by 1998.

Adding past MER disturbances to anticipated future disturbances yields total estimated habitat disturbance on NPR-1 resulting from DOE activities through the life of MER production (1976-2025), or 4,105 acres (3,227 +878 = 4,105). In addition, non-Federal third party pipeline projects are expected to disturb 691 acres through the year 2025 (DOE 1991). Because the Department has indicated its willingness to consider these as DOE disturbance for the purpose of this consultation (Jim Killen, DOE, pers. comm.), total disturbance resulting from DOE and related activities during MER production is 4,796 acres.

In addition, 547 acres within the NPR-1 civil boundaries have been disturbed in the past by activities not constructed or undertaken by the Department.

These include 133 acres disturbed by the California Aqueduct, 45 acres occupied by the town of Taft, and 369 acres of agricultural lands not owned by DOE (EG&G unpublished data). An estimated 79 acres have been disturbed since 1988 as a result of third party projects on NPR-1 (DOE 1991). However, these disturbances are either the result of non-DOE projects or are addressed and mitigated under separate biological opinions. Finally, third party seismic surveys are expected to result in minor temporary disturbances of 3,390 acres through 2025 (DOE 1991).

Estimated temporary disturbance on NPR-1 resulting from past MER development totals 432 acres, while estimated permanent disturbance totals 2,795 acres. Estimated temporary disturbance resulting from proposed new activities totals 50 acres, and estimated permanent disturbance totals 828 acres. Temporary disturbance throughout the life of MER development (1976-2025) totals 482 acres and permanent disturbance totals 3,623 acres (DOE 1995).

Cumulative Effects

Cumulative effects are those impacts of future State and private actions that are reasonably certain to occur. Future Federal actions will be subject to the consultation requirements established in section 7 of the Act and, therefore, are not considered cumulative to the proposed action.

Our agency is aware of other projects currently under review by State, county, and local authorities where biological surveys have documented the occurrence of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Hoover's woolly-star, Kern mallow, and San Joaquin wooly-threads. These projects include urban, mineral, and energy development, and flood control and reservoir construction.

However, we do not anticipate that the project under evaluation in this biological opinion, considered together with other non-Federal actions, would appreciably reduce the likelihood of survival and recovery of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Hoover's woolly-star, Kern mallow, or San Joaquin wooly-threads.

Conclusion

After reviewing the current status of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Kern mallow, San Joaquin wooly-threads and the Hoover's woolly-star; the environmental baseline for the action area; the effects of the action and the cumulative effects; it is the Service's biological opinion that the proposed continuation of the oil development program on NPR-1 at Maximum Efficient Rate, as implemented, is not likely to jeopardize the continued existence of these species. No critical habitat has been designated for these species, therefore, none will be affected. This conclusion is based on (1) continuing implementation by DOE of its mitigation commitments, and (2) the fact that most proposed future MER-related disturbances would occur in the central upland portions of NPR-1 where few populations of threatened and endangered species currently exist.

INCIDENTAL TAKE STATEMENT

Sections 4(d) and 9 of the Endangered Species Act prohibit any taking (i.e., to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct) of listed fish and wildlife species without special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly

disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant. Under the terms of sections 7(b)(4) and 7(o)(2), taking that is incidental to and not a intended as part of the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

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

Sections 7(b)(4) and 7(o)(2) of the Act do not apply to the incidental take of listed plant species. However, protection of listed plants is provided to the extent that the Act requires a Federal permit for removal or reduction to possession of endangered plants from areas under Federal jurisdiction, or for any act that would remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any regulation of any State or in the course of any violation of a State criminal trespass law.

San Joaquin kit foxes, blunt-nosed leopard lizards, giant kangaroo rats, and Tipton kangaroo rats may be taken incidentally during continued MER production and proposed construction of new facilities on NPR-1. Project actions that may result in the mortality, harm, or harassment of these species have been previously discussed in this biological opinion. Mitigation measures proposed by the Department will substantially reduce but not eliminate the potential for incidental taking of these species during proposed NPR-1 activities.

Amount of Extent of Take

Based on information provided in the project biological assessment (DOE 1991), information on past incidental takings on NPR-1 provided by EASI, information in our files, and through prior consultations, the Service anticipates that the following numbers of kit foxes, leopard lizards, and kangaroo rats may be subject to harm or mortality during proposed NPR-1 project activities through the year 2025:

1. Ninety (90) San Joaquin kit foxes (3/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

2. Two hundred and ten (210) blunt-nosed leopard lizards (7/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

3. Nine hundred (900) giant kangaroo rats (30/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

4. Thirty (30) Tipton kangaroo rats (1/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

The number of animals subject to incidental take must not exceed the annual amounts stated above, and the total for 30 years is cumulative only.

The number of San Joaquin kit foxes, blunt-nosed leopard lizards, giant kangaroo rats and Tipton kangaroo rats subject to harassment from noise, vibrations, and capture or excavation of dens and burrows cannot be estimated because the number of individuals of these species within potential project areas is unknown. Therefore, the Service anticipates harassment of all individuals of these federally listed species inhabiting areas where project activities would occur provided that such harassment: (1) Is the result of bona fide project activities; (2) is inadvertent or for the express purpose of removing individual animals from construction areas to safe locations; and 3) that all terms and conditions specified below are fully implemented.

Effect of the Take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species discussed.

Reasonable and Prudent Measures

The Service states that the following reasonable and prudent measures are necessary and appropriate to minimize the potential for incidental take of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, and Tipton kangaroo rat authorized by this biological opinion.

1. The potential for harm or mortality to federally listed wildlife species and their habitats resulting from project related activities shall be minimized.

2. The potential for inadvertent entrapment of federally listed wildlife species during construction activities shall be minimized.

3. Compliance with the reasonable and prudent measures, terms and conditions, reporting requirements, and reinitiation requirements contained in this biological opinion shall be ensured.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the Department must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

The terms and conditions specify measures considered necessary by the Service or modify mitigation commitments proposed by the Department. Unless otherwise indicated, all terms and conditions described shall be implemented by the Department at each project site. Where terms and conditions vary from or contradict mitigation commitments as proposed in this or any previous document, specifications in these terms and conditions shall apply.

1. The potential for harm or mortality to federally listed wildlife shall be minimized by implementing the following procedures:

   (a) The Department shall continue to conduct pre-activity surveys prior to all surface disturbing activities on NPR-1. Any change in preactivity surveys would have to be approved by the Service, and may involve reinitiation of consultation.

   (b) Biological monitors (see attachment 1), shall be present, or readily available, on NPR-1 construction sites during all critical construction activities occurring within or adjacent to sensitive endangered species habitat as identified during pre-activity surveys. Examples of activities for which such monitors may be

present include surveys or flagging necessary to determine and delineate specific construction areas, pipeline alignments, and location of access routes and storage areas; grading and trenching activities; checking of pipes, pipeline trench segments, and similar structures for entrapped wildlife; backfilling pipeline trench segments; den and burrow excavations; and other activities as determined by monitoring biologists to be necessary.

(c) The areas disturbed by construction related activities and routine day-to-day operation on NPR-1 shall be minimized to the maximum extent practicable. All NPRC and Contractor vehicles shall be confined to existing roads or to project areas which have received a preactivity survey.

(d) All spills of oil, liquids contaminated by oil, hazardous materials within NPR-1 shall be cleaned up in a manner consistent with the NPR-1 Spill Prevention, Control and Countermeasure Plan.

(e) Speed limits in all construction areas shall not exceed 25 mph.

(f) A litter control program shall be implemented during project activities. This program shall include daily collection of trash, especially that which is food-related, disposal in covered receptacles, and regular removal from project sites.

(g) Construction activities (but not drilling, operations, maintenance, or any other activities) between dusk and dawn shall be minimized.

(h) Personnel performing pre-activity surveys, wildlife handling, kit fox den excavations, and monitoring activities are to be qualified to perform these duties as described by Attachment 1. One supervisory biologist as a training officer who will be given responsibility over all trainees, with full authority to deny or grant trainees the ability to perform permitted activities. This will provide some level of consistency regarding qualifications and employee certification.

2. The potential for inadvertent entrapment of federally listed wildlife species during construction activities shall be minimized by implementing the following procedures:

(a) The Department shall make every reasonable effort to avoid damage or destruction of San Joaquin kit fox dens, giant and Tipton kangaroo rat burrows, and burrows potentially utilized by blunt-nosed leopard lizards during proposed MER activities on NPR-1. Such avoidance measures may include minor re-location of project facilities and minimization of construction impacts to the least possible area.

(b) Known San Joaquin kit fox dens shall not be damaged or destroyed by project related actions unless written or verbal concurrence is obtained from the Service's Sacramento Field Office prior to such effects. If concurrence cannot reasonably be obtained in a timely manner (e.g., on weekends), destruction of known kit fox dens may proceed only if qualified personnel determine that the den cannot reasonably be avoided and if the Service is verbally notified as soon as possible after the fact. Any known kit fox den that must be destroyed shall first be monitored for three consecutive nights by qualified personnel to ensure that it is not occupied by kit foxes, and then shall be excavated by or under the direct supervision of qualified personnel and backfilled to preclude later use by kit foxes. Destruction of all known kit fox dens shall be documented in the annual report.

Potential San Joaquin kit fox dens may be excavated without prior notification to the Service, provided that qualified personnel have determined that the den is not a known kit fox den. Alternately, excavation of potential kit fox dens need not be conducted prior to construction activities, provided that no evidence of kit fox use of such dens is observed after three consecutive nights of monitoring, and that construction operations over such dens occur no more than 24 hours after such dens are last determined to be unoccupied. In the event the Service modifies the procedures for monitoring dens prior to excavation, NPRC shall adopt the revised procedures, so as to be in compliance with this term and condition.

(c) San Joaquin kit foxes, blunt-nosed leopard lizards, and giant and Tipton kangaroo rats may from time to time be captured and relocated from construction sites, provided (i) that burrows of these animals cannot reasonably be avoided during construction activities; (ii) that associated conditions and actions deemed appropriate by the Service are satisfied; (iii) that verbal or written approval from the Sacramento Field Office is obtained prior to any such capture and removal; and (iv) that any person or persons conducting capture and relocation activities possess an appropriate scientific collecting permit issued by the Service or are otherwise qualified to conduct such activities, as determined by the Service in writing.

(d) At the end of each day during all major NPR-1 construction projects, all open pipeline trench segments and other steep-walled holes or trenches greater than two feet deep shall either be covered with plywood or similar materials, or shall be equipped with escape ramps constructed of wooden planks, earth fill, or similar materials and spaced no further than one-quarter mile apart. Projects to which this term and condition applies include the same as those described in term and condition 3(a).

(e) If entrapped wildlife is observed, said wildlife shall only be removed by qualified personnel (see Attachment 1).

3. Compliance with the reasonable and prudent measures, terms and conditions, reporting requirements, and reinitiation requirements contained in this biological opinion shall be ensured by:

(a) Prior to the sale of NPR-1, the Department shall initiate and complete a subsequent section 7 consultation as to this Federal action; and the reasonable and prudent measures and terms and conditions shall be adhered to by the subsequent owner until a section 10(a)(1)(B) permit and a CDFG 2081 permit are issued for their actions. In addition, as part of the subsequent section 7 consultation, the Department shall enter into a Conservation Agreement with the Service if the conservation area has not been established.

(b) Within 90 calendar days following the end of each fiscal year, the Department shall submit to the Services s Sacramento Field Office a brief annual report detailing the following information: (i) A summary of all major construction activities undertaken the previous year; (ii) dates that such construction occurred and the number of habitat acres permanently or temporarily disturbed; (iii) pertinent information concerning the Department's success in meeting project mitigation measures; (iv) an explanation of failure to meet such measures, if any; (v) known project effects on federally listed species, including an estimate of the number of kit fox dens and giant kangaroo rat burrows destroyed, including a general estimate of other small mammal burrows impacted, if any; (vi) known

occurrences of incidental take of listed species, if any; (vii) habitat reclamation efforts undertaken that year, if any; (viii) results of ongoing monitoring of habitats reclaimed in previous year; (ix) an estimate of habitat acres reclaimed to date; and (x) other pertinent information. The term "major construction activity" in this term and condition shall apply to the proposed gas plant, cogeneration plant, butane isomerization facility, all underground pipelines, and any other facility resulting in permanent disturbance of more than 3 acres at a time, or temporary disturbance of more than 5 acres at a time.

(c) If requested, upon completion of any proposed construction project, or at any reasonable time deemed appropriate by the Service, the Department or its contractors shall accompany Service personnel on site inspection tours of construction sites or other locations, as requested, to review project impacts to endangered species and their habitats.

(d) Unless otherwise authorized by the Service in writing, all terms and conditions within this biological opinion shall apply to all third party projects permitted by the Department on NPR-1.

Reviewing Requirement

The reasonable and prudent measures, with implementing terms and conditions, are designed to minimize incidental take that might otherwise result from project activities. If, during proposed project actions, the amount or extent of incidental take of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, or Tipton kangaroo rat is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. The Department must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Reporting Requirement

The Service is to be notified in writing within three working days of the accidental death or injury of a San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat or Tipton kangaroo rat or of the finding of any dead or injured kit fox, leopard lizard, or kangaroo rat, during project related actions. Notification must include the date, time and location of the incident or of the finding of a dead or injured animal, and any other pertinent information. The Service contact for this information is the Assistant Field Supervisor for Endangered Species at (916) 979-2725. To determine disposition of dead or injured San Joaquin kit foxes, blunt-nosed leopard lizards, or giant kangaroo rats, the California Department of Fish and Came, Region 4 Office, Fresno should be contacted (209/222-3761).

CONSERVATION RECONMENDATIONS

Sections 2(c) and 7(a)(1) of the Act direct 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 and the ecosystems upon which they depend. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. Therefore, the Service recommends the following additional actions to protect federally listed species and their habitats during proposed continuing MER activities at NPR-1:

(1) The Department should consider placing into conservation status all lands outside of the primary production and conservation areas for the benefit of listed species. These lands could be subject to oil development activities, however, the quality of the habitat should be maintained.

(2) The Department should consider, in the event of the sale of NPR-1 selling only the sub-surface mineral rights. The surface ownership should be retained by the Federal government for the long-term survival and recovery of the listed species that occupy NPR-1.

(3) The Department should direct EAST to continue monitoring of kit fox and lagomorph population trends and rainfall patterns on NPR-1 and NPR-2. This information and information obtained from CDFG survey routes, should be utilized to further clarify the relative importance of factors potentially affecting kit fox distribution and abundance on NPR-1. In accordance with the concluding paragraph below, the Department should reinitiate consultation concerning MER activities on NPR-1 should any such new information suggest that MER production is resulting in effects to San Joaquin kit foxes not considered in this opinion, or that the conclusions in this opinion with respect to effects of MER production on kit foxes is incorrect or inadequate.

(4) The Department should direct EASI to increase monitoring of population trends on NPR-1 of other federally listed species-(i.e., the blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Kern mallow, Hoover's woolly-star, and San Joaquin wooly-threads). The Department should reinitiate consultation concerning MER activities on NPR-1 should any new information suggest that MER production is resulting in effects on these species not considered in this opinion or that the conclusions in this opinion with respect to effects of MER production on these species is incorrect or inadequate.

(5) The Department should contribute funds to be utilized for research projects on federally listed San Joaquin Valley species conducted either on NPR-1 but by researchers other than EASI, or off NPR-1 in adjacent, nearby, or other San Joaquin Valley locations. The rationale for this recommendation is as follows.

First, NPR-1 is a highly lucrative oil field, generating average net revenues of approximately $750 million per year. Second, NPR-1 occupies a key location in the configuration of remaining San Joaquin Valley habitats in Kern County (near or adjacent to the Lokern Road area, Buena Vista Valley, and others) and DOE activities on NPR-1 have resulted in temporary or permanent disturbance to over 6,000 acres of endangered species habitat within this area- -by any measure a significant effect. Third, over 3,500 acres of habitat disturbance on NPR-1 resulted from Federal activities conducted prior to the onset of MER development and no mitigation for the effect has been required under this or previous biological opinions. Fourth, in the Service's view, restricting DOE research funds non-competitively to a single group (EASI) does not result in the greatest benefit to affected endangered species. Finally, as a Federal agency, the Department has significant responsibilities under section 7(a)(1) of the Act to utilize its authorities in carrying out endangered species programs.

Based on these considerations, the Service recommends that DOE contribute a sum of approximately $100,000 per year through the life of the NPR-1 oil field, or until federally listed species affected by DOE activities are delisted, whichever comes first, to a suitable interest-bearing account to be administered by the Service for research and management of such species.

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

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on proposed continuing MER production on NPR-1. 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 action that may affect federally listed species in a manner or to an extent not considered in this opinion; (3) the project is substantially modified in a manner that causes an effect to listed species that was not considered in this opinion; and/or (4) a new species is listed or critical habitat is determined that may be affected by the action.

We appreciate the cooperation of the Department, Chevron, and EASI throughout this consultation process. Please contact Jody Brown or Peter Cross of my staff at (916) 979-2728 if you have questions or information concerning this biological opinion with respect to federally listed wildlife species, and Kirsten Tarp at (916) 979-2120 if you have questions or information with respect to federally listed plants.

Sincerely,

Joel A. Medlin
Field Supervisor

Attachment

cc: ARD-ES, Portland, OR
Ms. Sandra Morey, CDFG Sacramento, CA
Regional Manager, CDFC, Fresno, CA
Mr. Jim Killen, U.S. Department of Energy, Tupman, CA
Mr. Brian Cypher, EASI Energy Advisory Services, Inc., Tupman, CA
Ms. Linda Spiegel, California Energy Commission, Sacramento, CA
Dr. Daniel F. Williams, SJVESRPP, Fresno, CA

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- Topical Report 110282-2178 'Operational Guidelines for Conducting Preactivity Surveys on Naval Petroleum Reserve No. 1" and its supplements; the current NPR-1 site wide Biological Assessments and Biological Opinions for NPR-1 and NPR-2; FWS's Standard Recommendations for Protection of protected species occurring on or adjacent to NPRC; and sections 9 and 10 of the Endangered Species Act.

- The video titled "Protecting Endangered Species on NPR-1.

2) Completing the following reviews with preactivity survey personnel and the lead person in charge of the project:

- Construction project boundaries;

- Areas demarcated to avoid disturbing endangered species or their habitat;

- Specific measures identified during the preactivity survey to avoid impacts to endangered species;

- Project scope and schedule;

- Designated points of contact and phone numbers.

Demonstrating the ability to successfully conduct monitoring is to be the basis for certification by the supervising biologist. Included in this is the knowledge to know when to ask for assistance from the person who conducted the preactivity survey, or from the supervising biologist.

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ATTACHMENT 1

DEFINITION OF QUALIFIED PERSONNEL
(FOR KIT FOX DEN EXCAVATION/REMOVAL OF ENTRAPPED WILDLIFE, PREACTIVITY SURVEYS AND MONITORING ACTIVITIES ONLY)

Kit Fox Den Excavation, Removal of Entrapped Wildlife, Preactivity Surveys

Personnel are to have either a 4-year degree in biology, or a related field, from an accredited college or university, plus 30 days of full time on-the-job training at NPRC performing preactivity surveys with another qualified person; or 2 years of field, or field related, experience working in an endangered species program on a full time basis, plus 90 days of full time on-the-job training at NPRC performing preactivity surveys with another qualified person. Training is to be carried out under the supervision of and be certified by a NPRC supervising biologist. The supervising biologist is to have a 4-year degree in biology, or a related field, from an accredited college or university, plus a combination of advanced education and field experience qualifying that person to work in the NPRC endangered species program both as a biologist and as a supervisor.

Training is to include:

* Identifying protected and candidate species known to occur on or adjacent to NPRC;

* Life history of protected and candidate species know to occur on or adjacent to NPRC;

* Topical Report 110282-2178 "Operational Guidelines for Conducting Preactivity Surveys on Naval Petroleum Reserve No. 1" and its supplements; the current NPR-1 site wide Biological Assessments and Biological Opinions for NPR-1 and NPR-2; FWS's Standard Recommendations for Protection of protected species occurring on or adjacent to NPRC; and sections 9 and 10 of the Endangered Species Act.

* The video titles "Protecting Endangered Species on NPR-1".

Demonstrating the ability to successfully conduct preactivity surveys is to be the basis for certification by the supervising biologist. Included in this is the knowledge to know when to ask for assistance from the supervising biologist.

Monitoring

For the purposes of monitoring activities occurring within or adjacent to endangered species habitat, monitors are considered to qualified upon:

1) Successfully completing an 8 hour training course. Training is to be carried out under the supervision of and be certified by a NPRC supervising biologist. The supervising biologist is to have a 4-year degree in biology, or a related field, from an accredited college or university, plus a combination of advanced education and field experience qualifying that person to work in the NPRC endangered species program both as a biologist and as a supervisor.

Training is to include:

* Identifying protected and candidate species known to occur on or adjacent of NPRC;

* Life history of protected and candidate species known to occur on or adjacent to NPRC;

* Topical Report 110282-2178 "Operational Guidelines for Conducting Preactivity Surveys on Naval Petroleum Reserve No. 1" and its supplements; the current NPR-1 site wide Biological Assessments and Biological Opinions for NPR-1 and NPR-2; FWS's Standard Recommendations for Protection of protected species occurring on or adjacent to NPRC; and sections 9 and 10 of the Endangered Species Act.

* The video titled "Protecting Endangered Species on NPR-1.

2) Completing the following reviews with preactivity survey personnel and the lead person in charge of the project:

* Construction project boundaries;

* Areas demarcated to avoid disturbing endangered species or their habitat;

* Specific measures identified during the preactivity survey to avoid impacts to endangered species;

* Project scope and schedule;

* Designated points of contact and phone numbers.

Demonstrating the ability to successfully conduct monitoring is to be the basis for certification by the supervising biologist. Included in this is the knowledge to know when to ask for assistance from the person who conducted the preactivity survey, or from the supervising biologist.

EXHIBIT 2

COVERED SPECIES

COMMON NAME	SCIENTIFIC NAME
San Joaquin kit fox	*Vulpes macrotis mutica*
blunt-nosed leopard lizard	*Gambelia sila*
giant kangaroo rat	*Dipodomys ingens*
Tipton kangaroo rat	*Dipodomys nitratoides nitratoides*
Kern mallow	*Eremalche kernensis*
Hoover's woolly-star	*Eriastrum hooveri*
San Joaquin woolly-threads	*Lembertia congdonii*
western burrowing owl	*Athene cunicularia hypugea*
oil neststraw	*Stylocline citroleum*
San Joaquin antelope squirrel	*Ammospermophilus nelsoni*

EXHIBIT 3

LIFE HISTORIES

EXCERPTS FROM THE

DRAFT RECOVERY PLAN FOR UPLAND SPECIES OF THE SAN JOAQUIN VALLEY, CALIFORNIA

Region 1
U.S. Fish and Wildlife Service
Portland, Oregon

1997

KERN MALLOW
(Eremalche Kernensis)

1. Description and Taxonomy

Taxonomy. - Kern mallow was first described as *Eremalche kernensis*, based on a specimen from the "Temblor Valley, 7 miles northwest of McKittrick", in Kern County (Wolf 1938, p.67). Both Kearney (1951) and Munz (1958) transferred this species to the genus Malvastrum then reconsidered (Kearney 1956, Munz 1968) and returned to the original name. Other combinations have been suggested (Leonelli 1986) but were not validly published. The most recently-published treatments (Bates 1992, 1993) assign Kern mallow the name *Eremalche parryi* ssp. *kernensis*. However, the taxonomy of Kern mallow remains controversial in terms of its rank and its relationship to Parry's mallow (*Eremalche parryi* ssp. *parryi*). Most local botanists continue to use the scientific name *Eremalche kernensis* (Medlin in litt. 1995*a*) for this member of the mallow family (Malvaceae).

Description. - The height and habit of Kern mallow vary depending on seasonal precipitation. The form can vary from single-stemmed to multiple-stemmed, with the central stem erect and the lateral stems trailing along the ground. Stem lengths at flowering may range from less than 2.5 centimeters (1 inch) to nearly 50 centimeters (20 inches). The flowers have 5 petals, and the wheel-shaped fruits are divided into single-seeded segments (Bates 1993).

Identification. - The taxonomic debate centers around the gender, color, and size of flowers indicative of Kern mallow versus Parry's mallow. Some populations in the Kern/Parry's mallow complex exhibit a condition known as *gynodioecy,* meaning that a population contains a mixture of plants that have only *pistillate* (female) flowers and plants that have only *bisexual* flowers (with both male and female parts). Bates (1992, 1993) considered any gynodioecious population in the Kern/Parry's mallow complex to be Kern mallow and those populations with only bisexual flowers to be Parry's mallow. On the other hand, Taylor and Davilla in litt. (1986) maintained that both Kern mallow and Parry's mallow were gynodioecious. Neither Wolf (1938) nor authors of early regional floras (Abrams 1951, Munz and Keck 1959) mentioned flower gender. Bisexual Kern mallow flowers produce fewer seeds per fruit (7 to 13) than do pistillate flowers (8 to 19). Parry's mallow and desert mallow *(Eremalche exilis)* fruits contain 10 to 22 and 9 to 13 segments, respectively (Abrams 1951, Munz and Keck 1959, Bates 1992, 1993, Mazer et al. in litt. 1993).

The strictest definition of Kern mallow applies only to populations in which white-flowered individuals predominate. Even in these areas, a few individuals may have pale lavender flowers (Wolf 1938, Bates 1992, Mazer et al. in litt. 1993), but lavender-flowered plants represented less than 10 percent of one population in 1994 (E. Cypher unpubl. data). Definite Parry's mallow populations consist of only pinkish-purple flowers, whereas those of questionable taxonomic affinity contain either exclusively pinkish-purple flowers or a very small proportion of white-flowered plants. Regardless of color, pistillate flowers have shorter petals than bisexual flowers in the same population (Bates 1992, 1993). Parry's

mallow has larger flower parts than Kern mallow. Another closely-related species that infrequently occurs with the other two taxa is desert mallow, which has trailing stems and bisexual flowers that are smaller than those of Kern mallow (Twisselmann 1956, Twisselmann 1967, Hoover 1970, Bates 1993). The populations of Kern mallow that are predominantly white-flowered are the object of conservation concern, and thus the strict interpretation is used in the following sections unless otherwise noted.

2. Historical and Current Distribution

Historical Distribution. - Kern mallow has always had a highly-restricted distribution. In the original description, Wolf (1938) mentioned specimens from the Temblor Valley, Belridge Oil Field, and two sites west of Buttonwillow; all these occurrences were in *western Kern County* north of McKittrick.

Current Distribution. - A 1986 status survey reported three additional occurrences in Lokern, which is the local name for the area between Buttonwillow and McKittrick (Taylor and Davilla in litt. 1986). More intensive surveys during the past few years (Anderson et al. 1991, Olson and Magney 1992, CDFG 1995, Stebbins et al. in litt. 1992, S. Carter pers. comm.) revealed that Kern mallow occurs intermittently within an area of approximately 100 square kilometers (40 square miles) in Lokern, which is best described as a single metapopulation. The California Native Plant Society (Skinner and. Pavlik 1994) and CDFG (1995) also accept reports of plants from three sites between Maricopa and McKittrick (in extreme western Kern County) as representing Kern mallow. Because specimens are not available to determine the color of the flowers and these sites are outside of the accepted range, they are treated here as representing Parry's mallow.

Pink-flowered plants fitting Bates' (1992, 1993) broader concept of Kern mallow are widespread. Recent reports indicated that these plants occurred in several areas of Kern County, including Buena Vista Valley, Elk Hills, Lost Hills, McKittrick Hills, Stockdale, and the Temblor Range. Recent and historical reports elsewhere included Corcoran in Kings County; the Carrizo Plain, Elkhorn Plain, Panorama Hills, and Temblor Range in San Luis Obispo County; the Cuyama Valley in Santa Barbara County; and Pixley in Tulare County (Hoover 1970, Leonelli 1986, Olson and Magney 1992, Skinner and Pavlik 1994, CDFG 1995, Taylor and Davilla in litt. 1986, E. Cypher unpubl. observ., S. Wilson pers. comm.). Parry's mallow ranges from Alameda to Ventura Counties (Bates 1992).

3. Life History and Habitat

As with many arid-land annuals, the form, density, *phenology* (timing of different stages in the life cycle), and reproduction of Kern mallow vary greatly depending on precipitation.

Reproduction and Demography. - In Lokern, Kern mallow seeds typically germinate in January and February, and the plants begin flowering in March. Fruit production begins within a few days after flowers appear; flower and fruit production may continue into May if sufficient moisture is available. The seeds fall from the fruits as soon as they are mature. Seeds are capable of germinating in the following growing season, but at least some remain

ungerminated. The duration of seed viability in the soil is not known. Seed dispersal agents are unknown but probably include animals and wind (Taylor and Davilla in litt. 1986, Mazer et al. in litt. 1993, E. Cypher unpubl. observ.).

Preliminary studies showed that insects facilitated pollination of Kern mallow. However, small numbers of seeds were produced when pollinators were excluded, even in pistillate plants which did not produce pollen. Possible explanations for this phenomenon were *apomixis (i.e.,* seed set without fertilization), contamination of the test plants by researchers, or wind pollination. However, a higher frequency of seed set would have been expected if pollen was carried by the wind (Mazer et al. in litt. 1993). Pollen-covered bees (family Apidae) and beetles (order Coleoptera) have been observed inside Kern mallow flowers (E. Cypher unpubl. observ.), but the insects have not been identified to species.

Population size of Kern mallow varies with rainfall. Several botanists familiar with this species were unable to find Kern mallow at known locations in years of below-average rainfall (Wolf 1938, Twisselmann 1956, Bates 1992). In Lokern, Kern mallow density was nearly 10 times as high in 1995, a year of much higher than average rainfall, as in 1994, which had below-average rainfall during the growing season. Similarly, the number of flowers per plant ranged from 1 to 8 in 1994 and from 1 to over 700 in 1995 (E. Cypher unpubl. data.).

Habitat and Community Associations. - Kern mallow typically occurs in the Valley Saltbush Scrub natural community, where it grows under and around spiny and common saltbushes and in patches with other herbaceous plants, rather than in the intervening alkali scalds. Associated herbs include red brome, redstemmed filaree *(Erodium cicutarium),* woolly goldfields *(Lasthenia minor),* and white Sierran layla (Layia *pentachaeta* ssp. *albida).* Kern mallow typically grows in areas where shrub cover is less than 25 percent (Taylor and Davilla in litt. 1986). The amount of herbaceous cover varies with rainfall and microhabitat; in occupied areas of Lokern, herbaceous cover averaged 80 percent in 1993 and 48 percent in 1994 (Cypher in litt. 1994a, 1994b, E. Cypher unpubl. data). Kern mallow occasionally has reinvaded disturbed sites when existing populations remained in adjacent areas to provide sources of seed (Mitchell in litt. 1989; E. Cypher unpubl. observ.).

Kern mallow occurs on alkaline sandy loam or clay soils at elevations of 95 to 275 meters (315 to 900 feet) (Wolf 1938, CDFG 1995). Leonelli's (1986) comparison of Kern mallow habitat in Lokern with Parry's mallow habitat in the Temblor Range revealed that Kern mallow grew on soils that were more alkaline, less saline, and less sandy than those where Parry's mallow grew.

HOOVER'S WOOLLY-STAR
(Eriastrum Hooveri)

1. Description and Taxonomy

Taxonomy. - Hoover's woolly-star was named originally by Jepson (1943) as *Huegelia hooveri.* In a later taxonomic revision, Mason (1945) assigned the currently-accepted name of *Eriastrum hooveri* to the species. Both the scientific and common names honor Robert F. Hoover, who collected the type specimen in 1937 in Kern County, 11 kilometers (7 miles) south of Shafter (Mason 1945). Hoover's woolly-star is an inconspicuous member of the phlox family (Polemoniaceae).

Description. - The wiry stems of this species may or may not branch and vary in height from 1 to 20 centimeters (0.4 to 8 inches) at flowering. The leaves are thread-like and may have two narrow lobes near the base. Hoover's woolly-star has tiny (less than 5 millimeters; less than 0.2 inch long), white to pale blue flowers that are nearly hidden in tufts of woolly hair. The *stamens* (male reproductive parts) are shorter than the corolla.

Identification. - Many-flowered eriastrum *(Eriastrum pluriflorum)* frequently occurs with Hoover's woolly-star; the former has dark blue flowers that are 16 millimeters (0.6 inch) or greater in length, stamens that protrude from the corolla, and leaves with up to 10 lobes. Small-flowered *Eriastrum* species that occur within the same range are distinguished from Hoover's woolly-star by flower color and stamen length (Abrams 1951, Munz and Keck 1959, Patterson 1993, Taylor and Davilla in litt. 1986, Lewis in litt. 1992).

2. Historical and Current Distribution

Historical Distribution. - Prior to 1986, Hoover's woolly-star was known from 19 sites in 4 counties, based on herbarium collections and written observations. The majority of the occurrences were on the San Joaquin and Cuyama Valley floors, and the others were from the low mountains at the west side of the San Joaquin Valley. In Kern County, Hoover's woolly-star was known from the vicinities of Lokern, Oildale, Semitropic, Shafter, and the Temblor Range. In Fresno County, known occurrences were concentrated near Kerman, Mendota, and Raisin City, except for one site each in the Jacalitos and Panoche Hills. The Cuyama Valley records consisted of one collection each from Santa Barbara and San Luis Obispo Counties (Taylor and Davilla in litt. 1986).

Current Distribution. - Hoover's woolly-star since has been discovered in Kings and San Benito Counties and at numerous additional sites in the 4 original counties, particularly in foothill areas. Most of the occurrences are concentrated in 4 metapopulations. In descending order by estimated number of individuals, these metapopulations are (1) the Kettleman Hills in Fresno and Kings Counties, (2) Carrizo Plain - Elkhorn Plain - Temblor Range - Caliente Mountains - Cuyama Valley - Sierra Madre Mountains in San Luis Obispo, Santa Barbara, and extreme western Kern Counties, (3) Lokern - Elk Hills - Buena Vista Hills - Coles Levee Taft -Maricopa in Kern County, and (4) Antelope Plain Lost Hills - Semitropic in Kern County. Small, isolated populations occur in scattered areas including the Alkali Sink Ecological Reserve and the Guijarral, Jacalitos, Panoche, and Turney Hills

in Fresno County; Buttonwillow, Devil's Den, Lamont, Midway Valley, and Rosedale in Kern County; and the Panoche Hills in San Benito County (Lewis in litt. 1992, 1994b, CDFG 1995, Holmstead in litt. 1993, Danielsen et al. in litt. 1994, EG&G Energy Measurements in litt. 1995). According to Skinner and Pavlik (1994), the species also occurs in Tulare County.

3. Life History and Habitat

Reproduction and Demography. - Hoover's woolly-star is an annual, but the seeds germinate later in the growing season than do those of many of the associated annual plants. Seedlings may emerge from January or February until mid-April (Taylor and Davilla in litt. 1986, E. Cypher unpubl. data). The typical flowering period for Hoover's woolly-star extends from March into June (Munz and Keck 1959, Skinner and Pavlik 1994, Lewis in litt. 1992, Cypher in litt. 1994*a*). Pollination ecology has not been investigated. The tiny seeds probably are dispersed by wind or by tumbling of dead stems (Taylor and Davilla in litt. 1986). Unlike many other annuals, dead stems of Hoover's woolly-star may persist until the next growing season (Lewis in litt. 1992).

Within metapopulations, Hoover's woolly-star typically occurs as scattered groups of plants, with each group occupying an area of less than 0.4 hectare (1 acre) (Lewis in litt. 1994b). Densities are highly variable among sites and among years. In 1993, average densities reported for Hoover's woolly-star in occupied habitat were 3.6 per square meter (0.3 per square foot) at Elk Hills (EG&G Energy Measurements unpubl. data), 8.4 per square meter (0.8 per square foot) in Lokern, and 10.3 per square meter (0.9 per square foot) in the Kettleman Hills (Cypher in litt. 1994*a*). However, metapopulation densities would be considerably smaller due to the presence of unoccupied stretches between the groups of plants. Densities of Hoover's woolly-star fluctuate from year to year and are highest in years of above-average precipitation (Holmstead in litt. 1993). At Elk Hills, densities in natural colonies were 5 to 15 times greater in 1993, a year of above-average rainfall, than in 1991, which was a year of average rainfall (EG&G Energy Measurements in litt. 1995).

Habitat and Community Associations. - Hoover's woolly-star seems to be much more adaptable than other endemic plants of the San Joaquin Valley. Optimal habitats for Hoover's woolly-star are characterized by stabilized silt to sandy soils, a low cover of competing herbaceous vegetation, and the presence of *cryptogamic crust* (a layer of moss, lichen, and algae). However, this species also has been found on loamy soils, in areas of dense vegetation, and in areas lacking cryptogamic crust (Taylor and Davilla in litt. 1986, Cypher in litt. 1994a, Lewis in litt. 1994b, EG&G Energy Measurements in litt. 1995). Hoover's woolly-star may reinvade disturbed soil surfaces such as well pads and dirt roads within 1 year after the disturbance ceases if seed sources remain in the vicinity (Holmstead in litt. 1993, Danielsen et al. in litt. 1994, EG&G Energy Measurements unpubl. data, R. Lewis pers. comm.). In fact, this species may benefit from light to moderate soil disturbance in areas that are densely vegetated by exotic plants (Holmstead and Anderson in litt. 1993, EG&G Energy Measurements unpubl. data).

Populations of Hoover's woolly-star occur in alkali sinks, washes, on both north- and south-facing slopes, and on ridgetops. This species occurs in a wide variety of plant communities. Most are characterized by shrubs such as common saltbush, seepweed, and matchweed *(Gutierrezia californica)*, but shrub cover in occupied habitats typically is less than 20 percent. Herbaceous plant species frequently found in association with Hoover's woolly-star include red brome, goldfields, many-flowered eliastrum, and red-stemmed filaree. Populations of Hoover's woolly-star have been reported at elevations ranging from 50 to 915 meters (165 to 3,000 feet) (CDFG 1995, Taylor and Davilla in litt. 1986, Holmstead in litt. 1993, Cypher in litt. 1994a, Danielsen et al. in litt. 1994, Lewis in litt. 1992, 1994b, EG&G Energy Measurements in litt. 1995).

SAN JOAQUIN WOOLLY-THREADS
(Lembertia Congdonii)

1. Description and Taxonomy

Taxonomy. - In 1883, Gray named San Joaquin woolly-threads as *Eatonella congdonii.* The type specimen had been collected by Congdon near Deer Creek (Tulare County) in that same year. The current name, *Lembertia congdonii,* was published by Greene in 1897, who determined that San Joaquin woolly-threads should be separated from snowy eatonella *(Eatonella* nivea). Subsequent taxonomists have upheld Greene's taxonomy (Johnson 1993, Taylor in litt. 1989). San Joaquin woolly-threads is the sole species in the genus *Lembertia,* which is in the aster family (Asteraceae).

Description. - The common name "woolly-threads" is derived from the many long (up to 45 centimeters; 18 inches), trailing stems covered with tangled hairs. However, San Joaquin woolly-threads plants also can be tiny (less than 7 centimeters; less than 3 inches) and erect with a single stem (Cypher in litt. 1994*a*). The tiny, yellow flower heads are clustered at the tips of the stems and branches (Figure 13). Each flower head is approximately 6 millimeters (0.25 inch) long and contains two types of *florets* (the tiny flowers characteristic of the aster family); the 4 to 7 outer florets differ in shape from the numerous inner florets. The two types of florets produce *achenes* (tiny, one-seeded fruits) that also differ in shape (Johnson 1993, Taylor in litt. 1989).

Identification. - San Joaquin woolly-threads differs from snowy eatonella in the shape of the florets and achenes and in geographical range (Munz and Keck 1959, Johnson 1993, Taylor in litt. 1989).

2. Historical and Current Distribution

Historical Distribution. - The historical range of San Joaquin woolly-threads is based on 47 herbarium specimens and literature reports dating from 1883 to 1983; 30 of the occurrences were from the floor of the San Joaquin Valley, four were from the Cuyama Valley, and the remainder were in the hills west of the San Joaquin Valley (Figure 14). These occurrences were concentrated in eight areas (in descending order of abundance): (1) the plains between Avenal and Mendota in Kings and Fresno Counties, (2) from Bakersfield to Shafter in Kern County, (3) the inner Coast Ranges of western Fresno and eastern San Benito Counties, (4) from north of Lokern to Lost Hills in Kern County, (5) the Carrizo and Elkhorn Plains in San Luis Obispo County, (6) the Cuyama Valley in Santa Barbara County, (7) east of Edison in Kern County, and (8) the type locality. However, 33 of the historical occurrences had been eliminated by 1989 (Taylor in litt. 1989).

Current Distribution. - Many new occurrences of San Joaquin woolly-threads have been discovered since 1986, primarily in the hills and plateaus west of the San Joaquin Valley. These constitute four metapopulations and several small, isolated populations. The largest metapopulation occurs on the Carrizo Plain Natural Area, where the occupied habitat totaled over 1,100 hectares (2,800 acres) in 1993 (Lewis in litt. 1993*b*), which was a

particularly favorable year. In years of lower rainfall, the occupied area is much smaller (E. Cypher unpubl. observ.). Much smaller metapopulations are found in Kern County near Lost Hills, in the Kettleman Hills of Fresno and Kings Counties, and in the Jacalitos Hills of Fresno County. The isolated occurrences are known from the Panoche Hills in Fresno and San Benito Counties, the Bakersfield vicinity, and the Cuyama Valley (CDFG 1995, Taylor in litt. 1989, Stebbins et al. in litt. 1992, Lewis in litt. 1993*b*, Taylor and Buck in litt. 1993, USBLM in litt. 1994, S. Carter pers. comm., R. Lewis pers. comm., S. Wilson pers. comm.).

3. Life History and Habitat

Reproduction and Demography. - San Joaquin woolly-threads is an annual herb, and its phenology varies with weather and site conditions. In years of below-average precipitation, few seeds of this species germinate, and those that do typically produce tiny plants. Seed germination may begin as early as November but usually occurs in December and January. San Joaquin woolly-threads typically flowers between late February and early April, but flowering may continue into early May if conditions are optimal (B. Delgado pers. comm.). Populations in the northern part of the range flower earlier than does the Carriso Plain metapopulation. Each plant may have from 1 to more than 400 flower heads. Seed production depends on plant size and the number of flower heads; in 1993, achene production ranged from 10 to 2,500 seeds per individual (Mazer and Hendrickson in litt. 1993*b*, Cypher in litt. 1994*a*, E. Cypher unpubl. data). The seeds are shed immediately upon maturity, and all trace of the plants disappears rapidly after their death in April or May. Seed dispersal agents are unknown, but possible candidates include wind, water, and animals. Seed-dormancy mechanisms apparently allow the formation of a substantial seed bank in the soil (Twisselmann 1967, Taylor in litt. 1989, Lewis in litt. 1993*b*, Mazer and Hendrickson in litt. 1993*b*, Cypher in litt. 1994*a*).

Insect pollinators are not required for seed-set in San Joaquin woolly-threads (Mazer and Hendrickson in litt. 1993*b*). However, animals may be important to this plant species in other ways. On the Carrizo Plain Natural Area, giant kangaroo rat activity contributes to greater plant size and flower head production in San Joaquin woolly-threads, probably by increasing available soil nutrients and reducing competition from other plants. The microhabitat offered by giant kangaroo rat *precincts* also contributes to earlier seed germination and maturation of San Joaquin woolly-threads, possibly because precinct surfaces are warmer than the surrounding area during the winter months (Cypher in litt. 1994*a*, 1994*b*).

Habitat and Community Associations. - San Joaquin woolly-threads occurs in Nonnative Grassland, Valley Saltbush Scrub, Interior Coast Range Saltbush Scrub, and Upper Sonoran Subshrub Scrub (Cypher in litt. 1994*a*). This species typically occupies microhabitats with less than 10 percent shrub cover, although herbaceous cover may be either sparse or dense, and cryptogamic crust may or may not be present. Plant species that often occur with San Joaquin woolly-threads include red brome, red-stemmed filaree, goldfields, Arabian grass (*Schismus* spp.), and mouse-tail fescue (*Vulpia myuros*). Hoover's woolly-threads often occurs in populations of San Joaquin woolly-threads, although the reverse is not true (Taylor in litt. 1989, Lewis in litt. 1993*b*, Taylor and Buck in litt. 1993,

Cypher in litt. 1994*a*). In two cases San Joaquin woolly-threads was found at low densities in previously disced areas that were adjacent to undisturbed populations (Lewis in litt. 1993*b*, Taylor and Buck in litt. 1993).

San Joaquin woolly-threads occurs on neutral to subalkaline soils that were deposited in geologic times by flowing water. On the San Joaquin Valley floor, this species typically is found on sandy or sandy loam soils, particularly those of the Kimberlina series, whereas on the Carrizo Plain it occurs on silty soils. San Joaquin woolly-threads frequently occurs on sand dunes and sandy ridges as well as along the high-water line of washes and on adjacent terraces. Occurrences have been reported at elevations ranging from approximately 60 to 260 meters (200 to 850 feet) on the Valley floor and surrounding hills, and from 600 to 800 meters (2,000 to 2,600 feet) in San Luis Obispo and Santa Barbara Counties (Hoover 1937, CDFG 1995, Taylor in litt. 1989, Lewis in litt. 1993*b*, Taylor and Buck in litt. 1993, E. Cypher unpubl. observ., R. van de Hock pers. comm.).

OIL NESTSTRAW
(Stylocline citroleum)

1. Description and Taxonomy

Taxonomy. - Oil neststraw was recently recognized as a distinct species, *Stylocline citroleum* (Morefield 1992), even though herbarium specimens were collected as early as 1883. Munz collected the type specimen in 1935 from flats near Taft, in Kern County (Morefield 1992). Oil neststraw is believed to have originated as a hybrid of two common species, everlasting neststraw *(Stylocline gnaphaloildes)* and California filago *(Filago californica)*. However, oil neststraw satisfies the definition of a species because it is capable of reproducing itself without further crossing of the parental species (Morefield 1992). Oil neststraw is a member of the aster family.

Description. - Oil neststraw is inconspicuous because it grows low to the ground and does not have showy flowers. It has trailing, woolly stems less than 13 centimeters (5 inches) long and small, woolly leaves. The round flower heads are 5 millimeters (0.2 inch) or less in diameter. Each flower head contains many individual florets, which consist of reproductive parts and papery scales covered with woolly hairs. The fruits are tiny, brown achenes. Oil neststraw is difficult to distinguish from closely related species because the identifying characters are microscopic (Morefield 1992, 1993).

2. Historical and Current Distribution

Historical Distribution. - Five populations of oil neststraw were known historically, based on collections made from 1883 to 1935. Four of the occurrences were in Kern County, in the vicinities of Bakersfield, McKittrick, and Taft (two sites, including the type locality). The fifth collection was made in San Diego County.

Current Distribution. - Morefield (pers. comm.) was unable to rediscover oil neststraw at any of the historical locations. Although natural land remains at most sites, the location descriptions are vague. Four new occurrences were discovered between 1988 and 1995 on the Elk Hills Naval Petroleum Reserves in California in Kern County (J. Hinshaw pers. comm., D. Taylor pers. comm.).

Life History and Habitat. - Oil neststraw, an annual, flowers in April and reproduces strictly by self-pollination. The extant occurrences and several of the historical localities are in petroleum-producing areas, giving rise to both the common and scientific names. This species grows on flats and on slopes. One of the Elk Hills populations of oil neststraw occurs on the bank of a wash in a very sparsely vegetated area that has well-developed cryptogamic crust. The few plant species associated with oil neststraw at that site are natives such as everlasting neststraw, California filago, Hoover's woolly-star, and many-flowered eriastrum. Plant species that occur with oil neststraw in the other Elk Hills sites are red brome, common saltbush, and white burrobush *(Hymenoclea salsola)*. All the extant occurrences are in the Valley Saltbush Scrub plant community in undeveloped areas.

Oil neststraw has been found at elevations of 60 to 320 meters (200 to 1,050 feet) on both sandy and clay soils (Morefield 1992, EG&G Energy Measurements unpublished data, D. Taylor pers. comm.).

GIANT KANGAROO RAT
(Dipodomys Ingens)

1. Description and Taxonomy

Taxonomy. - *Dipodomys ingens* was described as *Perodipus ingens* by Merriam (1904*a*), who listed the type locality as Painted Rock, 20 miles SE Simmler, Carrizo Plain, San Luis Obispo, California. The type locality was amended to 41 kilometers (25 miles) SE of Simmler by Williams and Kilburn (1991). The genus name *Perodipus* was used for several years to include all the kangaroo rats with five toes on the hind feet. Grinnell (1921) relegated *Perodipus* to a synonym of *Dipodomys.* This taxonomy has been sustained in the latest taxonomic review of the family Heteromyidae (Williams et al. 1993*b*).

Description. - The giant kangaroo rat is adapted for bipedal locomotion (two-footed hopping) (Eisenberg 1963). The hind limbs are large compared to the size of the forelimbs; the neck is short; and the head is large and flattened. The tail is longer than the combined head and body length and has a dorsal crest of long hairs towards the end of the tail, terminating in a large tuft. Large, fur-lined cheek pouches open on each side of the mouth. The pouches extend as deep invaginated pockets of skin folded inward along the sides of the head (Grinnell 1922).

Identification. - Giant kangaroo rats are distinguished from the coexisting species, San Joaquin kangaroo rat (*D. nitratoides)* and Heermann's kangaroo rat *(D. heermanni),* by size and number of toes on the hind foot. The hind feet of adult giant kangaroo rats each have five toes and are longer than 47 millimeters (1.85 inches) (Best 1993). The giant kangaroo rat is the largest of more than 20 species in the genus (Grinnell 1922, Hall 1981, Best 1993). Grinnell (1932*a*) reported a mean mass of 157.0 grams (5.54 ounces) for 15 adult males and 151.4 grams (5.34 ounces) for 7 adult females. Adult Heermann's kangaroo rats average 65 to 80 grams (2.29 to 2.82 ounces), with maximum weights not exceeding about 90 grams (3.17 ounces) (Williams 1992); the hind foot also has five toes but individuals' feet usually measure less than 45 millimeters (1.77 inches) (Best 1993). Average weight of San Joaquin kangaroo rats is less than 45 grams (1.59 ounces), and they have four toes on each hind foot. Length of the hind feet do not exceed 39 millimeters (1.54 inches) (Grinnell 1922).

2. Historical and Current Distribution

Historical Distribution. - Up until the 1950s colonies of giant kangaroo rats were spread over hundreds of thousands of acres of continuous habitat in the western San Joaquin Valley, Carrizo Plain, and Cuyama Valley (Grinnell 1932*a*, Shaw 1934, Hawbecker 1944, 1951). The historical distribution of giant kangaroo rats encompassed a narrow band of gently sloping ground along the western edge of the San Joaquin Valley, California, from the base of the Tehachapi Mountains in the south, to a point about 16 kilometers (10 miles) south of Los Banos, Merced County in the north; the Carrizo and Elkhorn Plains and San Juan Creek watershed west of the Temblor Mountains, which form the western

boundary of the southern San Joaquin Valley; the upper Cuyama Valley next to and nearly contiguous with the Carrizo Plain; and scattered colonies on steeper slopes and ridge tops in the Ciervo, Kettleman, Panoche, and Tumey Hills, and in the Panoche Valley. Within this circumscribed geographic range were about 701,916 to 755,844 hectares (1,734,465 to 1,867,723 acres), which included different estimates of the amount of nonhabitat depending on different assumptions. The most liberal estimate of historical habitat was about 631,724 hectares (1,561,017 acres; Williams 1992).

Current Distribution. - The species population is currently fragmented into six major geographic units: A) the Panoche Region in western Fresno and Eastern San Benito Counties; B) Kettleman Hills in Kings County; C) San Juan Creek Valley in San Luis Obispo County; D) western Kern County in the area of the Lokern, Elk Hills, and other uplands around McKittrick, Taft, and Maricopa; E) Carrizo Plain Natural Area in eastern San Luis Obispo County; and F) Cuyama Valley in Santa Barbara and San Luis Obispo Counties (Williams 1980, 1992, O'Farrell et al. 1987*a*, Williams et al. 1995). These major units are fragmented into more than 100 smaller populations, many of which are isolated by several miles of barriers such as steep terrain with plant communities unsuitable as habitat, or agricultural, industrial, or urban land without habitat for this species. Extant habitat was last estimated to be 11,145 hectares (27,540 acres), about 1.8 percent of historical habitat (Williams 1992).

Within the area of currently occupied habitat, populations of giant kangaroo rats have expanded and declined with changing weather patterns since 1979. At their peak in 1992 to 1993, there probably were about 6 to 10 times more individuals than at their low point in spring of 1991, when a majority of the 11,145 hectares (27,540 acres) probably was uninhabited and most of the rest was inhabited by less than 10 percent of peak numbers (Williams 1992, Williams et al. 1993*a*, Williams et al. 1995, Allred et al. in press, Williams and Nelson in press, D.F. Williams unpubl. data).

3. Life History and Habitat

Food and Foraging. - Giant kangaroo rats are primarily seed eaters, but also eat green plants and insects. They cut the ripening heads of grasses and forbs and cure them in small surface pits located on the area over their burrow system (Shaw 1934, Williams et al. 1993*a*). They also gather individual seeds scattered over the ground's surface and mixed in the upper layer of soil. Surface pits are uniform in diameter and depth (about 2.5 centimeters, 1 inch), placed vertically in firm soil, and filled with seed pods. After placing seeds and seed heads in pits, the animal covers them with a layer of loose, dry dirt. Pits are filled with the contents of the cheek pouches after a single trip to harvest seeds. Before being moved underground, the seeds, including filaree and peppergrass *(Lepidium nitidum),* are sun-dried which prevents molding (Shaw 1934).

Individuals in many populations of *D. ingens* also make large stacks of seed heads on the surfaces of their burrow systems (Hawbecker 1944, Williams et al. 1993*a*). The material is cured, then stored underground. Amounts cached in surface stacks may not correspond with annual herbaceous productivity. No stacks were found in 1990, a year

with no seed production, and 1991, a year with the second highest plant productivity between 1987 and 1994 (Williams and Nelson in press).

Grinnell (1932*a*, p. 313) examined three nursing females who had their cheek pouches "literally crammed with green stuff", and speculated that green foliage might be an important part of the diet during lactation. Other individuals, including a young female and adult males, were captured with foliage and fruits of peppergrass and foliage of filaree in their cheek pouches (Grinnell 1932*a*). In captivity, giant kangaroo rats have been maintained for periods from 2 weeks to more than 2 years on a diet of air-dried seeds, consisting primarily of millet, oat, and sunflower, occasionally supplemented with green plants. Of the green plants, captives preferred forbs to annual grasses, and usually ignored the blades of perennial grasses (Williams and Kilburn 1991). Shaw (1934) found a live insect of the bee and wasp family in the cheek pouch of a giant kangaroo rat. Eisenberg (1963) kept a giant kangaroo rat in captivity on a diet that included seeds, lettuce, and mealworm (darkling beetle) larvae (*Tenebrio* sp.).

Giant kangaroo rats forage on the surface from around sunset to near sunrise, though most activity takes place in the first 2 hours after dark. Foraging activity is greatest in the spring as seeds of annual plants ripen. Typically, plants such as peppergrass ripen first, and early caches, mostly in pits instead of stacks, consist of pieces of the seed-bearing stalks of this and other early-ripening species. The ability to transport large quantities of seeds and other food in cheek pouches and their highly developed caching behaviors, coupled with relatively high longevity of adults with established burrow systems, probably allow giant kangaroo rats to endure severe drought for 1 or 2 years without great risk of population extinction (Williams et al. 1993*a*, D.F. Williams unpubl. data).

Reproduction and Demography. - Results of studies conducted between 1987 and 1995 in colonies on the Elkhorn and Carrizo Plains indicate that giant kangaroo rats have an adaptable reproductive pattern that is affected by both population density and availability of food (Williams et al. 1993*a*, Williams and Nelson in press, Endangered Species Recovery Program unpubl. data). During times of relatively high density, females had a short, winter reproductive season with only one litter produced and there is no breeding by young-of-the-year. This was true both in years of high plant productivity and drought. In contrast, populations at low densities continue to breed into summer during drought. In 1990, a year of severe drought and no seed production, most females appeared not to reproduce; the few that bred apparently failed to raise young. In most years, females were reproductive between December and March or April, but in colonies with low densities, reproduction extended into August or September.

Giant kangaroo rats can breed the year of their birth when environmental and social conditions permit (sufficient food and space). At the Soda Lake colony, juvenile. females had their first litters at an estimated mean age of 5 months. Some females had 2 to 3 litters per year. This relatively high rate of reproduction probably was promoted by high plant productivity and low population density (Williams and Nelson in press).

Little information is available on litter size and none exists for age-specific litter size or a specific mating system. The mean of known embryo counts and litter sizes is 3.75,

probably a value higher than the number born (Williams and Kilburn 1991, D.F. Williams unpubl. data). A majority of females may have from 2 to 4 young.

The major time for dispersal of giant kangaroo rats seems to be following maturation of young, about 11 to 12 weeks after birth. However in years of high density, when most or all burrow systems are occupied, most young appear to remain in their natal burrows until opportunity to disperse arises or they finally are driven off by the mother or one of the siblings. Under these circumstances, death or dispersal of the resident does not leave a burrow system vacant for long. Williams and Nelson (in press) found on a study site at Soda Lake, San Luis Obispo County that more females than males dispersed although males more often moved longer distances. Females had a nearly 60 percent greater survival rate than males. Dispersal of adults with established burrow systems was occasionally detected; one adult male moved more than 120 meters (131.2 yards) from his established home to take up a new residence in a new burrow system he constructed (Williams et al. 1993*a*, Williams and Nelson in press, Williams and Tordoff in litt. 1988).

Estimated home range size ranges from about 60 to 350 square meters (71.8 to 418.6 square yards). There is no significant difference in size of home range between sexes. The core area of the territory, located over the burrow system *(precinct)* is the most intensely-used location in the home range (Braun 1985). Most often, territories are occupied by a single animal (Grinnell 1932*a*, Shaw 1934).

Estimates of density, employing both trapping and counts of precincts ranged from 1 to 110 animals per hectare (1 to 44 animals per acre) (Grinnell 1932*a*, Braun 1985, Williams 1992). Changes in density generally coincide with amount of rainfall and herbaceous plant productivity, though numbers in populations studied in 1989 remained high despite drought and low plant productivity. Large seed caches made in spring 1988 probably carried individuals through 1989 and 1990 during drought (Williams et al. 1993*a*, Williams and Nelson in press, D.F. Williams . unpubl. data). The population on the Elkhorn Plain typically was at much higher density than other populations recently studied, and fluctuated less than populations elsewhere, suggesting that the habitat on this part of the Elkhorn Plain is some of the best remaining.

Population Genetics. - Partial results of on-going studies of population genetics of giant kangaroo rats provide guidance for designing a recovery strategy. The northern populations in Fresno and San Benito Counties are highly differentiated genetically from the southern populations on the Carrizo Plain Natural Area.

The genetic structure of the Carrizo Plain population differs from northern populations in that it has effectively acted as one large population, though the genetic data strongly suggest that the inhabited areas there have gone through episodes of substantial expansion and contraction in size (Mosquin et al. in press). This is consistent with recent observations from population censuses (Williams 1992, Williams et al. 1993*a*, Williams and Nelson in press, Allred et al. in press, D.F. Williams unpubl. data).

In the north, the population along the edge of the Valley at the eastern base of Monocline Ridge (San Joaquin Valley population) is substantially differentiated genetically from the other large population in the southeastern end of Panoche Valley. These two populations show little evidence of gene flow between them, and the San Joaquin Valley population is closer genetically to the Carrizo Plain population than any other of the semi-isolated northern populations. Clearly, this represents the remnant of the historical population that was distributed along the western edge of the Valley between Merced and Kern Counties. The two large, northern populations (San Joaquin Valley and Panoche Valley) appear to have been the sources of the small, semi-isolated populations on ridge-tops in the Ciervo and Turney Hills. These latter populations are differentiated from both of the large populations, and from each other. They appear to have played the major role in gene flow between the Panoche Valley and San Joaquin Valley populations. Interpopulation movements appear to have been achieved over relatively long periods in a stepping-stone manner between small populations on these ridge tops. Though small, they contain a significant proportion of the rare and unique genes of the northern population (Mosquin et al. in press).

The genetic studies show that *effective population size* (number of successfully-breeding individuals) in the north is smaller than current population size, indicating there has been a large increase in the northern population size very recently. This is consistent with the increase measured after the end of the drought in 1991 (Williams et al. 1995). In the south, estimated effective population size is slightly greater than current population size, indicating that current and historical population sizes are approximately the same (Mosquin et al. in press).

The genetic structure of giant kangaroo rat populations also shows that the *effective dispersal* distance of giant kangaroo rats (i.e., dispersal of genes) is much greater than predicted on the basis of capture-recapture and behavioral studies. Results from trapping of kangaroo rats show most movements are less than 100 meters (328 feet) and rarely as much as 1 kilometer (0.62 mile) (Jones 1988, 1989, Williams and Nelson in press). The genetic data suggest that effective distances are several times greater than 1 kilometer. There are too few data, and analyses are too incomplete to make a precise estimate, but they do suggest effective dispersal over several kilometers and through highly inhospitable habitat in the northern population (Mosquin et al. in press).

Behavior and Species Interactions. - Little direct evidence exists on aggression by giant kangaroo rats, but they seem to be much more aggressive than the two co-occurring species. Wherever giant kangaroo rats were found by Grinnell (1932*a*), they dominated the community to the exclusion of other rodent species.

Hawbecker (1944, 1951) and Tappe (1941) corroborated Grinnell's observations, finding that giant kangaroo rats excluded all other nocturnal rodents from areas where they occurred.

Braun (1983), however, found that a population of giant kangaroo rats on the Carrizo Plain, San Luis Obispo County, did not exclude other species of rodents to the extent reported by others. Braun (1983) believed that the lack of exclusivity supported the hypothesis that this population was living in suboptimal habitat.

The giant kangaroo rat, by its relative abundance and burrowing activity, is a key species (i.e., keystone species) in grassland and shrub communities (Goldingay et. al. 1997). When abundant locally, giant kangaroo rats are a significant prey item for many species, including San Joaquin kit foxes (an umbrella species), American badgers *(Taxidea taxus)*, coyotes *(Canis latrans)*, long-tailed weasels *(Mustela frenata)*, burrowing owls *(Athene cunicularia)*, barn owls *(Tyto alba)*, great horned owls *(Bubo virginianus)*, and short-eared owls *(Asio flammeus)*. Snakes seen within giant kangaroo rat colonies included the coachwhip *(Masti- cophis flagellum)*, gopher snake *(Pituophis melano- leucus)*, common king snake *(Lampropeltis getulus)*, and western rattlesnake *(Crotalis viridis;* Williams 1992). Giant kangaroo rat burrows also are used by blunt-nosed leopard lizards and San Joaquin antelope squirrels. On the Carrizo Plain Natural Area, the endangered California jewelflower grows primarily on the burrow systems of giant kangaroo rats (Cypher in litt. 1994*a*). In spring, precincts show as distinct, evenly-spaced, dark green patches because of the more lush growth of herbaceous plants compared to intervening spaces (Grinnell 1932*a*). Measurements of plant productivity on and off precincts over an 8-year period show that when rainfall was sufficient to promote growth and fruiting of plants, the net productivity of herbaceous plants was two to five times greater on precincts than surrounding ground (Hawbecker 1944, Williams et al. 1993*a*, Williams and Nelson in press). Further, growth of herbaceous plants on precincts contained about 4 percent more protein than plants from surrounding ground. These differences were attributed directly to the presence and activities of the giant kangaroo rats (Williams et al. 1993*a*).

Activity cycles. - Giant kangaroo rats are active all year and in all types of weather. They do not migrate or become dormant or torpid. Although primarily nocturnal, giant kangaroo rats have been seen above ground during daylight, including midday in the hottest part of the year (Williams et al. 1993*a*, Williams and Tordoff in litt. 1988). Giant kangaroo rats typically emerge from their burrows soon after sunset and are active for about 2 hours (time of first emergence to time of last disappearance). There usually is no second period of activity before dawn. Animals are above ground only for about 15 minutes per night, Activity patterns appear to be unaffected by distance from the home burrow, snow, rain, wind, moonlight, or season (Braun 1985).

Habitat and Community Associations. - Historically, giant kangaroo rats were believed to inhabit annual grassland communities with few or no shrubs, well-drained, sandy-loam soils located on gentle slopes (less than 11 percent) in areas with about 16 centimeters (6.3 inches) or less of annual precipitation, and free from flooding in winter (Grinnell 1932*a*, Shaw 1934, Hawbecker 1951). However, more recent studies in remaining fragments of historical habitat found that giant kangaroo rats inhabited both grassland and shrub communities on a variety of soil types and on slopes up to about 22 percent and 868 meters (2,850 feet) above sea level. This broader concept of habitat requirements probably reflects the fact that most remaining populations are on poorer and marginal habitats compared to the habitats of the large, historical populations in areas now

cultivated. Yet these studies demonstrated that the preferred habitat of giant kangaroo rats still was annual grassland communities on gentle slopes of generally less than 10 percent, with friable, sandy- loam soils. Few plots in flat areas were inhabited, probably because of periodic flooding during heavy rainfall (Williams 1992, Williams et al. 1995, Allred et al. in press).

Below about 400 meters (1,312 feet), at Panoche Creek in western Fresno County and in the Lokern, Buena Vista Valley, and Elk Hills regions of the southern San Joaquin Valley, giant kangaroo rats are found in annual grassland and saltbush scrub. Scattered common and spiny saltbushes characterize areas where giant kangaroo rats are associated with shrubs. The most common herbaceous plants are red brome, annual fescue, and red-stemmed filaree (Williams 1992).

Upper Sonoran subshrub scrub associations support relatively large populations of giant kangaroo rats at elevations above about 400 meters (1,312 feet). In the southern portion of the extant geographic range of giant kangaroo rats, these communities are characterized by open stands of the dominant shrub, California ephedra. Annual grasses and forbs, particularly red-stemmed filaree, peppergrass, and Arabian grass dominate areas between shrubs. Giant kangaroo rats are most numerous where annual grasses and forbs predominate, with scattered ephedra bushes and fewer shrubs such as Anderson desert thorn *(Lyciuni andersonii),* eastwoodia *(Eastwoodia elegans),* and pale-leaf goldenbush *Isocoma acradenia var. bracteosa)* (Williams 1992).

Above about 600 meters (1,968 feet) in elevation, eastwoodia, California buckwheat, winter fat *(Krascheninnikovia lanata),* and chaparral yucca *(Yucca whipplei)* are more common on steep slopes (greater than about 5-6 percent) and sandy ridgetops. Cheesebush *(Hymenoclea salsola)* and matchweed are common only in arroyos. Only satellite colonies of giant kangaroo rats or scattered individuals are found in these latter associations. In the northern portion of the geographic range of giant kangaroo rats, Anderson desert thorn is absent; otherwise, the woody shrubs comprising the ephedra community are the same or closely-related species (Williams 1992, Williams et al. 1995).

TIPTON KANGAROO RAT
(Dipodomys Nitratoides Nitratoides)

1. Description and Taxonomy

Taxonomy. - The Tipton kangaroo rat is one of three subspecies of the San Joaquin kangaroo rat. The type specimen of the Tipton kangaroo rat was collected from Tipton, Tulare County, California, in 1893 (Merriam 1894). See account of the Fresno kangaroo rat for a discussion of taxonomic history of *D. n. nitratoides.* Hafner in litt. (1979) examined samples of Tipton and short-nosed kangaroo rats, and, using detailed analyses, established better-defined boundaries between the two subspecies than those of previous researchers. He concluded that samples from populations northeast and east of Bakersfield, and in upland saltbush communities above the southern and eastern borders of the Tulare Basin floor were characteristic of populations of short-nosed kangaroo rats, typified by reference samples from the Carrizo Plain, San Luis Obispo County. Hafner's in litt. (1979) analyses showed that the subspecies boundary on the southwest in Kern County nearly coincided with the California Aqueduct, which is positioned just above the Valley floor along the edge of the more steeply sloping foothills in areas that do not flood extensively. The natural boundary between these two subspecies on the southwest was probably a narrow zone of seasonal and permanent wetlands around Kern and Buena Vista lakes and the Kern River channel that meandered north from the east edge of the Elk Hills to historical Goose Lake. Historical barriers between the two subspecies probably were intermittent in some spots. More recent flood control and diversion of waters from the Kern River for irrigation and other purposes removed these barriers and probably allowed for increased genetic exchange between the two subspecies. Today, the California Aqueduct and large expanses of irrigated cropland again have isolated these populations.

Description. - See account of the Fresno kangaroo rat for a general description of the species. On average, adult Tipton kangaroo rats weigh about 35 to 38 grams (1.23 to 1.34 ounces), have a head and body length of about 100 to 110 millimeters (3.94 to 4.33 inches) and a tail about 125 to 130 millimeters (4.92 to 5.12 inches) in length. The Tipton kangaroo rat is larger than the Fresno kangaroo rat and smaller than the short-nosed kangaroo rat.

Identification. - See the Fresno kangaroo rat account for distinguishing Tipton kangaroo rats from other co-occurring species. The Tipton kangaroo rat can be distinguished from the Fresno kangaroo rat by its larger average measurements: total length for males, 235 millimeters (9.25 inches), for females, 221 millimeters (8.7 inches); length of hind foot for males 34.7 millimeters (1.37 inches), for females, 33.6 millimeters (1.32 inches); mean inflation of the auditory bullae for males, 22.1 millimeters (0.87 inch), for females, 21.8 millimeters (0.86 inch) (Hoffmann 1975) (see accounts of Fresno and short-nosed subspecies for corresponding average measurements).

2. Historical and Current Distribution

Historical Distribution. - The historical geographic range of Tipton kangaroo rats was estimated to cover approximately 695,174 hectares (1,716,480 acres) (Williams in litt. 1985). Tipton kangaroo rats were distributed within an area on the floor of the Tulare Basin, extending from approximately the southern margins of Tulare Lake on the north; eastward and southward approximately along the eastern edge of the Valley floor in Tulare and Kern Counties. The southern and western extent of their range was the foothills of the Tehachapi Mountains (south) and the marshes and open water of Kern and Buena Vista lakes, and the sloughs and channels of the Kern River alluvial fan. Farther north, the western boundary was approximately along the Buena Vista slough of the Kern River channel into Goose Lake. The approximate line on the northwest is marked by the city of Lost Hills, Kern County; Kettleman City, Kings County; and Westhaven, Fresno County. Prior to development of water-diversion and irrigation systems over the past several decades, this area bounded three large lakes, Tulare, Kern, and Buena Vista, together with marshlands that were unsuitable habitat for kangaroo rats (Boolootian 1954, Hoffmann 1974, Hafner in litt. 1979, Williams et al. 1993*b*, Williams in litt. 1985).

Current Distribution. - By July 1985, the area inhabited had been reduced, primarily by cultivation and urbanization, to about 25,665 hectares (63,367 acres), only about 3.7 percent of the historical acreage. Additional small parcels not surveyed by Williams (in litt. 1985) have since been found to be inhabited. Tipton kangaroo rats also have reinhabited several hundred to a few thousand acres that were in crop production in 1985 but have since been retired because of drainage problems or lack of water, or acquired by State and Federal agencies for threatened and endangered species conservation. Most notable has been a mix of mostly agricultural and some natural land acquired by the State for the Kern Fan Water Bank, managed by the California Department of Water Resources. This project was to provide over 2,023 hectares (5,000 acres) of habitat for threatened and endangered species management (Jean Hopkins & Associates in litt. 1994), though a lesser, unknown amount actually has been naturally recolonized from adjacent natural land. Offsetting these gains has been the loss of several hundred to a few thousand acres of habitat that have been developed. Thus, the current acreage of occupied habitat is unknown, but probably does not differ much from the 1985 estimate.

Current occurrences are limited to scattered, isolated areas clustered west of Tipton, Pixley, and Earlimart, around Pixley National Wildlife Refuge, Allensworth Ecological Reserve, and Allensworth State Historical Park, Tulare County; between the Kern National Wildlife Refuge and Delano, Kern County; and other, scattered units to the south in Kern County.

3. Life History and Habitat

Food and Foraging. - Tipton kangaroo rats eat mostly seeds, with small amounts of green, herbaceous vegetation and insects supplementing their diet when available. Most aspects of food and foraging of Tipton kangaroo rats are identical to those of Fresno kangaroo rats. See the account of the Fresno kangaroo rat for more information.

Reproduction and Demography. - Little specific information has been published on reproduction of Tipton kangaroo rats. Generally, this aspect of their biology is extremely similar to that of the Fresno kangaroo rat (see that account for details). Five Tipton kangaroo rats being held in captivity to prevent their death by permitted destruction of their habitats each gave birth to two young (D.G. Germano pers. comm., D.F. Williams unpubl. observ., S. Yoerg pers. comm.).

Reproduction commences in winter and peaks in late March and early April. Most females appear to have only a single litter, though some adult females have two or more, and females born early in the year also may breed (Endangered Species Recovery Program unpubl. data).

At the Paine Wildflower Preserve south of Kern Wildlife Refuge, Clark et al. (1982) estimated a density of 2.6 Tipton kangaroo rats per hectare (1.05 per acre) in the "best" habitat above flood level, and 1.5 per hectare (0.61 per acre) in "poor" habitats subjected to flooding and disturbance by past disking of the soil. Hafner in litt. (1979) estimated relative densities of Tipton kangaroo rats at 13 sites representing areas from throughout the geographic range and most plant communities in which Tipton kangaroo rats were known to occur. Densities ranged from a low of 1 to 2 per hectare (0.4 to 0.8 per acre) in alkaline and terrace grasslands with a sparse cover of seepweed to a high of about 7 to 9 per hectare (2.8 to 3.6 per acre) in saltbush scrub.

In 1985, surveys through the remaining extant habitat resulted in estimated densities, based on numbers of burrow systems, ranging from less than 1 per hectare to 50 per hectare (less than 0.4 to 20.2 per acre). Areas supporting very low densities had few noticeable features in common. Sites on the eastern perimeter of the geographic range in terrace grasslands had consistently low densities. Areas subjected to prolonged flooding also supported few kangaroo rats. Many sites showed no evidence of kangaroo rats on one or more randomly chosen transects. Although a cause for lack of occupancy could not be determined in most cases, the environment at the sites suggested periods of extensive flooding. Floods in the Tulare Basin were extremely severe in 1983 (Williams in litt. 1985).

At Pixley National Wildlife Refuge on two plots, density estimates in June 1991 during drought were 3.0 to 3.8 Tipton kangaroo rats per hectare (1.2 to 1.5 per acre). After the end of a 5.5 year drought in April 1991, a population irruption occurred, and peaked in January 1993. Subsequently, density declined from the high of 88.2 per hectare (35.7 per acre) in January 1993 to a low of 1.1 per hectare (0.45 per acre) in April 1995. The shape of this population decline is illustrated by the number of Tipton kangaroo rats known to be alive each month in Figure 47 (Endangered Species Recovery Program unpubl. data).

During the decline, annual rainfall was greater than average and little or no livestock grazing occurred in the pasture where the plot was located. Kangaroo rats could not use their usual defenses of speed and alertness, adaptations for habitats with sparse, low vegetation, and many may have been taken by predators. High rainfall also may have caused death from water penetrating burrows and drowning occupants, spoiling seed stores, or causing death from hypothermia or pneumonia-like diseases that have been observed to afflict these animals when placed in a cool, moist environment (Endangered Species Recovery Program unpubl. observ.).

Behavior and Species Interactions. - Tipton kangaroo rats live in ground burrows. Most burrows probably are dug by the occupant or a predecessor of the same species. Burrows are typically simple, but may be unbranched or branched, including interconnecting tunnels. Most burrows are less than 25 centimeters (10 inches) deep (Germano and Rhodehamel in litt. no date). Nothing else specific to the behavior of the Tipton subspecies has been published (see Fresno kangaroo rat for a general discussion of behavior and species interactions).

Tipton kangaroo rats are food for a variety of predators: coyotes, San Joaquin kit foxes, long-tailed weasels, American badgers, owls, hawks (San Joaquin kangaroo rats infrequently emerge from their burrows during daylight; Tappe 1941, Williams et al. 1993*a*), various species of snakes, and probably others. Except for small, isolated populations, predation is unlikely to threaten Tipton kangaroo rats. The increasing fragmentation of the range of Tipton kangaroo rats, however, increases the vulnerability of small populations to predation.

Habitat and Community Associations. - Tipton kangaroo rats are limited to arid-land communities occupying the Valley floor of the Tulare Basin in level or nearly level terrain. They occupy alluvial fan and floodplain soils ranging from fine sands to clay-sized particles with high salinity. Historically, populations apparently were most numerous and persistent in Relictual Interior Dune Grassland and Sierra-Tehachapi Saltbush Scrub communities. Today, much of the occupied remnants of their range have one or more species of sparsely scattered woody shrubs and a ground cover of mostly introduced and native annual grasses and forbs. Woody shrubs commonly associated with Tipton kangaroo rats are: spiny and common saltbushes, arrowscale *(Atriplex phyllostegia),* quailbush *(Atriplex lentiformis),* iodine bush, pale-leaf goldenbush, and honey mesquite *(Prosopis glandulosa var. torreyana).* A conspicuous semi-woody species is seepweed (Williams in litt. 1985).

Winter rains and runoff from the surrounding mountain ranges (Sierra Nevada to the east, Tehachapi Mountains to the south, and Temblor Range to the west) flood much of the area occupied by Tipton kangaroo rats. Areas with standing water during portions of winter and spring (vernal pools) become alkaline playas when the water has evaporated. Tipton kangaroo rats sometimes colonize areas that are flooded in winter and spring. Important existing communities for Tipton kangaroo rats are iodine bush shrubland (Valley Sink Scrub) and Valley Saltbush Scrub (Griggs et al. 1992). Much of these extant communities are flooded seasonally. Alkaline water lies close to the surface of the soil, year around. Presumably during flooding, individuals are either drowned or captured by

predators after being forced from their burrows, or escape to higher ground (Williams in litt. 1985).

Although Tipton kangaroo rats occur in terrace grasslands devoid of woody shrubs, sparse-to-moderate shrub cover is associated with populations of high density. Typically, however, burrow systems are located in open areas; only in areas of dense shrub cover are burrows usually located beneath shrubs. Terrain not subject to flooding is essential for permanent occupancy by Tipton kangaroo rats.

Burrows of Tipton kangaroo rats are commonly located in slightly elevated mounds, the berms of roads (where placed above ground level), canal embankments, railroad beds, and bases of shrubs and fences where windblown soils accumulate above the level of surrounding terrain. Soft soils, such as fine sands and sandy loams, and powdery soils of finer texture and of higher salinity are generally associated with greater densities of Tipton kangaroo rats than are less saline and alkaline, sandy-loam, loam, and clay-loam soils of portions of the eastern margins of their geographic range, supporting terrace grasslands. This may relate to how crumbly the soils are, the type of plant communities they support, or both (Williams in litt. 1985).

At Pixley National Wildlife Refuge, Tipton kangaroo rats are the most numerous small mammal. They dominate grazed annual grassland on the refuge, where they typically outnumber Heermann's kangaroo rats, the second most numerous species. Other common, small mammalian associates are San Joaquin pocket mice and deer mice (Williams and Germano in litt. 1991, D.F. Williams unpubl. data). Other common, mammalian associates include San Joaquin kit foxes, coyotes, American badgers, California black-tailed hares, California ground squirrels, harvest mice, and house mice.

BLUNT-NOSED LEOPARD LIZARD
(Gambelia Sila)

1. Description and Taxonomy

Taxonomy. - The blunt-nosed leopard lizard was described and named by Stejneger (1890) as *Crotaphytus silus,* from a specimen collected in Fresno, California. Cope (1900), however, considered the blunt-nosed leopard lizard to be a subspecies of the long-nosed leopard lizard (*C. wislizenii),* and listed it as *C. w. silus.* Under this arrangement, leopard lizards and collared lizards were placed in the same genus. Smith (1946) separated the collared from the leopard lizards, placing the latter in the genus *Gambelia.* The bases for separation were differences in head shape, presence or absence of *gular* (throat area) folds, and differences in bony plates on the head. The subspecific status of *G. w. silus* was retained by Smith (1946). This generic split was not universally agreed upon and the status, both generic and specific, of the lizards remained controversial until Montanucci (1970) presented a solid argument for specific status based upon the study of hybrids between the long-nosed and blunt-nosed leopard lizards. Montanucci et al. (1975) again separated *Gambelia* from *Crotaphytus,* resulting in the name *Gambelia silus* (Jennings 1987). Frost and Collins (1988), Collins (1990), and Germano and Williams (1993) used the spelling *sila* to properly agree in gender with the genus *Gambelia.*

Description. - The blunt-nosed leopard lizard is a relatively large lizard of the family Iguanidae, with a long, regenerative tail; long, powerful hind limbs; and a short, blunt snout (Smith 1946, Stebbins 1985). Males are significantly larger than females, ranging in size from 87 to 120 millimeters (3.4 to 4.7 inches) snout-vent length (Tollestrup 1982). From snout to vent, females are 86 to 111 millimeters long (3.4 to 4.4 inches). Adult males weigh between 31.8 and 37.4 grams (1.3 to 1.5 ounces), and adult females weigh between 20.6 and 29.3 grams (0.8 to 1.2 ounces) (Uptain et al. in litt. 1985). Males are distinguished from females by their enlarged postanal scales, femoral pores (visible pores on the underside of the thigh), temporal and mandibular muscles (muscles on the skull that close the jaws), and tail base (Montanucci 1965).

Although blunt-nosed leopard lizards are darker than other leopard lizards, they exhibit tremendous variation in color and pattern on the back (Tanner and Banta 1963, Montanucci 1965, 1970). Background color ranges from yellowish or light gray-brown to dark brown depending on the surrounding soil color and vegetation association (Smith 1946, Montanucci 1965, 1970, Stebbins 1985). The under surface is uniformly white.

The color pattern on the back consists of longitudinal rows of dark spots interrupted by a series of from 7 to 10 white, cream-colored, or yellow transverse bands. In the blunt-nosed leopard lizard, the cross bands are much broader and more distinct than in other leopard lizards and extend from the lateral folds on each side to the middle of the back, where they meet or alternate along the midline of the back. With increasing age the cross bands may fade and the spots may become smaller and more numerous, particularly in males (Montanucci 1967, Smith 1946). Similarly colored bands or rows of transverse spots produce a banded appearance to the tail (Smith 1946). Juveniles have blood-red spots on

the back that darken with age, becoming brown when sexual maturity is reached, although a few adults retain reddish centers to the spots (Montanucci 1967).

Except for the throat, undersides are uniformly white to yellow in immature lizards and prenuptial females. Nuptial females have bright red-orange markings on the sides of the head and body and the undersides of the thighs and tail. This color fades to pink or light orange by late July. Males in many populations develop a nuptial color during the breeding season that spreads over the entire undersides of the body and limbs. This salmon to bright rusty-red color may be maintained indefinitely (Montanucci 1965).

Identification. - The blunt-nosed leopard lizard can be distinguished from the long-nosed leopard lizard by its color pattern, truncated snout, and short, broad triangular head (Stejneger 1890, Smith 1946). The blunt-nosed leopard lizard has dark blotches on the throat instead of parallel streaks of the long-nosed leopard lizard. Other distinguishing characteristics are a significantly smaller number of maxillary and premaxillary teeth (this may be directly related to the shortened snout) and a smaller variation in the number of femoral pores (Smith 1946). In general, blunt-nosed leopard lizards can be distinguished from all other leopard lizards by their retention into adulthood of the primitive color pattern shared by all young leopard lizards (absence of ornamentation around the dorsal spots; retention of wide, distinct cross bands; presence of gular blotches; and fewer spots arranged in longitudinal rows) (Smith 1946, Montanucci 1970).

2. Historical and Current Distribution

Historical Distribution. - The blunt-nosed leopard lizard is endemic to the San Joaquin Valley of central California (Stejneger 1893, Smith 1946, Montanucci 1965, 1970, Tollestrup in litt. 1979). Although the boundaries of its original distribution are uncertain, blunt-nosed leopard lizards probably occurred from Stanislaus County in the north, southward to the Tehachapi Mountains in Kern County. Except where their range extends into the Carrizo Plain and Cuyama Valley west of the southwestern end of the San Joaquin Valley, the foothills of the Sierra Nevada and Coast Range Mountains, respectively, define the eastern and western boundaries of its distribution. The blunt-nosed leopard lizard is not found above 792 meters (2,600 feet) in elevation (Montanucci 1970). The blunt-nosed leopard lizard hybridizes with the long-nosed leopard lizard where their ranges meet in Ballinger Canyon (Santa Barbara and Ventura Counties) in the Cuyama River watershed (Montanucci 1970, Le Fevre in litt. 1976).

Current Distribution. - The currently occupied range of the blunt-nosed leopard lizard is in scattered parcels of undeveloped land on the Valley floor, and in the foothills of the Coast Range. Surveys in the northern part of the San Joaquin Valley documented the occurrence of the blunt-nosed leopard lizard in the Firebaugh and Madera Essential Habitat areas (Williams in litt. 1990). Essential Habitat Areas were defined in previous recovery plan editions for this species as undeveloped wildlands containing suitable habitat for the blunt-nosed leopard lizard and essential to the continued survival of the species (USFWS 1980*a*, in litt. 1985).

In the southern San Joaquin Valley, extant populations are known to occur on the Pixley National Wildlife Refuge, Liberty Farms, Allensworth, Kern National Wildlife Refuge, Antelope Plain, Buttonwillow, Elk Hills, and Tupman Essential Habitat areas, on the Carrizo and Elkhorn Plains, north of Bakersfield around Poso Creek, and in western Kern County in the area around the towns of Maricopa, McKittrick, and Taft (Byrne in litt. 1987, R.L. Anderson pers. comm., L.K. Spiegel pers. comm.). Remaining undeveloped lands farther north that support blunt-nosed leopard lizard populations include the Ciervo, Tumey, and Panoche Hills, Anticline Ridge, Pleasant Valley, and the Lone Tree, Sandy Mush Road, Whitesbridge, Horse Pasture, and Kettleman Hills Essential Habitat areas (CDFG in litt. 1985). The species is presumed to be present still in the upper Cuyama Valley, though no recent inventory is known for that area.

3. Life History and Habitat

Food and Foraging. - Blunt-nosed leopard lizards feed primarily on insects (mostly grasshoppers, crickets, and moths) and other lizards, although some plant material is rarely eaten or, perhaps, unintentionally consumed with animal prey. They appear to feed opportunistically on animals, eating whatever is available in the size range they can overcome and swallow. Which lizards are eaten is largely determined by the size and behavior of the prey. Lizard species taken as prey include: side-blotched lizards *(Uta stansburiana),* coast horned lizards *(Phrynosoma coronatum),* California *whiptails (Cnemidophorus tigris),* and spiny lizards *(Sceloporus* spp.). Young of its own species also are eaten (Montanucci 1965, Kato et al. 1987*b*, Germano and Williams 1994*a*). Because they have similar diets, interspecific competition probably occurs between the blunt-nosed leopard lizard and California whiptail (Montanucci 1965, Tollestrup 1979).

Reproduction and Demography. - Breeding activity begins within a month of emergence from dormancy and lasts from the end of April through the beginning of June, and in some years to near the end of June. During this period, and for a month or more afterward, the adults often are seen in pairs and frequently occupy the same burrow systems (Montanucci 1965, Germano and Williams 1994*b*). Male territories may overlap those of several females, and a given male may mate with several females. Copulation may occur as late as June (Montanucci 1965).

Two to six eggs averaging 15.6 by 25.8 millimeters (0.6 by 1.0 inch) are laid in June and July, and their numbers are correlated with the size of the female (Montanucci 1967). Under adverse conditions, egg-laying may be delayed 1 or 2 months or reproduction may not occur at all (Montanucci 1965, Tollestrup 1979, 1982, Germano et al. 1994). Eggs are laid in a chamber either excavated specifically for a nest or already existing within the burrow system (Montanucci 1965, 1967). Females typically produce only one clutch of eggs per year, but some may produce three or more under favorable environmental conditions (Montanucci 1967, USFWS 1985*a*, Germano and Williams 1992, Williams et al. 1993*a*). After about 2 months of incubation, young hatch from late July through early August, rarely to September, and range in size from 42 to 48 millimeters (1.7 to 1.9 inches) snout-vent length (Montanucci 1965, Tollestrup 1982). Before their first winter, young leopard lizards may grow to 88 millimeters (3.5 inches) in snout-vent length (Montanucci 1967).

Sexual maturity is reached in from 9 to 21 months, depending on the sex and environmental conditions (USFWS 1985*a*). Females tend to become sexually mature earlier than males, breeding for the first time after the second dormancy, while males usually do not breed until later (Montanucci 1965, 1967).

The relative proportions of the three age groups (adult, subadult, hatchling or young-of-the-year) change through the activity season as young are added to the population only in August or later and entry into dormancy and differential mortality affects the proportions in age groups above ground. Data based upon surface activity do not give an accurate estimate of the population age structure because the adults cease activity above ground from about 4 weeks before to about the same time as the eggs hatch. The best estimate of the relative proportions of adults and subadults (animals hatched the previous summer) may be made from data gathered in May because both groups are active on the surface then. In May the proportions were 85 percent adults and 15 percent subadults (Montanucci 1965). Montanucci (1965) believed that data gathered in August for subadults and hatchlings yielded the best estimate of their proportions because both groups were active. His data were about 2:1 hatchlings to subadults. Combining these numbers, the population consisted of about 67 percent adults, 11 percent subadults, and 22 percent hatchlings. The age structure of a population on Pixley National Wildlife Refuge consisted of 62 percent adults, 27 percent subadults, and 11 percent hatchlings in 1984 (Uptain et al. in litt. 1985).

Age structure of adults during a 7-year period on the Elkhorn Plain (Williams et al. 1993*b*, Endangered Species Recovery Program unpubl. data), was determined in 1995; percentages of 2, 3, 4, and 5 year-old males were 69.5, 21, 6.5, and 2, respectively. Percentages of females 2, 3, and 4 years old were 70, 22, and 7.5; none were recaptured older than 4 years. Parker and Pianka (1976) made estimates for the long-nosed leopard lizard based on their data for a Utah population, which are consistent with the age structure and reproductive situation described for the blunt-nosed leopard lizard. Maximum longevity would thus be 8 to 9 years with an annual survivorship of about 50 percent.

In several populations, and during most of the year, males appear to outnumber females by a ratio of 2:1 (Montanucci 1965, Uptain et al. in litt. 1985, Kato et al. 1987*a*). Mullen (1981) reported that the ratio of males to females was 3:1, whereas Montanucci (1965) found that the numbers in a Valley floor population were equal. Uptain et al. (in litt. 1985) showed that, although 63 percent of the hatchlings in a population on Pixley National Wildlife Refuge were male, the male:female ratio varied seasonally from 2:1 in the spring, to 1:1 in the summer, and to 2:3 in the fall. These were all based on short-term studies. In contrast, populations on two plots on the Elkhorn Plain over several years typically had adult and subadult sex ratios of about 1:1 (1:1.04). Females outnumbered males more often than the reverse during census periods in May and June. Hatchling sex ratios, however, showed the opposite, with males outnumbering females, most censuses with ratios varying between about 1.5:1 and 2.5:1 male:female (Williams et al. 1993*a*, Germano and Williams 1994*b*, Endangered Species Recovery Program unpubl. data).

Male and female home ranges often overlap. The mean home range size varies from 0.1 to 1.1 hectares (0.25 to 2.7 acres) for females and 0.2 to 1.7 hectares (0.52 to 4.2 acres) for males (Tollestrup 1983, Kato et al. 1987*a*).

There are no current overall population size estimates for the species. Uptain et al. (in litt. 1985) reported densities ranging from 0.3 to 10.8 lizards per hectare (0.1 to 4.2 per acre) for a population on the Pixley National Wildlife Refuge in Tulare County. In a previous study of this population, Tollestrup (1979) estimated an average density of 3.3 lizards per hectare (1.3 per acre). In 1991, after three previous years of severe drought, two 8.1-hectare (20-acre) plots had estimated densities of 6.7 and 7.0 lizards per hectare (2.7 and 2.8 per acre) on Pixley National Wildlife Refuge (Williams and Germano in litt. 1991). On the Elkhorn Plain, estimated population size on two 8.1-hectare plots of adult and subadult blunt-nosed leopard lizards in June (period of peak above-ground activity) varied between 0 in 1990 to more than 170 in 1993. Only subadult lizards were active above ground in April and no lizards were active by June 1990, the year of severest drought (Williams et al. 1993*a*, Germano et al. 1994, D. J. Germano and D.F. Williams unpubl. data). Turner et al. (1969) estimated that the average density of a southern Nevada population of the long-nosed leopard lizard was 3 lizards per hectare (1.2 per acre). Population densities in marginal habitat generally do not exceed 0.5 blunt-nosed leopard lizards per hectare (0.2 per acre) (Mullen 1981, Le Fevre in litt. 1976, Madrone Associates in litt. 1979).

Behavior and Species Interactions. - Social behavior is more highly developed in the blunt-nosed leopard lizard than in the long-nosed leopard lizard. For example, territorial defense and related behavioral activity are completely absent in the long-nosed leopard lizard, whereas blunt-nosed leopard lizards are highly combative in establishing and maintaining territories (Montanucci 1970). In addition, Tollestrup (1979, 1983) observed six distinct behavioral displays specific to the blunt-nosed leopard lizard. Behavioral displays of all types were more frequent during the breeding season.

Leopard lizards use small rodent burrows for shelter from predators and temperature extremes (Tollestrup 1979). Burrows are usually abandoned ground squirrel tunnels, or occupied or abandoned kangaroo rat tunnels (Montanucci 1965). Each lizard uses several burrows without preference, but will avoid those occupied by predators or other leopard lizards. Montanucci (1965) found that in areas of low mammal burrow density, lizards will construct shallow, simple tunnels in earth berms or under rocks. While foraging, immature lizards also take cover under shrubs and rocks.

Potential predators of blunt-nosed leopard lizards include whipsnakes, gopher snakes, glossy snakes *(Arizona elegans)*, western long-nosed snakes *(Rhinocheilus lecontei)*, common king snakes, western rattlesnakes, loggerhead shrikes *(Lanius ludovicianus)*, American kestrels *(Falco sparverius)*, burrowing owls, greater roadrunners *(Geococcyx californianus)*, golden eagles *(Aquila chrysaetos)*, hawks, California ground squirrels, spotted skunks *(Spilogale putorius)*, striped skunks *(Mephitis mephitis)*, American badgers, coyotes, and San Joaquin kit foxes (Montanucci 1965, Tollestrup 1979). Blunt-nosed leopard lizards are hosts to endoparasites such as nematodes, and ectoparasites such as mites and harvest mites (Montanucci 1965).

Activity Cycles. - Seasonal above-ground activity is correlated with weather conditions, primarily temperature. Optimal activity occurs when ground temperatures are between 22 degrees and 36 degrees Celsius (72 and 97 degrees Fahrenheit) or slightly

higher (USFWS 1985*a*, J. Brode pers. comm.). Smaller lizards and young have a wider activity range than the adults (Montanucci 1965). This results in the smaller, subadult lizards emerging from hibernation earlier than adults, remaining active later in the year, and being active during the day earlier and later than adults (Montanucci 1965). Adults are active above ground in the spring months from about March or April through June or July, with the amount of activity decreasing so that by the end of June or July almost all sightings are of subadult and hatchling leopard lizards (Williams et al. 1993*a*). Also, following the breeding season, the proportion of each sex active changes as males tend to cease surface activity sooner than females (Montanucci 1967, Williams and Tordoff in litt. 1988). Adults captured on the surface in August are about 70 percent females (Montanucci 1967). Adults retreat to their burrows to *brummate* (dormancy in *poikilothermic* vertebrates [having a body temperature that varies with the temperature of its surroundings]), beginning in August or September, but hatchlings are active until mid-October or November, depending on weather.

Because diurnal activity is temperature dependent, blunt-nosed leopard lizards are most likely to be observed in the morning and late afternoon during the hotter days (Tollestrup in litt. 1976). Lizards are active on the surface when air temperatures are between 23.5 degrees and 40.0 degrees Celsius (74 and 104 degrees Fahrenheit) and surface soil temperatures are 22 to 50 degrees Celsius (72 to 122 degrees Fahrenheit) (O'Farrell and Kato 1980, Mullen 1981, Tollestrup in litt. 1976, Williams and Tordoff in litt. 1988). Body temperatures range from 32.2 to 42.0 degrees Celsius (90 and 108 degrees Fahrenheit) (Cowles and Bogert 1944, Mullen 1981).

Habitat and Community Associations. - Blunt-nosed leopard lizards inhabit open, sparsely vegetated areas of low relief on the San Joaquin Valley floor and in the surrounding foothills (Smith 1946, Montanucci 1965). On the Valley floor, they are most commonly found in the Nonnative Grassland and Valley Sink Scrub natural communities described by Holland (1986). The Valley Sink Scrub is dominated by low, alkali-tolerant shrubs of the family Chenopodiaceae, such as iodine bush, and seepweeds. The soils are saline and alkaline lake bed or playa clays which often form a white salty crust and are occasionally covered by introduced annual grasses. This may not have been the best habitat, historically, for blunt-nosed leopard lizards because the sandy and sandy-loam soils supporting perennial and annual grasses and forbs were the first to be developed and cultivated. Prior to agricultural development, Valley Sink Scrub was widespread around Kern, Buena Vista, Tulare, and Goose lakes and extended north to the Sacramento Valley along the trough of the San Joaquin Valley. Nearly all the remaining natural lands on the Valley floor are seasonally flooded fragments of this historical complex, and support elements of the alkali sink communities. This community corresponds to two that Tollestrup (in litt. 1976) described as *Allenrolfea* grassland and *Suaeda* flat.

Valley Needlegrass Grassland, Nonnative (Annual) Grassland, and Alkali Playa (Holland 1986) also provide suitable habitat for the lizard on the Valley floor. Valley Needlegrass Grassland is dominated by native perennial bunch grasses, including purple needlegrass *(Nassella pulchra)* and alkali sacaton. Associated with the perennial grasses are native and introduced annual plants. Both the Valley Needlegrass Grassland and Nonnative/Annual Grassland occur on fine-textured soils and probably were widespread in

the Valley before large areas were converted to agriculture. The Alkali Playa community occurs on poorly drained, saline and alkaline soils in small, closed basins. The small, widely spaced, dominant shrubs include: iodine bush, saltbushes, and greasewood *(Sarcobatus vermiculatus).*

Blunt-nosed leopard lizards also inhabit Valley Saltbush Scrub, which is a low shrubland, with an annual grassland understory, that occurs on the gently sloping alluvial fans of the foothills of the southern San Joaquin Valley and adjacent Carrizo Plain. This community is dominated by the chenopod shrubs, common saltbush *(Atriplex polycarpa)* and spiny saltbush *(Atriplex spinifera),* and is associated with non-alkaline, sandy or loamy soils. Tollestrup (in litt. 1976) described this plant community as *Atriplex* grassland. Similar to this community, but dominated principally by common saltbushes, are the Sierra-Tehachapi Saltbush Scrub (extending from the southern Sierra Nevada north of Porterville to the Grapevine in the Tehachapi Mountains) and Interior Coast Range Saltbush Scrub. The latter ranges from Pacheco Pass to Maricopa but, for the most part, has been converted by grazing and fire to Nonnative/Annual Grassland. Other foothill communities that occur within the range of the blunt-nosed leopard lizard are Upper Sonoran Subshrub Scrub and Serpentine Bunchgrass (Holland 1986). In general, leopard lizards are absent from areas of steep slope, dense vegetation, or areas subject to seasonal flooding (Montanucci 1965).

SAN JOAQUIN KIT FOX
(Vulpes Macrotis Mutica)

1. Description and Taxonomy

Taxonomy. - The kit fox, *Vulpes macrotis,* was described by C. Hart Merriam (1888). The area of the type locality, near Riverside in Southern California, is now highly urbanized. Eight subspecies were recognized historically (e.g., Hall 1981). Today, only *V. m. macrotis* and *V. m. mutica* are recognized (Mercure et al. 1993). *V. m. mutica,* the San Joaquin kit fox, was first described by Merriam (1902). The type locality is near Tracy, San Joaquin County, California.

Several different taxonomies for the species and subspecies of small, North American foxes have been proposed over the last 110 years (historical literature summarized by Hall 1946, Hall and Kelson 1959, Rohwer and Kilgore 1973, Waithman and Roest 1977, Hall 1981). Two recent studies examined the evolutionary and taxonomic relationships among small, North American foxes (Dragoo et al. 1990, Mercure et al. 1993). Dragoo et al. (1990) concluded that all North American arid-land foxes belonged to the species *V. velox* (swift fox). The subspecific statuses of the taxa historically regarded as subspecies of *V. macrotis* also were challenged by Dragoo et al. (1990), who recommended that all be synonymized under *V. velox macrotis.* Genetic work by Mercure et al. (1993) led them to conclude that, though there was evidence of hybridization between kit and swift foxes over a limited geographic area, they should be considered separate species. Further, Mercure et al. concluded that of the traditional subspecies of the kit fox, the San Joaquin Valley population is the most distinct and should be considered a subspecies (1993, p. 1323). Their data recognize the swift fox as a separate monotypic species, and two subspecies of kit foxes: *V. macrotis macrotis,* found throughout the remaining habitat within the historical range of the species, except the San Joaquin Valley; and *V. macrotis mutica,* the San Joaquin kit fox.

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. Grinnell et al. (1937) found a difference in body size between males and females: males averaged 80.5 centimeters (31.7 inches) in total length, and 29.5 centimeters (11.6 inches) in tail length; females averaged 76.9 centimeters (30.3 inches) in total length, and 28.4 centimeters (11.2 inches) in tail length. Kit foxes have long slender legs and are about 30 centimeters (12 inches) high at the shoulder. The average weight of adult males is 2.3 kilograms (5 pounds), and 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). The guard hairs on the back are black tipped, which accounts for

the grizzled appearance (Bell 1994). Two distinctive coats develop each year: a tan summer coat and a silver-gray winter coat (Morrell 1972). The undersides vary from light buff to white (Grinnell et al. 1937), with the shoulders, lower sides, flanks and chest varying from buff to a rust color. 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.

Identification. - The foot pads of kit foxes are small by comparison with other canids. A sample of 21 tracks from throughout the San Joaquin Valley had an average length of 3.1 centimeters (1.2 inches) and an average width of 2.6 centimeters (1 inch) (Orloff et al. 1993). Other characteristics such as the degree to which the feet are furred and the size, shape, and configuration of the pads distinguish kit fox tracks from those of co-occurring canids, and domestic cats (Orloff et al. 1993).

Because all three fox species that occur in the San Joaquin Valley are primarily nocturnal, identification of free-living, and often fast-moving, animals can be a challenge. The black-tipped tail and coat color differences usually distinguish kit foxes from red foxes *(V. vulpes).* At 4 to 5 kilograms (8 to 11 pounds the red fox also is much heavier than the kit fox. Gray foxes *(Urocyon cinereoargenteus)* however are sometimes misidentified as kit foxes, especially in winter when the kit fox coat is thicker and has more gray. Both species have a black tail tip but gray foxes also have a distinctive black stripe running along the top of the tail. Gray foxes are more robust than kit foxes; they are heavier with an average body weight of about 3.6 kilograms (8 pounds) (Grinnell et al. 1937). However, San Joaquin kit foxes have longer ears, averaging 8.6 centimeters (3.4 inches) compared with 7.8 centimeters (3 inches) for gray foxes (Grinnell et al. 1937).

2. Historical and Current Distribution

Historical Distribution. - The historical range was first defined by Grinnell et al. (1937). Prior to 1930, kit foxes inhabited most of the San Joaquin Valley from southern Kern County north to Tracy, San Joaquin County, on the west side, and near La Grange, Stanislaus County, on the east side. These authors believed that by 1930 the kit fox range had been reduced by more than half, with the largest portion of the range remaining in the southern and western parts of the Valley, though they provided no indication for why they believed foxes had been eliminated from most of the east side and Valley floor.

Current Distribution. - Although the San Joaquin kit fox has been listed as endangered for 29 years, there has never been a comprehensive survey of its entire historical range. And, despite the loss of habitat and apparent decline in numbers since the early 1970s, there has been no new survey of habitat which was then thought to be occupied (Morrell 1975). In 1990, USFWS (USFWS in litt. 1990) produced a range map for use by U.S. Department of Agriculture Animal Damage Control officers who were conducting coyote control programs. This range map was based on Morrell's 1975 map, with adjustments reflecting new information.

Kit foxes currently inhabit 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 (Williams in litt. 1990). Kit foxes are known from all the larger, scattered islands of natural land on the Valley floor in Kern, Tulare, Kings, Fresno, Madera, and Merced Counties. Kit foxes also occur in the interior coastal ranges in Monterey, San Benito, and Santa Clara Counties (Pajaro River watershed), in the Salinas River watershed, Monterey and San Luis Obispo Counties, and in the upper Cuyama River watershed in northern Ventura and Santa Barbara Counties and southeastern San Luis Obispo County (Laughrin 1970, Jensen 1972, Morrell 1975, O'Farrell 1983, Swick in litt. 1973, Waithman in litt. 1974*a*, Endangered Species Recovery Program unpubl. data).

Some researchers have suggested that as San Joaquin Valley natural lands were cultivated or otherwise developed, displaced kit foxes colonized nearby valleys and foothills (Laughrin 1970, Jensen 1972); however, there is no concrete evidence to support this assertion (O'Farrell 1983). It is more probable that kit foxes have always occurred in these areas, possibly at low density, and their occurrence went unnoticed or unrecorded by biologists until the 1970s.

The largest extant populations of kit foxes are in western Kern County on and around the Elk Hills and Buena Vista Naval Petroleum Reserves in California, Kern County, and in the Carrizo Plain Natural Area, San Luis Obispo County. Smaller populations are found at several locations. The kit fox populations of the Naval Petroleum Reserves in California (B.L. Cypher pers. comm.), Carrizo Plain Natural Area (White and Ralls 1993, Ralls and White 1995), Ciervo-Panoche Natural Area, Fresno and San Benito Counties (Endangered Species Recovery Program), Fort Hunter-Liggett, Monterey County (V. Getz pers. comm.), and Camp Roberts, Monterey and San Luis Obispo Counties (W. Berry pers. comm.) have been recently, or are currently, the focus of various research projects. Though monitoring has not been continuous in the central and northern portions of the range, populations were last recorded in the late 1980s at the San Luis Reservoir, Merced County (Briden et al. 1987), North Grasslands and Kesterson National Wildlife Refuge area on the Valley floor, Merced County (Paveglio and Clifton in litt. 1988), and in the Los Vaqueros watershed, Contra Costa County (V. Getz pers. comm.). Smaller populations and isolated sightings of kit foxes are also known from other parts of the San Joaquin Valley floor, including Madera County and eastern Stanislaus County (Williams in litt. 1990).

3. Life History and Habitat

Food and Foraging. - Diet of kit foxes varies geographically, seasonally, and annually, based on variation in abundance of potential prey. In the southern portion of their range, kangaroo rats, pocket mice, whitefooted mice *(Peromyscus* spp.), and other nocturnal rodents comprise about one-third or more of their diets. Kit foxes there also prey on California ground squirrels, black-tailed hares, San Joaquin antelope squirrels, desert cottontails, ground-nesting birds, and insects (Scrivner et al. 1987*a*). Vegetation and insects occur frequently in feces. Grass is the most commonly ingested plant material (Morrell

1971, C.A. Vanderbilt-White pers. comm.). In the central portion of their geographic range, defined here as Kings, Tulare, Fresno, Madera, San Benito, Merced, Stanislaus, and Monterey Counties, known prey species include white-footed mice, insects, California ground squirrels, kangaroo rats, San Joaquin antelope squirrels, black-tailed hares, and chukar *(Alectoris chukar)* (Jensen 1972, Archon 1992), listed in approximate proportion of occurrence in fecal samples. In the northern part of their range, defined here as San Joaquin, Alameda and Contra Costa Counties, kit foxes most frequently consume California ground squirrels (Orloff et al. 1986). Cottontails, black-tailed hares, pocket mice, and kangaroo rats also are eaten (Hall 1983, D.F. Williams unpubl. data). Though ground squirrels are diurnal and kit foxes are predominantly nocturnal, kit foxes are commonly seen during the day during late spring and early summer (Orloff et al. 1986).

Reproduction and Demography. - Kit foxes can breed when 1 year old, but may not breed their first year of adulthood (Morrell 1972). Adult pairs remain together all year, sharing the home range but not necessarily the same den (K. Ralls pers. comm.). During September and October, adult females begin to clean and enlarge natal or pupping dens (they select dens with multiple openings; Morrell 1972). Mating and conception take place between late December and March (Egoscue 1956, Morrell 1972, Zoellick et al. 1987*a*, Spiegel et al. in press). The median gestation period is estimated to range from 48 to 52 days (Spiegel et al. in press). Litters of from two to six pups are born sometime between February and late March (Egoscue 1962, Morrell 1972, Zoellick et al. 1987*a*, Spiegel et al. in press).

The female is rarely seen hunting during the time she is lactating. During this period the male provides most of the food for her and the pups. The pups emerge above ground at slightly more than 1 month of age. After 4-5 months, usually in August or September, the family bonds begin to dissolve and the young begin dispersing. Occasionally a juvenile female will remain with the adult female for several more months (O'Neal et al. 1992, Spiegel et al. in press). Offspring of both sexes sometimes remain with their parents through the following year and help raise a subsequent litter (White and Ralls 1993, Spiegel et al. in press, B.L. Cypher pers. comm.).

Reproductive success of kit foxes is correlated with abundance of their prey (Egoscue 1975). Success decreases when the density of prey species drops because of drought, too much rainfall, or other circumstances (White and Ralls 1993, Spiegel et al. in press, B.L. Cypher pers. comm.).

During a 6-year study at the Elk Hills Naval Petroleum Reserves in California, pups dispersed an average of 8 ± 1.4 kilometers (5.0 ± 0.9 miles; Scrivner et al. 1987*b*). Maximum reported distances can vary considerably (Hall 1983). One individual traveled a minimum of 40 kilometers (25 miles) from its whelping den (V. Getz pers. comm.). Adult and juvenile kit foxes radio-collared at the Elk Hills Naval Petroleum Reserves in California dispersed through disturbed habitats, including agricultural fields, oil fields, rangelands, and across highways and aqueducts. One pup crossed the Temblor Range into the Carrizo Plain (Scrivner et al. 1987*b*).

The average age of kit foxes in a Utah population was about two years (Egoscue 1975). One fox in another Utah study was estimated to be at least seven years old (Egoscue 1962). Kit foxes on Naval Petroleum Reserve-1 in California can live as long as eight years but such longevity is rare; animals less than one year old outnumber older foxes by 2.8:1 (Berry et al. 1987*b*). Annual survival rates of juvenile foxes have ranged from 0.26 on Naval Petroleum Reserve-1 in California (Berry et al. 1987b) to 0.21 to 0.41 on the Carrizo Plain (Ralls and White 1995). In captivity, kit foxes have lived up to ten years (McGrew 1919, M. Johnson pers. comm.).

An annual adult mortality rate of approximately 50 percent has been reported (Morrell 1972, Egoscue 1975, Berry et al. 1987b, Ralls and White 1995, Standley et al. in litt. 1992). The annual mortality rate for juvenile kit foxes may be closer to 70 percent (Berry et al. 1987b). The effects of disease, parasites and accidental death are largely unknown, but are thought to account for only a small portion of mortality (Berry et al. 1987*b*). Drought plays a role in low reproductive success (i.e., pups are born but do not survive to weaning). Adults can maintain weight and body condition and females can give birth, but pairs apparently cannot catch enough prey to support pups (White and Ralls 1993, Spiegel et al. in press).

San Joaquin kit fox densities on the west side of the San Joaquin Valley were estimated to be 0.4 per square kilometer (1.04 per square mile) prior to 1925, based on fur trapping efforts (Grinnell et al. 1937). In 1969, Laughrin (1970) estimated that range-wide kit fox densities were 0.2-0.4 per square kilometer (0.52-1.04 per square mile). Morrell (1975) estimated densities of 1.2 per square kilometer (3.11 per square mile) in optimal habitats in "good" years. O'Farrell (1983) corrected Morrell's data for habitat losses and obtained an estimate of 0.5 per square kilometer (1.30 per square mile). The estimated mean density of trappable adult kit foxes was from 0.8 to 1.1 per square kilometer (2 to 2.8 per square mile) between 1980 and 1982 on the Naval Petroleum Reserves in California of Kern County (O'Farrell 1984). More recently, kit fox densities at the Naval Petroleum Reserves were determined from annual live-trapping efforts (Enterprise Advisory Services, Inc., unpubl. data). On Naval Petroleum Reserve-1 in California, the mean density from 1981 to 1993 was 0.12 per square kilometer (0.31 per square mile) in winter, but varied from 0.72 per square kilometer (1.86 per square mile) in 1981 to 0.01 per square kilometer (0.03 per square mile) in 1991. On Naval Petroleum Reserve-2 in California, mean density from 1983 to 1993 was 0.38 per square kilometer (0.98 per square mile), and varied from 0.72 per square kilometer (1.86 per square mile) in summer 1983 to 0.1 per square kilometer (0.30 per square mile) in winter 1991. On the nearby Carrizo Plain Natural Area, kit fox densities were estimated to be 0.15 to 0.24 per square kilometer (0.39 to 0.62 per square mile) (White and Ralls 1993).

O'Farrell (1983) estimated that the population rangewide of adult kit foxes prior to 1930 may have been between 8,667 and 12,134 assuming an occupied range of 22,447 square kilometers (8,667 square miles) and densities of 0.4 to 0.6 per square kilometer (1.04 to 1.55 per square mile). The kit fox population in San Luis Obispo, Santa Barbara, Kings, Tulare and Kern Counties was estimated to be about I 1,000 animals in the early 1970s based on limited aerial surveys of pupping dens and amount of historic habitat, but without correction for cultivated and urbanized lands (Waithman in litt. 1974*b*). Laughrin

(1970) reported an estimated total population size of 1,000-3,000 foxes in 1969. Morrell (1975) conducted a more thorough investigation of kit fox abundance in 14 counties in which kit foxes were known to occur and estimated the total population at 14,832. O'Farrell (1983) adjusted Morrell's data for known habitat losses (primarily due to agriculture) and obtained a corrected estimate of 6,961 foxes in 1975. When compared to the pre- 1930 estimate, this represents a possible population decline of 20-43 percent. Approximately 85 percent of the fox population in 1975 was found in only 6 counties (Kern, Tulare, Kings, San Luis Obispo, Fresno, and Monterey), and over half the population occurred in two of those counties: Kern (41 percent) and San Luis Obispo (10 percent) (Morrell 1975).

Behavior and Species Interactions. - San Joaquin kit foxes use dens for temperature regulation, shelter from adverse environmental conditions, reproduction, and escape from predators. Though kit foxes are reputed to be poor diggers (Jensen 1972, Morrell 1972), the complexity and depth of their dens do not support this assessment (O'Farrell 1983). Kit foxes also modify and use dens constructed by other animals, such as ground squirrels, badgers, and coyotes (Jensen 1972, Morrell 1972, Hall 1983, Berry et al. 1987*a*), and human-made structures (culverts, abandoned pipelines, and banks in sumps or roadbeds) (Spiegel et al. in press, B.L. Cypher pers. comm.).

Den characteristics vary across the San Joaquin kit fox's geographic range. In the southernmost portion, dens with two entrances are most frequently found. Natal and pupping dens, in which pups are born and raised, tend to be larger with more entrances (2 to 18) (Morrell 1972, O'Farrell and Gilbertson 1979, O'Farrell et al. 1980, O'Farrell and McCue 1981, Berry et al. 1987*a*). Entrances are usually from 20 to 25 centimeters (8 to 10 inches) in diameter and normally are higher than wide.

Ramp-shaped mounds of dirt from 1 to 2 meters (3 to 6 feet) long are deposited at some den entrances (Morrell 1972). Most hillsides where kit fox dens are found (90 percent) have a slope of less than 40 degrees , usually between 19 degrees and 22 degrees. Natal and pupping dens are found on flatter ground with slopes of about 6 degrees (O'Farrell and McCue 1981, O'Farrell et al. 1980). The entrances of pupping dens show more evidence of use, such as fox scat, prey remains, and matted vegetation. In the central portion of their geographic range, dens also have several openings; however, instead of a mound of dirt in front of the opening, the dirt is more often scattered into a long tailing ramp, generally with a runway down the middle. In areas of tall grass, matted grass in front of the entrance is obvious. In western Merced County, most dens are found on slopes of less than 10 degrees, but a few are found on slopes of up to 55 degrees (Archon 1992). In the northern portion of the kit fox range, dens appeared to be placed higher than most surrounding ground compared to areas farther south, perhaps reflecting the topography of the area. Dens most often are located on the lower section of the slope (Orloff et al. 1986), yet foxes are sometimes seen entering dens on the upper part of a slope (Bell in litt. 1992). Most dens lack the ramp or runway characteristic of dens in the southern and central portions of the Valley. No evidence has been found to indicate that kit foxes in this area construct their own dens (Hall 1983). Kit foxes probably enlarge California ground squirrel burrows (Orloff et al. 1986), but they also may construct their own dens.

Kit foxes often change dens and numerous dens may be used throughout the year. However, evidence that a den is in use may be absent (V. Getz pers. comm.). Foxes change dens four or five times during the summer months, and change natal dens one or two times per month (Morrell 1972). One family of 7 kit foxes used 43 dens; the maximum number used by 1 individual was 70 (Hall 1983). Foxes on the Carrizo Plain Natural Area changed dens much more frequently than indicated by Morrell's study (White and Ralls 1993). Radiotelemetry studies indicate that foxes use individual dens for a median of 2 days (mean of 3.5 days) before moving to a different den. One fox was tracked to 70 different dens (K. Ralls pers. comm.). Den changes have been attributed to depletion of prey in the vicinity of the den or to increases in external parasites such as fleas (Egoscue 1956). Avoidance of coyotes is a more probable reason for frequently changing dens because kit foxes can easily search their home range in one night for prey, and parasites are unlikely to build to intolerable levels in 2 or 3 days (K. Ralls pers. comm.)

Nightly movements on the Elk Hills Naval Petroleum Reserves in California averaged 15.4 kilometers (9.6 miles) during the breeding season and were significantly longer than the average nightly movements of 10.2 kilometers (6.3 miles) during the pup-rearing season. Movements during the breeding season also were significantly longer than those made during the pup-dispersal season (10.4 kilometers, 6.5 miles) (Zoellick et al. 1987*b*).

Home ranges of from less than 2.6 square kilometers (1 square mile) up to approximately 31 square kilometers (12 square miles) have been reported by several researchers (Morrell 1972, Knapp 1978, Zoellick et al. 1987*b*, Spiegel and Bradbury 1992, White and Ralls 1993, Paveglio and Clifton in litt. 1988). The maintenance of large and relatively non-overlapping home ranges, as noted on the Carrizo Plain, may be an adaptation to drought-induced periods of prey scarcity that are episodic and temporary on the Carrizo Plain (White and Ralls 1993).

Kit foxes are subject to predation or competitive exclusion by other species, such as the coyote, normative red foxes, domestic dog *(Canis familiaris),* bobcat *(Felis rufus),* and large raptors (Hall 1983, Berry et al. 1987*b*, O'Farrell et al. 1987*b*, Ralls and White 1995, CDFG in litt. 1987). Coyotes are known to kill kit foxes, though an experimental coyote-control program at the Elk Hills Naval Petroleum Reserves in California did not result in an increase in survival rate for kit foxes, nor did coyote-induced mortality decrease (Cypher and Scrivner 1992, Scrivner and Harris in litt. 1986, Scrivner in litt. 1987). The extent to which gray and kit foxes compete for resources is unknown. The need for similar den sites and prey species probably place nonnative red foxes in direct competition with the much smaller kit fox. Nonnative red foxes are expanding their geographic range in central California (Orloff et al. 1986, Lewis et al. 1993), and competition with or predation on kit foxes may be a factor in the apparent decline of kit foxes in the Santa Clara Valley (T. Rado pers. comm.), and perhaps elsewhere in the northwestern segment of their range. Coyotes aggressively dominate encounters with red foxes and will pursue and kill both red and gray foxes (Sargeant and Allen 1989), as well as kit foxes. Coyotes may reduce the negative impacts of red foxes on kit foxes by limiting red fox abundance and distribution, but details of interactions between the two species and the extent to which coyotes might

slow or prevent the invasion of red foxes into kit fox habitats are unknown (White et al. 1994, Ralls and White 1995).

Activity Cycle. - San Joaquin kit foxes are primarily active at night (i.e., nocturnal), and active throughout the year (Grinnell et al. 1937, Morrell 1972). Adults and pups sometimes rest and play near the den entrance in the afternoons, but most above-ground activities begin near sunset and continue sporadically throughout the night. Morrell (1972) reported that hunting occurred only at night. Yet predation on ground squirrels, which are active during the day (i.e., diurnal), by some populations indicates that kit foxes are not strictly nocturnal, adapting to the activities of available prey (Balestreri 1981, Hall 1983, Orloff et al. 1986, O'Farrell et al. 1987*b*, Hansen in litt. 1988).

Habitat and Community Associations. - 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 Altarriont Pass area in Alameda County, where they modify burrows dug by other animals (Orloff et al. 1986).

Historically, San Joaquin kit foxes occurred in several native plant communities of the San Joaquin Valley. Because of extensive land conversions and intensive land use, some of these communities only are represented by small, degraded remnants today. Other habitats in which kit foxes are currently found have been extensively modified by humans. These include grasslands and scrublands with oil exploration and extraction equipment and wind turbines, and an agricultural matrix of row crops, irrigated pasture, orchards, vineyards, and grazed annual grasslands (nonirrigated pasture). Other plant communities in the San Joaquin Valley providing kit fox habitat include Northern Hardpan Vernal Pool, Northern Claypan Vernal Pool, Alkali Meadow, and Alkali Playa. These are found as relatively small patches in scattered locations. In general, they do not provide good denning habitat for kit foxes because all have moist or waterlogged clay or clay-like soils. However, where they are interspersed with more suitable kit fox habitats they provide food and cover.

In the southernmost portion of the range, the kit fox is commonly associated with Valley Sink Scrub, Valley Saltbush Scrub, Upper Sonoran Subshrub Scrub, and Annual Grassland. Kit foxes also inhabit grazed grasslands, and survive adjacent to tilled or fallow fields (Jensen 1972, Ralls and White in litt. 1991), and petroleum fields (Morrell 1971, O'Farrell in litt. 1980). In the central portion of the range, the kit fox is associated with Valley Sink Scrub, Interior Coast Range Saltbush Scrub, Upper Sonoran Subshrub Scrub, Annual Grassland and the remaining native grasslands. Agriculture dominates this region where kit foxes mostly inhabit grazed, nonirrigated grasslands, but also live next to and forage in tilled or fallow fields, irrigated row crops, orchards, and vineyards. In the northern portion of their range, kit foxes commonly are associated with annual grassland (Hall 1983) and Valley Oak Woodland (Bell 1994). Kit foxes inhabit grazed grasslands, grasslands with wind turbines, and also live adjacent to and forage in tilled and fallow fields, and irrigated row crops (Bell 1994).

Kit foxes use some types of agriculture where uncultivated land is maintained, allowing for denning sites and a suitable prey base (Jensen 1972, Knapp 1978, Hansen in litt. 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).

SAN JOAQUIN ANTELOPE SQUIRREL
(Ammospermophilus nelsoni)

1. Description and Taxonomy

Taxonomy. - The San Joaquin antelope squirrel is one of five species of antelope squirrels. Members of the genus *Ammospermophilus* are confined to desert, arid steppe, and open shrubland communities in the southwestern United States and northern Mexico. *Ammospermophilus nelsoni* was described by Merriam (1893) as a member of the genus *Spermophilus;* the type specimen was from Tipton, Tulare County, California. *A. nelsoni* also has been placed in the genus *Citellus.* Taylor (1916) distinguished the northern populations as a subspecies, *A. nelsoni amplus,* but *A. nelsoni* currently is considered to be monotypic (Hall 1981, Hafner 1981).

Description. - San Joaquin antelope squirrel has a typical ground-squirrel shape: tiny, rounded ears, and streamlined, *fusiform* (spindleshaped) body with relatively short legs and tail. The tail has laterally projecting thick fringes of hairs, and is usually held cocked or curled over the back. The upper parts are colored buffy-tan with a light stripe along the sides. The underside of the tail is light grayish or whitish. Individuals range from about 218 to 240 millimeters (8.5 to 9.4 inches) in length (Hall 1981), and adults weigh from about 130 to 170 grams (4.6 to 6.0 ounces) (Williams 1980).

Identification. - The San Joaquin antelope squirrel can be distinguished from the co-occurring California ground squirrel by much smaller size; shorter, less bushy tail with a flattened shape rather than the bottle-brush shape of the California ground squirrel; and the presence of a light-colored stripe along the sides of the body. Many people think antelope squirrels are chipmunks, but antelope squirrels lack the light and dark stripes on the face and the light and dark stripes on the back, which are characteristic of western chipmunks *(Tamias* spp.).

2. Historical and Current Distribution

Historical Distribution. - The historical distribution of the San Joaquin antelope squirrel included the western and southern portions of the Tulare Basin, San Joaquin Valley, and the contiguous areas to the west in the upper Cuyama Valley and on the Carrizo and Elkhorn Plains. They ranged from western Merced County on the northwest, southward along the western side of the San Joaquin Valley to its southern end. They were distributed over the floor of the San Joaquin Valley in Kern County and along the eastern edge of the Valley northward to near Tipton, Tulare County (Hall 1981, Williams 1980). San Joaquin antelope squirrels range in elevation from about 50 meters (165 feet) on the San Joaquin Valley floor to about 1,100 meters (3,609 feet) in the Temblor Mountains. Antelope squirrels are not common above about 800 meters (2,625 feet) on the ridges and plains west of the San Joaquin Valley proper (Williams 1980, D.F. Williams unpubl. data). The area encompassed by the distribution records prior to cultivation was approximately 1,398,600 hectares (3,456,000 acres). Grinnell and Dixon (1918) wrote that San Joaquin

antelope squirrels were unevenly distributed and occurred in abundance in only a few localities; one was in the Lokern and Elk Hills region of western Kern County.

Current Distribution. - Extant, uncultivated habitat for San Joaquin antelope squirrels was estimated in 1979 to be 275,200 hectares (680,000 acres) (Williams 1980). This estimate encompassed the land occupied by towns, roads, canals, pipelines, strip mines, airports, oil wells, and other developments. None of the best habitat described by Grinnell and Dixon (1918) remained. Only about 41,280 hectares (102,003 acres) was rated as fair to good quality, supporting from 3 to 10 antelope squirrels per hectare (1 to 4 per acre). Antelope squirrels had been nearly eliminated from the floor of the Tulare basin, and existed mainly in marginal habitat in the mountainous areas bordering its western edge. Substantial populations were found only in and around Lokern and Elk Hills in western Kern County, and on the Carrizo and Elkhorn Plains in eastern San Luis Obispo County.

Since 1979, San Joaquin antelope squirrels have disappeared from many of the smaller islands of habitat on the Valley floor, including Pixley National Wildlife Refuge, Tulare County; Alkali Sink and Kerman Ecological Reserves, Fresno County; and several areas within the Allensworth Conceptual Reserve area of Tulare and Kern Counties (Williams 1980, Harris and Stearns 1991, D.F. Williams unpubl. observ., Endangered Species Recovery Program unpubl. data).

3. Life History and Habitat

Food and Foraging. - San Joaquin antelope squirrels are omnivorous. The amount and type of food consumed are mostly dependent upon availability. The squirrels eat green vegetation, fungi, and insects more often than seeds, even when seeds are relatively abundant (Hawbecker 1975, Harris 1993). Vegetation and seeds of filaree and red brome are the main food plants (Hawbecker 1953). Insects, principally grasshoppers, are eaten regularly when available. Seeds of shrubs such as ephedra and saltbush also are staples. Seeds and insects may be necessary in the diet as sources of protein. When seeds and grasshoppers are scarce, antelope squirrels eat harvester ants (Hawbecker 1975). During spring, especially during severe drought, San Joaquin antelope squirrels eat large quantities of ovaries and developing seeds of ephedra (D.F. Williams unpubl. observ.).

Reproduction and Demography. - The breeding period for San Joaquin antelope squirrels is late winter through early spring. There is only one breeding period per year, coinciding with the time of year when green vegetation is present (Hawbecker 1953, 1958). Young squirrels do not breed their first year (Hawbecker 1975). Testes of males begin to enlarge in September or October and reach maximum size by November or December, long before the ovaries of females begin to develop (Best et al. 1990). Copulation and conception usually take place in February or March. By the end of March, testes begin to regress in size and maintain a minimum size of about 4-8 millimeters (0.2 - 0.3 inch) through the summer. All males are not reproductively active at the same time; some males may have enlarged testes in May (Hawbecker 1975).

Gestation lasts about 26 days. Embryos are present in late January, but development is concentrated in February and early March. Embryos range in number from 6 to 11, with an average of 8.9 (Hawbecker 1975).

Young are born between March and April and are first seen above ground when about 30 days of age (Williams and Tordoff in litt. 1988). Young are weaned beginning in late April; the last young are weaned in mid- or late-May (Hawbecker 1975).

Timing, nature, and distance of dispersal are poorly documented; Hawbecker (1975) noted that weaned young were still together in late May. Williams and Tordoff (in litt. 1988) noted at least some family groups were still together in mid-July. Young San Joaquin antelope squirrels on the Elkhorn Plain Ecological Reserve had a mortality rate of about 70 percent during their first year of life, and adults had a mortality rate from about 50 to 60 percent (Williams and Tordoff in litt. 1988).

Behavior and Species Interactions. - San Joaquin antelope squirrels live in burrows, either of their own construction or ones dug by giant kangaroo rats. They may also take over and enlarge burrows dug by Heermann's kangaroo rats (Grinnell and Dixon 1918, Hawbecker 1947, 1953, Williams 1980). Hawbecker (1947, 1953) believed that antelope squirrels were dependent upon kangaroo rats to dig burrows because the many burrows examined by him all seemed to have been dug by kangaroo rats. In contrast, Grinnell and Dixon (1918) believed that they dug their own burrows. Burrows vary in complexity and length, but generally have two to six openings and are between about 30 and 50 centimeters (12 to 20 inches) deep. Favored locations for burrows are in the side of an arroyo, the berm of an unimproved road, or under shrubs (Williams 1980).

On shrubless plains with few or no erosion channels where they can burrow into the banks, they may be dependent upon burrows of giant kangaroo rats. Antelope squirrels make use of both shrubs and burrows of giant kangaroo rats as sites of refuge from predators as they move across their home ranges. They also regularly retreat to the shade of shrubs to avoid the heat of the sun and to dump excess body heat to the cooler, shaded ground. Burrows of giant kangaroo rats may serve the same purpose (Williams et al. 1988, Williams and Kilburn 1992).

California ground squirrels displace San Joaquin antelope squirrels and may even restrict the range of the antelope squirrel (Taylor 1916, Harris and Stearns 1991). Hawbecker (1953) noted that the range of the San Joaquin antelope squirrel may be determined, to some degree, by the range of co-occurring kangaroo rat species. The range of giant kangaroo rats most nearly coincides with that of the San Joaquin antelope squirrel, but their microhabitats generally differ in many areas. Populations of Heermann's kangaroo rats are common in most areas where antelope squirrels are found. San Joaquin kangaroo rats also occur in the same areas as San Joaquin antelope squirrels, but these kangaroo rats are much smaller; their small-diameter burrows would have to be enlarged considerably before antelope squirrels could use them (Williams 1980).

San Joaquin antelope squirrels probably compete with kangaroo rats for seeds, especially those of grasses and forbs, and, to a lesser extent, green herbaceous material. The extent to which kangaroo rats eat insects, an important staple for antelope squirrels, is unknown, but insects are probably only a minor part of their diets. Species of birds are probably the main competitors of antelope squirrels for insects (Williams and Tordoff in litt. 1988). San Joaquin antelope squirrels are prey for a variety of animals: hawks, falcons, eagles, snakes, kit foxes, coyotes, badgers and probably other predators (Williams and Tordoff in litt. 1988).

Activity Cycle. - San Joaquin antelope squirrels are primarily diurnal, usually active early or late in the day (Elliot 1904). Activity is reduced when ambient temperatures drop below about 10 degrees Celsius (Hawbecker 1958), but on sunny days they have been observed when air temperatures were around 0 degrees Celsius (D.F. Williams unpubl. observ.). Activity also is reduced at high ambient temperatures, but the amount and critical temperatures at which activity is curtailed is unclear. On the Elkhorn Plain Ecological Reserve, antelope squirrels were observed at all hours of the day and at ambient temperatures in excess of 42 degrees Celsius during July and August (Williams and Tordoff in litt. 1988). In contrast, Hawbecker (1958) noted that squirrels occasionally ventured into the hot sun only for short periods. They are active above ground for extensive periods during the day in the spring when temperatures are generally between about 20 degrees Celsius to 30 degrees Celsius.

Habitat and Community Associations. - San Joaquin antelope squirrels live in relatively arid annual grassland and shrubland communities in areas receiving less than about 23 centimeters (10 inches) of mean annual precipitation. They are most numerous in areas with a sparse-to-moderate cover of shrubs such as saltbushes, California ephedra, bladderpod, goldenbushes, matchweed, and others. Shrubless areas are only sparsely inhabited, especially where giant kangaroo rats are not present or not common.

Hawbecker (1953) believed that most antelope squirrels found in shrubless areas were nonbreeders. Yet, on the Carrizo Plain Natural Area antelope squirrels are widespread; permanent populations are found over thousands of acres without shrubs (Harris and Stearns 1991, D.F. Williams, unpubl. observ.). Grinnell and Dixon (1918) and Hawbecker (1953) observed that San Joaquin antelope squirrels rarely occurred on the Valley floor. In areas with alkaline soils supporting halophytes such as iodine bush and spiny saltbush. Highly alkaline soils on the Valley floor typically have water tables within a few centimeters to a meter (1 to 39 inches) or so from the surface, perhaps limiting habitation. Steep slopes and broken, rocky, upland terrain are also scarcely inhabited (Williams 1980).

San Joaquin antelope squirrels require areas free from flooding where they can place ground burrows. Soils must be friable. Substantial colonies investigated by Hawbecker (1953) were almost always confined to loam and sandy-loam soils with moderate amounts of soluble salts, but soils with a wide range of textures are used (Williams 1980). In shrubless areas, and many areas with sparse shrub cover, San Joaquin antelope squirrels are associated with giant kangaroo rats. The antelope squirrels are frequently seen entering and leaving the burrows of giant kangaroo rats. Most such observations indicate the burrows

are used for escape from heat and predators, but they also probably live in burrow systems made by giant kangaroo rats (Williams and Tordoff in litt. 1988, Williams et al. 1993*a*, D.F. Williams unpubl. observ.).

In the southern and western San Joaquin Valley, San Joaquin antelope squirrels are associated with open, gently sloping land with shrubs. Typical vegetation includes saltbushes and ephedra (Hawbecker 1975). Near Panoche, San Benito County, at an elevation of about 360 meters (1,181 feet), they are associated with such plants as California ephedra, California juniper, matchweed, one-sided bluegrass *(Poa secunda* ssp. *secunda),* red brome, and red-stemmed filaree (Hawbecker 1958). Near Los Banos, Merced County, and near Mendota, Fresno County, the habitat is mostly devoid of brushy cover (Hawbecker 1947).

WESTERN BURROWING OWL
(*Athene Cunicularia Hypugea*)

Burrowing Owls are medium-sized (body length averages 9.5 inches), yellow-eyed owls with disproportionately long legs, and no ear-tufts. Adults are sandy colored over the head, back and wings, and have barring on the breast and belly. Juveniles are buffy below. The Burrowing Owl breeds in midwestern and western North America and south-central florida. They winter throughout their breeding range and south to Central America. Several Breeding populations exist in the Central Valley. Burrowing Owls often wander outside their breeding range in the winter.

These owls will utilize burrows throughout the year. They most commonly use old burrows dug by other animals. In the Central Valley, Californian ground squirrel burrows are commonly used.

Burrowing Owls nest from early March to late August, with a peak from mid-April to mid-May. Nests in the southern San Joaquin Valley are often 2 or more feet below the surface, in at the end of burrows 5-18 feet long. Burrows may be on flat or sloping ground, and are often found on levees, spoil piles and other earth mounds. Surrounding vegetation is usually low and sparse.

Burrowing Owls may forage at any time of the day or night in areas adjacent to their burrows. They eat primarily insects and other arthropods, birds and small mammals.

Numbers of burrowing Owls have declined since the early 1900's, primarily due to habitat conversion. Assimilation of pesticides through prey, ground squirrel control with gas cartridges and alteration of prey base may also have affected this species. Burrowing Owls are often tolerant of human activity, but are vulnerable to predation by domestic pets. They are also vulnerable to accidental destruction of burrows, including those with active nests.

EXHIBIT 4

ADDITIONAL CONSERVATION MEASURES

Occidental shall comply with the following additional conservation measures for the Covered Species that are not specifically included in the Biological Opinion:

A. San Joaquin Antelope Squirrel

1. Any San Joaquin antelope squirrel discovered during pre-activity surveys shall be avoided, if reasonably practical.

2. If it is not reasonably practical to avoid a location where this species is present, known burrows will be excavated by hand if so required by the Department.

B. Western Burrowing Owl

1. Any burrowing owl discovered during pre-activity surveys shall be avoided, if reasonably practical.

2. Terms and conditions 2(a), 2(b) and 2(c) from the Biological Opinion (avoidance and relocation) shall apply, except that (i) notice shall be provided to the Department rather than the USFWS, and (ii) relocation shall be performed consistent with the relocation provisions in the Department's October 17, 1995, Staff Report on Burrowing Owl Mitigation, unless other arrangements are made with the Department.

C. Oil Neststraw

1. Any populations of oil neststraw discovered during floristic surveys or during the normal course of pre-activity surveys will be avoided, if reasonably practical.

2. If it is not reasonably practical to avoid a location where this species is present, the plant mitigation commitments numbered (3) c and (3) d in the Biological Opinion shall apply (seasonal and soil/seed salvage provisions).

3. The plant mitigation commitment numbered (6) in the Biological Opinion shall apply (protection of four known populations).

D. Kern Mallow and San Joaquin Woolly Threads

1. Any populations of either species discovered during floristic surveys or during the normal course of pre-activity surveys will be avoided, if reasonably practical.

2. If it is not reasonably practical to avoid a location where either or both of these species is present, the plant mitigation commitments numbered (3) c and (3) d in the Biological Opinion shall apply (seasonal and soil/seed salvage provisions).

COPY

Bill Dixon

FIRST AMENDMENT TO CALIFORNIA ENDANGERED SPECIES ACT MEMORANDUM OF UNDERSTANDING AND TAKE AUTHORIZATION

By and Between

OCCIDENTAL OF ELK HILLS, INC.

And

THE CALIFORNIA DEPARTMENT OF FISH AND GAME

Regarding

ELK HILLS UNIT
(Formerly Known as Naval Petroleum Reserve-1)

This amendment to the California Endangered Species Act Memorandum of Understanding, hereinafter referred to as ("First Amendment"), is entered into between Occidental of Elk Hills, Inc., hereafter referred to as ("Occidental") and the California Department of Fish and Game, hereafter referred to as the ("Department").

Explanatory Recitals

1. There is now in effect between the parties a California Endangered Species Act Memorandum of Understanding and Take Authorization, hereinafter referred to as "CESA MOU," which governs the operation and management of the Elk Hills Unit and provides authority for "take" of identified state-listed threatened and endangered species and other species of concern under authority of the California Fish and Game Code. The CESA MOU was executed by the Department on December 29, 1997 and has therefore been affirmed by the California Legislature in accordance with Fish and Game Code section 2081.1.

2. The duration of the CESA MOU was limited to two years, pending the preparation of a permanent wildlife habitat and management plan and the creation of a wildlife habitat reserve of at least 7,075 acres. See section 5.9 and 5.10 of the CESA MOU. Occidental has now prepared a permanent wildlife habitat and management plan in accordance with section 5.9, and has created a habitat reserve in accordance with section 5.10.

3. The parties desire to amend the CESA MOU with this First Amendment to authorize Occidental to continue implementation of the Elk Hills Unit as provided in the CESA MOU for a period of 10 years.

Agreement

NOW THEREFORE, in accordance with Section 13 of the CESA MOU, and in consideration of the mutual covenant contained in this First Amendment, the parties agree as follows:

1. Section 5.8 of the CESA MOU is revised to read as follows:

> Elk Hills Unit Operator shall provide an annual summary of surface disturbances and reclamation to the Department in the first quarter of each year.

2. Section 5.9 of the CESA MOU is revised to read as follows:

> Elk Hills Unit Operator shall fully implement and adhere to the "Conservation Management Agreement/Declaration of Restrictions for the Elk Hills Unit" dated November 6, 1998 ("Conservation Management Agreement") (Exhibit 5).

3. Section 5.10 of the CESA MOU is revised to read as follows:

> The Elk Hills Unit Operator shall manage the 7801 acre Conservation Area in accordance with the Conservation Management Agreement.

4. Section 5.12 of the CESA MOU is revised to read as follows:

> Occidental shall secure its faithful performance of its obligations under Section 5.10 above in accordance with the Conservation Management Agreement.

5. Section 14 of the CESA MOU is revised to read as follows:

> This CESA MOU may be terminated by the Department after thirty (30) days written notice to Elk Hills Unit Operator in the event of any material default by Elk Hills Unit Operator of its obligations hereunder or under the Biological Opinion, which default Elk Hills Unit Operator has failed to cure after reasonable notice and opportunity to cure. Additionally, this CESA MOU shall terminate without further action by any Party on December 31, 2009, unless otherwise extended in writing executed by all Parties.

6. Section 18 of the CESA MOU is revised to read as follows:

This CESA MOU includes and incorporates the following:

EXHIBIT 1: FEDERAL BIOLOGICAL OPINION

EXHIBIT 2: COVERED SPECIES

EXHIBIT 3: LIFE HISTORIES

EXHIBIT 4: ADDITIONAL CONSERVATION MEASURES

EXHIBIT 5: CONSERVATIONMANAGEMENT AGREEMENT/ DECLARATION OF RESTRICTIONS FOR THE ELK HISS UNIT

Except as hereby amended, the CESA MOU and all exhibits thereto shall remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this First Amendment to the CESA MOU to be in effect as of the date last signed below.

Date: September 27, 1999

CALIFORNIA DEPARTMENT OF FISH AND GAME

By: W. E. Loudermilk

William Loudermilk, ~~Acting~~ Regional Manager

Date: August 16, 1999

OCCIDENTAL OF ELK HILLS, INC.,
a Delaware Corporation

By: Don Romine

Don Romine, General Manager

Approved as to Form:

By: for

Ann S. Malcolm
Acting General Counsel
CA Department of Fish and Game

Approved as to Form:

By:

Harley F. Pinson
Managing Counsel
Occidental of Elk Hills Inc.

CALIFORNIA DEPARTMENT OF FISH AND GAME
CENTRAL REGION
1234 EAST SHAW AVENUE
FRESNO, CALIFORNIA 93710

AMENDMENT NO. 2
California Endangered Species Act
Incidental Take Authorization No. 2081-1997-000-04
Occidental of Elk Hills, Inc.
ELK HILLS UNIT IN KERN COUNTY
(Formerly Known as Naval Petroleum Reserve-1)

INTRODUCTION

On December 29, 1997, the California Department of Fish and Game (Department) issued a California Endangered Species Act (CESA) Memorandum of Understanding and Take Authorization (hereinafter, the CESA MOU) to Occidental of Elk Hills, Inc. (Occidental). (See Fish & G. Code, § 2081.1.) The CESA MOU authorizes take as defined by the Fish and Game Code of various plant and animal species incidental to oil and gas exploration, extraction, production, development, transport, processing and other related activities by Occidental in the Elk Hills Unit of what was formerly known as Naval Petroleum Reserve 1, located in western Kern County, California. (CESA MOU §§ 1.2, 1.4, 3.0. 5.0; see also Fish & G. Code, § 86.) "Covered Species" for which the CESA MOU provides take authorization include the giant kangaroo rat (*Dipodomys ingens*), Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), San Joaquin antelope squirrel (*Ammospermophilus nelsoni*), and San Joaquin kit fox (*Vulpes macrotis mutica*). (CESA MOU § 5.0 and Exhibit 2.) The giant kangaroo rat and Tipton kangaroo rat are designated as endangered species under CESA. (Fish & G. Code, § 2062; Cal. Code Regs., tit. 14, § 670.5, subd. (a)(6)(C), (D).) The San Joaquin antelope squirrel and kit fox are designated as threatened species under CESA. (Fish & G. Code, § 2067; Cal. Code Regs., tit. 14, § 670.5, subd. (b)(6)(B), (E).) In authorizing incidental take of these Covered Species as provided by the CESA MOU, the Department certified and made the findings required by Fish and Game Code section 2081.1. (CESA MOU § 6.0.)

The CESA MOU originally provided take authorization to Occidental through December 31, 1999, except as extended by written agreement between the Department and Occidental. (CESA MOU § 14.0.) The original term of the CESA MOU was limited to two (2) years, pending Occidental's preparation of a permanent wildlife habitat and management plan, and the creation of a wildlife habitat reserve of at least 7,075 acres. (*Id.* §§ 5.9, 5.10.) Occidental prepared the permanent wildlife and habitat management plan, and established the wildlife habitat reserve as required by the CESA MOU.

On September 27, 1999, the Department amended the CESA MOU for the first time (hereafter, Amendment No. 1). Amendment No. 1 authorized Occidental to continue operations and development of the Elk Hills Unit as provided by the CESA MOU for an additional period of ten (10) years, expiring on December 31, 2009 unless otherwise extended in writing by the Department and Occidental. Amendment No. 1 also modified the CESA MOU by requiring: (1) an annual summary of surface disturbances and reclamation to the Department in the first quarter of each year; (2) full implementation and adherence to the "Conservation Management Agreement/Declaration of Restrictions for the Elk Hills Unit" dated November 6, 1998; (3) management of the 7,801-acre Conservation Area in accordance with the Conservation Management Agreement; and (4) security of faithful performance of Occidental's obligations under Section 5.10 of the CESA MOU in accordance with the Conservation Management Agreement; and (5) allowed the Department to terminate the CESA MOU after thirty (30) days written notice to Occidental or the Elk Hills Unit Operator, and after reasonable notice and an opportunity to cure, in the event of any material default of any obligation under the CESA MOU. In issuing Amendment No. 1 the Department affirmed its certification and findings pursuant to Fish and Game Code section 2081.1, including a determination that Occidental's compliance with the CESA MOU, as amended, would fully mitigate impacts to and not jeopardize the continued existence of any Covered Species.

In a letter to the Department dated November 3, 2009, Occidental requested an extension of the CESA MOU, as amended, for an additional term of five (5) years. Occidental requested the extension in order to continue operations in the Elk Hills Unit as authorized under the CESA MOU, pending completion of and final action by the Department concerning a proposed incidental take permit (ITP) intended to supersede the existing CESA MOU, as amended. (See generally Fish & G. Code, § 2081, subd. (b).) The Department and Occidental, along with the Service under the federal Endangered Species Act (ESA) (16 U.S.C. § 1531 et seq.), have been working in close coordination since early 2003 on this updated permitting effort, including lead agency review by the Department and Service under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.) and the National Environmental Policy Act (NEPA) (42 U.S.C. § 4321 et seq.), respectively. Due in part to the State of California's ongoing fiscal crisis, the Department has not be able to complete the environmental review and updated permitting effort during the term of the CESA MOU, as amended.

This Second Amendment to the CESA MOU (Amendment No. 2) extends the term of the CESA MOU, as amended in 1999, for an additional five (5) years, up to and including December 31, 2014.

Amendment No. 2 also modifies Section 5.0 of the CESA MOU (Take Authorization), clarifying that the authorization provided by the Department extends only to those Covered Species currently protected by the CESA take prohibition set forth in Fish and

Game Code section 2080. (See *Environmental Protection Information Center v. California Dept. of Forestry and Fire Protection* (2008) 44 Cal.4th 459, 507, fn. 18.)

As set forth below, the Department finds that Amendment No. 2 will not significantly modify the scope or nature of Occidental operations in the Elk Hills Unit as authorized, or any of the minimization or monitoring conditions, or the amount of mitigation required by the CESA MOU, as amended. (Cal. Code Regs., tit. 14, § 783.6, subd. (c)(4).)

AMENDMENT

The CESA MOU, including Amendment No. 1, is hereby amended as follows:

a. Section 5 under "Agreement" on page 2 of Amendment No. 1 as executed by the Department on September 27, 1999, which revised Section 14.0 of the CESA MOU, is replaced in its entirety with the following:

> 5. This CESA MOU may be terminated by the Department after thirty (30) days written notice to Elk Hills Unit Operator in the event of any material default by Elk Hills Unit Operator of its obligations hereunder or under the Biological Opinion, which default Elk Hills Unit Operator has failed to cure after reasonable notice and opportunity to cure. Additionally, this CESA MOU shall terminate without further action by any Party on December 31, 2014, unless otherwise extended in writing and executed by all Parties.

b. Section 5.0 of the CESA MOU, as executed by the Department on December 27, 1997, is replaced in its entirety with the following:

> Subject to the terms and conditions of the federal Biological Opinion and this CESA MOU, specifically including this provision of the CESA MOU and pursuant to Section 2081 of the Fish and Game Code, the Department authorizes take of Covered Species currently designated as endangered or threatened under CESA (but not any such Covered Species also designated as a Fully Protected Species under the Fish and Game Code) where such take is incidental to the Project as described in Section 3.0. Non-incidental take of the Covered Species by Elk Hills Unit Operator or on Elk Hills Unit Operator's behalf by its employees, contractors, or designated agents that is deliberate or that otherwise results from any act by Elk Hills Unit Operator or on Elk Hills Unit Operator's behalf by its employees, contractors or designated agents outside the scope of the Project as defined in Section 3.0 is not authorized. For any Covered Species not currently designated as endangered or threatened under CESA, where any such Covered Species is designated as an endangered or threatened under CESA during the term of the CESA MOU, as amended, or where any such

Covered Species is designated as a candidate species subject to the prohibition on take established by Fish and Game Code section 2080 during the term of the CESA MOU, as amended, Occidental shall seek to amend this CESA MOU to obtain take authorization for such Covered Species from the Department or, in the alternative, obtain take authorization as otherwise required by the Fish and Game Code.

The State Fully Protected blunt-nosed leopard lizard is known to occur on the Elk Hills Unit. Take of this species is prohibited by the Fish and Game Code and take of blunt-nosed leopard lizard is not authorized by the Department through this CESA MOU, as amended, despite the species' inclusion as a Covered Species.

c. All other requirements and provisions of the CESA MOU, as amended by Amendment No. 1, remain in full force and effect.

FINDINGS

Amendment No. 2 will not increase the amount of take of the Covered Species compared to the Project as originally approved, nor will this Amendment increase other Project impacts on the Covered Species for which take authorization is provided by the Department through the CESA MOU, as previously amended..

Discussion: This Amendment makes two specific changes to the CESA MOU as originally issued in 1997 and amended previously in 1999. Neither the extension of the term of the CESA MOU or the clarification regarding the take authorization allows for or otherwise authorizes any change or expansion in Project activities as previously authorized by the Department pursuant to the CESA MOU in 1997, and as also amended in 1999. The resulting impacts to the Covered Species, as a result, including the estimated acreage to be impacted on a permanent and temporary basis will remain the same with Amendment No. 2.

Amendment No. 2 does not affect the Department's *previous certification and finding that the CESA MOU, as previously amended, meets and is otherwise consistent with Fish and Game Code section 2081, subdivisions (b) and (c).*

Discussion: The Department certified and made findings in December 1997 consistent with Fish and Game Code section 2081.1. Amendment No. 2 does not alter the Department's earlier certification and finding that the CESA MOU meets the substantive criteria established by the Fish and Game Code section 2081, subdivision (b) because Amendment No. 2 modifies the CESA MOU, as previously amended, only in two respects, neither of which allows for any change or expansion of the Project, including authorized impacts on Covered Species. The Department finds, in this respect, consistent with its previous certification and findings, that the CESA MOU, now as further amended, only authorizes take incidental to an otherwise lawful activity; that required

mitigation and other measures will minimize and fully mitigate the impacts of the authorized taking of Covered Species; that Occidental has ensured adequate funding to implement such mitigation and other measures, and for monitoring compliance with and the effectiveness of such measures; and that the CESA MOU, as further amended, will not jeopardize the continued existence of any Covered Species.

None of the factors that would trigger the need for subsequent or supplemental environmental analysis of the Project under Public Resources Code section 21166 or California Code of Regulations, Title 14, sections 15162 and 15163, exist as a result of Amendment No. 2.

Discussion: The Department issued the CESA MOU in December 1997 as a responsible agency under CEQA after, among other things, considering the joint Supplemental Environmental Impact Statement (SEIS) and a Program Environmental Impact Report (PEIR) prepared under NEPA and CEQA, respectively. The Department amends the CESA MOU, as also previously amended, in the same capacity. (See generally Pub. Resources Code, §§ 21002.1, subd. (d), 21069; Cal. Code Regs., tit. 14, § 15096.) As explained above, in approving and issuing Amendment No. 2, the Department is not authorizing any change in Project activities as previously approved, and neither modification to the CESA MOU provided by Amendment No. 2 is expected to increase or otherwise change the environmental impacts previously considered in issuing the CESA MOU in 1997, or in previously amending the CESA MOU in 1999. In this respect, given the minor nature of Amendment No. 2, the Department finds that approval of Amendment No. 2 will not result in and does not have the potential to create any new significant or substantially more severe environmental effects than previously analyzed and disclosed by Kern County during its lead agency review of the Project, particularly with respect to the impacts authorized by the Department pursuant to the CESA MOU as amended. As a result the Department finds that no additional subsequent or supplemental environmental review is required by CEQA as part of the Department's approval of this Amendment.

The Department finds that Amendment No. 2 is a Minor Amendment pursuant to California Code of Regulations, Title 14, section 783.6, subdivision (c) (4).

Discussion: The two changes to the CESA MOU, as previously amended, provided by Amendment No. 2 will not: (1) increase the level of take or other Project impacts on Covered Species previously analyzed and authorized by the CESA MOU, as amended; (2) significantly modify the scope or nature of the Project; (3) affect Occidental's substantive mitigation, minimization or monitoring, or any other obligations under the CESA MOU, as amended; (4) require further environmental review under CEQA; or (5) increase temporal impacts on the Covered Species. As a result, the Department finds that Amendment No. 2 is a minor amendment under CESA pursuant to California Code of Regulations, Title 14, section 783.6, subdivision (c) (4).

AUTHORIZATION AND EFFECTIVE DATE

The authorization provided by Amendment No. 2 is not valid and effective unless and until Occidental signs and dates the acknowledgement below, and returns one of the duplicate originals of this Amendment to the Department at:

Department of Fish and Game
Habitat Conservation Planning Branch
Attention: CESA Permitting Program
1416 Ninth Street, Suite 1260
Sacramento, California 95814

APPROVED BY THE CALIFORNIA DEPARTMENT OF FISH AND GAME ON

_____ Dean Marston for 7-30-10

Jeffrey R. Single, Ph.D.
Regional Manager
Central Region

ACKNOWLEDGMENT BY OCCIDENTAL OF ELK HILLS, INC.

The undersigned: (1) warrants that he or she is acting as a duly authorized representative of the Permittee, (2) acknowledges receipt of the original CESA MOU, Amendment No. 1, and this Amendment No. 2; and (3) agrees on behalf of the Permittee to ensure that all terms and conditions of the CESA MOU, as amended, will be implemented by the Permittee.

By: Shann M Kerns Date: 8/3/10

Printed Name: SHANN M. KERNS

Title: President & General Manager, OEHI

APPENDIX C

LIST OF FEDERALLY ENDANGERED AND THREATENED SPECIES THAT OCCUR IN OR MAY BE AFFECTED BY PROJECTS IN THE U.S. GEOLOGICAL SURVEY, 7½-MINUTE QUADS

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

May 22, 2012

Document Number: 120522034016

Jan Novak
URS Corporation
1333 BROADWAY STE 800
OAKLAND, California 94612

Subject: Not specified

Dear: Mr.

We are sending this official species list in response to your May 22, 2012 request for information about endangered and threatened species. The list covers the California counties and/or U.S. Geological Survey 7½ minute quad or quads you requested.

Our database was developed primarily to assist Federal agencies that are consulting with us. Therefore, our lists include all of the sensitive species that have been found in a certain area *and also ones that may be affected by projects in the area*. For example, a fish may be on the list for a quad if it lives somewhere downstream from that quad. Birds are included even if they only migrate through an area. In other words, we include all of the species we want people to consider when they do something that affects the environment.

Please read Important Information About Your Species List (below). It explains how we made the list and describes your responsibilities under the Endangered Species Act.

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be August 20, 2012.

Please contact us if your project may affect endangered or threatened species or if you have any questions about the attached list or your responsibilities under the Endangered Species Act. A list of Endangered Species Program contacts can be found here.

Endangered Species Division

These buttons will not appear on your list.

Revise Selection

Print this page

Print species list before going on to letter.

Make Official Letter

U.S. Fish & Wildlife Service

Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 120522034737

Database Last Updated: September 18, 2011

Quad Lists

Listed Species

Invertebrates

- Branchinecta lynchi
  - vernal pool fairy shrimp (T)
- Desmocerus californicus dimorphus
  - valley elderberry longhorn beetle (T)

Fish

- Hypomesus transpacificus
  - delta smelt (T)

Amphibians

- Rana draytonii
  - California red-legged frog (T)

Reptiles

- Gambelia (=Crotaphytus) sila
  - blunt-nosed leopard lizard (E)

- Thamnophis gigas
  - giant garter snake (T)

Mammals

- Dipodomys ingens
  - giant kangaroo rat (E)

- Dipodomys nitratoides nitratoides
  - Tipton kangaroo rat (E)

- Sorex ornatus relictus
  - Buena Vista Lake shrew (E)

- Vulpes macrotis mutica
  - San Joaquin kit fox (E)

Plants

- Eremalche kernensis
  - Kern mallow (E)

- Monolopia congdonii (=Lembertia congdonii)
  - San Joaquin woolly-threads (E)

Quads Containing Listed, Proposed or Candidate Species:

RIO BRAVO (241A)

BUTTONWILLOW (241B)

EAST ELK HILLS (241C)

TUPMAN (241D)

LOKERN (242A)

WEST ELK HILLS (242D)

County Lists

No county species lists requested.

Key:

- (E) Endangered - Listed as being in danger of extinction.
- (T) Threatened - Listed as likely to become endangered within the foreseeable future.
- (P) Proposed - Officially proposed in the Federal Register for listing as endangered or threatened.
- (NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.
- Critical Habitat - Area essential to the conservation of a species.
- (PX) Proposed Critical Habitat - The species is already listed. Critical habitat is being proposed for it.
- (C) Candidate - Candidate to become a proposed species.
- (V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.
- (X) Critical Habitat designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, or may be affected by projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list.
See our Protocol and Recovery Permits pages.
For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.
- During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.
- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.
- Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6520.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be August 20, 2012.

APPENDIX D

QUALIFICATIONS OF CONTRIBUTING BIOLOGISTS

Name	Education	Experience	Expertise
Alyssa Berry	B.A. Earth and Environmental Studies, Wesleyan University	3 years	Plant and wildlife surveys
Andy Evans	B.S. Geological Sciences, UCSB	2 years	Blunt-nosed leopard-lizard surveys
Chris Julian	B.S. Biology, UCSB	10 years	Wetland regulatory sciences, clean water act regulation
Cletis England	B.S. Ecology and Systematic Biology, California Polytechnic, San Luis Obispo	11 years	Ecologist
David Compton	M.A. U.S. History, Marquette University	11 years	General biology, BNLL
David Kisner	M.S., Ecology, San Diego State University	19 years	Plant and wildlife surveys
Gilda Barboza	B.A. Geography and Environmental Studies/International Development Studies, UCLA	6 years	Section 7consultation, rare plant and wildlife surveys
Jamie Deutsch	B.S. Forestry, California Polytechnic, San Luis Obispo	4 years	Plant and wildlife surveys
Jan Novak	B.S. Soils Science, California Polytechnic, San Luis Obispo	11 years	Clean Water Act regulations, wetland delineations
Jane Donaldson	B.S. Biological Sciences, California Polytechnic, San Luis Obispo	15 years	Sensitive species monitoring; botany
Jessica Birnbaum	M.S. Natural resources; Planning and Interpretation, Humboldt State University	7 years	Botany, BNLL surveys, habitat assessment.
Johanna Kisner	M.S. Environmental Science and Management, UCSB	11 years	Botany, wetland delineation.
Jolie Henricks	B.S. Wildlife and Fisheries, UC Davis	8 years	Wildlife biology, GIS analysis
Kate Eldredge	B.S. Biology, California State University, Bakersfield	21 years	Plant and wildlife surveys, BNLL
Kelly Kephart	B.S. Forestry, California Polytechnic, San Luis Obispo	6 years	Botany, wetland delineation, rare plant surveys
Mark Wilson	B.A., Environmental Studies, Saint Mary's College of	3 years	Biology/Conservation Biology, Biological

Name	Education	Experience	Expertise
	California		Monitoring, Habitat Assessments
Melissa Newman	M.S. Biology, UC San Diego	6 years	Wildlife biology surveys, habitat assessment, environmental impact analysis, ESA
Robin Murray	B.S. Botany, Humboldt State University	3 years	Botany, BNLL
Ronald Cummings	B.S. General Biology, Oregon State University	22 years	General biology, BNLL
Steve Zembsch	B.S., Soil Resource Management, UC Berkeley	31 years	Stream Restoration, Wetland Mitigtion/Creation, Revegetation/Pest Species Eradication
Wayne Vogler	B.S., Biological Sciences, UC Irvine	12 years	Biological surveys, BNLL

APPENDIX E

PLANT SPECIES OBSERVED IN THE BIOLOGICAL RESOURCES STUDY AREA

Appendix E

Plant Species Observed in the Biological Resources Study Area

Scientific Name	Common Name	Native/ Exotic	Wetland Indicator Status	CNPS Status
Acroptilon repens	Russian knapweed	E	NI	None
Allenrolfea occidentalis	iodine bush	N	NI	None
Ambrosia dumosa	burrobush	N	NI	None
Amsinckia menziesii var. *intermedia*	fiddleneck	N	NI	None
Amsinckia menziesii var. *menziesii*	fiddleneck	N	NI	None
Anethum graveolens	dill	E	NI	None
Aster sp.	N/A	N/A	NI	None
Astragalus lentiginosus	freckled milkvetch	N	NI	None
Atriplex lentiformis	quailbush	N	NI	None
Atriplex phyllostegia	leaf cover saltweed	N	FACW	None
Atriplex polycarpa	desert saltbush	N	FACU	None
Atriplex triangularis	spear leaved saltbrush	N	FACW	None
Atriplex vallicola	Lost Hills saltbush	N	NI	1B.2
Avena fatua	Common wild oats	E	NI	None
Baccharis salicifolia	mule fat	N	NI	None
Bassia hyssopifolia	five hook bassia	E	NI	None
Brassica nigra	black mustard	E	NI	None
Bromus hordeaceus	soft chess	E	NI	None
Bromus madritensis ssp. *Rubens*	red brome	E	NI	None
Calycadenia spicata	spiked western rosinweed	N	NI	None
Camissonia boothii ssp. *Decorticans*	shredding evening primrose	N	NI	None
Camissonia campestris	Mojave suncup	N	NI	None
Capsella bursa-pastoris	shepherd’s purse	E	FAC-	None
Castilleja exserta ssp. exserta	purple owl’s clover	N	NI	None
Centaurea melitensis	tocalote	E	NI	None
Centaurea solstitialis	yellow star thistle	E	NI	None
Centromadia pungens ssp. *pungens*	common tarweed	N	NI	None
Chaenactis sp.	N/A	N/A	NI	None
Chenopodium berlandieri	Berlandier's goosefoot	N	NI	None
Chenopodium sp.	N/A	N/A	NI	None

Appendix E Plant Species Observed in the Biological Resources Study Area				
Chloracantha sp.	N/A	N/A	NI	None
Convolvulus arvensis	bindweed	E	NI	None
Crassula connata	sand pygmy weed	N	NI	None
Cuscuta sp.	dodder	N/A	NI	None
Cynodon dactylon	Bermuda grass	E	NI	None
Datura stramonium	jimson weed	E	NI	None
Deinandra pallida	Kern tarweed	N	NI	None
Deschampsia danthonioides	annual hairgrass	N	FACW	None
Delphinium hesperium ssp. hesperium	Western larkspur	N	NI	None
Delphinium gypsophilum	gypsum loving larkspur	N	NI	4.2
Descurainia incisa	mountain tansy mustard	N	NI	None
Dichelostemma capitatum	blue dicks	N	NI	None
Distichlis spicata	salt grass	N	NI	None
Eastwoodia elegans	yellow mock aster	N	NI	None
Encelia actoni	Acton encelia	N	NI	None
Eremalche parryi	Parry's mallow	N	NI	None
*Eriastrum hooveri**	Hoover's eriastrum	N	NI	4.2
Eriastrum pluriflorum	Tehachapi woolystar	N	NI	None
Eriogonum angulosum	anglestem buckwheat	N	NI	None
Eriogonum gossypinum	cottony buckwheat	N	NI	4.2
Eriogonum gracillimum	slender stemmed buckwheat	N	NI	None
Erodium botrys	broad leaf filaree	E	NI	None
Erodium cicutarium	redstem stork's bill	E	NI	None
Euphorbia chamaesyce	prostrate spurge	E	NI	None
Filago californica	California filago	N	NI	None
Frankenia salina	alkali heath	N	NI	None
Galium sp.	bedstraw	N	NI	None
Gilia tricolor ssp. diffusa	bird's eye Gilia	N	NI	None
Guillenia lasiophylla	California mustard	N	NI	None
Helianthus annuus	common sunflower	N	NI	None
Heliotropium curassavicum	heliotrope	N	NI	None
Hemizonia sp.	N/A	N/A	NI	None

Appendix E Plant Species Observed in the Biological Resources Study Area				
Hordeum brachyantherum	meadow barley	N	NI	None
Hordeum intercedens	bobtail barley	N	NI	3.2
Hordeum marinum	seaside barley	E	NI	None
Hymenoclea salsola	cheesebrush	N	NI	None
Isocoma acradenia var. *bracteosa*	alkali goldenbush	N	NI	None
Isomeris arborea	bladderpod	N	NI	None
Juncus/Carex sp.	N/A	N/A	NI	None
Kochia californica (Bassia californica)	Mojave red sage	N	FACW	None
Lactuca serriola	prickly lettuce	E	NI	None
Lastarriaea coriacea	leather spineflower	N	NI	None
Lasthenia californica	goldfields	N	NI	None
Lasthenia chrysantha	alkali goldfields	N	NI	None
Layia glandulosa	white tidytips	N	NI	None
Layia pentachaeta ssp. *albida*	Sierra tidytips	N	NI	None
Lepidium dictyotum	alkali pepperweed	N	OBL	None
Lepidium nitidum	peppergrass	N	NI	None
Lessingia glandulifera	valley lessingia	N	NI	None
Lupinus bicolor	bi-color lupine	N	NI	None
Lycium cooperi	Cooper's box thorn	N	NI	None
Malacothrix californica	desert dandelion	N	NI	None
Malacothrix coulteri	snake’s head	N	NI	None
Malva parviflora	cheeseweed	E	NI	None
Malvella leprosa	alkali mallow	N	NI	None
Marrubium vulgare	horehound	E	NI	None
Matricaria discoidea	pineapple weed	E	NI	None
Melilotus indicus	annual yellow sweetclover	E	NI	None
Mentzelia affinis	yellow blazing stars	N	NI	None
Mesembryanthemum crystallinum	crystalline ice plant	E	NI	None
Mesembryanthemum nodiflorum	slender-leaf iceplant	E	NI	None
Monolopia stricta	Crum's monolopia	N	NI	None
Mucronea perfoliata	perfoliate spineflower	N	NI	None
Nicotiana glauca	tree tabacco	E	NI	None

Appendix E Plant Species Observed in the Biological Resources Study Area				
Oligomeris linifolia	oligomeris	N	NI	None
Pectocarya heterocarpa	hairy-leaved comb bur	N	NI	None
Pectocarya linearis ssp. ferocula	slender comb seed	N	NI	None
Phacelia distans	common Phacelia	N	NI	None
Phacelia tanacetifolia	lacy phacelia	N	NI	None
Phalaris aquatica	Harding grass	E	NI	None
Plagiobothrys canescens	valley popcorn flower	N	NI	None
Plagiobothrys trachycarpus	roughfruit popcorn flower	N	NI	None
Plantago elongata	long leaf plantain	N	FACW*	None
Plantago ovata	wooly plantain	N	NI	None
Poa annua	annual bluegrass	E	NI	None
Polygonum argyrocoleon	silversheath knotweed	E	NI	None
Portulaca oleracea	purslane	E	NI	None
Prosopis glandulosa	honey mesquite	N	NI	None
Psilocarphus tenellus	woolyheads	N	NI	None
Psilocarphus tenellus var. tenellus	woolyheads	N	FAC	None
Psilocarphus oregonus	Oregon woolyheads	N	OBL	None
Rumex crispus	curly dock	E	NI	None
Rumex sp.	N/A	N/A	NI	None
Salicornia virginica	pickleweed	N	OBL	None
Salix nigra	black willow	N	NI	None
Salsola tragus	Russian thistle	E	NI	None
Salvia carduacea	thistle sage	N	NI	None
Salvia columbariae	chia	N	NI	None
Schismus barbatus	Mediterranean grass	E	NI	None
Senecio vulgaris	common groundsel	E	NI	None
Sisymbrium altissimum	tumble mustard	E	NI	None
Solanum lanceolatum	lance-leaf nightshade	E	NI	None
Sonchus asper	spiny sow thistle	E	NI	None
Sonchus oleraceus	sow thistle	E	NI	None
Spergularia marina	salt sandspurry	N	NI	None
Spergularia sp.	N/A	N/A	NI	None

Appendix E Plant Species Observed in the Biological Resources Study Area				
Stephanomeria exigua	small wirelettuce	N	NI	None
Stylocline citroleum	oil nest straw	N	NI	1B.1
Stylomecon heterophylla	wind poppy	N	NI	None
Suaeda moquinii	seablite	N	NI	None
Tamarisk sp.	salt cedar	E	NI	None
Trifolium sp.	clover	N/A	NI	None
Trichostema ovatum	San Joaquin bluecurls	N	NI	4.2
Typha sp.	cattail	N	NI	None
Urtica urens	dwarf nettle	E	NI	None
Uropappus lindleyi	silver puffs	N	NI	None
Vulpia myuros	foxtail fescue	E	NI	None
Vulpia microstachys	small fescue	N	NI	None
Vulpia sp.	fescue	E	NI	None
Xanthium strumarium	cocklebur	N	NI	None

Notes:

* formerly listed as Federally Threatened but delisted in 2003; currently CNPS Light 4.2

CNPS = California Native Plant Society
N/A= not available
NI= Non-Indicator
FACW=Facultative Wetland, usually occurs in wetlands, but occasionally found in non-wetlands.
FAC= Facultative, equally likely to occur in wetlands or non-wetlands.
FACU= Facultative Upland, usually occurs in non-wetlands, but occasionally found on wetlands.
OBL= Obligate Wetland, occurs almost always under natural conditions in wetlands.

APPENDIX F

WILDLIFE SPECIES OBSERVED IN THE BIOLOGICAL RESOURCES STUDY AREA

Appendix F
Wildlife Species Observed in the Biological Resources Study Area

Scientific Name	Common Name	Observation Type	Federal/State/Other Listing Status
Invertebrates			
Pogonomyrmex californicus	California harvester ant	Visual	
Family: Hymenoptera	"furry black" bee	Visual	
Apis mellifera	honey bee	Visual	
Family: Tenebrionidae	stink beetle	Visual	
Family: Coccinellidae	lady beetle	Visual	
Family: Sphingidae	sphinx moth	Visual	
Order: Scorpionidae	scorpion	Visual	
Amphibians			
Rana catesbiana	bullfrog	Visual	Non-native
Hyla regilla	Pacific treefrog	Visual	
Bufo boreas	Western toad	Visual	
Spea hammondii	Western spadefoot (tadpoles)	Visual	SSC
Reptiles			
Uta stansburiana	side blotch lizard	Visual	
Gambelia sila	blunt-nosed leopard lizard	Visual	CE, Fully Protected/FE
Aspidoscelis tigris tigris	Great Basin whiptail	Visual	
Crotalus spp.	rattlesnake species	Shed skin	
Birds			
Ardea alba	great egret	Visual	
Circus cyaneus	northern harrier	Visual	
Accipiter striatus	sharp-shinned hawk	Visual	
Accipiter cooperii	Cooper's hawk	Visual	SSC (nesting)
Buteo lineatus	red-shouldered hawk	Visual	WL (nesting)
Falco sparverius	American kestrel	Visual	WL (nesting)
Falco columbarius	merlin	Visual	
Callipepla californica	California quail	Visual	
Gallinago delicata	Wilson's snipe	Visual	
Numenius americanus	long-billed curlew	Visual	WL (wintering)
Tringa melanoleuca	greater yellowlegs	Visual	

Appendix F
Wildlife Species Observed in the Biological Resources Study Area

Scientific Name	Common Name	Observation Type	Federal/State/Other Listing Status
Tringa flavipes	lesser yellowlegs	Visual	WL/BCC (nesting)
Charadrius vociferus	killdeer*	Visual	
Larus argentatus	herring gull	Visual	
Columba livia	rock pigeon*	Visual	Non-native
Zenaida macroura	mourning dove*	Visual	
Geococcyx californianus	greater roadrunner*	Visual	
Bubo virginianus	great-horned owl*	Pellets, feathers	
Athene cunicularia	burrowing owl	Visual	SSC (nesting)
Lanius ludovicianus	loggerhead shrike*	Visual	SSC (nesting)
Corvus corax	common raven	Visual	
Toxostoma sp.	thrasher species	Visual	
Salpinctes obsoletus	rock wren*	Visual	
Stelgidopteryx serripennis	northern rough-winged swallow*	Visual	
Hirundo rustica	barn swallow*	Visual	
Petrochelidon pyrrhonota	cliff swallow*	Visual	
Sturnus vulgaris	European starling	Visual	Non-native
Mimus polyglottos	Northern mockingbird*	Visual	
Eremophila alpestris	horned lark*	Visual	SSC
Spizella breweri	Brewer's sparrow	Visual	
Sayornis saya	Say's phoebe*	Visual	
Sayornis nigricans	black phoebe*	Visual	
Passer domesticus	house sparrow*	Visual	Non-native
Anthus rubescens	American pipit	Visual	
Carpodacus mexicanus	house finch*	Visual	
Chondestes grammacus	lark sparrow*	Visual, call	
Zonotrichia leucophrys	white-crowned sparrow	Visual	
Passerculus sandwichensis	savannah sparrow	Visual	
Amphispiza belli	sage sparrow*	Visual	
Vermivora celata	orange-crowned warbler	Visual	

Appendix F
Wildlife Species Observed in the Biological Resources Study Area

Scientific Name	Common Name	Observation Type	Federal/State/Other Listing Status
Dendroica coronata	yellow-rumped warbler	Visual	
Icterus bullockii	Bullock's oriole	Visual	
Sturnella neglecta	Western meadowlark*	Visual	
Euphagus cyanocephalus	Brewer's blackbird*	Visual	
Agelaius phoeniceus	red-winged blackbird*	Visual	
Molothrus ater	brown-headed cowbird*	Visual	Non-native
Mammals			
Canis latrans	coyote	Tracks, Scat	
Canis lupus familiaris	domestic dog	Tracks/Visual	
Ovis sp.	domestic sheep	Carcass	
Vulpes macrotis mutica	San Joaquin kit fox	Tracks, scat, and active dens	FE, CT
Spermophilus beecheyi	California ground squirrel	Burrows	
Ammospermophilus nelsonii	San Joaquin antelope squirrel	Visual	
Thomomys sp.	pocket gopher	Burrows	
Dipodomys sp.	short-nosed kangaroo rat	Burrows, tracks, and scat	SSC
Lepus californicus	black-tailed jackrabbit	Visual	
Sylvilagus audubonii	Audubon's cottontail	Visual	
Taxidea taxa	American badger	Digs, carcass	SSC
Procyon lotor	Raccoon	Tracks	

Source: HECA Project Team. CDFG, 2008b

Notes:

* Bird species indicting nesting behavior and/or expected to breed in the study area.

BCC = Bird of Conservation Concern (USFWS)
CE = California Endangered
CT = California Threatened
FE = Federally Endangered
SSC = Species of Special Concern (CDFG)
WL = Watch List (CDFG)

DATA REQUEST

A211. Please amend Table 2-1 "Disturbed Acreage" to include the PG&E switching station as a project component and include the size, temporary disturbance and permanent disturbance figures.

SUPPLEMENTAL RESPONSE

Revised Table A211-1 reflects updated values for all of the Project components, including the Pacific Gas and Electric Company switching station and Occidental of Elk Hills, Inc. project components. This updated table supersedes previously submitted Table A211-1 provided in response to CEC Data Request A211 and 2012 Amended AFC Table 2-1.

Revised Table 211-1
Disturbed Acreage

Project Component	Description	Approx. Linear Length (miles)	ROW Construction	ROW Permanent	Temporary Disturbance[1] (acres)	Permanent Disturbance[2] (acres)
Project Site	453-acre HECA Project Site	N/A	N/A	N/A	453	453
Temporary Construction Area	**Temporary disturbance:** 91 acres in the Controlled Area. **Permanent disturbance:** None.	N/A	N/A	N/A	91	None
Railroad spur	Single track railroad. **Temporary disturbance:** 75 feet wide along linear length, plus 3 acres of laydown area. **Permanent disturbance:** 60 feet wide along linear length.	5.3	75 feet	60 feet	51.0	38.4
Natural gas linear	**Temporary disturbance:** 50 feet wide along linear length, plus 100-foot by 100-foot metering station at the inlet. Disturbance area shared with railroad spur. **Permanent disturbance:** Only the metering station at the inlet.	13	50 feet	25 feet	47.43[3]	0.23
BVWSD well field and process water pipeline	**Temporary disturbance:** 50 feet wide along linear length, plus 150-foot by 100-foot area of disturbance around each of 5 wells. **Permanent disturbance:** Only the areas around each well (100 feet by 100 feet).	15	50 feet	25 feet	90.25	1.15
Electrical transmission line	**Temporary disturbance:** 25-foot-wide road throughout linear length, plus up to 25-foot-diameter structural base for each of 15 poles. **Permanent disturbance:** Only the up to 25-foot-diameter structural base for each of 15 poles.	2.1	100 feet	100 feet	7.35	0.15
PG&E Switching Station	Proposed switching station site (417 feet by 417 feet).	N/A	N/A	N/A	4	4
Potable water pipeline	**Temporary disturbance:** 10 feet wide along linear length and within transmission line corridor. **Permanent disturbance:** None.	1	10 feet	N/A	Included with transmission line[4]	N/A

Revised Table 211-1
Disturbed Acreage (Continued)

Project Component	Description	Approx. Linear Length (miles)	ROW Construction	ROW Permanent	Temporary Disturbance[1] (acres)	Permanent Disturbance[2] (acres)
OEHI CO_2 pipeline[5]	**Temporary disturbance:** 80 feet along 15,240.8 feet of trenched pipe, plus 2 entry pits (120-foot by 100-foot each) and 2 exit pits for HDD (75-foot by 100-foot each), plus two 50-foot by 50-foot valve box areas. **Permanent disturbance:** Only the two 50-foot by 50-foot valve box areas.	3.4	50 to 80 feet	25 feet	29.00	0.11
OEHI EOR[6]	EOR Processing Facility of 1,200 feet by 2,200 feet, plus 3 satellites (230 by 200 feet).	N/A	N/A	N/A	63.79	63.79
Total Disturbance					**836.8**	**560.8**

Source: HECA, 2012.

Notes:

1 Temporary disturbance area is the total area disturbed during construction.

2 Permanent disturbance area is the disturbed/developed area that remains after construction.

3 The temporary disturbance area along the portion of the natural gas linear that follows the railroad spur from the Project Site to the interconnection of the railroad with the existing San Joaquin Valley Railroad line is included in the temporary disturbance area for the railroad spur.

4 The potable water pipeline temporary disturbance area is included in the temporary disturbance area for the electrical transmission line.

5 Sources: 2012 Amended AFC, Appendix A-2 [Stantec (Stantec Corporation). Modified CO_2 Supply Line Alignment Data Gap Analysis. Prepared for Occidental of Elk Hills, Inc. April 2012.] and Response to CEC Data Request A59.

6 See Biological Assessment in Attachment A59-1.

BVWSD = Buena Vista Water Storage District
CO_2 = carbon dioxide
EOR = Enhanced Oil Recovery
N/A = not applicable
PG&E = Pacific Gas and Electric Company
OEHI = Occidental Elk Hills, Incorporated
ROW = right-of-way

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT
COMMISSION OF THE STATE OF CALIFORNIA
1516 NINTH STREET, SACRAMENTO, CA 95814
1-800-822-6228 – WWW.ENERGY.CA.GOV

AMENDED APPLICATION FOR CERTIFICATION FOR THE HYDROGEN ENERGY CALIFORNIA PROJECT

Docket No. 08-AFC-08A
PROOF OF SERVICE
(Revised 3/4/13)

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After docketing, the Docket Unit will provide a copy to the persons listed below. Do not send copies of documents to these persons unless specifically directed to do so.

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Adviser for Facility Siting

DECLARATION OF SERVICE

I, Dale Shileikis, declare that on March 5, 2013, I served and filed copies of the attached Supplemental Responses to CEC Data Requests: Nos. A56 and A211, dated March, 2013. This document is accompanied by the most recent Proof of Service, which I copied from the web page for this project at: http://www.energy.ca.gov/sitingcases/hydrogen_energy/.

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___ I e-mailed the document to all e-mail addresses on the Service List above and personally delivered it or deposited it in the US mail with first class postage to those persons noted above as "hard copy required"; OR

_X_ Instead of e-mailing the document, I personally delivered it or deposited it in the US mail with first class postage to all of the persons on the Service List for whom a mailing address is given.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct, and that I am over the age of 18 years.

Dated: 3/5/13