# Integrated Natural Resources Management Plan

JULY 2014

## Naval Air Station Lemoore

NAVAL AIR STATION LEMOORE, CALIFORNIA

# Integrated Natural Resources Management Plan

Naval Air Station Lemoore

July 2014

**Prepared for:**

Naval Air Station Lemoore
Public Works Department–Environmental
750 Enterprise Avenue
Lemoore, California 93246

**Under Contract with:**

Naval Facilities Engineering Command Southwest
1220 Pacific Highway
San Diego, CA 92132

**Contract No. N62473-06-D-2402/0027**

**Prepared by:**

Tierra Data Inc.
10110 W. Lilac Road
Escondido, CA 92026

## INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
## Naval Air Station Lemoore, California

### APPROVAL

This Integrated Natural Resources Management Plan (INRMP) fulfills the requirements for the INRMP in accordance with the Sikes Act (as amended), and DoDI 4715.03 and OPNAVINST 5090.1C CH-1. This document was prepared and reviewed in coordination with U.S. Department of the Interior, Fish and Wildlife Service, and California Department of Fish and Wildlife Central Region in accordance with the 2013 Memorandum of Understanding for a Cooperative Integrated Natural Resource Management Program on Military Installations.

**Approving Official–U.S. Navy, Naval Air Station Lemoore**

04 MARCH 2015
Date

Captain Monty G. Ashliman, U.S. Navy
Commanding Officer
Naval Air Station Lemoore
Lemoore, California

**Approving Official–U.S. Navy, Naval Air Station Lemoore**

23 FEB 2015
Date

Kim Rasmussen
Installation Environmental Program Director
Naval Air Station Lemoore
Lemoore, California

**Approving Official–U.S. Navy, Naval Air Station Lemoore**

23 Feb 2015
Date

Timothy Schweizer
Natural Resources Manager
Naval Air Station Lemoore
Lemoore, California

**Approving Official–U.S. Navy, Naval Facilities Engineering Command Southwest and the Commander, Navy Region Southwest**

23 Feb 2015
Date

Douglas Powers
Natural Resources Program Manager
Naval Facilities Engineering Command Southwest/
Commander, Navy Region Southwest
San Diego, California

**This Page Intentionally Blank**

## INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
## Naval Air Station Lemoore, California

### APPROVAL

This Integrated Natural Resources Management Plan (INRMP) was prepared and reviewed in coordination with the U.S. Department of the Navy, U.S. Department of the Interior, Fish and Wildlife Service, and California Department of Fish and Wildlife Central Region in accordance with the 2006 Memorandum of Understanding for a Cooperative Integrated Natural Resource Management Program on Military Installations. The U.S. Department of the Interior, Fish and Wildlife Service concurs that the INRMP will provide a framework to manage natural resources on Naval Air Station Lemoore.

### Concurring Agency - U.S. Fish and Wildlife Service

Jennifer Norris
Field Supervisor
U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
Sacramento, California

7/1/2015
Date

**This Page Intentionally Blank**

## INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
## Naval Air Station Lemoore, California

### APPROVAL

This Integrated Natural Resources Management Plan (INRMP) was prepared and reviewed in coordination with the U.S. Department of the Navy, U.S. Department of the Interior, Fish and Wildlife Service, and California Department of Fish and Wildlife Central Region in accordance with the 2006 Memorandum of Understanding for a Cooperative Integrated Natural Resource Management Program on Military Installations. The California Department of Fish and Wildlife concurs that this INRMP will provide a framework to manage natural resources on Naval Air Station Lemoore.

### Concurring Agency - California Department of Fish and Wildlife

Terry L Palmisano for

Jeffrey R. Single, Ph.D.
Regional Manager, Region 4
California Department of Fish and Wildlife
Fresno, California

July 10, 2015
Date

**This Page Intentionally Blank**

# INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
# Naval Air Station Lemoore, California

## APPROVAL

This Integrated Natural Resources Management Plan (INRMP) fulfills the requirements for the INRMP in accordance with the Sikes Act (as amended), and DoDI 4715.03 and OPNAVINST 5090.1C CH-1. This document was prepared and reviewed in coordination with U.S. Department of the Interior, Fish and Wildlife Service, and California Department of Fish and Wildlife Central Region in accordance with the 2013 Memorandum of Understanding for a Cooperative Integrated Natural Resource Management Program on Military Installations.

## Annual Naval Air Station Lemoore Metrics Meeting, Review, and Approval

| Plan Period | Date of Annual Metrics Meeting and Review | Name and Title of Reviewer(s) | Signature(s) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**This Page Intentionally Blank**

# INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
# Naval Air Station Lemoore, California

## APPROVAL

This Integrated Natural Resources Management Plan (INRMP) was prepared and reviewed in coordination with the U.S. Department of the Navy, U.S. Department of the Interior, Fish and Wildlife Service, and California Department of Fish and Wildlife Central Region in accordance with the 2013 Memorandum of Understanding for a Cooperative Integrated Natural Resource Management Program on Military Installations. The U.S. Department of the Interior, Fish and Wildlife Service concurs that the INRMP will provide a framework to manage natural resources on Naval Air Station Lemoore.

## Annual U.S. Fish and Wildlife Service Metrics Meeting, Review, and Approval

| Plan Period | Date of Annual Metrics Meeting and Review | Name and Title of Reviewer(s) | Signature(s) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**This Page Intentionally Blank**

# INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
# Naval Air Station Lemoore, California

## APPROVAL

This Integrated Natural Resources Management Plan (INRMP) was prepared and reviewed in coordination with the U.S. Department of the Navy, U.S. Department of the Interior, Fish and Wildlife Service, and California Department of Fish and Wildlife Central Region in accordance with the 2013 Memorandum of Understanding for a Cooperative Integrated Natural Resource Management Program on Military Installations. The California Department of Fish and Wildlife concurs that this INRMP will provide a framework to manage natural resources on Naval Air Station Lemoore.

## Annual California Department of Fish and Wildlife Metrics Meeting, Review, and Approval

| Plan Period | Date of Annual Metrics Meeting and Review | Name and Title of Reviewer(s) | Signature(s) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**This Page Intentionally Blank**

# Executive Summary

This Integrated Natural Resources Management Plan (INRMP) is to provide Naval Air Station (NAS) Lemoore with a basis and criteria for sound land use and management of natural resources that is integrated with its U.S. Department of the Navy (Navy) mission. The Sikes Act (as amended) committed the U.S. Department of Defense (DoD) to prepare and implement INRMPs for its installations. This INRMP's purpose is to help NAS Lemoore's Commanding Officer manage natural resources effectively to ensure natural resources remain available and in optimal condition to support all aspects of the military mission.

The official mission of NAS Lemoore is to support Navy fleet carrier attack and strike-fighter squadrons and the operational training of personnel, to maintain the proficiency of personnel who are already qualified, and to form first-line combatant attack and strike-fighter capability. NAS Lemoore is a shore activity under the command of the Commander, Navy Region Southwest. It is the Navy's largest and only west coast Master Jet Base. NAS Lemoore's major tenant is the Navy's Commander Strike Fighter Wing, U.S. Pacific Fleet, and its mission is to train, man, and equip west coast strike fighter squadrons.

In the heart of the San Joaquin Valley, a major agricultural region within the Central Valley of California, NAS Lemoore is composed of approximately 18,784 acres (7,602 hectares) in fee simple ownership. In addition, NAS Lemoore holds an air safety easement over approximately 11,020 acres (4,460 hectares) of agricultural land adjacent to Station-owned land for flight safety and noise mitigation.

In developing this INRMP, many Navy stakeholders internal to NAS Lemoore were engaged, as well as the command level Chief of Naval Operations and Commander, Naval Installations Command. The INRMP planning team also worked with its INRMP partner agencies, the U.S. Fish and Wildlife Service and California Department of Fish and Wildlife.

Objectives and strategies are presented in this INRMP consistent with the range of topics stipulated in the Sikes Act (as amended) that this INRMP provide. These include objectives and strategies for the use and conservation of natural resources that integrate regional ecosystem, military, social (community), and economic concerns. It identifies natural resource constraints and opportunities; supports the resolution of land use conflicts; provides baseline descriptions of natural resources necessary for the development of conservation strategies and environmental assessment; serves as the principal information source for the preparation of future environmental documents for proposed NAS Lemoore actions; and provides guidance for annual natural resources management reviews, internal compliance audits, and annual budget submittal. It integrates natural resource components of existing NAS Lemoore plans, environmental documents, and the requirements of all applicable DoD, Navy, and installation regulations and guidelines.

As part of INRMP development, several key issues were identified for the plan's focus:

- Bird/Animal Aircraft Strike Hazard: A goal of effective land management at NAS Lemoore is to discourage wildlife activity near runways and operational areas. This is important as the speed and number of aircraft operating at the Station increases.
- Maintaining an encroachment buffer: A buffer of compatible land uses and buildings around the Station provides protection for NAS Lemoore installation activities and natural resources. This is important as the region's population expands and it includes maintaining the status quo in terms of the type and heights of buildings in proximity to NAS Lemoore.
- Maintaining agriculture: Agriculture at NAS Lemoore provides the safety functions listed above and is compatible with operation of the military airfield; however, it is vulnerable due to future

projections of decreased surface water availability and its dependence on groundwater, which has been over-utilized in the Central Valley and is not necessarily renewable. Managing these water sources sustainably is important for the military mission.

- Dust abatement and air quality: Dust is a Foreign Object Damage hazard, and when it reduces visibility for pilots it increases risk to operations. At NAS Lemoore, blowing dust is frequent, caused by a semiarid climate, soil conditions, and wind patterns, and it contributes to the spread of soil-borne fungal spores that cause Valley Fever. Natural resources management at NAS Lemoore addresses dust by providing suitable ground cover to control blowing soil.

To support addressing these and other concerns, documentation of the current natural resource conditions at NAS Lemoore have been updated since the last INRMP (Navy 2001b), and are presented in Chapter 3: Natural Resources Status and Condition. INRMP objectives, strategies, and project actions are proposed in Chapter 4: Natural Resources Management Strategy and Prescriptions and Chapter 5: Sustainability and Compatible Use at NAS Lemoore. Project actions that may need to be programmed for funding are prioritized and scheduled in Appendix A: Implementation Summary Table. Major project themes include:

- Management of federally listed species and Species At Risk that could be listed in the future;
- Sustainable agriculture and water resources management;
- Support of the Bird/Animal Aircraft Strike Hazard program;
- Habitat-level management as a first order of business due to cost-effectiveness, over species-level management;
- Control of invasive species using best, cost-effective practices, in order: prevention, early detection, and strategic control;
- Support of beneficial pollinators consistent with federal policy;
- Baseline inventories, including unsurveyed natural resources and improvements to existing species lists;
- Inclusion of a monitoring component for resource management and enhancement work to facilitate adaptive management, and to support the resource manager's ability to ensure avoidance and minimization of impacts as needed.

The DoD is required to ensure that ecosystem management is the basis for all management of DoD lands and waters (Office of the Under Secretary of Defense Memorandum of 08 August 1994, Implementation of Ecosystem Management in the Department of Defense, and DoD Instruction 4715.03). Based on an ecosystem approach, this INRMP takes a large geographic view to ensure achievement of the overriding goal of protecting the properties and functions of natural ecosystems. NAS Lemoore is encouraged to form cooperative partnerships with nearby communities, as appropriate, and take part in public awareness initiatives in an effort to manage ecosystems successfully. DoD 4715.03 provides principles and guidelines for implementing ecosystem management on DoD lands. This is discussed in Section 1.10 Management Approaches, Chapter 4: Natural Resources Management Strategy and Prescriptions and Chapter 5: Sustainability and Compatible Use at NAS Lemoore.

Navy property outside of NAS Lemoore's Administration and Operations Areas consists of leased agricultural land and multiple Natural Resources Management Areas (NRMAs). Portions of the NRMAs are comprised of native plant communities. The "ecological services" (as defined in DoD Instruction 4715.03) provided by diverse natural communities will be managed through this INRMP in as integrated a fashion as possible with the military mission and agricultural production. These services include

protection of watersheds and floodplains, moderation of climate, abatement of water and air pollution, biological control of pest populations, and maintenance of habitat for wild pollinators of agricultural crops. Conceptually, maintaining ecological services through protection of natural ecosystems is very inexpensive compared to the technological alternatives. Technologies to control floods, abate pollution and control pests can be expensive, hazardous, and often ineffective. And they can have far-reaching adverse side effects. The challenge is to work with the fragments and remnants of natural communities that remain, which are often artificially supported with water and sometimes habitat restoration investments, and impacted by their interface with competing uses.

This INRMP, and future choices made by NAS Lemoore through its environmental documentation process under the National Environmental Policy Act, are important tools for the Navy to communicate with other agencies and the public about its choices in the future. This INRMP will identify the constraints and conflicts between agriculture and wildlands, and seek compatibilities and opportunities to adapt, restore, and enhance natural resources.

Annual reviews, reports and updates, as necessary, are required to implement this INRMP. A commitment to implement priority project actions, as funding permits, is provided with the signatures in the front of this document.

**This Page Intentionally Blank**

# Table of Contents

## List of Figures



## List of Maps

## List of Photos



## List of Tables

# INRMP Cross-Walk to the U.S. Department of Defense Template

Office of the Under Secretary of Defense (Acquisition, Technology and Logistics) Memorandum on the Integrated Natural Resources Management Plan Template, 14 August 2006.

| DoD Template | NAS Lemoore Table of Contents |
|---|---|
| DoD Title Page | Title Page |
| DoD Signature Page | Signature Pages |
| DoD Executive Summary | Executive Summary |
| DoD Table of Contents | Table of Contents |
| DoD 1 - Overview | 1.0 Introduction and Overview |
| DoD 1.a - Purpose | 1.1 Purpose and Scope |
| DoD 1.b - Scope | 1.1 Purpose and Scope |
| DoD 1.c - Goals and Objectives | 1.7 INRMP Vision, Goals and Objectives |
| DoD 1.d - Responsibilities | 1.9 Roles, Responsibilities and Stakeholders |
| DoD 1.d.1 - Installation Stakeholders | 1.9.2 Internal Stakeholders |
| DoD 1.d.2 - External Stakeholders | 1.9.3 External Stakeholders |
| DoD 1.e - Authority | 1.2 Authority |
| DoD 1.f - Stewardship and Compliance Discussion | 1.6 Achieving INRMP Success<br>6.3 Funding and INRMP Implementation |
| DoD 1.g - Review and Revision Process | 1.11 INRMP Review and Revision Process<br>6.2 INRMP Review and Metrics |
| DoD 1.h - Management Strategy | 1.10 Management Approaches |
| DoD 1.i - Other Plan Integration | 1.12 Integrating Other Plans<br>5.7 Integrating Other Internal Plans and Programs |
| DoD 2 - Current Conditions and Use | 2.0 Military and Other Uses of Land and Natural Resources<br>3.0 Natural Resources Current Condition and Management |
| DoD 2.a - Installation Information | 1.3 Location and Real Estate Summary<br>1.5 NAS Lemoore Special Areas<br>2.2 Navy Operations and Activities<br>2.3 Facilities and Services<br>2.4 Other Land Uses |
| DoD 2.a.1 - General Description | 2.0 Military and Other Uses of Land and Natural Resources |
| DoD 2.a.2 - Regional Land Uses | 2.1 Regional Land Use |
| DoD 2.a.3 - Abbreviated History and Pre-Military Land Use | 2.6 Historical Overview of Land Use |
| DoD 2.a.4 - Military Mission | 1.4 NAS Lemoore and Tenant's Military Mission<br>2.2 Navy Operations and Activities |
| DoD 2.a.5 - Operations and Activities | 2.2 Navy Operations and Activities |
| DoD 2.a.6 - Constraints Map | Map 5-1 |
| DoD 2.a.7 - Opportunities Map | Map 5-3 |
| DoD 2.b - General Physical Environment and Ecosystems | 3.1 Ecoregional Setting<br>3.2 Climate<br>3.3 Physical Conditions |
| DoD 2.c - General Biotic Environment | 3.1 Ecoregional Setting<br>3.4 Vegetation Communities and Wildlife Habitat |
| DoD 2.c.1 - Threatened and Endangered Species and Species of Concern | 3.5.1.1 Special Status Plants<br>3.6.1 Federally Listed Species<br>3.6.2 Other Special Status Species<br>Appendix G: Special Status Species Profiles and List |

| DoD Template | NAS Lemoore Table of Contents |
|---|---|
| DoD 2.c.2 - Wetlands and Deep Water Habitats | 3.4.4 Wetlands and Jurisdictional Waters |
| DoD 2.c.3 - Fauna | 3.5.2 Fauna<br>Appendix J: Species List |
| DoD 2.c.4 - Flora | 3.5.1 Flora<br>Appendix J: Species List |
| DoD 3 - Environmental Management Strategy and Mission Sustainability | 1.10 Management Approaches<br>5.0 Sustainability and Compatible Use at NAS Lemoore |
| DoD 3.a - Supporting Sustainability of the Military Mission and the Natural Environment | 5.1 Sustainability of the Military Mission and the Natural Environment |
| DoD 3.a.1 - Integrated Military Mission and Sustainable Land Use | 5.1.1 Integrated Military Mission and Sustainable Land Use Decisions |
| DoD 3.a.2 - Define Impact to the Military Mission | 1.6.2 Mission Sustainability and the INRMP "No Net Loss" Requirement<br>5.1 Sustainability of the Military Mission and the Natural Environment |
| DoD 3.a.3 - Describe Relationship to Range Complex Management Plan or other operational area plans | 1.6.3 Relationship to Other Operational Plans<br>2.2 Navy Operations and Activities<br>5.1 Sustainability of the Military Mission and the Natural Environment<br>5.7 Integrating Other Internal Plans and Programs |
| DoD 3.b - Natural Resources Consultation Requirements | 5.9 Natural Resources Consultation Planning |
| DoD 3.c - NEPA Compliance | 5.8 NEPA Compliance |
| DoD 3.d - Beneficial Partnerships and Collaborative Resource Planning | 5.6 Beneficial Partnerships and Collaborative Planning |
| DoD 3.e - Public Access and Outreach | 5.11 Environmental Education and Public Outreach<br>5.12 Public Access |
| DoD 3.e.1 - Public Access and Outdoor Recreation | 5.10 Outdoor Recreation<br>5.12 Public Access |
| DoD 3.e.2 - Public Outreach | 5.11 Environmental Education and Public Outreach |
| DoD 3.f - Encroachment Partnering | 5.1 Sustainability of the Military Mission and the Natural Environment<br>5.6 Beneficial Partnerships and Collaborative Planning |
| DoD 3.g - State Comprehensive Wildlife Plans | 1.12 Integrating Other Plans<br>5.6 Beneficial Partnerships and Collaborative Planning |
| DoD 4 - Program Elements | 4.0 Natural Resources Management Strategy and Prescriptions<br>5.0 Sustainability and Compatible Use at NAS Lemoore |
| DoD 4.a - Threatened and Endangered Species management and species, benefit, Critical Habitat, and Species of Concern Management | 3.5.1.1 Special Status Plants<br>3.6 Special Status Wildlife<br>4.5 Special Status Species Protection<br>Appendix G: Special Status Species Profiles and List<br>Appendix L: Reporting on Benefits for Endangered Species and Critical Habitat Concerns |
| DoD 4.b - Wetlands and Deep Water Habitats Management | 4.3.2 Wetlands and Jurisdictional Waters of the U.S. |
| DoD 4.c - Law Enforcement of Natural Resources Laws and Regulations | 5.14 Natural Resources Law Enforcement |
| DoD 4.d - Fish and Wildlife Management | 4.4 Management of Flora and Fauna Populations |
| DoD 4.e - Forestry Management | 4.3 Management of Vegetation Communities and Habitats |
| DoD 4.f - Vegetative Management | 4.3 Management of Vegetation Communities and Habitats |
| DoD 4.g - Migratory Birds Management | 4.4.5 Birds<br>Appendix N: Reporting on Migratory Bird Management |
| DoD 4.h - Invasive Species Management | 4.6 Invasive Species Management |
| DoD 4.i - Pest Management | 4.7.1 Pest and Predator Control<br>5.7.2 Integrated Pest Management |

| DoD Template | NAS Lemoore Table of Contents |
|---|---|
| DoD 4.j - Land Management | 4.1 Managing with an Ecosystem Approach<br>4.2 Managing the Physical and Chemical Environment<br>4.3 Management of Vegetation Communities and Habitats |
| DoD 4.k - Agricultural Outleasing | 5.2.1 Agricultural Outlease Management<br>5.2.2 Livestock Grazing |
| DoD 4.l - Geographical Information Systems Management, Data Integration, Access, and Reporting | 4.8 Data Integration, Access, and Reporting |
| DoD 4.m - Outdoor Recreation | 5.10 Outdoor Recreation |
| DoD 4.n - Bird/Animal Aircraft Strike Hazard | 4.7.2 BASH Program |
| DoD 4.o - Wildland Fire Management | 4.2.4 Wildland Fire Management |
| DoD 4.p - Training of Natural Resource Personnel | 5.13 Training of Natural Resources Management Personnel |
| DoD 4.q - Coastal / Marine Management | Not Applicable |
| DoD 4.r - Floodplains Management | 4.2.3 Floodplains |
| DoD 4.s - Other Leases | 5.2 Management of Other Uses & Real Estate Outgrants |
| DoD 5 - Implementation | 6.0 Implementation Strategy |
| DoD 5.a - Summary of the Process of Preparing Prescriptions Driving Projects | 6.1 General Considerations<br>6.3 Funding and INRMP Implementation |
| DoD 5.b - Achieving No Net Loss | 1.6.2 Mission Sustainability and the INRMP "No Net Loss" Requirement<br>5.1 Sustainability of the Military Mission and the Natural Environment<br>6.1 General Considerations |
| DoD 5.c - Use of Cooperative Agreements | 6.3.4.2 External Assistance |
| DoD 5.d - Funding | 6.3.4 Funding Sources |
| Appendix 1 - List of Acronyms | Appendix B: Acronyms and Abbreviations |
| Appendix 2 - Detailed natural resources management prescriptions that drive the projects | 4.0 Natural Resources Management Strategy and Prescriptions<br>5.0 Sustainability and Compatible Use at NAS Lemoore |
| Appendix 3 - List of Projects | Appendix A: Implementation Summary Table |
| Appendix 4 - Surveys | 3.0 Natural Resources Status and Condition<br>Appendix J: Species List |
| Appendix 5 - Research Requirements | 6.3.5 Research Funding Requirements<br>Appendix M: Research Requirements |
| Appendix 6 - Migratory Bird Management | Appendix N: Reporting on Migratory Bird Management |
| Appendix 7 - INRMP Benefits for Endangered Species | Appendix L: Reporting on Benefits for Endangered Species and Critical Habitat Concerns |
| Appendix 8 - Critical Habitat Issues | Appendix L: Reporting on Benefits for Endangered Species and Critical Habitat Concerns |

**This Page Intentionally Blank**

# 1.0 Introduction and Overview

## 1.1 Purpose and Scope

Naval Air Station (NAS)[1] Lemoore (also referred to as Station or installation) adopts this Integrated Natural Resources Management Plan (INRMP or Plan) as the framework for managing natural resources on land it owns or controls. The purpose of this INRMP is to help NAS Lemoore's Commanding Officer (CO) manage natural resources effectively to ensure installation lands remain available and in optimal condition to support all aspects of the military mission.

This INRMP is a requirement of the Sikes Act[2] (as amended, 2012). It is implemented by way of Department of Defense Instruction (DoDI) 4715.03 18 March 2011 for military lands of the U.S. Department of Defense (DoD). The INRMP is the primary means by which natural resources compliance and stewardship priorities are set and funding requirements are determined (U.S. Congress 2000). The U.S. Department of the Navy (Navy) guides implementation of the Sikes Act (as amended) through Chief of Naval Operations (CNO) Instruction 5090.1C CH-1 18 July 2011, Environmental Readiness Program Manual (hereinafter 5090.1C CH-1).

This INRMP considers a long-term planning horizon with annual reviews and updates to be made as necessary. A commitment to implement priority project actions, as funding permits, is provided with the signatures in the front of this Plan.

Project actions are proposed that cover the range of topics identified by the Sikes Act (as amended), which stipulates that this INRMP provide for:

- Conservation and rehabilitation of natural resources;
- Sustainable, multipurpose use of resources;
- Public access that is necessary and appropriate for the use described above, subject to safety and military security requirements;
- Specific natural resources goals and objectives, and time frames for acting on them;
- Fish and wildlife management, land management, forest management, and fish and wildlife-oriented recreation;
- Fish and wildlife habitat enhancement or modifications;
- Wetlands protection, enhancement, and restoration, where necessary for support of fish, wildlife, or plants;
- Integration of, and consistency among, the various activities conducted under the Plan;
- Sustainable use by the public of natural resources to the extent that use is not inconsistent with needs of the fish and wildlife resources;
- Enforcement of natural resources laws and regulations;

[1] Note that all acronyms and abbreviations are presented in Appendix B.

[2] Note that all laws and regulations relevant to this INRMP are presented in Appendix C.

- No net loss in the capability of installation lands to support the military mission of the installation; and
- Such other activities as the Secretary of the Navy determines appropriate.

The DoD is required to ensure that ecosystem management is the basis for all management of DoD lands and waters (Office of the Under Secretary of Defense [OUSD] Memorandum of 08 August 1994, Implementation of Ecosystem Management in the Department of Defense, and DoDI 4715.03). Based on an ecosystem approach, this INRMP takes a large geographic view to ensure achievement of the overriding goal of protecting the properties and functions of natural ecosystems. Since ecosystem boundaries are rarely synonymous with property ownership, installations such as NAS Lemoore are encouraged to form cooperative partnerships with nearby communities, as appropriate, and take part in public awareness initiatives in an effort to manage ecosystems successfully. DoD 4715.03 provides principles and guidelines for implementing ecosystem management on DoD lands. This is discussed further in Section 1.10 Management Approaches, and in Chapters 4 and 5.

Consistent with all of the above, this INRMP provides objectives and strategies for the use and conservation of natural resources at NAS Lemoore that integrate regional ecosystem, military, social (community), and economic concerns.

Designed to facilitate both stewardship and compliance with natural resources laws in the context of military mission requirements, this INRMP integrates natural resources components of existing NAS Lemoore plans, environmental documents, and the requirements of all applicable DoD, Navy, and installation regulations and guidelines.

## 1.2 Authority

The Sikes Act (as amended) directs the DoD to take the appropriate management actions necessary to protect and enhance the land and water resources on all installations under its control. DoD Directive 4700.4, Natural Resources Management Program, and DoDI 4715.03 are implemented herein to establish fundamental land management policies and procedures for all military lands to preserve the military mission, and at the same time protect natural resources. In Chapter 24 of 5090.1C CH-1, program responsibilities and standards are set for complying with resource protection laws, regulations, and Executive Orders (EOs) to conserve and manage natural resources on Navy installations in the United States and its territories and possessions. Finally, the CNO INRMP Guidance for Navy Installations (How to Prepare, Implement, and Revise INRMPs, April 2006) supplies guidelines on the process and procedure for developing an INRMP. Additional policy, regulation, and legislation regarding land management are contained in the remaining references cited in this chapter.

Federal and state legal requirements that are primary drivers for natural resources management are listed in Appendix C (U.S. Codes [USC], Public Laws, EOs, and Codes of Federal Regulations).

Organization of this INRMP contains all the elements of the DoD Template for INRMPs (OUSD Acquisition, Technology and Logistics Memorandum, 14 August 2006 [DoD 2006b]). Since both DoD and Navy guidance (DoDI 4715.03, CNO Guidance of April 2006, and 5090.1C CH-1) are more comprehensive than that identified in the DoD Template, the outline has been re-worked so that additional material is added in the document to ensure compliance with all guidelines (Navy 2006a, 2011). A cross-walk between the DoD Template and this INRMP's content is provided in the front of this INRMP, after the Table of Contents.

# 1.3 Location and Real Estate Summary

## Location

NAS Lemoore is in the heart of the San Joaquin Valley, a major agricultural region within the Central Valley of California (Map 1-1). It is about 80 miles (129 kilometers [km]) inland from the Pacific Ocean, and mid-way between Los Angeles and San Francisco, lying within the northwest part of Kings County and southwest part of Fresno County. The City of Fresno (population 494,665[3] and the Fresno County seat) is approximately 40 miles (64 km) north of NAS Lemoore, and Bakersfield (population 347,483) is approximately 80 miles (129 km) southeast. The City of Lemoore (population 24,531), a residential community and local agricultural center, is 7 miles (11 km) to the east of the Station on State Route 198. The City of Hanford (population 53,967) is the seat of Kings County and is approximately 17 miles (27 km) east of NAS Lemoore.

NAS Lemoore can be reached by State Route 198 between two of California's major north-south freeways: Interstate 5 to the west and State Route 99 to the east. The two main access points to NAS Lemoore are the Main Gate from State Route 198 on the southern edge and the Housing Gate from Avenal Road on the southeastern edge of NAS Lemoore. Most access to NAS Lemoore is through the Main Gate. The Grangeville Gate, located on the Station's northeastern edge along Grangeville Road, is not regularly manned (Map 1-2).

As of 2012, there are approximately 6,370 military personnel; 1,170 civilians, DoD, and government contractors; and 4,440 dependents on NAS Lemoore (T. Schweizer, pers. com. 2012).

In addition, the Navy maintains agreements with the Bureau of Land Management (BLM) and U.S. Forest Service (USFS) establishing two Special Areas to allow tenants stationed at NAS Lemoore to conduct search and rescue training. The Forest Service Special Area (FSSA) includes approximately 9,165 acres (3,709 hectares [ha]) in the Sequoia National Forest in Tulare County, California. The Coalinga Hills Special Area (CHSA) includes approximately 4,407 acres (1,783 ha) in the interior coastal foothills of the Diablo Range in Fresno County, California. The Special Areas are discussed in more detail in Section 1.5 NAS Lemoore Special Areas.

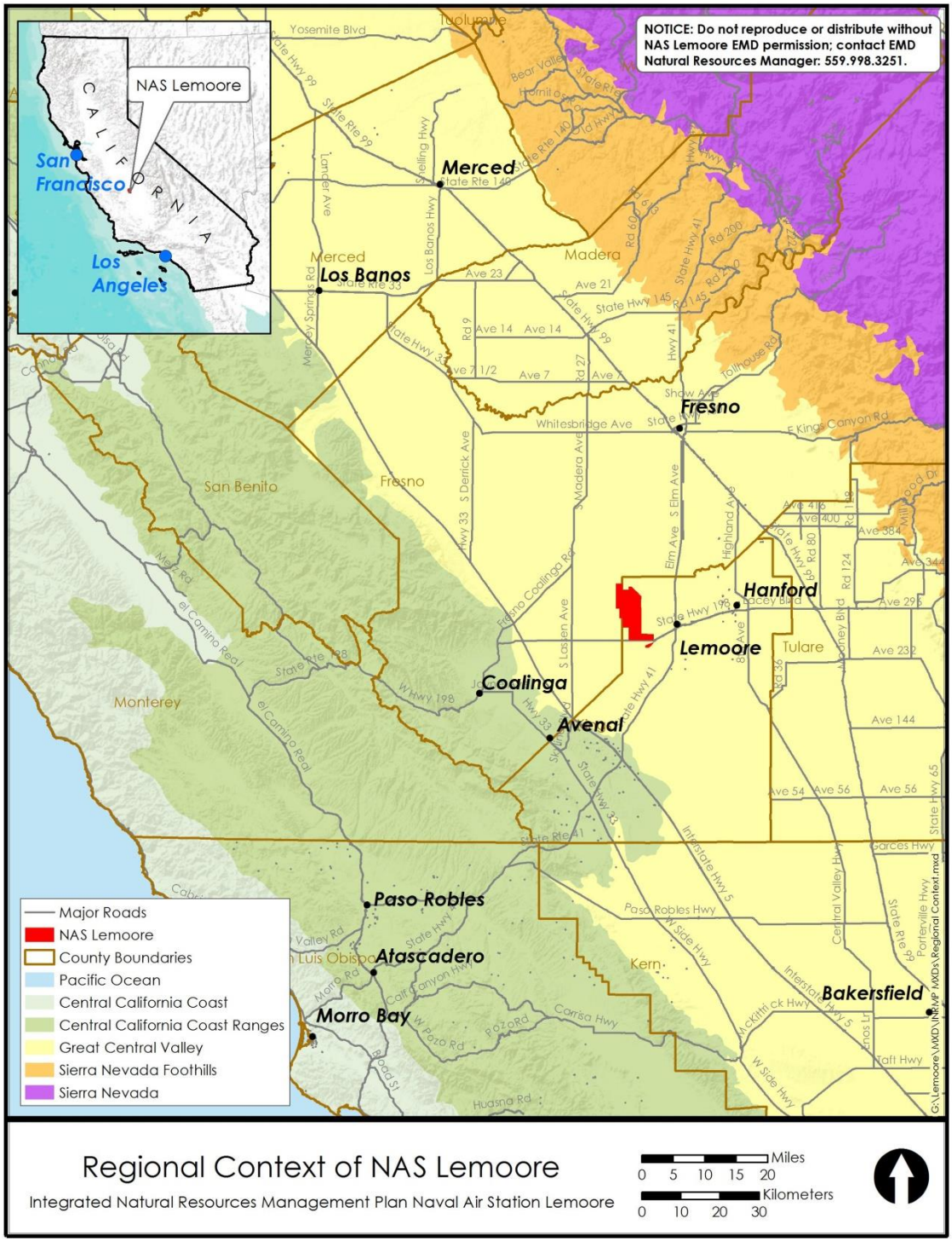
## Real Estate Summary

NAS Lemoore is composed of approximately 18,784 acres (7,602 ha) in fee simple ownership. The Station is split between two counties: the majority is located in Kings County (15,744 acres [6,372 ha]) with the remainder (3,040 acres [1,230 ha]) in Fresno County. In addition, NAS Lemoore holds an air safety easement over approximately 11,020 acres (4,460 ha) of agricultural land adjacent to Navy-owned land for flight safety and noise mitigation. The easement was obtained in 1958 at the same time as the purchase of land for construction of the Station (Navy 2001b; Map 1-2).

### *Developed Areas*

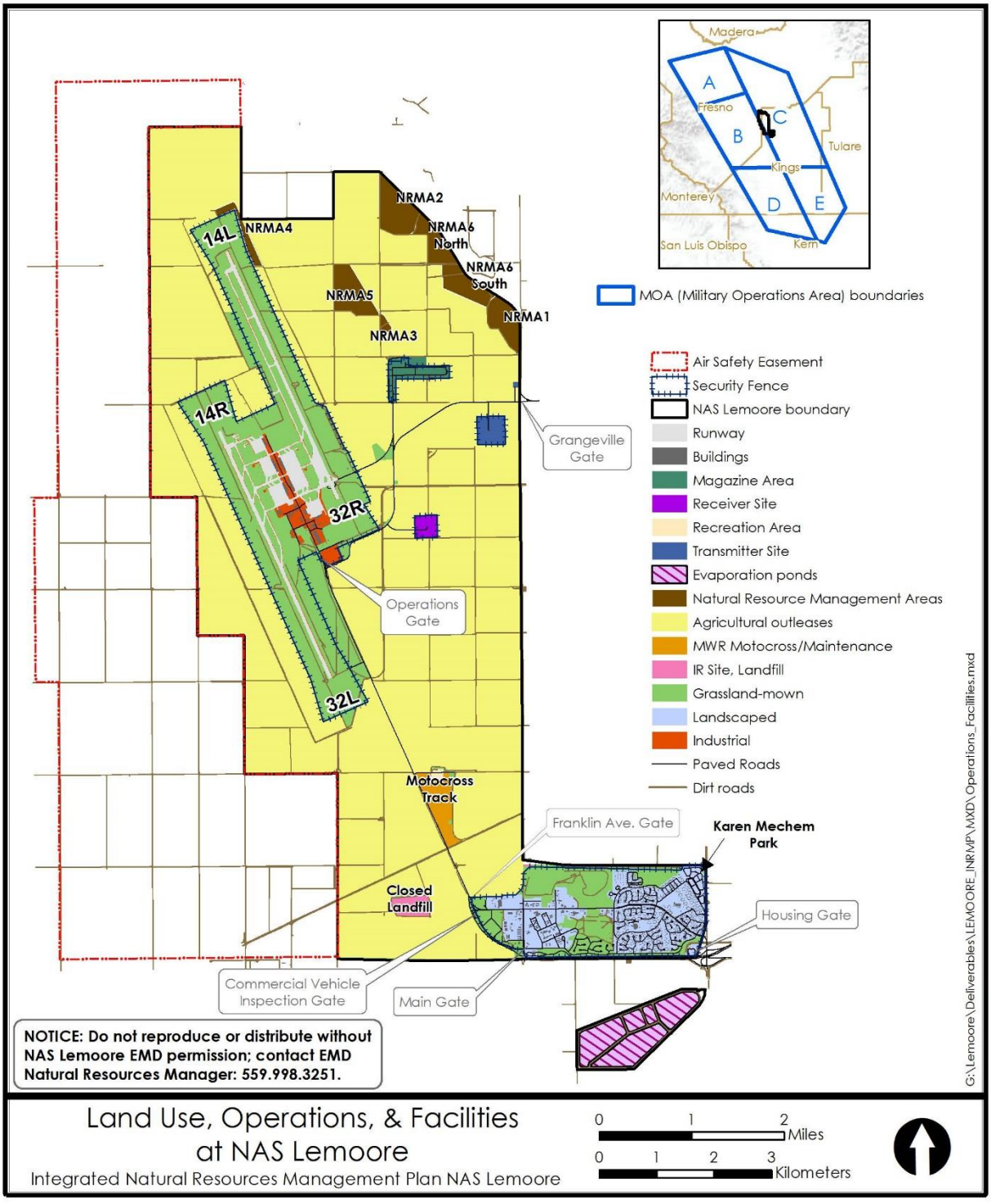
On NAS Lemoore there are two primary developed areas. The Operations Area occupies approximately 4,100 acres (1,660 ha) in the central part of the Station and primarily contains functions that directly support air operations (Map 1-2). The landing field at NAS Lemoore is within the Operations Area and consists of two parallel runways, 14R/32L and 14L/32R, both of which are 13,500 feet (4,114 meters) long.

[3] All population numbers given here are drawn from the U.S. Census Bureau (www.census.gov) and based on the 2010 census.




*Map 1-1. Naval Air Station Lemoore regional map.*[4]

[4] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.




*Map 1-2. Naval Air Station Lemoore property.*[5]

[5] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.

The Administration and Housing Areas each occupy approximately 600 acres (243 ha) at the southeastern end of NAS Lemoore. Housing, personnel support facilities, and recreational facilities are the largest components of these areas with a limited number of training, operations, and administration facilities. These areas contain the majority of landscaping on the Station.

### *Agricultural Outleases*

NAS Lemoore operates approximately 54 agricultural outleases on 12,776 acres (5,170 ha), with 13 lessees (C. Dahlstrom pers. com. 2014, T. Schweizer pers. com. 2014). This land area is leased for agricultural purposes in accordance with 10 USC 2667, Outleasing for Grazing and Agriculture on Military Lands.

### *Natural Resources Management Areas*

Six Natural Resources Management Areas (NRMAs) are located on NAS Lemoore and cover a total of 621 acres (251 ha). They encompass remnant native habitats and continue to be managed for the benefit of wildlife and native plant communities.

More detailed information regarding NAS Lemoore land use, operations, and facilities is provided in Chapter 2.

## 1.4 NAS Lemoore and Tenant's Military Mission

The official mission of NAS Lemoore is to support Navy fleet carrier attack and strike fighter squadrons and the operational training of personnel, to maintain the proficiency of personnel who are already qualified, and to form first-line combatant attack and strike fighter capability (Navy 2005).

NAS Lemoore is a shore activity under the command of Commander, Navy Region Southwest (CNRSW). It is the Navy's largest and only west coast Master Jet Base. NAS Lemoore's major tenant is Commander Strike Fighter Wing, U.S. Pacific Fleet, and its mission is to train, man, and equip west coast strike fighter squadrons. Major tenants on NAS Lemoore include the following:

- Strike Fighter Wing, U.S. Pacific Fleet (SFWP);
- Carrier Air Wing 2, 9, 11, 14, and 17;
- Naval Hospital Lemoore;
- Marine Aviation Training;
- Fixed Wing Strike Fighter Squadrons – 2, 14, 22, 25, 41, 86, 94, 97, 113, 137, 146, 147, 151, 154, and 192;
- Marine Fighter Attack Training Squadron-101;
- Fixed Wing Strike Fighter Squadron-122 Special Augment Unit;
- Strike Fighter Weapons School Pacific;
- Center for Naval Aviation Technical Training Unit;
- Navy Operational Support Center Lemoore;
- Fleet Readiness Center - West;
- SFWP Maintenance Unit;
- Commander, Strike Fighter Wing Pacific Aviation Supply Detachment;
- Personnel Support Detachment Lemoore; and
- Construction Battalion Maintenance Unit-303.

The primary aircraft based at NAS Lemoore is the F/A-18 Hornet Strike Fighter. Currently, there are a total of 280 Legacy Hornets and Super Hornets home-based at NAS Lemoore operating from 15 Strike Fighter Fleet [operational] Squadrons and one Strike Fighter Replacement [training] Squadron (T. Schweizer, pers. com. 2013). The Search and Rescue Squadron and associated Sikorsky MH-60S Seahawk helicopters have been introduced to NAS Lemoore. The Search and Rescue Squadron mission is to provide airborne search, rescue, and Medical Evacuation services for the training airspaces and transit routes utilized by NAS Lemoore-based squadrons, including the offshore Warning Areas situated due west of the central California coastline. The Station is also a potential home-basing site for the F-35 Joint Strike Fighter, in the near future.

Additional details on how NAS Lemoore achieves its military mission are provided in Chapter 2.

# 1.5 NAS Lemoore Special Areas

Per DoDI 4715.03 and Navy Guidance for INRMPs (April 2006), INRMPs are required to address all areas owned, leased, permitted, or controlled by the United States and used by the DoD for military training and testing. NAS Lemoore has two Special Areas that are addressed in this document.

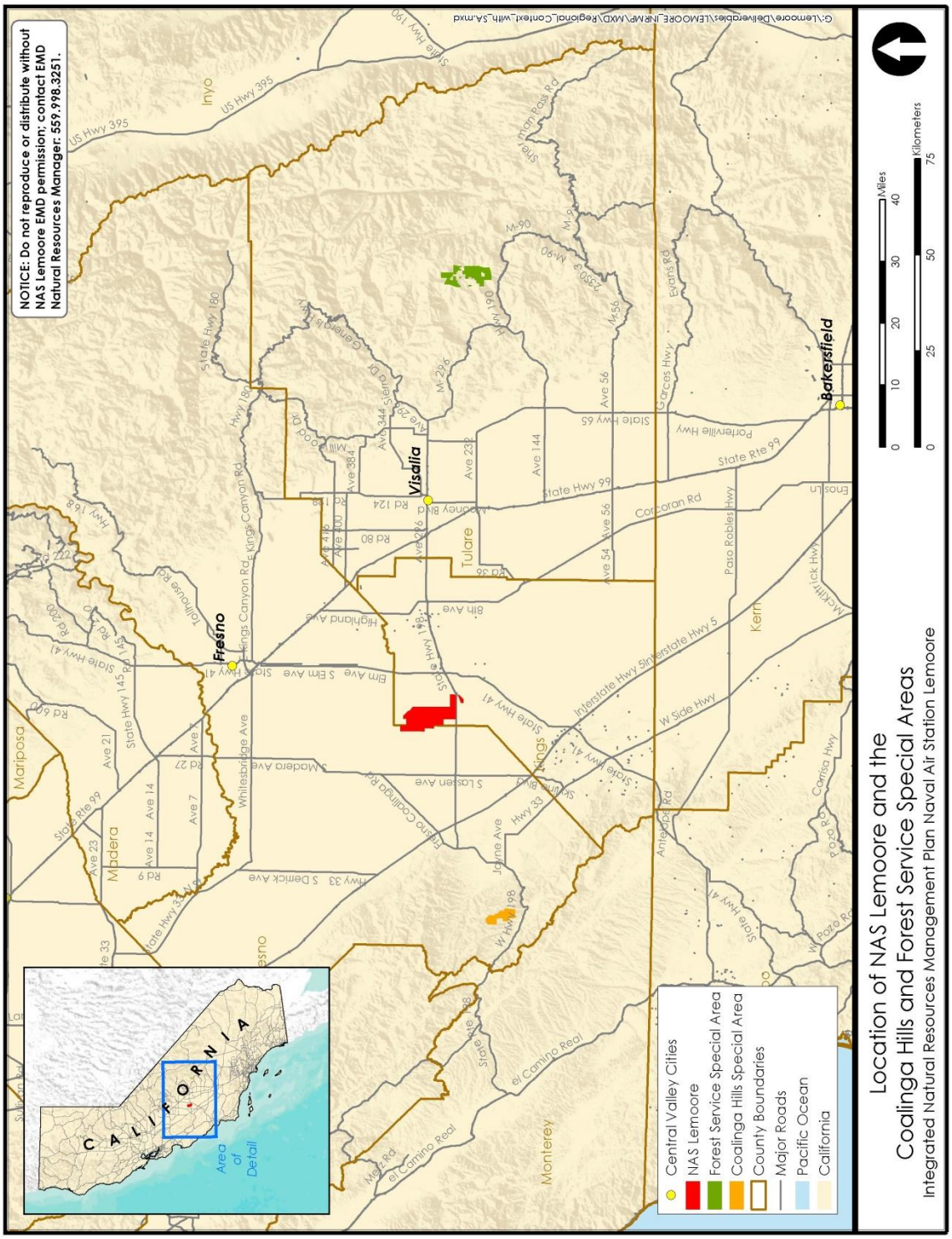
## Forest Service Special Area

The NAS Lemoore FSSA includes several properties totaling approximately 9,165 acres (3,709 ha) in Tulare County, California in the Sequoia National Forest (in the Western Divide Ranger District). Located in the southern Sierra Nevada Mountains, the FSSA ranges in elevation from 4,000 feet (1,220 meters) above sea level to 9,600 feet (2,930 meters) above sea level; it is 60 miles (97 km) directly east of the Station (Map 1-3 and Map 1-4).[6] The FSSA was originally memorialized in a 26 August 1965 Agreement between the USFS and the Navy to allow the Search and Rescue Squadron based at the Station to conduct search and rescue survival training. The 1965 Agreement has no expiration date and would continue to govern the use of the FSSA by the Navy should the Search and Rescue Squadron initiate training at this location (Appendix D). Use of National Forest System lands for military training is also guided by a 1988 Master Agreement between the DoD and the USDA (Appendix D; DoD and USDA 1988), which establishes procedures for planning, scheduling, and conducting authorized military activities.

The FSSA is currently managed by the USFS as part of the southern portion of the Giant Sequoia National Monument (designated on 15 April 2000 by President Bill Clinton, Proclamation 7295; Federal Register April 25, 2000 Vol. 65, No. 80, 24095-24100), the Management Plan for which was updated in August 2012 (U.S. Department of Agriculture 2012). The Navy maintains no jurisdiction or responsibility for managing the FSSA. The Navy is currently in consultation with the USFS regarding Navy training in the FSSA, since it has not been used by the Navy for such activities in the recent past. Should that consultation result in reactivation of training in the FSSA, appropriate permitting, as well as National Environmental Policy Act (NEPA) documentation to analyze any and all anticipated impacts would be required. Any change to the location of the FSSA for Navy training would have to be approved by both the Navy and the USFS and could result in a new agreement to delineate its location and govern its use. Any new agreement, permitting, or NEPA analysis would be incorporated into the NAS Lemoore INRMP at that time.

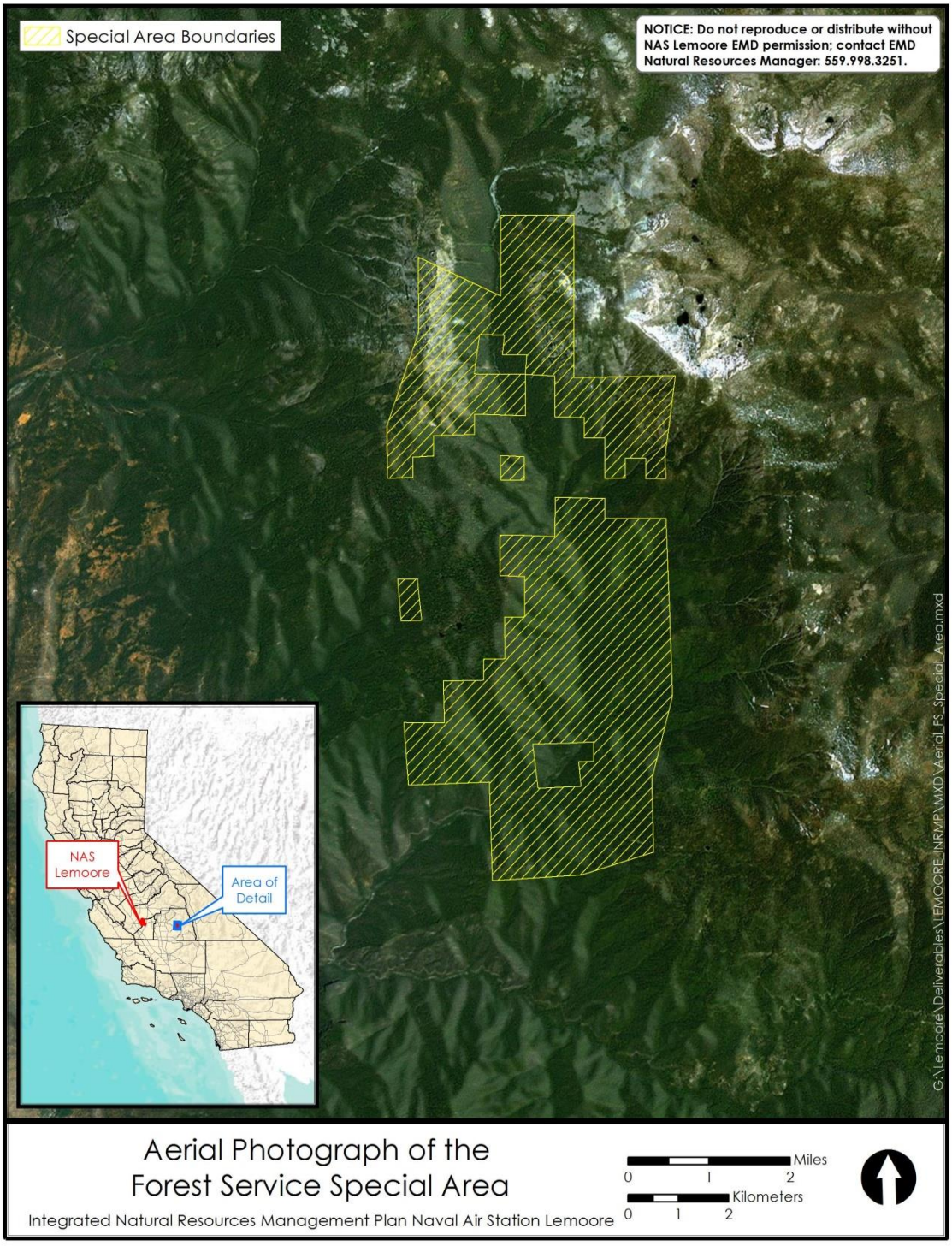
In addition to the Sequoia National Forest, Mountain Home Demonstration State Forest (under the jurisdiction of the California Department of Forestry and Fire) and a number of private cabins are currently located in the vicinity of the FSSA.

[6] The FSSA is 60 miles (97 km) directly east of NAS Lemoore and approximately 110 driving miles (177 km).




*Map 1-3. Regional context of Naval Air Station Lemoore Special Areas.*[7]

[7] All maps were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either, expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.




*Map 1-4. Aerial photo of the Naval Air Station Lemoore Forest Service Special Area.*[8]

[8] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.

### Coalinga Hills Special Area

The permit authorizing search and rescue training in the Clear Creek Management Area in the Coalinga Hills was originally memorialized in a 16 April 1985 Agreement between the U.S. Department of the Interior, BLM, and the Navy to allow the Search and Rescue Squadron based at the Station to conduct search and rescue survival training. The permit would continue to govern the use of the Clear Creek Management Area by the Navy for Search and Rescue Squadron training until December 31, 2022 (Appendix D). The Station CO expressed safety concerns in 1988 about continued use of the area due to its proximity to closed asbestos mines in the area.

The current NAS Lemoore CHSA is comprised of one property totaling approximately 4,407 acres (1,783 ha) in Fresno County, California. Located along the Juniper Ridge of the interior coastal foothills of the Diablo Range, the CHSA is located approximately 31 miles (50 km) west-southwest of the Station (Map 1-3 and Map 1-5).[9] The CHSA in the Juniper Ridge area of the Coalinga hills is currently managed by the BLM. The Right-of-Way Permit Area authorized use of 3,921 acres (1,587 ha) of the area. The Navy maintains no jurisdiction or responsibility for managing the CHSA. Any change to the location of the CHSA for Navy training would have to be approved by both the Navy and the BLM and could result in a new agreement to delineate its location and govern its use. Any new agreement, permitting, or NEPA analysis would be incorporated into the NAS Lemoore INRMP at that time.

# 1.6 Achieving INRMP Success

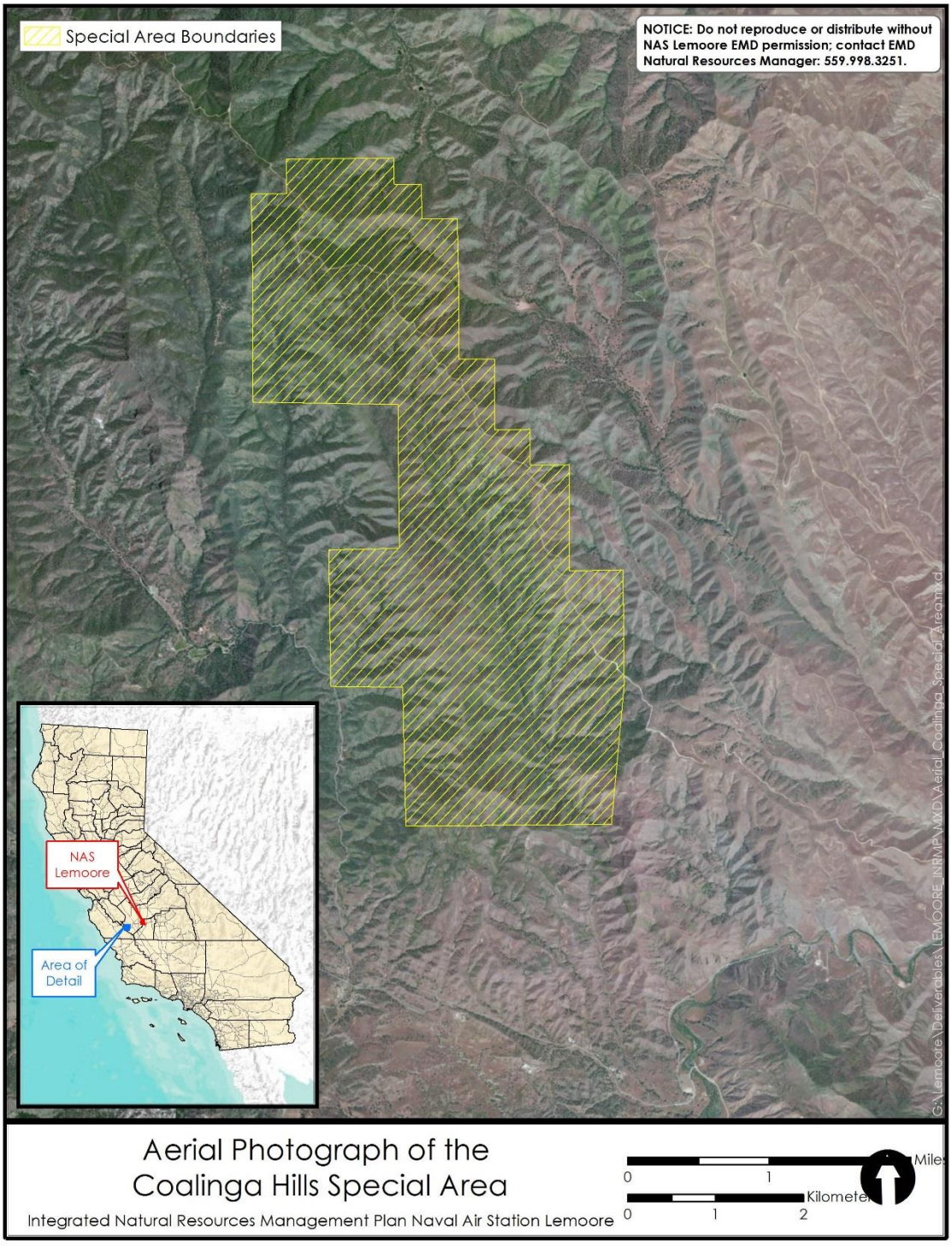
## 1.6.1 INRMP Implementation

Secretary of the Navy Instruction 6240.6E assigns responsibility for establishing, implementing, and maintaining the natural resources programs under the jurisdiction of Secretary of the Navy to Commander, Navy Installations Command (CNIC). At the installation level, the CO ensures that military operations and natural resources conservation measures are integrated and consistent with stewardship and legal requirements through the development of the INRMP.

### 1.6.1.1 Funding Implementation

For the purposes of this INRMP, the terms compliance and stewardship have specific meanings as criteria for implementing project action lists. Overall project or activity rankings are aligned with Naval Operations N45 Environmental Readiness Levels to ensure the installation's highest priorities are promoted in future budget cycles. Environmental Readiness Level 4 (the highest priority) is assigned to projects or activities based on compliance with legal requirements, such as the Endangered Species Act, Clean Water Act, and Migratory Bird Treaty Act. Alternatively, a project or activity may be considered good land stewardship but is not considered a legal obligation, and this investment may yield only undefined future benefits. High priority compliance project actions to comply with legal obligations are generally funded within annual budget constraints; however, future federal budgets could decrease available funding for both compliance and lower ranked stewardship project actions. Annual funding for all conservation projects are ranked on a regional basis and each project action must compete for available funds among multiple Navy installations. It is the Navy's policy to promote long-term mission and environmental sustainability measures, including good stewardship practices, and all valid compliance and stewardship requirements are submitted for consideration during budget-programming cycles.

[9] The CHSA is 31 miles (50 km) directly west of the NAS Lemoore and approximately 45 driving miles (72 km).




*Map 1-5. Aerial photo of Naval Air Station Lemoore Coalinga Hills Special Area.*[10]

[10] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.

The various project ranking scenarios are described in Chapter 6.

#### 1.6.1.2 Anti-Deficiency Act

The Navy and NAS Lemoore intend to implement actions in this INRMP within the framework of regulatory compliance, national Navy mission obligations, anti-terrorism and force protection limitations, and funding constraints. The execution of any of the INRMP project actions will be dependent on the availability of appropriate funding sources. Any requirement for the obligation of funds for projects or actions in the INRMP shall be subject to the availability of funds appropriated by Congress. None of the proposed projects or actions shall be interpreted to require obligations or payment of funds in violation of any applicable federal law, including the Anti-Deficiency Act, 31 USC § 1341.

### 1.6.2 Mission Sustainability and the INRMP "No Net Loss" Requirement

Under the Sikes Act (as amended), NAS Lemoore must ensure that there is no net loss to the military mission due to implementation of this INRMP in conserving natural resources. To do this, the link between Navy land use, environmental compliance, and the mission of supporting Navy strike fighter squadrons needs to be described. The INRMP attempts to anticipate and protect against all encroachment on resources available for fulfilling the military mission, and provide for the protection of environmental resources that are key to sustaining the military mission.

The U.S. Congress endowed the Navy with public lands as an investment in national security. The common denominator between national security and public land stewardship is the concept of sustainability. Sustainability is a relative condition of the ecosystem and the military mission that can be measured. Measures of sustainability are scale-dependent.

The sustainability and no net loss of the resources that support NAS Lemoore are considered further in Chapter 5. Sustainability may be considered as having at least several components in the context of this INRMP, including: facilitation of military use now and into the future (including a safety buffer on land and in the air); security considerations for information, property, and human life; clean air quality without dust; soil and water resources protection; ecological integrity; and protection of cultural resources.

For the purpose of this INRMP, an impact to mission accomplishment has occurred when any of the above are constrained or when one of the following conditions occurs:

1. Access to land and airspace is constrained. In particular:
   - Availability of sufficient space to safely support strike fighter training;
   - Capability to support essential activity tempo and intensity to attain sufficient readiness to deploy under surge (high tempo) conditions; and
   - Capability to successfully coordinate and deconflict environmental compliance and safety and security requirements.
2. Security and safety of life, property, or information for current and future use is impaired. The ability to keep the airfield clean of hazardous material aids in assuring the safety of the range, not just for current training purposes but potentially for an alternate future use. Maintenance of safety and security measures requires:
   - Security clear zones, including cooperation from neighboring landowners;
   - Ability to secure water supply in emergencies; and

- Compliance with anti-terrorism force protection standards for construction which include landscaping described in DoDI 2000.16, DoD Antiterrorism Standards 02 October 2006.

3. Soil and water resources or supply are impaired such that environmental compliance has become a problem and irreparable damage has occurred. Soil surface stabilization is needed to avoid foreign debris on the airfield, minimize erosion, and maximize opportunities for soils to self-stabilize after disturbance. Water for agricultural purposes at NAS Lemoore is essential to most functions, including safety at the airfield. Protection of soil and water resources will protect the capacity of the ecosystem to recover from disturbance, sustain its natural carrying capacity to support plants and animals, and provide as natural a landscape as possible. Water supply, intact natural hydrologic processes, and water quality are essential to most ecological functions, including recoverability from disturbance and sustainability of resources at strategic sites.
4. Ecological integrity is irreparably harmed. Compliance under the Sikes Act (as amended) for mission sustainability (no net loss) is also defined in this Plan to include the ecological integrity of NAS Lemoore lands still dominated by natural resources, since this integrity will carry these lands into the long-term future with all the elements that allow self-recovery to occur. Keeping all the components (habitats and species) that allow the ecosystem to function at various scales and at the highest level possible, given the mandate for use of natural resources (including agriculture), is a component of sustainability. Use of management focus (indicator) species,[11] when combined with physical biological disturbance indicators, are a means to track whether management is keeping all the key ecosystem components and relationships intact.
5. Cultural resources compliance is impaired. Long-term strategies include cultural resources surveys of areas that are not targeted for immediate use. Such investigations aid in long-term planning and also contribute to the archaeological and historical context that is developed to evaluate resources.

## 1.6.3 Relationship to Other Operational Plans

As required by DoD policy, this INRMP integrates the principal objectives and guidelines from several key NAS Lemoore plans (which are interrelated with natural resources planning), and establishes a unified approach to natural resources management. Coherency with these plans is a function of this INRMP and is detailed in Chapters 4 and 5. The plans include:

### Master Plan

Land use planning at NAS Lemoore is guided by the Station's Master Plan (Navy 1992). The Master Plan develops and facilitates the orderly and realistic development of NAS Lemoore by integrating short-term land use activities with long-term management objectives. The Master Plan establishes an infrastructure, development, and land use layout that supports the long-term mission and future growth of NAS Lemoore. It also includes a Capital Improvement Plan that identifies short-term construction projects at NAS Lemoore. One of the primary land use issues addressed in the NAS Lemoore Master Plan is ensuring the protection of military aircraft personnel, ground support crew, Station residents, and local citizens from air operation accidents. The primary means of ensuring this protection is by designing special use airspace and identifying land use planning requirements.

[11] Management focus species are those identified in this INRMP and by NAS Lemoore for which there is a special management focus. Indicator species are those used in monitoring for habitat and ecosystem health.

## Air Installation Compatibility Use Zones

The Navy implements the Air Installation Compatibility Use Zones (AICUZ) program (Navy 2010b) as a component of the Master Plan. The purpose of the AICUZ program is to achieve compatibility between air installations and neighboring communities by:

- Protecting the health, safety, and welfare of civilians and military personnel by encouraging land use that is compatible with aircraft operations;
- Protecting Navy and Marine Corps installation investment by safeguarding the installation's operational capabilities;
- Reducing noise impacts caused by aircraft operations while meeting operational, training, and flight safety requirements, both on and in the vicinity of air installations; and
- Informing the public about the AICUZ program and seeking cooperative efforts to minimize noise and aircraft accident potential impact by promoting compatible development in the vicinity of military air installations.

The Navy requires that an AICUZ program also address accident potential zones (APZs) and imaginary surface restrictions. APZs identify areas that would most likely be affected by an aircraft accident. Three types of APZs are identified—the Clear Zone, APZ I, and APZ II. These are described in Chapter 2.

## Integrated Cultural Resources Management Plan

The Integrated Cultural Resources Management Plan for NAS Lemoore (Navy 2012c) is a dynamic five-year planning tool for the management of cultural resources on the installation. It presents information regarding the types of cultural resources that have been previously identified (e.g., Navy 1997; Milliken and Young 2000) or are likely to be encountered in facilitating the installation's mission, and procedures for management of these resources in accordance with federal statutes, regulations, EOs, and instructions. The Integrated Cultural Resources Management Plan provides a plan for compliance strategies and standard operating procedures for management of the cultural resources program.

## Integrated Pest Management Plan

The NAS Lemoore Integrated Pest Management Plan (Naval Facilities Engineering Command [NAVFAC] Southwest 2010) puts pesticide management within the framework of the DoD and Navy Environmental Management System (EMS). The purpose of the pest management program is to aggressively control, by mechanical or chemical methods, all noxious and undesirable weeds, rodents, insects, and other pests on NAS Lemoore's improved grounds and agricultural outlease parcels. This program includes annual monitoring of pesticide applications on all leased lands and subsequent review of pest management plans from individual agricultural lessees. The Integrated Pest Management Plan also supports reduced reliance on chemical means of pest control, per DoDI 4150.07 (DoD Pest Management Program 29 May 2008) and Naval Operations Instruction 6250.4C (Navy Pest Management Programs 11 April 2012). It is included in Appendix E.

## Bird/Animal Aircraft Strike Hazard Plan

The NAS Lemoore Bird/Animal Aircraft Strike Hazard (BASH) Plan (NAS Lemoore Instruction 11015.1B; NAS Lemoore 2012) supports the zero-mishap safety policy of the installation. Recent updates incorporated the results of a Wildlife Hazard Assessment performed by the U.S. Department of Agriculture (Lang 2012). It identifies specific guidelines, strategies, and procedures, as well as roles and parties responsible to achieve its implementation. Management strategies to reduce BASH incidents include wildlife avoidance and control through harassment, grounds maintenance, habitat modification, and depredation when necessary. The key to this program is to track BASH incidents through reporting

and to collect and analyze remains. This plan is reviewed and updated annually by the NAS Lemoore Aviation Safety Officer. It is included in Appendix D.

## Soil and Water Conservation Plan for Agricultural Outleases

The Soil and Water Conservation Plan for Agricultural Outleases provides strategies, standards, required actions, and restrictions according to which agricultural outlease holders should manage their leased parcels to conserve soil resources and consumption of water resources. It also regulates the use of apiaries, defines and describes reimbursable projects, and establishes the rate structure for groundwater use for those parcels with access to groundwater for irrigation. The original plan was written by the Soil Conservation Service (the agency precursor to the Natural Resources Conservation Service); it is updated as needed by NAVFAC Southwest. The plan is included as an exhibit with each agricultural outlease agreement. As necessary, it provides specific guidance per individual parcel to reflect any unique constraints.

## Burrowing Owl Management Plan

The NAS Lemoore Burrowing Owl Management Plan (Rosenberg et al. 2009) guides the management of burrowing owl (*Athene cunicularia*) resources at the Station. The plan provides guidelines for monitoring and protecting burrowing owls and their habitat. It identifies current potential limiting factors at NAS Lemoore, which are the availability of burrows, vegetation structure, winter food, and pesticide exposure. Activities include researching intensive demographic and space use, which is part of a state-wide research program, protecting owls during construction activities, creating native grasslands, avoiding disking in grassland areas, and using mowing and prescribed burns to manage vegetation. In addition, the current management plan suggests a trigger point of 32 pairs (total Station population), at which the Navy should initiate an investigation to determine the reason for decline. This plan is projected to be updated in 2014. The current plan is included in Appendix E.

## San Joaquin Kangaroo Rat Management Plan

The NAS Lemoore San Joaquin Kangaroo Rat Management Plan (Morrison and Smallwood 2003a) guides management practices in NRMA 5 to benefit the federally and state endangered San Joaquin kangaroo rat (*Dipodomys nitratoides*). Management recommendations in the plan are based on studies conducted by the Endangered Species Recovery Program from 1995 to 1998 and later studies by K.S. Smallwood and M.L. Morrison (e.g., Smallwood and Morrison 2011). The NAS Lemoore Environmental Management Division (EMD) has determined that additional biological data are needed to update this plan. To this end, additional research and population surveys are anticipated and will be implemented during the timeframe of this INRMP. NAS Lemoore consults with the U.S. Fish and Wildlife Service (USFWS) to determine appropriate management strategies for the San Joaquin kangaroo rat in NRMA 5.

## NAS Lemoore Habitat Maintenance Prescription Burn Plan

The NAS Lemoore Habitat Maintenance Prescription Burn Plan (NAS Lemoore 2010) describes the methods, goals, and safety requirements for implementing prescribed burns in NRMA 5. The purpose of the burns is to manage the vegetative complex of invasive, Mediterranean, annual grasses and weeds that degrade habitat for the federally and state endangered San Joaquin kangaroo rat in NRMA 5. Periodic burning opens up the habitat, removes the heavy thatch created by exotic grasses, and allows native vegetation the opportunity to reestablish; it appears to be highly beneficial to the survival of kangaroo rats.[12] They also help to reduce threat of wildfires. Scheduling the burns is primarily determined by air quality and availability of resources; all burning is conducted in conformance with San Joaquin Valley

[12] Previous burns in NRMA 5 (2002, 2005, 2007) have improved habitat for the San Joaquin kangaroo rat and been found to present very little risk to the population per implementation of the burn methods and safety measures described in the plan.

Air Pollution Control District (hereinafter Air District) requirements. Prior burn plans for NAS Lemoore had allowed for prescribed burning in other areas of the Station to reduce the risk of wildfire. It is considered the best method for clearing accumulated tumbleweeds and weedy species through eliminating surface vegetation and a major portion of accumulated seed bank; however, such burning is no longer as freely permitted by the Air District. Prescribed burning is now restricted to NRMA 5 for habitat management purposes only, as regulated by this plan. It is included in Appendix E.

### Installation Restoration Program Site Management Plan

NAS Lemoore is planning and executing environmental restoration activities in response to releases of hazardous substances and contamination. The Installation Restoration Site Management Plan (Navy 2012b) covers the status, management, response strategy, and action items related to these environmental restoration activities and closure for each site. It establishes a strategy and sets priorities for environmental investigation and restoration. The plan is updated periodically and its activities satisfy the corrective action obligations of the Navy under the Resource Conservation and Recovery Act; Comprehensive Environmental Response, Compensation and Liability Act; and the National Oil and Hazardous Substances Pollution Contingency Plan (Title 40 of the Code of Federal Regulations, Part 300).

### Hunting Instruction

NAS Lemoore maintains a Hunting Instruction (NAS Lemoore Instruction 1710.13J, 13 May 2013) that describes the rules and regulations of the hunting opportunities on the Station. It includes a map illustrating areas on the Station that either allow or do not allow hunting. A copy of the latest instruction is included in Appendix D.

## 1.7 INRMP Vision, Goals and Objectives

The NAS Lemoore Natural Resources Management Program is managed by the Public Works Department's (PWD) EMD and supports the Navy's mission through responsible stewardship of the Station's natural resources. NAS Lemoore seeks to use integrated natural resources management and principles of ecosystem management to ensure ecosystem viability and biodiversity in support of the military mission and training activities, while providing recreation and education opportunities to Station personnel and, where appropriate, the public.

This INRMP is an update to the NAS Lemoore INRMP and Environmental Assessment, published in June 2001 (Navy 2001b). The original NAS Lemoore Natural Resources Management Plan was published in 1995 (Navy 1995). The 2001 INRMP Environmental Assessment remains in place for this INRMP update.

The INRMP's purpose is to support the vision of the CO by charting the management and use of natural resources, establishing conservation priorities, and providing a basis for formulating budgets. Where appropriate, specific methods for reaching stated objectives are outlined within the document. These may change as evolving resources and priorities dictate and are not meant to be a prescriptive or exhaustive list.

The INRMP is intended to be a living document and will be updated annually as needed to keep the material, objectives, and strategies relevant to current conditions. The INRMP and any proposed revisions will be reviewed every year during the annual INRMP metrics review meeting. Signatures will be requested each year from the two primary stakeholders (USFWS and California Department of Fish and Wildlife [CDFW]) and the NAS Lemoore CO, documenting concurrence for operation and effect.

The CO of NAS Lemoore issued an Environmental Policy Statement (Navy 2009) stating that NAS Lemoore is committed to actively promoting mission readiness through environmental stewardship across the Station's activities. To achieve this, NAS Lemoore commits to:

1. Being environmentally responsible neighbors where we operate to ensure public health and safety and protection of the environment.
2. Preserving significant aspects of the natural and cultural environment.
3. Developing and continually improving operation and technologies that minimize solid and hazardous waste, prevent air and water pollution, and minimize health and safety risks.
4. Complying with applicable environmental federal, state, and local regulations, DoD and Navy policies, and other available requirements.
5. Ensuring the responsible use of energy and water, including conservation and improved efficiency.
6. Sharing appropriate pollution prevention and technologies, knowledge, and methods.
7. Participating in efforts to improve environmental protection and understanding in our communities.
8. Ensuring this policy is communicated to all military, civilian personnel, contractors, and to the public to encourage continual improvement within the region.

## Vision and Goals

The vision for the INRMP is that the Navy achieves its current and evolving mission requirements while conserving its natural resources. The INRMP's goal is to:

*Provide the guidelines, means, and mechanisms for assuring long-term sustainability and vitality of both the military mission and the health of NAS Lemoore's natural resources. This will be accomplished such that natural resources conservation, restoration, and enhancement can proceed without loss to the military mission.*

This INRMP aims to improve the condition of an ecosystem that contains land and water dedicated to the support of national security, while achieving long-term certainty and permanence for the Navy mission at all associated properties. It seeks maximum landscape and natural ecosystem health, productivity, biodiversity, and recovery of habitats and Species At Risk,[13] and to lead the Navy in institutionalizing a Navy Conservation Ethic.

To achieve this Vision and Goal, work should contribute to the following standards of success:[14]

- Navy mission accomplishment that is unimpeded;
- A net gain in agricultural productivity, natural biodiversity, and recovery of Species At Risk;
- Natural resources that are resilient and recover naturally with minimal human intervention;
- Navy projects that are not delayed and that contribute no net loss to conservation goals;

[13] Species At Risk are defined in DoDI 4715.03: "Includes species on lists maintained by USFWS, National Oceanic and Atmospheric Administration Fisheries Service, and state agencies as threatened or endangered or candidates for such lists. Species At Risk also include species whose designation as threatened or endangered that may require conservation efforts significantly impacting a military mission." DoDI 4715.03 goes on to state: "To the extent practicable, all DoD Components shall establish policy and procedures for the management of species at risk to prioritize proactive management of those species that, if listed, could adversely impact military readiness. Program objectives shall focus on efforts that have the greatest potential to prevent the listing of Species At Risk (e.g., habitat conservation, planning level surveys, monitoring). Protecting these species is critical; therefore, the installation INRMP should consider funding for Species At Risk protection a high priority."

[14] These standards of success are general guidelines for achieving the Vision and Goals of this INRMP over the long term. Ideally, management and project actions at NAS Lemoore will contribute to some if not all of these standards. It is possible that some necessary actions may lead to a conflict among these standards in the short term. In such cases, mission accomplishment in compliance with relevant natural resources laws and regulations is most important. Beyond that, such conflicts will be handled on a case-by-case basis.

- Interagency partnerships that result in mutual benefits and improved cost-effectiveness of the work undertaken; and
- A growing internal (NAS Lemoore) and external (public) conservation ethic as measured by volunteerism, public interest, and participation.

### Definition of Planning Terms

INRMPs have specific objectives and tasks shaped by DoD guidelines and directives, laws and regulations, public needs, public values, ecological theory and practice, and management experience. A goal statement is necessary for setting the course towards a successful plan. The planning terms used in this document cover a gradient of specificity and durability, ranging from a very broad, enduring goal, to resource- or topic-specific objectives, which in turn encompass specific strategies or tasks (Table 1-1). For each topic area in Chapters 4 and 5, they are presented in a step-down approach.

*Table 1-1. Planning definitions.*

| Hierarchy | Definition |
|---|---|
| Goal | Broad statement of intent, direction, and purpose. An enduring, visionary description of where you want to go, an end outcome. A goal is not necessarily completely attainable. It does, however, describe a desired outcome related to the mission, rather than an activity or a process. |
| Objective | Specific statement that describes a desired future condition or successful outcome. Can be quantitative. Should be followed by a "standard," which is an observable indicator by which successful attainment of a condition stated in the objective is measured. "How do we know we are making progress or have attained the desired condition or successful outcome?" Should be good for at least five years. |
| Strategy | Explicit description of ways and means chosen to achieve objectives or standards. "What are we going to do about it?" |
| Task | Specific step, practice, or method to get the job done, usually organized sequentially with timelines and duty assignments. These go out of date quickly and should be updated annually. |

## 1.8 Key Issues

The Navy recognizes that healthy and viable natural resources aid in supporting the military mission at NAS Lemoore by minimizing hazards to aircraft operations and by providing a safety buffer for potential accidents. Effective natural resources management provides a security buffer to incompatible land uses, facilitates dust control, minimizes the potential for Foreign Object Damage, mitigates BASH, and provides fire control in the event of an accident, lightning strikes, etc. It also enhances the quality of life for Navy personnel and their dependents by providing outdoor recreational opportunities. The following natural resources issues have been identified, which are connected to sustaining the military mission at NAS Lemoore.

- BASH: A goal of effective land management at NAS Lemoore is to discourage wildlife activity near runways and operational areas. This is important as the speed and number of aircraft operating at the Station increases.
- Maintaining an encroachment buffer: A buffer of compatible land uses and buildings around the Station provides protection for NAS Lemoore installation activities and natural resources. This is important as the region's population expands and it includes maintaining the status quo in terms of the type and heights of buildings in proximity to NAS Lemoore.
- Maintaining agriculture: Agriculture at NAS Lemoore provides the safety functions listed above and is compatible with operation of the military airfield; however, it is vulnerable due to future projections of decreased surface water availability and its dependence on groundwater, which has been over-utilized in the Central Valley and is not necessarily renewable. Managing these water sources sustainably is important for the military mission.

- Dust abatement and air quality: Dust is a Foreign Object Damage hazard, and when it reduces visibility for pilots it increases risk to operations. At NAS Lemoore, blowing dust is frequent, caused by a semiarid climate, soil conditions, and wind patterns, and it contributes to the spread of soil-borne fungal spores that cause Valley Fever. Natural resources management at NAS Lemoore addresses dust by providing suitable ground cover to control blowing soil.

# 1.9 Roles, Responsibilities, and Stakeholders

Much of the natural resources management on NAS Lemoore is shared across adjoining jurisdictions. Close collaboration and partnering is required between the Navy and external stakeholders (see Section 1.9.3 External Stakeholders), in order to be cost effective, provide consistent management across jurisdictions, avoid redundancy, and optimize the use of scarce resources.

## 1.9.1 Navy Roles and Responsibilities

The following is a list of roles and responsibilities of the Navy chain of command in supporting the installation and development, revision, and implementation of this INRMP. Policy leadership and liaison with non-Navy partners is provided by CNRSW N40, NAVFAC Southwest, and NAS Lemoore.

### Chief of Naval Operations

CNO serves as the principal leader and overall Navy program manager for the development, revision, and implementation of this INRMP. CNO regularly updates policy and issues specific implementing guidance based on new or changing laws and regulations for the development, revision, and implementation of the INRMP and associated NEPA documentation. CNO addresses and coordinates resolution of natural resources issues affecting the Navy mission. Additionally, CNO approves all INRMP projects prior to submittal to regulatory agencies for signature.

### Commander, Navy Installations Command

CNIC reviews the entire INRMP. Their role is to ensure that all lands under the control of the Navy are evaluated for significant natural resources. CNIC ensures that those installations with significant natural resources prepare, maintain, and implement a Natural Resources Management program. This includes development, implementation, review, and necessary updates and revisions of INRMPs. CNIC maintains and upgrades, as necessary, a web-based Navy Conservation website, which includes Environmental Program Requirements (EPR)-web. EPR-web is a web-based program in which all installations submit their natural resources projects for approval during the Program Objective Memorandum cycle.[15] Program Objective Memorandum is the Navy's annual process to budget funding four years in advance.

### Navy Region Southwest

Regional Commanders ensure that installations comply with DoD, Navy, and CNO policy on INRMPs and their associated NEPA documentation. They ensure that installations under their purview review their INRMPs for operations and effect. They ensure the programming and budgeting of resources necessary to maintain and implement INRMPs, which involves the evaluation and validation of EPR-web based project proposals and the funding of installation Natural Resources Management staff. Navy Region

[15] A Program Objective Memorandum is a recommendation from the Services and Defense Agencies to the Secretary of Defense concerning how they plan to allocate resources for program(s). The Program Objective Memorandum covers the 5-year Future Year Defense Program and presents the Services and Defense Agencies proposal on how they will balance their allocation of available resources. It is submitted each August and includes an analysis of missions, objectives, alternative methods to accomplish objectives, and allocation of resources. More information on the Program Objective Memorandum cycle is available at: http://www.acqnotes.com/Acquisitions/Program%20Objective%20Memorandum%20%28POM%29.html.

Southwest (NRSW) maintains a close liaison with the INRMP signatory partners (USFWS and CDFW) and other INRMP stakeholders. NRSW endorses INRMPs prior to finalization and promotes and coordinates their implementation through CNIC.

### Naval Facilities Engineering Command Southwest

NAVFAC Southwest is responsible for the planning, engineering/design, construction, real estate (including the acquisition and disposal of), and environmental services, in a six-state area on the West Coast. The command also provides public works services such as transportation, maintenance, utilities/energy delivery, facilities management, and base operations support to Navy and Marine Corps installations within its geographic area of responsibility, as well as support to other federal agencies. NAVFAC Southwest assists in implementing Navy policy to ensure stewardship of Navy lands and resources and compliance with natural resources laws and regulations. It also provides technical expertise to evaluate and validate funding requests for natural resources projects. NAVFAC Southwest also provides contracting authority, technical oversight, planning documents, and contracts (including Cooperative Agreements) for installations within its jurisdiction.

## 1.9.2 Internal Stakeholders

The following is a list of internal stakeholders that support the development, revision, and implementation of this INRMP. Approval Officials review and approve the INRMP.

### Commanding Officer

The NAS Lemoore CO is responsible for managing and operating NAS Lemoore and all associated property. Operational health and safety is a primary concern, so the CO must ensure that the Natural Resources Management Program supports the military mission and does not pose risks to pilots or other personnel. Navy policy for safety is to manage for a zero mishap rate.

The CO ensures the preparation, completion, and implementation of INRMPs and associated NEPA documentation. Their role is to:

- Act as stewards of natural resources under their jurisdiction and integrate natural resources requirements into the day-to-day decision-making process;
- Ensure natural resources management and INRMPs comply with all natural resources related federal regulations, directives, instructions, and policies;
- Ensure implementation of the INRMP through annual evaluations of the natural resources metrics;
- Involve appropriate tenant, operational, training, or research and development commands in the INRMP review process to ensure no net loss of military mission;
- Designate a Natural Resources Manager/Coordinator responsible for the management efforts related to the preparation, revision, implementation, and funding for INRMPs (Appendix F), as well as coordination with subordinate commands, installations, and other federal and state agencies;
- Involve appropriate Navy Judge Advocate General or Office of the General Counsel legal counsel to provide advice and counsel with respect to legal matters related to natural resources management and INRMPs; and
- Endorse INRMPs via the CO's signature.

This INRMP is the direct vehicle for accomplishment of many of the responsibilities of the CO.

### Public Works Department

NAVFAC Southwest's NAS Lemoore PWD plans, designs, constructs, repairs, and maintains all real property facilities and utility plants on NAS Lemoore, in addition to providing housing and basic services (utilities, refuse collection, pest management, fire protection, and custodial services) for all personnel in support of the NAS Lemoore community. The PWD also researches, develops, and implements the NAS Lemoore Master Plan, in which the INRMP is identified as a supporting document.

### Environmental Management Division

NAS Lemoore PWD's EMD, as delegated by command directive, is responsible for the preparation and implementation of this INRMP. Acting through the Natural Resources Manager, the EMD is responsible for management of natural resources as part of the overall NAS Lemoore environmental program. Areas of responsibility include NEPA, air and water resources, solid and hazardous waste, cultural resources, and natural resources, including agronomy, pest management, wildlife management, and outdoor recreation. The NAS Lemoore EMD staff provides technical support. Appendix F contains the NAS Lemoore Natural Resources Manager Designation Letter.

### Approving Officials

- Installation CO
- NRSW Natural Resources Program
- NAVFAC Southwest Natural Resources Program
- NAVFAC Southwest PWD EMD

### Other Internal Stakeholders

- All NAS Lemoore departments
- NAS Lemoore tenant commands
- CNRSW (N40)
- NRSW Public Affairs Office
- NRSW Office of Counsel
- NAVFAC Southwest PWD
- NAVFAC Southwest Office of Counsel
- NAVFAC Southwest Integrated Product Team

## 1.9.3 External Stakeholders

External Sikes Act Stakeholders review and sign the INRMP. Other External Stakeholders have the opportunity to review the INRMP.

### 1.9.3.1 External Sikes Act Stakeholders (Concurring Officials)

The Sikes Act (as amended) requires the Secretary of the Navy to prepare INRMPs in cooperation with the USFWS and state wildlife agencies, which in California is the CDFW. An INRMP reflects mutual agreement of the parties concerning the conservation, protection, and management of fish and wildlife resources. Mutual agreement should be the goal with respect to the entire INRMP. No element of the Sikes Act (as amended) is intended to either enlarge or diminish the existing responsibility and authority of the wildlife agencies concerning natural resources management on military lands. A Memorandum of Understanding, signed in July 2013, establishes a cooperative tripartite agreement between the DoD, the U.S. Department of the

Interior USFWS, and the state fish and wildlife agencies as represented by the International Association of Fish and Wildlife Agencies recognizing the partnerships necessary to prepare, review, and implement INRMPs on military installations. This tripartite agreement is presented in Appendix D.

This INRMP has been prepared in accordance with the Sikes Act (as amended) and in cooperation with USFWS and CDFW. Implementation of this INRMP and any changes in planned activities will be undertaken with the cooperation and agreement of USFWS and CDFW. This INRMP is a living document and will be updated to reflect improved management practices, changes in proposed actions within NAS Lemoore, and agency comments or concerns about ongoing or proposed activities. DoD policy requires installations to review INRMPs annually in cooperation with the two primary parties to the INRMP (USFWS and the state fish and wildlife agency). Annual reviews facilitate adaptive management by providing an opportunity for the parties to review the goals and objectives of the INRMP, as well as establish a realistic schedule for undertaking proposed actions. As this INRMP is considered a long-term document with no set expiration date, the annual review process allows a yearly opportunity for updating the plan when necessary.

#### 1.9.3.2 Other External Stakeholders

- USFS
- BLM
- Natural Resources Conservation Service
- Fresno County and Kings County Agricultural Commissioners
- San Joaquin Valley Endangered Species Recovery Program
- Audubon Society of Kings County, Tulare County, and Fresno County

## 1.10 Management Approaches

### 1.10.1 Ecosystem Management

In an effort to manage from a broader perspective than merely funding classifications, the DoD and the Navy have adopted a policy of ecosystem management for INRMPs (DoDI 4715.03 and 5090.1C CH-1).

DoDI 4715.03 describes ecosystem management as "a goal-driven approach to managing natural and cultural resources that supports present and future mission requirements; preserves ecosystem integrity; is at a scale compatible with natural processes; is cognizant of nature's time-frames; recognizes social and economic viability within functioning ecosystems; is adaptable to complex and changing requirements; and is realized through effective partnerships among private, local, state, tribal, and federal interests. Ecosystem-based management is a process that considers the environment as a complex system functioning as a whole, not as a collection of parts, and recognizes that people and their social and economic needs are a part of the whole."

This approach integrates ecological, economic, and social factors, taking a long-term view of human activities, including military uses, and biological resources as part of the same environment (5090.1C CH-1). Managing for military readiness and sustainability and ecosystem management are both approaches that attempt to integrate long-term goals with short-term project action lists.

DoDI 4715.03 specifies five elements of ecosystem-based management, which are supported by 5090.1C CH-1:

- *Multiple species management*—Avoid single-species management and implement an ecosystem-based multiple species management approach, insofar as that is consistent with the requirements of the Endangered Species Act.
- *Adaptive management*—Use an adaptive management approach to manage natural resources, such as climate change.
- *Partnerships*—Evaluate and engage in the formation of local or regional partnerships that benefit the goals and objectives of the INRMP.
- *Information*—Use the best available scientific information in decision-making and adaptive management techniques in natural resources management.
- *Ecosystem services*—Foster long-term sustainability of ecosystem services. Ecosystem services are benefits obtained from the ecosystem that maintain the conditions for life on Earth, such as food and water; flood and disease control; spiritual, recreational, and cultural benefits; and nutrient cycling, among others.

Besides a component of ecosystem management, adaptive management is also a separate requirement for INRMPs under DoDI 4715.03, when it states "whenever practicable to manage and monitor resources over sufficiently long time periods to allow for adaptive management and assessment of changing ecosystem dynamics (i.e., incorporate a monitoring component to management plans)." Adaptive management accommodates the reality that ecosystems are complex and continually changing by employing flexible management practices that can be modified as the environment changes. Based on observations, data, or increased scientific knowledge, adjustments may be made to objectives and management activities to meet the current situation. This flexibility in management practices is permissible if executed within the constraints of the INRMP.

This INRMP and the objectives and strategies it establishes are consistent with the ecosystem-based management approach in DoDI 4715.03 and 5090.1C CH-1.

## 1.10.2 Environmental Management System

DoD policy states that "DoD Components shall adopt an environmental management system and work to integrate in all core business areas." The goal is to "establish robust systems that sustain compliance, avoid risk and pollution, inform the public, and promote interoperability among the DoD components, other nations' militaries, and with industry." The remainder of this policy is found in the memorandum from the OUSD (Acquisition, Technology and Logistics) dated 05 April 2002.

The Navy's EMS integrates environmental considerations into day-to-day activities across all levels and functions of Navy enterprise with regard to best practices for the use of renewable and non-renewable resources and how pollution and wastes are prevented and processed. It is a formal management framework required under EO 13514, Federal Leadership in Environmental, Energy, and Economic Performance (05 October 2009), that provides a systematic way to review and improve operations, create awareness, and improve environmental performance (CNO Policy 06 December 2001). Systematic environmental management as an integral part of day-to-day decision making and long-term planning processes is an important step in supporting mission readiness and effective use of resources. The most significant resource for every organization is their senior leadership's commitment and visibility in EMS implementation and sustainability. A robust EMS is essential to sustaining compliance, reducing pollution, and minimizing risk to the mission. The Navy EMS conforms to the International Organization for Standardization 14001:2004 EMS standard. A working EMS "should be a tool to help organizations

not only stay in compliance with legislated and voluntary environmental requirements, but also continuously improve their overall environmental performance."[16]

EO 13514 requires that each federal agency conduct a self audit of pollution prevention practices using an accepted EMS framework. Components of the approach include advancing the national policy that, whenever feasible and cost-effective, pollution should be prevented or reduced at the source. Funding for regulatory compliance programs shall emphasize pollution prevention as a means to address environmental compliance. Each agency must reduce its use of toxic chemicals and hazardous substances; reduce the toxic release inventory and off-site transfers of toxic chemicals for treatment and disposal; develop a plan to phase out the procurement of Class I ozone-depleting substances for all non-excepted uses; and promote the sustainable management of federal facility lands through the implementation of cost-effective, environmentally-sound landscaping practices and programs to reduce adverse impacts to the natural environment.

# 1.11 INRMP Review and Revision Process

Section 101(b)(2) of the Sikes Act (as amended) [16 USC 670a(b)(2)] specifically directs that the INRMPs be reviewed "as to operation and effect" by the primary parties "on a regular basis, but not less often than every five years," emphasizing that the review is intended to determine whether existing INRMPs are being implemented to meet the requirements of the Sikes Act (as amended) and contribute to the conservation and rehabilitation of natural resources on military installations. OUSD guidance (01 November 2004) states that joint review should be reflected in a memorandum or letter.

In accordance with the above, DoD policy requires installations to review INRMPs annually in cooperation with the two primary parties to the INRMP (USFWS and CDFW). Annual reviews facilitate adaptive management by providing an opportunity for the parties to review the goals and objectives of the Plan, as well as establish a realistic schedule for undertaking proposed actions (Section 6.2 INRMP Review and Metrics). Annual reports are provided to the USFWS and the state fish and wildlife agency describing the outcome of the INRMP annual review; this keeps the agencies informed on INRMP implementation and the benefits they provide to threatened and endangered species (CNO Memorandum 19 December 2012).

Recent guidance on INRMP implementation interpreted that the five-year review would not necessarily constitute a revision; that this would occur only if deemed necessary. The Annual Review process is broadly guided by the Real Estate Manual (DoD Directive 4715.DD-R 1996 [DoD 1996]) and by 5090.1C CH-1, Environmental and Natural Resources Program Manual. Policy memoranda in 2002, supplemented in 2004 and 2005, clarified procedures for INRMP reviews and revisions.

- Deputy Under Secretary of Defense for Installations and the Environment Policy Memorandum 10 October 2002, which replaced a 1998 policy memorandum.
- Assistant Deputy Under Secretary of Defense for Environment, Safety and Occupational Health Policy Memorandum (01 November 2004).
- Assistant Deputy Under Secretary of Defense for Environment, Safety and Occupational Health Policy Memorandum (17 May 2005).

The INRMP Implementation Guidance (10 October 2002 Memorandum) improved coordination external to the DoD (USFWS, state agencies, and the public) and internal to the DoD (military operators and trainers, cultural resources managers, pest managers). It also added new tracking procedures, called metrics, to ensure proper INRMP coordination occurred and that project actions were implemented. These

[16] https://www.denix.osd.mil/denix/Public/Library/EMS/emswhat.html.

natural resources metrics have been updated, and are available on the Navy Conservation website (refer to Section 6.2.1 INRMP Metrics). The 2002 guidance also required that each installation provide a notice of intent to prepare or revise the INRMP. Each military installation now must request that USFWS and the state fish and wildlife agency participate in both the development and review of the INRMPs. Current coordination guidelines are that the USFWS field office is the appropriate entry point for military installations, and the USFWS Regional Sikes Act Coordinator is the liaison to facilitate INRMP review.

The Supplemental DoD INRMP Guidance (01 November 2004 Memorandum) further defined the scope of the annual and five-year review, public comment on INRMP reviews, and Endangered Species Act consultation. A formal review must be performed by the parties at least every five years. Less formal annual reviews facilitate adaptive management, during which INRMP goals, objectives, and must fund project actions are reviewed, and a realistic schedule established to undertake proposed actions. The resulting written documentation of the review should be jointly executed or in some other way reflect the parties' mutual agreement and summarize the rationale for the conclusions the parties have reached.

As an INRMP is a public document that is required to reflect, to the extent achievable, the mutual agreement of the installation, USFWS, and state fish and wildlife agencies (Navy 2006a), it is crucial that a common understanding be reached regarding which project actions contained in a draft INRMP are most likely to be funded under existing policy.

The Supplemental DoD INRMP Guidance (17 May 2005 Memorandum) stated that all INRMPs must address resource management on all of the lands for which the subject installation has real property accountability, including lands occupied by tenants or lessees or being used by others pursuant to a permit, license, right-of-way, or any other form of permission. Per this memorandum, installation COs may require tenants, lessees, permittees, and other parties that request permission to occupy or use installation property to accept responsibility, as a condition of their occupancy or use, for performing appropriate natural resources management actions. This does not, however, obviate the need to address natural resources management on any such lands in the INRMP.

DoD policy states that there is no legal obligation to invite the public either to review or to comment upon the parties' mutually agreed upon decision to continue implementation of an existing INRMP without revision (Navy 2006a).

If the parties determine that revisions to an INRMP are necessary, public comment shall be invited in conjunction with any required NEPA analysis. In general, limited revisions that are not expected to result in biophysical consequences different from those in the existing INRMP and NEPA document do not require an updated NEPA document or public comment period. More substantial revisions to an INRMP would require new or supplemental NEPA analysis and a 30-day review period (barring extraordinary circumstances) to allow the public to comment on both documents (Navy 2006a).

## 1.12 Integrating Other Plans

This INRMP is fully integrated with the installation planning processes of NAS Lemoore, including NEPA documentation, Biological Opinions (if any), and all existing plans and documents. As part of DoD's policy to promote collaborative partnerships and integration of INRMP activities with external stakeholders, including consistency with state and regional natural resources plans, the following have been identified as relevant to natural resources management at NAS Lemoore.

In addition, the updated natural resources baseline condition described in this INRMP provides the foundation for the ecosystem-based approach to management and conservation of natural resources at NAS Lemoore. This information is shared with other agencies and public interests participating in regional land use and environmental resources management initiatives in accordance with command directives.

## State Comprehensive Wildlife Plan

The California Wildlife Action Plan (Bunn et al. 2007)[17] is a comprehensive state wildlife conservation strategy. It addresses the area encompassing NAS Lemoore in its subregional emphasis on the Central Valley and Bay Delta Region. For this region, these stressors for wildlife were identified:

- Growth and development (urban, residential, and agricultural);
- Water management conflicts and reduced water for wildlife;
- Water pollution;
- Invasive species; and
- Climate change.

The Wildlife Action Plan focuses on conservation of increasingly rare alkali sink and saltbush shrublands, remnant wetlands, and riparian habitats. It identifies a number of management focus species for the region, including Swainson's hawk (*Buteo swainsoni*), Buena Vista Lake shrew (*Sorex ornatus relictus*), and Tulare grasshopper mouse (*Onychomys torridus tularensis*).

The following recommendations made for public trust land managers in the region are relevant for NAS Lemoore:

- The California Resources Agency, CDFW, USFWS, public land managing agencies, and local governments need to develop integrated, multicounty regional habitat conservation and restoration plans.
- Public land managers need to continue improving and managing wildlife habitat for a variety of species on public lands. Establishment of management practices that incorporate recommendations in existing species- or habitat-specific conservation plans include such actions as monitoring, research, and restoration for both ecosystems and species of special interest.
- Improve the management of large rural public lands to support functioning ecosystems and enhanced wildlife populations, including reducing the effects of invasive species.
- Public agencies and private organizations need to collaboratively protect and restore:
  - Habitat connectivity along major rivers in the Central Valley. Two important rivers and tributaries near NAS Lemoore include the Kings and Kern Rivers.
  - Upland linkages among protected areas in the San Joaquin Valley.
  - Water-dependent habitats throughout the region, factoring in the likely effects of climate change. This includes reestablishing wetlands and aquatic communities in the Tulare Lake Basin, building on efforts of the Central Valley Joint Venture and local initiatives.
- Restore surface and groundwater sources, stream channels, and natural storage places for sediment and water.

[17] The California Wildlife Action Plan can be accessed online at http://www.dfg.ca.gov/wildlife/wap/report.html.

## Recovery Plan for Upland Species of San Joaquin Valley, California

The Recovery Plan for Upland Species of the San Joaquin Valley, California (USFWS 1998) covers 34 species of plants and animals that occur in the aforementioned area. All are federally or state listed species, candidate species, or others identified as species of concern.[18] Those that occur or could occur at NAS Lemoore include: Lost Hills crownscale (*Atriplex coronata* var. *vallicola*), lesser saltscale (*Atriplex minuscula*), Munz's tidy-tips (*Layia munzii*), Jared's peppergrass (*Lepidium jaredii*), Fresno kangaroo rat (*Dipodomys nitratoides exilis*), Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), Tulare grasshopper mouse (*Onychomys torridus tularensis*), Buena Vista Lake shrew, and San Joaquin kit fox (*Vulpes macrotis mutica*) (Appendix G).

The ultimate goal of this recovery plan is to delist the endangered and threatened species and ensure the long-term conservation of the candidates and species of concern. An interim goal is to reclassify the endangered species to threatened status.

In formulating the community-level strategy, greater emphasis was placed on two groups of species due to their pivotal roles in either conservation (umbrella species) or ecosystem dynamics (keystone species). The San Joaquin kit fox is an example of an umbrella species due to its broad distribution and requirement for relatively large areas of habitat; kangaroo rats are keystone species in their communities because they provide important or essential components of the biological niche of some other listed and candidate species.

The USFWS has published 5-Year Reviews for a number of these species; the reviews evaluate and update the recovery and downlisting criteria for each species, as applicable.

## Central Valley Joint Venture

As one of 18 national Joint Ventures, the Central Valley Joint Venture (2006) brings together conservation organizations, public entities, private landowners, and other partners interested in the conservation of bird habitat within California's Central Valley. The 22-member Management Board brings together private conservation groups with state and federal agencies. The 2006 Implementation Plan is a five-year strategy addressing the habitat and water needs of six bird groups: wintering waterfowl; breeding waterfowl; wintering shorebirds; breeding shorebirds; waterbirds; and riparian songbirds. The development of the 2006 Plan was a collaborative effort using the best available science. The Plan identifies the critical role of agriculture in bird conservation.

## Water Quality Control Plan for the Tulare Lake Basin

According to the Porter-Cologne Water Quality Control Act (Appendix C), water quality protection at NAS Lemoore is the responsibility of the State Water Resources Control Board and the Central Valley Regional Water Quality Control Board (Central Valley Water Board). Authority comes from the Porter-Cologne Act and the federal Clean Water Act. With the State Water Resources Control Board setting statewide water quality objectives, the Central Valley Water Board carries out specific aspects of surface and groundwater regulations. NAS Lemoore is located in the Central Valley Water Board's Tulare Lake Basin Planning Area.

The Water Quality Control Plan for the Tulare Lake Basin (Basin Plan) contains the water quality standards and control measures for surface and groundwaters of NAS Lemoore (Central Valley Water Board 2004). The plan designates beneficial uses for water bodies and establishes water quality objectives, waste discharge requirements, and other implementation measures to protect those beneficial uses. State water quality standards also include a Nondegradation Policy. Water quality control measures include Total

[18] Listing designations for some of these species may have changed since the publication of this 1998 plan.

Maximum Daily Loads, which are often, but not always, adopted as Basin Plan amendments. The Tulare Lake Basin Planning Area Water Board's Total Maximum Daily Load is maintained online.

## California Water Plan Update

The Tulare Lake Integrated Water Management regional report is part of the California Water Plan Update (California Department of Water Resources 2009b),[19] focusing on the Tulare Lake Hydrologic Region in which NAS Lemoore is located. The South Central Region Office of the Department of Water Resources, which oversees the Tulare Lake Hydrologic Region, is located in Fresno.

The plan identifies a number of concerns for the valley portion of the Tulare Lake region, which are relevant for NAS Lemoore, including:

- Salinity
- Water and wind erosion
- Brackish agricultural drainage water
- Areas of toxic salt accumulation
- Excess use of groundwater and water penetration problems
- Extensive flooding of agricultural lands
- High water table/perched water conditions
- Water quality and quantity
- Erosion and sedimentation both in agricultural lands and subdivisions
- Irrigation water management problems
- Drainage problems both surface and subsurface
- Environmental education
- Alternate energy sources
- Groundwater depletion/recharge
- Groundwater/surface water quantity/quality
- Surface/irrigation water management/availability

In addition, the report provides a summary of current status and challenges of water use and management in the region, as well as some innovative projects and initiatives to address them, including water management partnerships. The larger California Water Plan Update (California Department of Water Resources 2009a) provides a multitude of additional resources that land and water managers throughout California can use to achieve improved water management.[20] Various resource management strategies and additional references cover multiple topics, including: climate change, crop water use, drought contingency plan, economics and energy, environmental water use, floods, landscape water use, legislation, litigation and law, planning, sustainability, water quality, and water rights.

Included among a suite of actions, the State Water Resources Control Board and Regional Water Quality Control Board are responding to watershed challenges such as the above through the Watershed Management Initiative,[21] which is "designed to integrate various surface water and groundwater regulatory programs while promoting cooperative, collaborative efforts within a watershed" (California

[19] Available online at: http://waterplan.water.ca.gov/cwpu2009/index.cfm#volume3.

[20] Available online at http://www.waterplan.water.ca.gov/cwpu2009/index.cfm

[21] Online at www.swrcb.ca.gov/centralvalley.

Department of Water Resources 2009b). The report emphasizes that such Integrated Water Resource Management will be an important part of the Tulare Lake Hydrologic Region's future water management including strategies such as supply augmentation, water use efficiency, demand reduction, flood control improvement, and salt management.

## Westside Integrated Water Resources Plan

The 2006 Westside Integrated Water Resources Plan was developed by the Bureau of Reclamation, the San Luis and Delta-Mendota Water Authority, and local stakeholders to guide future water management and planning decisions in the Westside Region (U.S. Bureau of Reclamation and San Luis and Delta-Mendota Water Authority 2006). The Westlands Water District (WWD), which serves NAS Lemoore, is located in the San Luis Unit of the Westside Region.

The overarching goal of the plan is to minimize regional conflict by addressing the most problematic sources of tension affecting agricultural, municipal, and environmental water use. The plan surmises that water supply challenges for the region will be exacerbated by estimates that Central Valley Project Agricultural Contractors (of which WWD is one) will receive approximately 59% allocation on a long-term average (between 1999 and 2025) and 25 to 27% allocation during a multi-year critical dry period.

General plan objectives relevant for NAS Lemoore include:

- Maximizing utility of regional aquifers while reducing potential for overdraft;
- Capturing stormwater for higher beneficial use whenever practicable;
- Promoting and enhancing water conservation and water recycling;
- Improving regional water quality;
- Complementing existing wetlands;
- Developing regional solutions that protect environmental and habitat concerns;
- Improving south-of-Delta water supply reliability by an average of 25%; and
- Providing reasonable opportunities to advance ecosystem restoration.

Of the projects identified in the plan, the most geographically relevant for NAS Lemoore, is the Arroyo Pasajero Groundwater Banking Project: "WWD is working cooperatively with State and other local interests to identify and evaluate locations for a groundwater recharge facility on the west side of the San Joaquin Valley. WWD envisions that the facility would be used for banking water to meet local agriculture supply needs by utilizing unused rescheduled Central Valley Project water. WWD estimates that up to 50,000 acre-feet per year could be recharged into the Arroyo Pasajero Fan for short-term storage. It is estimated that there is up to one million acre-feet of storage capacity." WWD is currently seeking sources of funding for this project.

**This Page Intentionally Blank**

# 2.0 Military and Other Uses of Land and Natural Resources

*This Chapter describes the operations, facilities, services, and other land uses at Naval Air Station Lemoore which support the installation's military mission and ongoing activities. It includes a focus on both past and current use of land and natural resources. Together with Chapter 3, which describes the natural resources themselves, a picture of the current condition, use, and capabilities of the Station is provided. Based on an analysis of these conditions, management strategies are developed in Chapters 4 and 5.*

## 2.1 Regional Land Use

Naval Air Station (NAS) Lemoore (also referred to as Station or installation) is located in the heart of the Central Valley, California's top agricultural region (Map 1-1). The San Joaquin region alone produces more in farm sales than any other individual state in the country.[1] The local counties consistently rank among the top counties in the state and the nation in the production of cotton, barley, and alfalfa seed (California Department of Food and Agriculture 2014). Field crops are the predominant commodity, with smaller concentrations of vegetable and seed crops. Livestock production in this region is also an important agricultural commodity. Fruit and nut crops are primarily concentrated along the Kings River, the California Aqueduct, and the Interstate 5 corridor.

Approximately 15,744 acres (6,372 hectares [ha]) of NAS Lemoore lands are within Kings County (to the south and east), and 3,040 acres (1,230 ha) are within Fresno County (to the north and west), which administer and regulate land uses within their respective boundaries. Because NAS Lemoore is a federal property, it is not within the legal jurisdiction of either county.

To prevent residential and commercial encroachment that could pose a safety hazard to NAS Lemoore's military mission, and future problems associated with jet aircraft noise, the Kings and Fresno Counties Planning Commissions zoned approximately 108 square miles (280 square kilometers) of land surrounding the Station as agricultural (U.S. Department of the Navy [Navy] 1992, 1994, 2001b; Tetra Tech Inc. 2011).[2] Zoning for exclusive agriculture within a 3-mile (5-kilometer [km]) buffer area around the Station remains a general goal for both counties (Tetra Tech Inc. 2011).[3] As such, the zoned agricultural land is currently compatible with and provides an opportunity to preserve security and limit encroachment concerns for the Station over the long term (Tetra Tech Inc. 2011).

[1] Kings County ranked 11th in the State in 2009 for gross value of agricultural production, and Fresno County ranked first (California Department of Food and Agriculture 2014).

[2] Adjacent lands within approximately 4 miles (6 kilometers) of the installation airfield is zoned for farms with a minimum of 40 acres (16 ha). In addition, lands between 4 and 10 miles (6–16 kilometers) of the Station airfield is zoned by both counties for farms with a minimum of 20 acres (8 ha).

[3] In Fresno County's Zoning Map, the zoning designation is Exclusive Agriculture - 40 Acre Minimum (AE-40) and Exclusive Agriculture - 20 Acre Minimum (AE-20). In Kings County, the zoning designation is Exclusive Agriculture (AX) and was established in 1963 (TetraTech Inc. 2011). See also the recommendations to continue these zoning practices in the NAS Lemoore Joint Land Use Study (TetraTech Inc. 2011).

In Fresno County, zoned agricultural land generally surrounds small communities, such as Huron, San Joaquin, and Riverdale. The Mendota Wildlife Area is also along the northernmost boundary of NAS Lemoore's airspace within the county. According to the Fresno County General Plan, the agricultural designation provides for crop and livestock production, and for location of necessary agriculture commercial centers, agricultural processing facilities, and certain nonagricultural activities. Typical uses of this type of land include certain crop and livestock production, certain packing, processing, and sale of crops, sale of livestock, residences, and certain oil and gas development activities.

In Kings County, other than exclusive agricultural land surrounding the Station, to a lesser extent there is some land around the larger cities of Lemoore, Hanford, and Corcoran designated for limited agriculture. Smaller communities beneath the Station's airspace include Stratford, Avenal, and Kettleman City (Kings County 2010).

Map 2-1 shows regional land use in the area of NAS Lemoore.

Establishing NAS Lemoore in California's Central Valley serves several purposes:

- NAS Lemoore is close enough to the Navy's seaport facilities for logistical support, but far enough from major population centers to allow for possible expansion.
- The remote location provides flexibility in use and infrastructure to accommodate rapidly advancing jet technology.
- Regional land uses support good agricultural land practices, which minimize dust and Foreign Object Damage (FOD) to jet aircraft (Navy 1958, 1995).

Since its development in 1961, NAS Lemoore has been a strong economic force in the region, particularly in Kings County (Kings County 2010), helping to alleviate an economic downturn[4] that is amplified by severe cutbacks in water supply associated with an extended drought and regulatory concerns for federally listed fish species in California's streams and rivers.

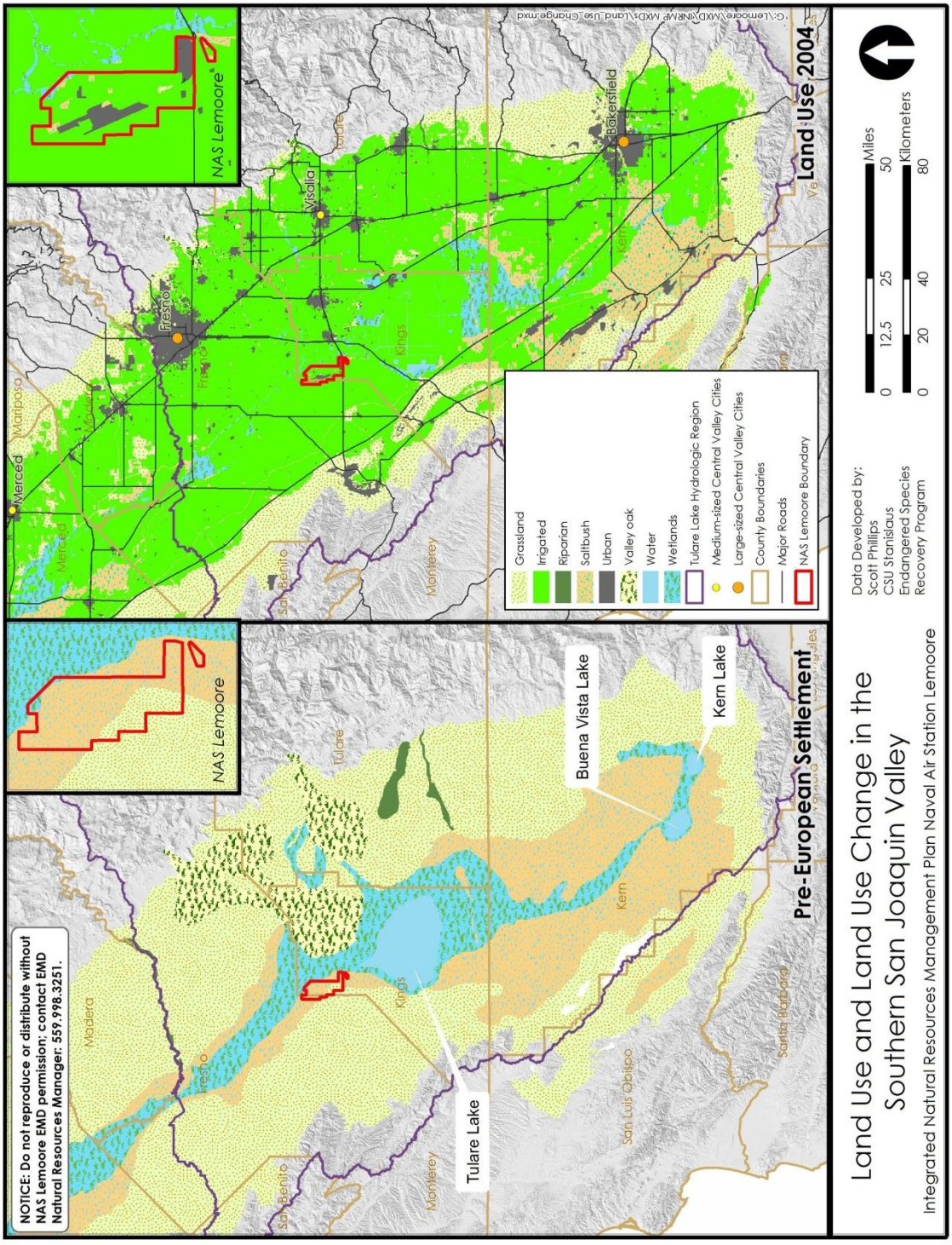
In addition, the Natural Resources Conservation Service (NRCS), under the Wetlands Restoration Program, is restoring 818 acres (331 ha) of land previously used for agricultural production. The site is located adjacent to the east side of the Station's Housing Area (Map 2-2).

Map 2-3 provides an aerial image with the NAS Lemoore boundary and its air safety easement to the west (discussed in Section 2.2.2.1 Military Influence Area and Air Safety Easement).

## 2.2 Navy Operations and Activities

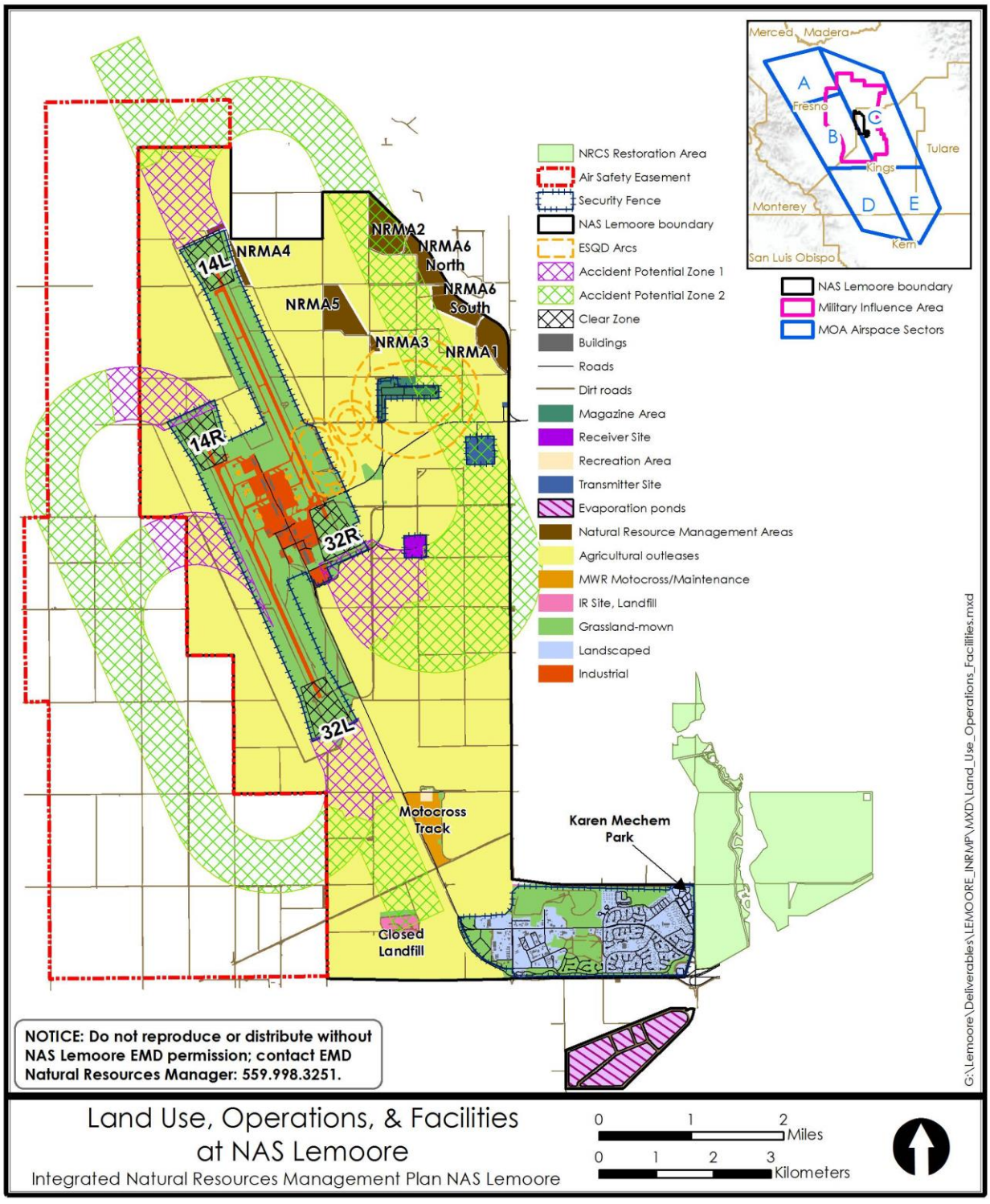
Commissioned in 1961, NAS Lemoore is the Navy's largest and only west coast Master Jet Base. Its official mission is to support Navy fleet carrier attack and strike fighter squadrons and the operational training of personnel, to maintain the proficiency of personnel who are already qualified, and to form first-line combatant attack and strike fighter capability.

[4] By a wide range of indicators, the San Joaquin Valley is one of the most economically depressed regions of the United States, and has been compared to Appalachia with respect to poverty indicators. Unemployment rates in the San Joaquin Valley are higher than in California or the United States. During the past 25 years, population growth rates in the Valley were significantly higher than that for the State or nation, and projected growth rates over the next 20 years are also significantly higher. Per capita income in the Valley was lower than in the Appalachian region as a whole (Congressional Research Service 2005).



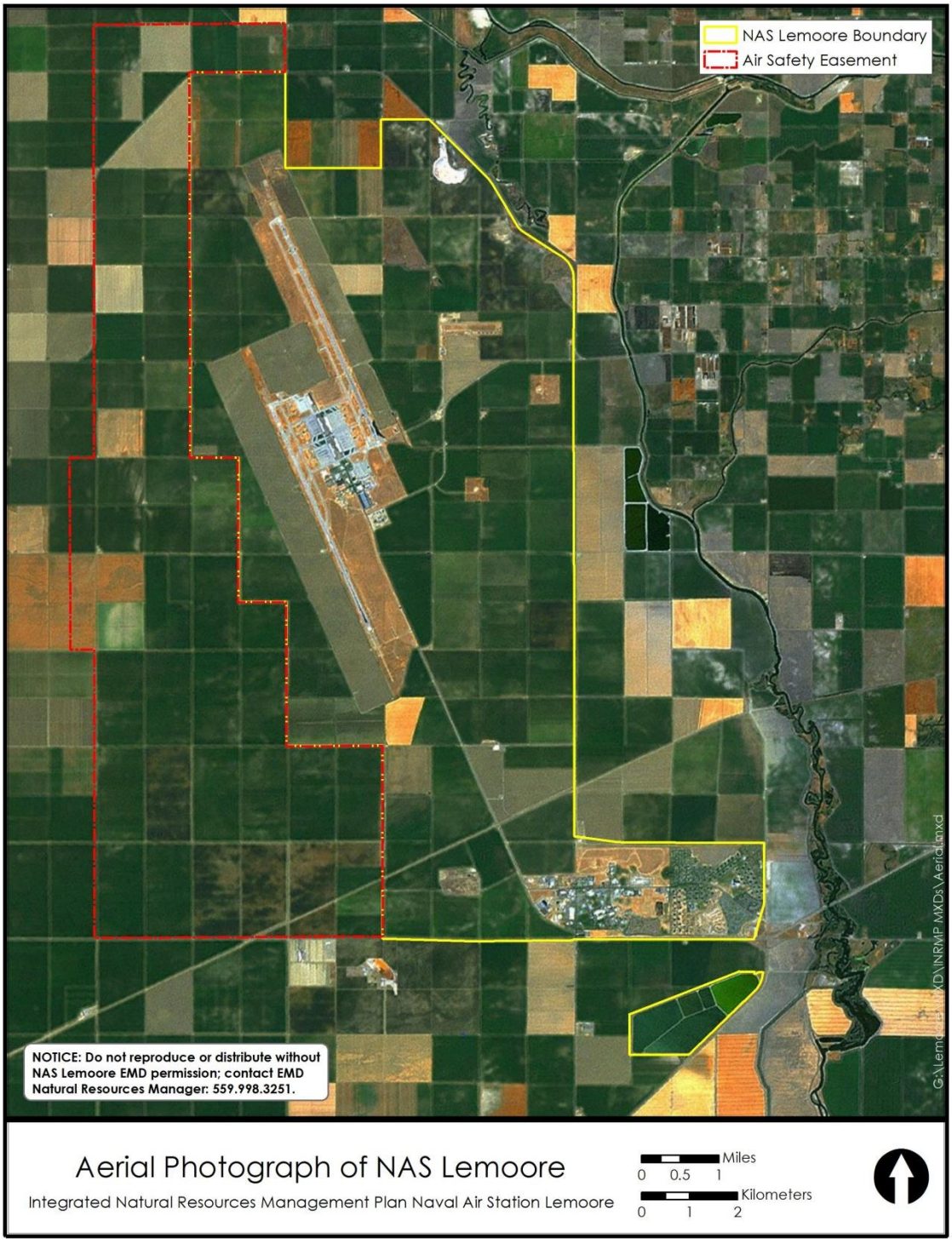

*Map 2-1. Naval Air Station Lemoore regional land use.*[5]

[5] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.




*Map 2-2. Naval Air Station Lemoore Land Use, Operations, and Facilities.*[6]

[6] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.




*Map 2-3. Naval Air Station Lemoore aerial image.*[7]

[7] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.

NAS Lemoore hosts 15 operation Strike Fighter squadrons, one Strike Fighter Fleet replacement squadron, and all five west coast Carrier Air Wing Commanders and their staffs. With the primary focus on offensive tactical Strike Fighter operations, the 280 F/A-18 Legacy Hornets and Super Hornets stationed at NAS Lemoore average approximately 210,000 flight operations per year (Tetra Tech Inc. 2011; T. Schweizer, pers. com. 2013). NAS Lemoore is also home to a Search and Rescue Squadron which is comprised of three Sikorsky MH-60S Seahawk helicopters. The Search and Rescue Squadron provides the Station with the ability to support Station personnel when operating over the Pacific Ocean training ranges.

It is necessary for the aircrew and technicians stationed at NAS Lemoore to continually train with the aircraft and for the aircraft to be operated as integral parts of the carrier airwing team with which they deploy. NAS Lemoore provides this integrated training, making it a strategic station in the Navy training and operation program. The Station also provides a wide range of services in support of personnel assigned to the activity and tenant commands, including housing, administration, medical services, recreation, and durable goods.

The following sections describe uses of both land and airspace that facilitate achievement of NAS Lemoore's military mission and assigned functions and tasks.

One of the primary land use issues addressed in the Master Plan for NAS Lemoore is ensuring the protection and safety of military aircraft personnel, ground support crew, Station residents, and local citizens from air operations accidents (Navy 1992). As with all Navy air stations, safety is a primary concern; therefore, NAS Lemoore strives for a zero mishap rate in flight-related and aviation ground activities. The primary means of ensuring this protection is through airspace safety planning and land use planning requirements.

## 2.2.1 Airfield Operations

### Aircraft Types

NAS Lemoore is the permanent station for all Pacific Fleet F/A-18 aircraft, except those forward deployed units permanently stationed in Japan. Currently, there are a total of 280 Legacy Hornets (F/A-18C/D) and Super Hornets (F/A-18E/F) based at NAS Lemoore, operating from 15 Strike Fighter Fleet Squadrons and one Strike Fighter Replacement Squadron (T. Schweizer, pers. com. 2013), as well as Strike Fighter Weapons School Pacific. The 144th Fighter Wing, California Air National Guard, Fresno (Fresno Air National Guard [FANG]) also operates the F-16 Falcon within NAS Lemoore's airspace (Navy 2006b).

### Airspace Military Operations Area and Training Activities

The Navy and California Air National Guard initiated the establishment of a new Special Use Airspace consisting of a Military Operations Area (MOA) and Air Traffic Controlled Assigned Airspace at NAS Lemoore. The Federal Aviation Administration is a cooperating agency in designating this airspace. The airspace is 30 nautical miles (nm) by 70 nm (approximately 34 by 80 standard miles, or 55 by 130 kilometers [km]), and is divided into five sectors (Map 2-2). The airspace enables Navy squadrons at NAS Lemoore and the California Air National Guard to meet mandated U.S. Department of Defense (DoD) training objectives.

The Lemoore MOA/Air Traffic Controlled Assigned Airspace became operational for DoD training events on 14 February 2008. The airspace overlies portions of Fresno, Kern, Kings, and Tulare Counties. Aircraft training within the airspace takes place between 5,000 feet and 26,000 feet (1,524-7,925 meters) above mean sea level. Typical military training at NAS Lemoore consists of various aircraft operations. NAS Lemoore's airspace is large enough for up to four pairs of F/A-18 or F-16 fighter aircraft to be operated within the airspace simultaneously. Typical operations involve two pairs of aircraft operating simultaneously, with a maximum of 10,000 sorties per year. A sortie is an operational flight by a single aircraft.

Airspace operations are suspended when NAS Lemoore radar is inoperable. The airspace is not used for air-to-air or air-to-surface weapons release or gunnery firing. Supersonic speeds are prohibited. The airspace is used by military pilots from NAS Lemoore, FANG, and other DoD users. NAS Lemoore and FANG each train for one weekend per month, sometimes simultaneously.

In addition to operational training in NAS Lemoore's airspace, NAS Lemoore provides air access to air and ground ranges for other air-to-air and air-to-ground training. NAS Lemoore- and Fresno-based aircraft previously trained in airspace up to 200 nm (230 standard miles [370 km]) from the Station, located at other DoD installations in California, Nevada, and over the Pacific Ocean.[8] Such distances require a considerable amount of fuel just to fly to and from the training area.

The scheduling agency for NAS Lemoore's airspace is the Navy, Commander, Naval Strike Fighter Wing, U.S. Pacific Fleet, NAS Lemoore, California.

The NAS Lemoore Radar Air Traffic Control Facility manages NAS Lemoore's airspace and provides radar coverage for the area. All training aircraft are kept within the airspace by use of global positioning systems, inertial navigation systems, and tactical air navigation systems. Participating training aircraft transit to and from the working areas within the airspace, and pilots assume responsibility for military aircraft separation or are vectored by NAS Lemoore approach control.

Any malfunctions associated with the use of the airspace is handled in accordance with the Navy's standard operating procedures. Pilots experiencing a serious malfunction can land their aircraft at NAS Lemoore or the Fresno Yosemite International Airport within ten minutes. This is an improvement over the 20 to 30 minutes previously required for an aircraft experiencing an in-flight emergency to reach NAS Lemoore or Fresno from Restricted Area R-2508 or Warning Areas W-283/285 (training airspaces used prior to the designation of NAS Lemoore's MOA/Air Traffic Controlled Assigned Airspace). It also improves pilot safety by reducing dangers involved in crossing the Sierra Nevada Mountains to the east, the coastal mountain range to the west of Lemoore, or the mountains around Naval Air Weapons Station China Lake and Edwards Air Force Base (where R-2508 is located) to reach a runway with proper emergency assist equipment and personnel (Navy 2006b).

A civilian pilot's interface with NAS Lemoore airport operations and the new training airspace is through the availability of a new airspace manager, called SHOWTIME, to assist both civilian and military pilots in managing a safe and efficient environment.

## 2.2.2 Land Use Safety Zones and Plans

A number of land use planning requirements in use at NAS Lemoore ensure the protection and safety of military aircraft personnel, ground support crew, Station residents, and local citizens from air operation accidents. They are described below and include, but are not limited to: NAS Lemoore's Military Influence Area (MIA), Air Safety Easement, Air Installation Compatibility Use Zones (AICUZ), FOD (including Bird/Animal Aircraft Strike Hazard [BASH]), Dust Abatement, Wildfire Control, Ordnance and Explosives, Explosive Safety Quantity Distances (ESQD), and Radar and Transmitter Equipment.

[8] Prior to designation of NAS Lemoore's airspace, pilots would train primarily at Restricted Area R-2508, a DoD joint use restricted airspace covering 20,000 square miles (32,187 square kilometers) and located in the China Lake/Edwards Air Force Base Complex approximately 68 nm east of NAS Lemoore; however, due to high terrain, the closest areas suitable for F/A-18 operations was approximately 120 miles (93 km) to the east. R-2508 supported 14 different joint participating bases and had become increasingly crowded and difficult to complete needed training efficiently, consistently, and safety for all its users. Other equally or closer training airspaces that were used included Warning Areas W-283/285, the Hunter MOA complex, and the Foothills MOA complex. Use of these airspaces was limited by a number of factors, including insufficient over-water search and rescue capability at W-283/285, and the small operating dimensions of the Hunter MOA and Foothills MOA complexes (Navy 2006b).

### 2.2.2.1 Military Influence Area and Air Safety Easement

NAS Lemoore has identified a MIA around the Station that is a designated geographic planning area where military operations may impact local communities and, conversely, where local activities may affect the military's ability to carry out its mission (Map 2-2). The specific MIA boundaries for NAS Lemoore were previously defined by the Station using prominent terrain and man-made features such as roads, aqueducts, canals, or streams. NAS Lemoore has suggested that development in this MIA should require additional analysis before being granted approval. The MIA is intended to support the community's planning efforts in selecting appropriate use for land within the MIA, and to encourage a dialogue between government agencies, private organizations, and NAS Lemoore regarding growth and development within the MIA (TetraTech Inc. 2011).

NAS Lemoore designated the MIA to accomplish the following purposes (Tetra Tech Inc. 2011):

- Promote an orderly transition between community and military land uses so land uses remain compatible.
- Protect public health, safety, and welfare.
- Maintain operational capabilities of military installations and areas.
- Promote the awareness of the size and scope of military training areas to protect areas separate from the actual military installation (for example, critical air and sea space) used for training purposes.
- Establish compatibility requirements within the designation area, such as requirements for sound attenuation, real estate disclosure, and aviation easements.

The NAS Lemoore MIA was also used as the study area for a recent Joint Land Use Study (Tetra Tech Inc. 2011; refer to Section 5.1.1 Integrated Military Mission and Sustainable Land Use Decisions and Section 5.6 Beneficial Partnerships and Collaborative Planning).

In addition, NAS Lemoore holds an air safety easement over approximately 11,020 acres (4,460 ha) of agricultural land adjacent to Navy-owned land for flight safety and noise mitigation. The easement was obtained in 1958 at the same time as purchase of land for construction of the Station (Navy 2001b; Map 2-2 and Map 2-3).

### 2.2.2.2 Air Installation Compatibility Use Zones

The Navy implements the AICUZ program as a component of the NAS Lemoore Master Plan (Navy 1992, 2010b). The AICUZ program is used to promote compatible development in areas that would expose the public to potential health and safety hazards associated with normal aircraft operations, such as noise, and in areas that would jeopardize pilot safety and operational compatibility of NAS Lemoore. The AICUZ provides recommendations for land use planning and policies that affect military installations and surrounding communities.

The Navy requires that an AICUZ program also address Accident Potential Zones (APZs) and imaginary surface restrictions (Navy 2010b). The APZ boundaries and the extent of the outer horizontal imaginary surface are shown in Map 2-2. Agriculture, the predominant surrounding land use, is appropriate within the Clear Zone and in areas where noise levels exceed 85 decibels (Navy 2010b). The western portion of the City of Lemoore is below the outer horizontal imaginary surface.

### Accident Potential Zones

APZs identify areas that would most likely be affected by an aircraft accident (Navy 2010b). The purpose of defining APZs is to identify areas where surrounding land uses should be restricted to protect the public, pilots, and property on the ground. Three types of APZs are identified: the Clear Zone, APZ I, and APZ II (Map 2-2). The Clear Zone is required to contain no obstructions because it has the highest probability of being affected by accidents. The APZ I and APZ II are curved to conform to the shape of the flight paths and have respectively decreasing accident potentials compared to the Clear Zone.

### Imaginary Surface Restrictions

Another land use issue associated with air operations is the proximity of structures to imaginary surfaces. An imaginary surface is the slope or angle at which an aircraft departs or arrives at an airfield. Imaginary surfaces are another way to describe clearances for air navigation. Federal aviation regulations specify a series of imaginary height restrictions surfaces surrounding an airport to prevent conflicts with aircraft approach and departure paths.

The Federal Aviation Administration considers any terrain or engineered objects that extend above the imaginary surface as an obstruction. All obstructions are reviewed by the Federal Aviation Administration to determine if they represent a hazard to air navigation. The imaginary surface should not be penetrated and all new development should not extend into the imaginary surfaces. Imaginary surfaces can affect NAS Lemoore and regional land use planning. There are a number of imaginary surfaces associated with NAS Lemoore that restrict or limit structure height for safety purposes. There are currently no violations of imaginary surface restrictions at NAS Lemoore other than those necessary for air navigation. Imaginary surface restrictions at NAS Lemoore can extend up to 10 miles (16 km) from the Operations Area (Navy 1998).

## 2.2.2.3 Foreign Object Damage

NAS Lemoore has a FOD prevention program. FOD is caused when objects, such as dirt, rock, vegetation, ground debris, metal parts, and even wildlife, infiltrate or collide with jet engines, the aircraft structure, or electrical systems. FOD creates a hazard to the pilots, aircrew, and maintenance personnel and increases maintenance costs and aircraft downtime. Given the resulting hazard created by a FOD incident, FOD occurrences are not acceptable to zero-mishap management, and every step is taken at NAS Lemoore to minimize the hazard. In addition to aircraft damage, extensive property damage can result from aborted takeoffs and emergency landings of aircraft with FOD. Most importantly, however, FOD jeopardizes the safety of flight and ground crew.

### Bird/Animal Aircraft Strike Hazard

As part of efforts to reduce impacts to human safety from FOB, a BASH Plan is implemented at NAS Lemoore (NAS Lemoore 2012). Wildlife strike hazards are of major concern to air operations, especially as the speed and number of aircraft operating at NAS Lemoore has increased. The goal of effective land management is to discourage wildlife activity near runways and operational areas. Management techniques include mowing vegetation, prey species reduction, and planting specified crops in close proximity of the runways. For example, long-term crops are prohibited, and, to minimize the potential for BASH, certain crops are restricted on parcels adjacent to the Operations Area without prior authorization.

## 2.2.2.4 Dust Abatement

In addition to being a FOD hazard, dust reduces visibility and increases the risk to aircraft operations. Naval flight regulations require that a pilot must have visibility of at least 0.5 mile (0.8 km) to land. When

dust reduces visibility below this limit, aircraft must land at an alternative airfield. Blowing dust also contributes to spread of the dust-borne fungal spores that cause Valley Fever.

Blowing dust is frequent at NAS Lemoore due to the semiarid climate, soil conditions, and wind patterns. Dense vegetative cover, such as agricultural crops, aids in preventing wind erosion and dust. As with all safety issues, minimizing this risk is the primary objective under zero-mishap management.

### 2.2.2.5 Wildfire Control

Aircraft-related accidents during takeoffs and landings can cause fires. There are three primary issues to consider when analyzing fire hazards on NAS Lemoore: pilot and public safety, potential hazards to adjacent properties and structures, and damage to aircraft.

- Of primary concern is pilot and public safety; if an aircraft crashes in the Clear Zone, APZ I, or APZ II, a resulting fire must be minimal and easily contained so that rescue efforts are not hampered.
- With regard to adjacent properties and structures: Given the distance between NAS Lemoore and the City of Lemoore, the probability of a wildfire emanating from NAS Lemoore and spreading to the City is extremely low.

The major land use at NAS Lemoore is irrigated agriculture, and the crops remain green for most of the year. Such ground cover (as opposed to dry cover) reduces the potential for fires and slows the dispersion of flare-up; this is important for containing fires to improve pilot safety, reduce public exposure to fire hazards, and protect property.

In other areas of the Station, naturally occurring vegetation has a history of disturbance and includes annual weeds with low moisture content that grow high and dense. During hot summer and fall months, this vegetation becomes more flammable than cultivated vegetation. Such conditions make most disturbed lands with weeds prone to wildfire and a safety hazard.

Overall, the wildfire danger to natural resources at NAS Lemoore is limited. The major areas of concern are the areas with natural vegetation. The Operations Area control tower offers an excellent fire lookout for the Station. Control tower personnel are charged with being alert to possible safety and security violations. Wildfire incidents are reported to the NAS Lemoore Fire Department (Navy 1995).

### 2.2.2.6 Ordnance and Explosives

The military mission at NAS Lemoore requires that ordnance be handled and stored. ESQD arcs have been developed to protect personnel and local residents from the possible sabotage or accidental detonation of explosives and munitions. They surround each magazine and facility used for storing and handling ordnance; the distance that the ESQD arc extends for the magazine or facility depends on the type and quantity of explosive. The DoD Explosive Safety Board's policy prohibits placing inhabited buildings and non-essential personnel within these ESQD arcs. NAS Lemoore follows strict adherence to the five ESQD arcs designated within its boundaries; they are illustrated in Map 2-2.

The Chief of Naval Operations Ammunition and Hazardous Material Handling Review Board has authorized Exemption NAS Lemoore E-1-81. This exemption permits the agricultural outlease of land that falls within the ESQD Arcs. The agricultural outlease exemption allows for the cultivation of non-labor-intensive/machine harvested crops.

#### 2.2.2.7 Radar and Transmitter Equipment

The NAS Lemoore Master Plan has identified 12 hazards of electromagnetic radiation to ordnance-susceptible areas generated by on-Station equipment (Navy 1992). No ordnance classified as hazards of electromagnetic radiation to ordnance-unsafe is allowed within specified distances. A hazard of electromagnetic radiation to an ordnance-susceptible ordnance system is any tested ordnance system proven to contain electro-explosive devices that can be adversely affected by radio frequency energy so that the safety and reliability of the system is jeopardized when the system is employed.

Radar and other high-energy electromagnetic emissions can constitute a hazard of electromagnetic radiation to personnel exposed to radiation above a maximum power density. These effects are managed under the regulations of the Navy Hazard of Electromagnetic Radiation to Personnel program.

Fuel is also susceptible to the hazards of electromagnetic radiation. These effects are managed under the Navy regulations for hazards of electromagnetic radiation to fuel. Safety arcs, much like the ones described in the paragraph above for ESQD, provide for a safe distance for storing these substances in relation to communication and radar equipment (Navy 1998).

## 2.3 Facilities and Services

### 2.3.1 Operations Area

The Operations Area occupies approximately 4,100 acres (1,660 ha) in the central part of NAS Lemoore and primarily contains functions that directly support air operations, including training/operations, public works, maintenance, administration, and supply facilities. There are also a few personnel support functions in this area. The Operations Area facilities are illustrated in Map 2-2.

The airfield at NAS Lemoore is within the Operations Area and consists of two runways, 14R/32L and 14L/32R, both of which are 13,500 feet (4,114 m) long. NAS Lemoore's dual offset parallel runways permit simultaneous operations. The Operations Area also contains parking aprons for more than 200 aircraft, maintenance hangars comprising approximately 550,000 square feet (51,097 square meters), intermediate level maintenance facilities for aircraft, flight simulation facilities, weapons storage, and facilities for supplies and air operations. It is bordered primarily by land in agricultural outlease (discussed below).

Some Operations-related areas, such as the transmitter and receiver area, and some support functions, such as ordnance storage and handling, are located in the undeveloped lands east of the Operations Area. These facilities are surrounded by agricultural outlease lands and are entirely fenced. ESQD arcs are designated around the ordnance storage and handling facilities.

### 2.3.2 Administration and Housing Areas

The Administration and Housing Areas each occupy approximately 600 acres (243 ha) at the southeastern end of NAS Lemoore. Housing, personnel support facilities, and recreational facilities are the largest components of these areas, with a limited number of training, operations, and administration facilities. The Administration and Housing Areas are bordered by agricultural outlease lands to the north and west, and non-Navy agricultural lands along the south and east. NAS Lemoore wastewater treatment facility evaporation ponds are south of the Administration and Housing Areas.

### Military Family Housing

Housing at NAS Lemoore is available to all pay grades. As of 2012, more than 1,640 family housing units were present in the Housing Area, divided into seven family housing neighborhoods (TEC Inc. 2007; Navy 2012c; T. Schweizer, pers. com. 2013). Three bachelor housing areas, including officer and enlisted quarters, are within walking distance of the Administration Area. Additional housing construction on the installation is ongoing (Navy 2012c). As of 2007, the Housing Area (not including the Akers and Neutra elementary schools) is managed by Lincoln Military Housing through a Public-Private Venture with the Navy. The current Public-Private Venture and associated lease will expire in 2057, at which time the housing units and any improvements revert to federal control. The land remains federal property and is still subject to federal natural and cultural resources laws, regulations, Executive Orders, and instructions (Navy 2012c).

## 2.3.3 Services and Utilities

The services and utilities at NAS Lemoore include, but are not limited to: fire protection, water, electricity, natural gas, and solid waste.

### 2.3.3.1 Fire Protection

The NAS Lemoore Fire Department has responsibility for controlling any wildfires that occur on NAS Lemoore. Wildfires are not a major concern at the Station given that most land is in irrigated agricultural production. These lands tend to minimize the risk of a fire spreading throughout NAS Lemoore. Unlike other military installations that have intensive ground training components, there are few activities on NAS Lemoore that generate fire ignitions (e.g., use of flares).

Prescribed burns are used to benefit wildlife habitat and to control federally listed noxious and invasive weeds. As necessary, the NAS Lemoore Environmental Management Division (EMD) prepares a prescribed burn management plan in order to obtain the proper permits from the San Joaquin Valley Air Pollution Control District. Most burning activities are conducted by NAS Lemoore staff, Kings County Fire Departments, the California Department of Forestry and Fire, and the Bureau of Land Management Bakersfield District Hotshot Fire Crew. All have cooperated in burning larger areas, such as in Natural Resources Management Area (NRMA) 5.

### 2.3.3.2 Water Resource Supply and Use

NAS Lemoore's municipal and industrial activities rely primarily on purchased surface water deliveries from the Westlands Water District (WWD).[9] Agricultural outleases at NAS Lemoore also rely on WWD water, as well as groundwater (for those parcels containing groundwater wells). The WWD receives water from the U.S. Bureau of Reclamation's Central Valley Project (CVP). NAS Lemoore's CVP water is received from the San Luis Canal.

NAS Lemoore's historical annual applied water demand for crop irrigation on its agricultural outleases (1978-2010) ranged from 1.9 acre-feet (AF)/acre[10] to 3.2 AF/acre, with an average of 2.6 AF/acre (Corbett et al. 2011). Currently, groundwater pumping on average provides between 8,000 AF/year and 13,000

[9] Water resource use and efficiency (including conservation actions for all uses of water at NAS Lemoore are described in Chapters 2 and 5. Water as a natural resources, including groundwater resources, wetlands, jurisdictional water, water quality, and floodplains, is described and addressed in Chapters 3 and 4. Section 2.4.1 Agricultural Outleases provides a discussion of water resource provision and use for the Agricultural Outlease Program.

[10] An acre-foot is a unit of volume commonly used in the U.S. in reference to large-scale water resources, such as reservoirs, aqueducts, canals, sewer flow capacity, and river flows. It is defined as the volume of one acre of surface area to a depth of one foot. One acre-foot is exactly 43,560 cubic feet (1,233 cubic meters).

AF/year, but may be as little as 5,000 AF/year (Corbett et al. 2011; T. Schweizer, pers. com. 2013),[11] often depending on the percent allocation of WWD water received and drought cycles. For more details on water provision and use in agricultural outlease areas, refer to Section 2.4.1 Agricultural Outleases.

As of 2011, NAS Lemoore uses approximately three million gallons per day (mgd) (11.3 millions liters per day [mld]) or 3,400 AF/year of WWD-delivered water to meet its municipal and non-agricultural, operational water supply needs (Corbett et al. 2011).

Water for municipal and industrial use is piped to the treatment plant in the Operations Area. It is treated with chlorine prior to use. The facility has a capacity to treat 7.5 mgd (28.4 mld). Storage facilities consist of six 600,000-gallon (2,271,000-liter) tanks and one 2,660,000-gallon (10,068,100-liter) tank located in the Operations Area and the Administration Area.

While groundwater and local surface water are not a primary source of potable water for NAS Lemoore or the surrounding communities, the Station has developed a potable deepwater well in the Administration Area to serve as a back-up to the municipal and industrial water supplied by the WWD. The potable water well will serve as an emergency water source in the event the Station's water supply from the California aqueduct is jeopardized. A study of groundwater resources in the Administration Area was completed in 2009 to support its development (Saenz and Goss 2009).

### 2.3.3.3 Wastewater Treatment and Disposal

The wastewater treatment facility, located near the southeast corner of the Station, treats domestic wastewater, treated industrial wastewater, and dry weather storm drain flow collected from both the Operations Area and the Administration and Housing Areas. After treatment it is discharged into the wastewater treatment facility evaporation ponds south of the Administration Area (Map 2-2), across State Route 198. The maximum capacity of the facility is 2.12 mgd with normal operations at 75% of maximum capacity. The pump station to the evaporation ponds has an average flow capacity of 2 mgd (8 mld) but can accommodate a peak flow of 4 mgd (15 mld). The average flow to the pump station in 1999 was 1.7 mgd (6.4 mld), with peak flows of 7.0 mgd (11.3 mld). Effluent is monitored daily for volume and quality, in compliance with the Central Valley Regional Water Quality Control Board (Central Valley Water Board) requirements.

Industrial waste is collected in the Operations Area and is treated in the industrial wastewater treatment plant to remove organic chemicals, hydrocarbons, and heavy metals. In general, sanitary and industrial wastewater collection systems are located within the developed areas of NAS Lemoore or parallel to existing roadways in undeveloped areas.

### 2.3.3.4 Stormwater Collection

The stormwater collection system at NAS Lemoore consists of a network of underground drains in the Operations Area and Administration Area and a series of ditches in the undeveloped areas. These drains and ditches transport stormwater runoff to a wet well and stormwater pumping station where it is mixed with wastewater when the discharge rate of the wastewater system is low. Wet weather runoff is discharged into the Kings River from an open channel if the flow cannot be accommodated by the pump station. In the undeveloped areas, stormwater normally dissipates by evaporation and percolation. NAS Lemoore maintains a National Pollutant Discharge Elimination System permit regulating its stormwater discharges from industrial activities.

[11] Corbett et al. (2011) indicates that groundwater pumping for agriculture at NAS Lemoore could be as high as 30,000 AF/year. This is no longer the case as the capacity for groundwater pumping in the agricultural outlease area has decreased significantly in recent years due to the current functionality of groundwater wells and pumps in the outlease area (T. Schweizer, pers. com. 2013).

#### 2.3.3.5 Electricity and Natural Gas

Natural gas is provided to NAS Lemoore and local residents by the Southern California Gas Company. NAS Lemoore also rents natural gas storage facilities from the Southern California Gas Company.

Western Area Power Administration and Pacific Gas and Electric furnish NAS Lemoore with electricity, transmitted over Pacific Gas and Electric power lines. Western Area Power Administration allocates a maximum of 18 megawatts of power per month. Pacific Gas and Electric provides electricity to the surrounding communities and supplements NAS Lemoore's power needs in the summer when air conditioner use increases.

In general, gas and electrical supply systems are located within the developed areas of NAS Lemoore or parallel to existing roadways in undeveloped areas.

NAS Lemoore is currently looking into renewable energy opportunities. A potential option under consideration is the placement of photovoltaic cells on a portion of the agricultural outlease area (Section 2.5 Future Land Use and Airspace Patterns and Plans).

#### 2.3.3.6 Solid Waste

Solid waste produced by NAS Lemoore and in local areas is removed weekly by a private contractor. Solid waste is transported by Chemical Waste Management to the Kettleman City landfill. Solid waste from industrial activities at NAS Lemoore is disposed of at the Kings Waste and Recycling facility located approximately 12 miles (19 km) from the Station.

Green waste from NAS Lemoore, such as grass clippings, is hauled by the waste contractor to an off-site waste management facility. NAS Lemoore manages the Earth Care Recycling Center on the Station. However, the Public-Private Venture manages the pick-up and transfer of recycling for the Housing Area to an off-site facility.

### 2.3.4 Transportation and Circulation

Transportation systems on NAS Lemoore consist primarily of paved roadways in and between the developed areas of the Station and unpaved roadways in the undeveloped areas (Map 2-2).

The primary on-Station roadways are Enterprise, Avenger, and Franklin Avenues and Hancock Circle in the Administration and Housing Areas, Reeves Boulevard between the Main Gate and the Operations Area, and Gateway Road between the Operations Area and the Grangeville Gate. A number of paved secondary roads also are found within the Operations Area and the Administration and Housing Areas.

A network of dirt roadways are principally used to access agricultural outlease lands, NRMAs, and for remote operational uses. These roads also provide limited access to NAS Lemoore from adjacent private lands.

A rail line running from Exeter, California to Huron, California, managed by the San Joaquin Valley Railroad, crosses NAS Lemoore between the Operations Area and the Administration Area.

# 2.4 Other Land Uses

The Navy accommodates nonmilitary land use that does not adversely affect military operations or create safety, security, fiscal, or regulatory concerns. These considerations apply to all nonmilitary use currently or potentially accommodated on NAS Lemoore lands.

## 2.4.1 Agricultural Outleases

### Overview

Agriculture is the dominant land use at NAS Lemoore, covering about three-quarters of its total acreage (12,843 acres [5,197 ha]). Such land use is historic to the property and consistent with the region. The State of California has classified the agricultural land at NAS Lemoore as Farmland of Statewide Importance (California Department of Conservation 2008). The Agricultural Outlease Program is essential at NAS Lemoore to maintain the mission and no net loss per the following:

- Supports the military mission through compatible land or airfield management; it provides vegetative cover and land management practices to control dust, FOD, fire, and assists with minimizing the potential for BASH.
- Allows for maintenance and stewardship of lands at no cost to taxpayers, including weed abatement, groundskeeping, and fire-break construction. As part of the Outlease Program, lessees are required to perform land maintenance and stewardship projects to preserve and enhance natural resources.
- Provides revenue from the leases to fund natural resources management programs at NAS Lemoore.
- Provides employment and generates revenue, which benefits local communities.[12]

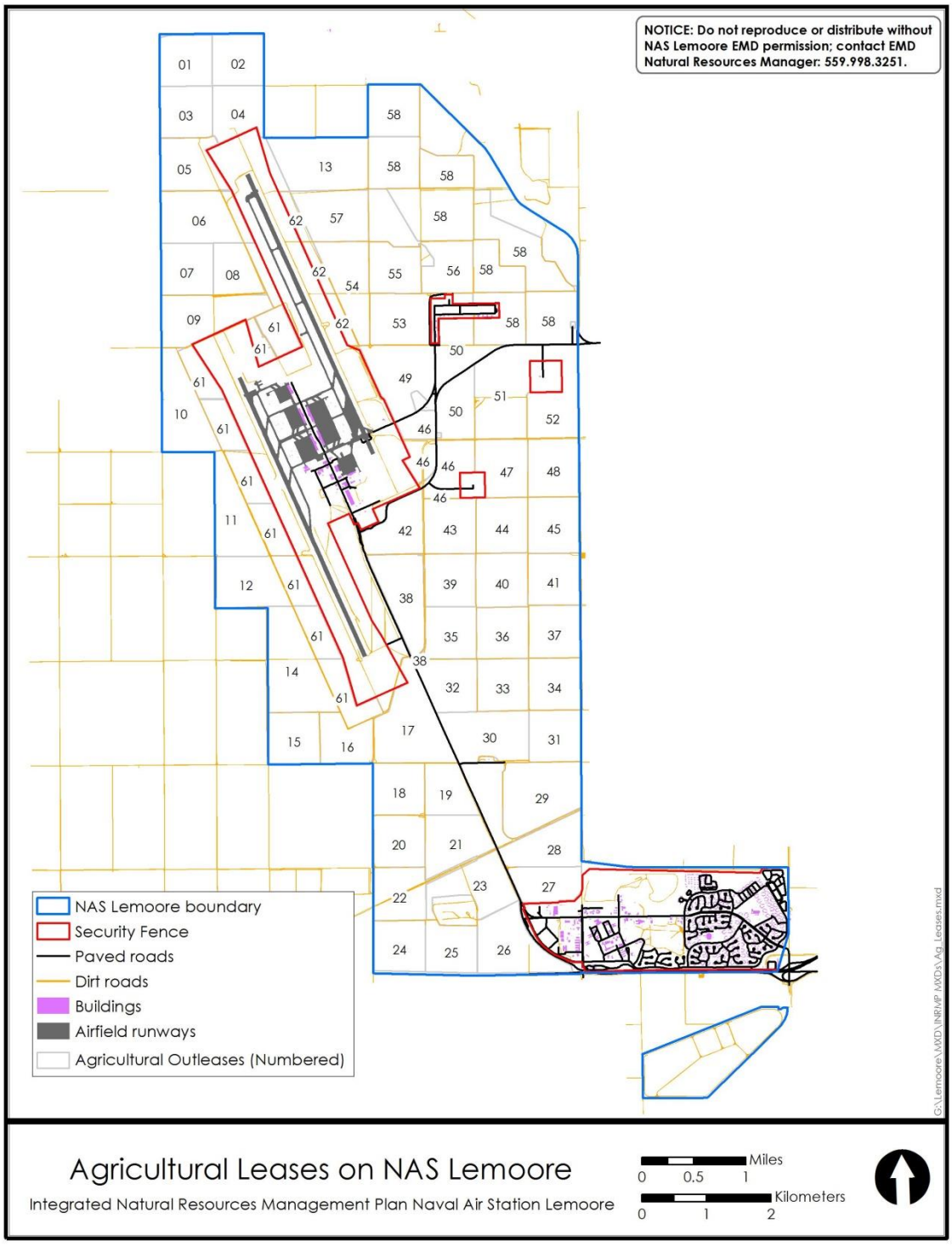
It is the policy of the DoD and the Navy, under the Sikes Act (as amended), to promote agricultural outleases (along with other land uses) to the maximum extent compatible with the military mission and ecological constraints. Many military installations include agricultural and/or grazing lands that must be retained for a buffer or safety zones, security of the installation, mobilization needs, or future mission requirements. Where feasible, these lands may be put under production to optimize natural resources and to minimize funds expended in maintaining these lands.

The Outlease Program is extended to the public using a sealed bid process. Once sealed bids are opened on a specified date and time, leases are evaluated and awarded based on Congressional approval, highest bids, and provision of a performance bond and certificate of insurance. NAS Lemoore dominates the Navy and Marine Corps Outlease Program with 16 farming entities, on average, leasing approximately 54 agricultural outleases on 12,776 acres (5,170 ha).[13]

The agricultural outlease lands are generally leased for five-year terms; however, in 2011, it was determined that varying the lease terms between five and nine years would better distribute the number of leases that need to be advertised each year. Approval from CNO is needed for any lease over one year. These agricultural outleases are illustrated in Map 2-4.

[12] Unemployment rates in the San Joaquin Valley are higher than in California or the U.S. During the past 25 years, population growth rates in the Valley were significantly higher than that for the state or nation, and projected growth rates over the next 20 years are also significantly higher. Per capita income in the Valley was lower than in the Appalachian region as a whole (Congressional Research Service 2005).

[13] Total agricultural outlease area at NAS Lemoore is 12,843 acre (5,197 ha), which includes roads and maintenance areas. Total leased area not including roads or maintenance areas is 12,776 acres (5,170 ha).




*Map 2-4. Agricultural outleases at Naval Air Station Lemoore.*[14]

[14] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.

#### 2.4.1.1 Agricultural Outlease Program Management

The Agricultural Outlease Program at NAS Lemoore is managed by Naval Facilities Engineering Command (NAVFAC) Southwest in San Diego, California with the assistance of the Public Works Department (PWD) at NAS Lemoore (which includes the EMD). NAVFAC Southwest and NAS Lemoore EMD work together, managing the Outlease Program to ensure compatibility of land use with the military mission and the use of good conservation practices. The EMD has day-to-day responsibility for lease management with the goal that the maximum benefit is derived from the use of natural resources. The EMD accomplishes this through verifying that each lessee adheres to the provisions outlined in the lease's Soil and Water Conservation Plan and by acting as an on-Station Point of Contact for the lessee. NAVFAC Southwest is responsible for awarding and administering leases, for preparing Soil and Water Conservation Plans, and for coordinating with lessees that are not in compliance with the terms and conditions of the lease. Additionally, NAVFAC Southwest works to establish best management practices for managing natural resources under each lease to maintain consistency throughout all NAVFAC Southwest agricultural outleases.

Under the lease agreements, lessees are required to comply with conservation and maintenance measures stipulated in the Soil and Water Conservation Plan included in each lease agreement. Conservation and maintenance provisions include the following:

- Irrigation water management;
- Ditch and drainage system maintenance;
- Pest management;
- Road damage prevention and maintenance;
- Erosion, dust, fire, and weed control;
- Debris removal; and
- Other management practices necessary to ensure the sustainability of agriculture on NAS Lemoore.

In addition to obtaining a major portion of the Natural Resources Management Program's annual administrative and logistical support from the agricultural outlease fund, NAS Lemoore has benefited directly from the receipt of agricultural outlease funded projects. A number of these projects have been developed to provide: improvement to the real estate value of NAS Lemoore's lands; parcel maps of NAS Lemoore's agricultural outleases; invasive species control; Wildlife Hazard Assessments (e.g., Lang 2012); equipment to aid in burrowing owl (*Athene cunicularia*) management; BASH studies; and general wildlife habitat enhancements.

### Crops at NAS Lemoore

There are cropping restrictions in the Soil and Water Conservation Plan, outlining particular types of crops permitted to be planted on parcels closest to the airfield in the Operations Area. The cropping restrictions are in place to support the mission through the reduction of BASH concerns. The majority of the parcels in NAS Lemoore's Agricultural Outlease Program currently do not have any cropping restrictions and the crops grown are determined by the lessee. Historically, cotton has been the favored crop grown on the installation. Other primary crops include wheat, tomatoes, and alfalfa, while sugar beets, corn, garlic, onions, lettuce, garbanzo beans, and safflower are also commonly produced. In more recent years, NAS Lemoore has seen significant conversion to vegetable crops, primarily tomatoes, garbanzo beans, onions, and garlic (Corbett et al. 2011; T. Schweizer, pers. com. 2012). Due to lease term restrictions, long-term crops, such as grapes and orchards, are prohibited. In general, NAS Lemoore does not dictate crops to be farmed, but rather gives as much flexibility to the lessee as possible to foster economic viability of the leases.

### Dust Abatement

Sources of dust from agriculture include plowing, disking, and road use in the agricultural outlease areas. The Soil and Water Conservation Plan requires lessees to reduce dust through the application of water to their parcels and adjacent roads. NAS Lemoore anticipates that the San Joaquin Valley Air Pollution Control District will most likely increase enforcement of dust abatement requirements in its jurisdiction.

### Pest Management

Compliance checks for invasive species and pest management on the agricultural parcels is performed twice each year by the NAS Lemoore EMD. Agricultural lessees are required to report pesticide use on their parcels. As part of this requirement, each new lessee submits a pest management plan for the upcoming agricultural year to the NAS Lemoore Integrated Pest Management Coordinator for review. Generally, the plans take the shape of a pesticide list. Annual resubmissions of these plans are required as a condition of each lease. Lack of a current pest management plan for any agricultural outlease is reported as noncompliance. The NAS Lemoore Integrated Pest Management Plan (NAVFAC Southwest 2010) describes pest management roles and responsibilities in detail. Agricultural lessees must notify the NAS Lemoore Safety Office, via the EMD, prior to aerial applications. The Integrated Pest Management Plan describes those conditions that are most favorable for aerial applications (i.e., little to no wind).

To aid in pest management, the Soil and Water Conservation Plans include a requirement for crop rotation. If a lessee is growing cotton, for example, another crop must be planted once every five years.

### Collaboration with Natural Resources Conservation Service

Collaboration with the U.S. Department of Agriculture NRCS takes place regarding agricultural best practices and management. The original Soil and Water Conservation Plan that is part of the agricultural leases was written with the Soil Conservation Service (the agency precursor to the NRCS). Other collaborations with NRCS offices in Hanford, Visalia, and Fresno have included plant species selections for windbreak plantings, revegetation of natural areas, and soil questions with respect to specific agricultural outleases.

## 2.4.1.2 Agricultural Water Resource Supply and Use

### Current Supply Systems

Agricultural irrigation water demand at NAS Lemoore is met by both surface water deliveries from WWD (under contracts between the lessees and WWD) and on-Station groundwater pumping. The WWD receives water from the U.S. Bureau of Reclamation's CVP, which sources its water from Northern California reservoirs via the Sacramento-San Joaquin Delta and the California Aqueduct and the Delta-Mendota Canal. Ultimately, NAS Lemoore's CVP water is received via the nearby San Luis Canal (refer to Map 3-7).

Approximately two-thirds (8,233 acres [3,332 ha]) of the Station's leased agricultural acreage depends solely on surface water delivered through WWD (Table 2-1). Another nearly 3,000 acres (1,214 ha) are variably irrigated with surface water or groundwater (Corbett et al. 2011). One lease (parcel 4A58 in the northeastern corner of the Station) comprising 1,161 acres (470 ha), is prohibited from receiving CVP water due to the salinity of the soils, the high perched water table and impeded drainage (J. Crane, pers. com. 2010).[15] This lease relies on an unrestricted allocation of groundwater as a source of irrigation. It is proposed to be retired from agricultural use in phases, beginning in 2015 (T. Schweizer, pers com. 2014; Section 5.2.1 Agricultural Outlease Management).

[15] These characteristics apply to much of NAS Lemoore agricultural lands that are located above a perched aquifer. Agricultural irrigation contributes to this perched aquifer in addition to increasing its alkaline concentration, which stems from the alkaline soils on the Station. Refer to Section 3.3.3.2 Groundwater Resources and Water Quality for more details on the Station's perched aquifer.

*Table 2-1. Irrigation water supply sources for agricultural leases at Naval Air Station Lemoore (2011).*

| Water Type | Number of Leases | Number of Lessees | Irrigable Acres (ha) |
|---|---|---|---|
| WWD only | 43 | 8 | 8,232.8 (3,331.7) |
| WWD and Groundwater wells | 16 | 13 | 2,956.8 (1,196.6) |
| Groundwater wells only (unrestricted allocation) | 1 | 1 | 1,161.0 (469.8) |

*Source: Corbett et al. 2011*

Only irrigable acres at NAS Lemoore receive water from WWD. This figure is different from the acreage listed for each lease as it concerns only those acres that can actually be irrigated. The figure is determined from surveys and resulting maps of farm land produced periodically by the U.S. Department of Agriculture Farm Services Agency. For 2013, the Farm Services Agency determined that total irrigable land at NAS Lemoore is 11,052 acres (4,473 ha), which does not include the lease that relies solely on groundwater (parcel 4A58) (C. Dahlstrom pers. com. 2013).

Irrigation water from the WWD is diverted into delivery pipelines that extend into the agricultural outlease lands from the San Luis Canal (refer to Map 3-7). These pipelines generally parallel existing roadways or follow the perimeter of agricultural outlease parcels (Map 2-5).

There are 26 groundwater wells on NAS Lemoore (Map 2-5). Some wells pump water from depths exceeding 1,000 feet (305 meters) below ground surface (Corbett et al. 2011);[16] quality groundwater at NAS Lemoore is at least 600 feet (183 meters) deep (Section 3.3.3.2 Groundwater Resources and Water Quality). Typical well yields in the Westside basin, of which NAS Lemoore is a part, average around 1,100 gallons per minute (4,164 liters per minute) (California Department of Water Resources [CDWR] 2003).[17] A number of the groundwater wells have fallen into disuse due to age and other factors (many are 20 to 30 years old). NAS Lemoore is working on a project to study these wells to determine appropriate restoration and/or decommission actions (C. Dahlstrom and T. Schweizer, pers. com. 2013). To prevent particulates in the water from clogging irrigation equipment, filtration systems are installed at the water source to remove them before water is applied to the fields.

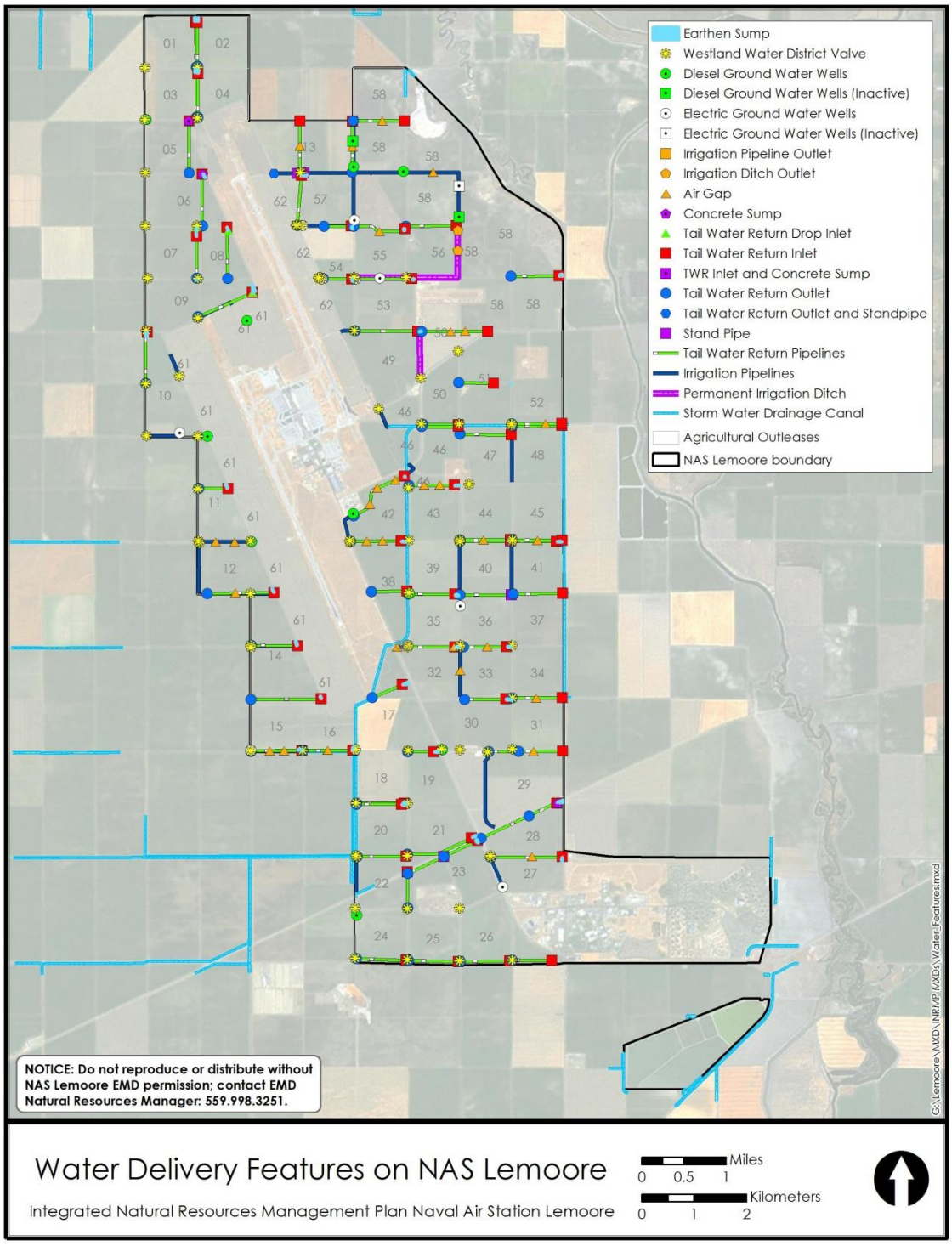
Passive drainage systems, consisting of drainage sumps and canals, are used throughout most of the agricultural outlease areas to retrieve and reuse excess irrigation tailwaters (Map 2-5). Ninety percent of parcels have return water pipes to prevent runoff and return water to the fields. The percentage of parcels using drip irrigation systems in 2013 was approximately thirty percent (T. Schweizer, pers. com. 2014). Currently, agricultural runoff from any lease is prohibited and NAS Lemoore encourages lessees to conserve water where they can, including encouraging installation of more efficient irrigations system (such as drip irrigation) where feasible (J. Crane, pers. com. 2010).[18]

In addition to encouraging water conservation in a region that is semiarid, this technique helps prevent runoff contributions to soil erosion and the perched aquifer.

[16] This is common in the San Joaquin Valley sub-basins where aquifers are generally quite thick and wells commonly exceed 1,000 feet (305 meters) in depth. Other wells in the larger Central Valley can be close to 2,000 feet (610 meters) deep. For water quality and economic reasons, groundwater in the region is seldom pumped from below 2,000 feet (610 meters) below ground surface (Corbett et al. 2011). Refer to Section 3.3.3.2 Groundwater Resources and Water Quality for more information regarding groundwater aquifers at NAS Lemoore and in the region.

[17] In the larger San Joaquin Valley, well yields range from 300 gallons per minute to 2,000 gallons per minute (1,136-7,571 liters per minute), with yields of 4,000 gallons per minute (15,142 liters per minute) possible (CDWR 2003).

[18] More efficient irrigation systems are currently not required so that local, small farmers are not excluded from NAS Lemoore leases. Agricultural outlease holders are responsible for purchasing, installing and operating/ maintaining all above-ground equipment needed for farming and irrigation activities, including any irrigation infrastructure.




*Map 2-5. Water delivery and drainage features for agricultural water use at Naval Air Station Lemoore.*[19]

[19] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.

## Agricultural Water Demand

NAS Lemoore's estimated historical annual applied water demand for crop irrigation on the irrigable acres in its agricultural outleases is presented in Table 2-2.

*Table 2-2. Historical range of and average estimated applied water demand for crop irrigation on agricultural outleases at Naval Air Station Lemoore from 1978 to 2010.*

| Applied Water Demand | Low End | High End | Annual Average |
|---|---|---|---|
| Per irrigable acre | 1.9 AF/acre/year | 3.2 AF/acre/year[1] | 2.6 AF/acre/year |
| Total | 24,000 AF/year | 42,000 AF/year | 32,700 AF/year |

*Source: Corbett et al. 2011*

1. The low end of 1.9 AF/acre/year was documented in 1975, 1977, and 2009. The high end of 3.2 AF/acre/year was documented in 1987 (Corbett et al. 2011). Total applied water demand is the sum of surface water demand and groundwater demand.

Of this total applied water demand, current groundwater pumping, on average, provides between 8,000 AF/year and 13,000 AF/year, but may be as little as 5,000 AF/year (Corbett et al. 2011; T. Schweizer, pers. com. 2013)[20] often depending on the percent of the Basic Water Allocation (BWA) received from WWD and drought cycles.

## Westlands Water District Allocation for NAS Lemoore

Prior to 1992, the BWA of WWD irrigation water for NAS Lemoore was 5.2 AF/acre/year, which represented a theoretical maximum (100%) water delivery. In that year, the Central Valley Project Improvement Act (CVPIA) reduced it to the Station's current BWA of 2.6 AF/acre/year (Corbett et al. 2011). In actuality, NAS Lemoore receives an annually varying fraction of its BWA (Table 2-3 and Table 2-4) at the beginning of each growing year, in March.

In years of state-wide water shortages, water delivered to each of the State's water districts is reduced by an equal percentage, and that reduction of allocation is passed on to water consumers, in this case by WWD. Such shortages, combined with other varying and competing demands on CVP water, are responsible for the fact that NAS Lemoore rarely receives close to its full BWA. A recent court decision related to the Endangered Species Act (2008) has affected the pumping of Delta water into the California Aqueduct and into the Delta-Mendota Canal, and it could potentially reduce NAS Lemoore's BWA for future years (Table 2-3). Biological Opinions for the steelhead trout (*Oncorhynchus mykiss*), spring run and winter run Chinook salmon (*Oncorhynthus tshawytscha*), and green sturgeon (*Acipenser medirostris*) in 2009 (National Marine Fisheries Service) and delta smelt (*Hypomesus transpacificus*) in 2008 (USFWS)[21] also led to reductions in export pumping from the Delta and could reduce NAS Lemoore's BWA.[22]

[20] Corbett et al. indicates that groundwater pumping for agriculture at NAS Lemoore could be as high as 30,000 AF/year. This is no longer the case as the capacity for groundwater pumping in the agricultural outlease area has decreased significantly in recent years due to the current functionality of groundwater wells and pumps in the outlease area (T. Schweizer, pers. com. 2013).

[21] The application of the delta smelt Biological Opinion, relative to the CVP and State Water Project, has been the subject of a number of recent court cases, leading to a Settlement Agreement in February 2011 (http://www.fws.gov/sfbaydelta/cvp-swp/cvp-swp.cfm).

[22] In general, environmental water demands for habitat enhancement, including to support Wild/Scenic River status in the Sierra Nevada, have increased the need for water beginning with the CVPIA in 1992. The Sacramento-SanJoaquin River Delta water quality and habitat needs are reducing the export volume of water pumped and available in the Tulare Lake Region (in which NAS Lemoore is located). Changes to the Long-Term Operational Criteria Plan for coordination of the CVP and State Water Project (the California Aqueduct) could worsen water delivery reliability for imported water and the growing acreage of permanent crops.

*Table 2-3. Historical and potential fluctuations in Westlands Water District allocations for agricultural irrigation at Naval Air Station Lemoore.*

| Allocation Description | Allocation Percentage | Allocation (AF/acre/year) |
|---|---|---|
| ***1992 Central Valley Project Improvement Act*** | | |
| Pre-CVPIA Basic Water Allocation | 100% | 5.2 |
| Post-CVPIA Basic Water Allocation | 100% | 2.6 |
| ***Typical Allocations*** | | |
| Average year allocation | 60% | 1.56 |
| Typical drought year allocation, pre-2009 | 30-40% | 0.78-1.04 |
| Record-low allocation, pre-2009 (1977 & 1992) | 25% | 0.65 |
| ***Projected Allocations after Endangered Species Act Court Ruling Affecting Delta Water*** | | |
| Post-court ruling, wet year | 70% | 1.82 |
| Post-court ruling, average year | 40% | 1.04 |
| Post-court ruling, drought year | 0-10% | 0.26 |

*Source: Corbett et al. 2011*

*Table 2-4. Actual Westlands Water District allocations for agriculture at Naval Air Station Lemoore (2007-2013).*

| Year[1] | Allocation Percentage | Basic Water Allocation (AF/acre/year) | Supplemental Water Agreement Allocation (AF/year)[2] |
|---|---|---|---|
| 2007 | 50% | 1.3 | 5,000 |
| 2008 | 40% | 1.04 | 4,000 |
| 2009 | 10% | 0.26 | 1,000 |
| 2010 | 45% | 1.17 | 4,500 |
| 2011 | 80% | 2.08 | 8,000 |
| 2012 | 40% | 1.04 | 4,000 |
| 2013 | 20% | 0.52 | 2,000 |

*Source: Corbett et al. 2011; C. Dahlstrom, pers. com. 2013*

1. WWD allocation year runs from the beginning of March to the end of February.
2. The theoretical maximum (100%) delivery of NAS Lemoore's Supplemental Water Agreement Allocation is 10,000 AF/year for the entire Station.

In 2003, NAS Lemoore entered into a Supplemental Water Agreement with WWD to secure an additional 10,000 AF/year of water for agricultural lessees (above the 2.6 AF/acre/year allocation) in an effort to protect itself from potential future reductions of its BWA. As part of the agreement, WWD purchased and retired land within its district, 10,000 AF/year of whose water allocation was obligated to NAS Lemoore. The 10,000 AF/year Supplemental Water Agreement allocation is subject to the annually varying CVP allocation percentage (Table 2-4). The agreement set up a Reserve Account into which NAS Lemoore pays an annual amount of $1,022,020 toward the total cost of the land purchase and water delivery. Lessees make payments directly to the Reserve Account based on how many AF of water they received in a given year. Payments started in 2003 and are expected to end in 2033, unless the Navy pays off the balance in advance (C. Dahlstrom, pers. com. 2013).

For multiple years in the recent past (including 2009 and 2010), NAS Lemoore has requested from the Bureau of Reclamation a baseline allocation of 24,000 AF[23] for agriculture. This is the amount of water NAS Lemoore requires to ensure its agricultural outleases can sustain production and maintain a greenbelt around the Station's airfield, which contributes to preventing firespread, reducing dust (improving air quality and visibility for pilot training), and stemming the spread of Valley Fever (fungal spores borne by the dust). NAS Lemoore is working to solidify this into a more long-standing agreement so that the Station no longer has to submit annual requests to the Bureau of Reclamation (J. Crane, pers. com. 2011).

[23] This is approximately 2 AF/acre of agricultural land at NAS Lemoore.

In the event that there is insufficient water available for agricultural production in any given year, an agricultural lessee may decide to fallow their parcel.[24] In 2009, 5,000 to 6,000 acres (2,023–2,428 ha) were fallowed due to a significantly decreased WWD allocation that growing year (Table 2-4). In 2010, 500 acres (202 ha) were fallowed and crops were converted from cotton and tomatoes to garbanzo beans and dehydrator onions (C. Dahlstrom, pers. com. 2011). Approximately 8,759 acres (3,544 ha) are proposed to be fallowed in 2014 due to ongoing drought conditions and regulatory water allocation restrictions (T. Schweizer, pers. com. 2014).

## Impacts of Historic and Current Balance of WWD Water and Groundwater Use

The Tulare Lake Region initially developed with surface water supplies; however, local water users soon learned that such supplies could vary widely from year to year and drought conditions could quickly develop. Deep well turbines were introduced in the early 1900s and led quickly to a dramatic rise in groundwater use (CDWR 2009b). At that time, farmers within WWD relying on natural surface water and groundwater sources primarily grew cotton and grain crops, such as wheat and barley, and some vegetables. This dependence combined with agricultural expansion throughout the region during the 20th century led to increased pumping in the Tulare Lake Basin and San Joaquin Valley and significant water level declines in the area around NAS Lemoore. The overdraft of the confined aquifer temporarily came to an end with the arrival of imported surface water through the CVP in the late 1960s. However, the decline in pressure in the confined aquifer and the decline of water levels within the upper semi-confined aquifer units in the region had already led to widespread and significant land subsidence (Ireland et al. 1984 and Galloway et al. 1999, as cited in Corbett et al. 2011).[25] The majority of land subsidence due to groundwater overdraft at NAS Lemoore—10 feet (3 m) between the early 1900s and 2010—occurred during the middle of the 20th century (1926 to 1972).[26]

While the arrival of CVP water did not reverse past land subsidence, the large land subsidence rates observed during the middle of the 20th century largely abated by the 1970s, at which time vegetable production began increasing. With the supply of imported surface water and the urbanization of the traditional "salad bowl" growing areas of California (such as Salinas-Monterey Area and the Central Coast)[27] the acreage devoted to vegetable production in the San Joaquin Valley increased while grains declined between 1980 and 1996.

Currently, the main use of groundwater at NAS Lemoore is to supplement surface water supplies, including replacement of temporary (one- to five-year) shortages (Corbett et al. 2011). Aside from managing land subsidence, NAS Lemoore has a high stake and interest in long-term maintenance of these groundwater levels to manage periodic surface water shortfalls. Accordingly, the rate structure for agricultural groundwater use (as defined in the Soil and Water Conservation Plan that accompanies each lease) prioritizes the use of WWD water over that of groundwater above the threshold of 1 AF of groundwater per acre.[28]

Over the past 35 years at NAS Lemoore, groundwater pumping in normal and wet years has generally been of similar magnitude as groundwater recharge: an estimated average of 7,500 to 11,500 AF/year (Corbett et al. 2011). However, in dry years, when there is low rainfall and a reduced percentage of the

[24] The decision to fallow belongs to the lessee, not NAS Lemoore. The lessee is still responsible for other maintenance requirements such as weed control. Lessees deciding to fallow due to a lack of water generally receive a rental adjustment on their lease. Those who fallow when there is sufficient water to support a crop and then sell their allocation of water, do not. The fallowing allowance for lessees who do fallow their parcel(s) is based on the percentage allocation of WWD water received that year.

[25] Refer to Section 3.3.1.1 Stratigraphy and Section 3.3.3.2 Groundwater Resources and Water Quality for additional details on regional geology and groundwater aquifers at NAS Lemoore.

[26] Historical subsidence data indicate that, within the WWD, each foot of subsidence has been caused by groundwater level declines of 20-45 feet (6-14 meters) (Corbett et al. 2011).

[27] Some of these coastal areas also face groundwater pumping limitations due to seawater intrusion.

[28] The first acre-foot/acre of groundwater for irrigation can be used by the lessees at no charge.

BWA from WWD, groundwater pumping increases (Corbett et al. 2011; T. Schweizer, pers. com. 2013). The groundwater use rate structure accommodates this by setting less expensive rates when NAS Lemoore lessees receive smaller percentages of the BWA.

During drought years, increased groundwater use is compounded by the fact that recharge is also likely lower due to higher irrigation efficiency and more land acreage out of production (and hence without groundwater recharge). The increasing number of droughts and recent court decisions that could decrease deliveries of CVP water from the Sacramento-San Joaquin Delta exacerbates this imbalance and has spurred an increase in groundwater pumping in the San Joaquin Valley since 2005.[29] This imbalance is not compensated for by equivalent amounts of recharge surplus at NAS Lemoore during normal and wet years (Corbett et al. 2011). Due to local geology that literally seals the surface soils from deeper soils and strata (Section 3.3.3.2 Groundwater Resources and Water Quality) and limits efficient recharge, the local area relies on outlying areas to the north and east for recharge of the lower aquifers. A by-product of this is the perched water table, which is receives water from rainfall, natural water deposition, or excess irrigation water, and is high in salts, which can inhibit the growth of plants.

The resulting decline of groundwater levels threaten to approach historic lows and lead to further compaction of fine grained sediments within the aquifer system surrounding NAS Lemoore and, thus, renewed land subsidence (Corbett et al. 2011; U.S. Geological Survey 2009). Currently, a major portion of the region in which NAS Lemoore is located has been identified by the CDWR as having critical groundwater overdraft conditions. In fact, significant subsidence has occurred since the 1970s: the extended drought during the early 1990s triggered nearly 2 feet (0.61 meters) of subsidence at NAS Lemoore, and the recent 2008-2010 drought appeared to be accompanied with approximately 0.5 feet (0.15 meters) of subsidence (Corbett et al. 2011).[30] Though, virtually all subsidence at NAS Lemoore related to groundwater withdrawal occurs so slowly that it largely goes unnoticed (K.D. Arroues, pers. com. 2012).

Differential (uneven) subsidence across a groundwater basin can be particularly damaging. It is a result of near-surface or shallow subsidence, generally caused by applications of water on loosely consolidated mudflows or water-laden sediments (K.D. Arroues, pers. com. 2012). Along the perimeter of the Central Valley, differential subsidence is a significant problem, causing damage estimated to be hundreds of millions of dollars annually. California sites outside the Central Valley, such as the Rogers Lake Bed at Edwards Air Force Base (Sneed and Galloway 2000, as cited in Corbett et al. 2011) have also been affected by differential subsidence. This form of subsidence brings its own set of serious problems and is potentially damaging to infrastructure, such as runways. The damage it inflicts on canals, levees, etc., can lead to a loss in conveyance capacity (Corbett et al. 2011). Differential subsidence, which would cause significant problems for NAS Lemoore's airfield, is largely absent at the Station (K.D. Arroues, pers. com. 2012).

## 2.4.2 Natural Resources Management Areas

Six NRMAs comprise a total of 621 acres (251 ha) at NAS Lemoore. They contain remnant native habitats which have been and continue to be managed for the benefit of wildlife and native plant communities (Map 2-2). The current condition of natural resources and habitats within each is discussed in detail in Chapter 3.

- *NRMA 1* is composed of 90 acres (36 ha) of ephemeral wetland and grassland adjacent to Parcel 4A58.

[29] About 32% of the AF of water used annually in the local region for all purposes is obtained from groundwater (Corbett et al. 2011).

[30] Earlier in the 2000s, an equivalent land-rise was measured by nearby extensometers, possibly due to increasing groundwater levels. Models of future subsidence scenarios for the NAS Lemoore area are provided in Corbett et al. (2011).

- *NRMA 2* is approximately 130 acres (53 ha) of wetland, including Sunset Lake (a seasonally flooded saline wetland), along the northern border of the Station.
- *NRMA 3* consists of approximately 12 acres (5 ha) and is primarily two ephemerally inundated water retention basins, located adjacent to parcels 4A55 and 4A56 in the northeastern portion of NAS Lemoore.
- *NRMA 4* is approximately 50 acres (20 ha) of annual grassland habitat located in the northern part of NAS Lemoore, formerly within parcel 4A62 and adjacent to runway 14L/32R of the Operations Area. It is maintained as native habitat. Installation of the Operations Area security fence and establishment of an airfield perimeter road in 2003 removed 59 acres (24 ha) from this NRMA, which was originally 109 acres (44 ha). The removed portion within the fence is now mowed regularly to support air traffic safety.
- *NRMA 5* is approximately 116 acres (47 ha) of annual grassland and brushland habitat managed for the federally and state endangered San Joaquin kangaroo rat (*Dipodomys nitratoides*)[31] in the northeastern part of NAS Lemoore.
- *NRMA 6* is approximately 164 acres (66 ha) located between NRMAs 1 and 2 along the northeastern border of the Station. It is discussed in later chapters as NRMA 6 North (76 acres [31 ha]) and NRMA 6 South (88 acres [36 ha]) given the sufficiently different vegetation assemblages in each area.

Agricultural outlease lands surround all six NRMAs. Fencing, to keep out illegal off-road vehicles, surrounds all NRMAs except NRMA 4. In addition, areas surrounding the Operations Area are managed to control BASH.

A greenhouse located on the Station is used to grow and house plants used in restoration projects at NAS Lemoore, including in the NRMAs. Water for these plants is secured from Municipal and Industrial water, provided to NAS Lemoore by WWD.

### 2.4.3 Installation Restoration Sites

The DoD established the Installation Restoration Program (IRP) in 1975 to provide guidance and funding for the investigation and remediation of hazardous waste sites caused by historical disposal activities at military installations. Legal requirements of the IRP are covered under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and Superfund Amendment and Reauthorization Act of 1986. The fundamental goal of the IRP is to protect human health, safety, and the environment. The IRP investigates and, if necessary, remediates former disposal and test areas, some of which were used before the disposal of chemicals was regulated or even fully understood. The Navy has taken an aggressive and proactive approach to identifying and cleaning up its hazardous waste sites and to reducing to prescribed safe levels any potential risks caused by the Navy's past operations on NAS Lemoore (Navy 2005).

In 1984, NAS Lemoore began environmental studies to determine if hazardous materials were disposed of at the Station. After the studies, 20 areas were identified as IRP sites. In 1986, the Navy combined Site 5 and Site 9 because the sites were close to each other and contained similar contaminants. Past disposal areas include the sanitary landfill, pesticide rinse areas, fire training areas, sludge ponds, and fuel spill areas. The Navy has conducted extensive investigations at the sites indicating varying degrees of contamination from trichloroethylene, gasoline, JP-5 jet fuel, heavy metals and pesticides. The Navy, with concurrence from the State of California, has closed 11 of the 19 sites. Currently there are eight active IRP sites: five are post-decision document stage and are part of a remedial clean up, land use restriction, or a long-term monitoring phase; three are in the investigation stage (Navy 2012b; R.M. Quesada, pers. com. 2013).

[31] Studies to determine whether the species present on NAS Lemoore is the Tipton kangaroo rat (*D. nitratoides nitratoides*) or the Fresno kangaroo rat (*D. nitratoides exilis*) have been inconclusive; both are subspecies of the San Joaquin kangaroo rat. As a result, the species is referred to as San Joaquin kangaroo rat throughout this document.

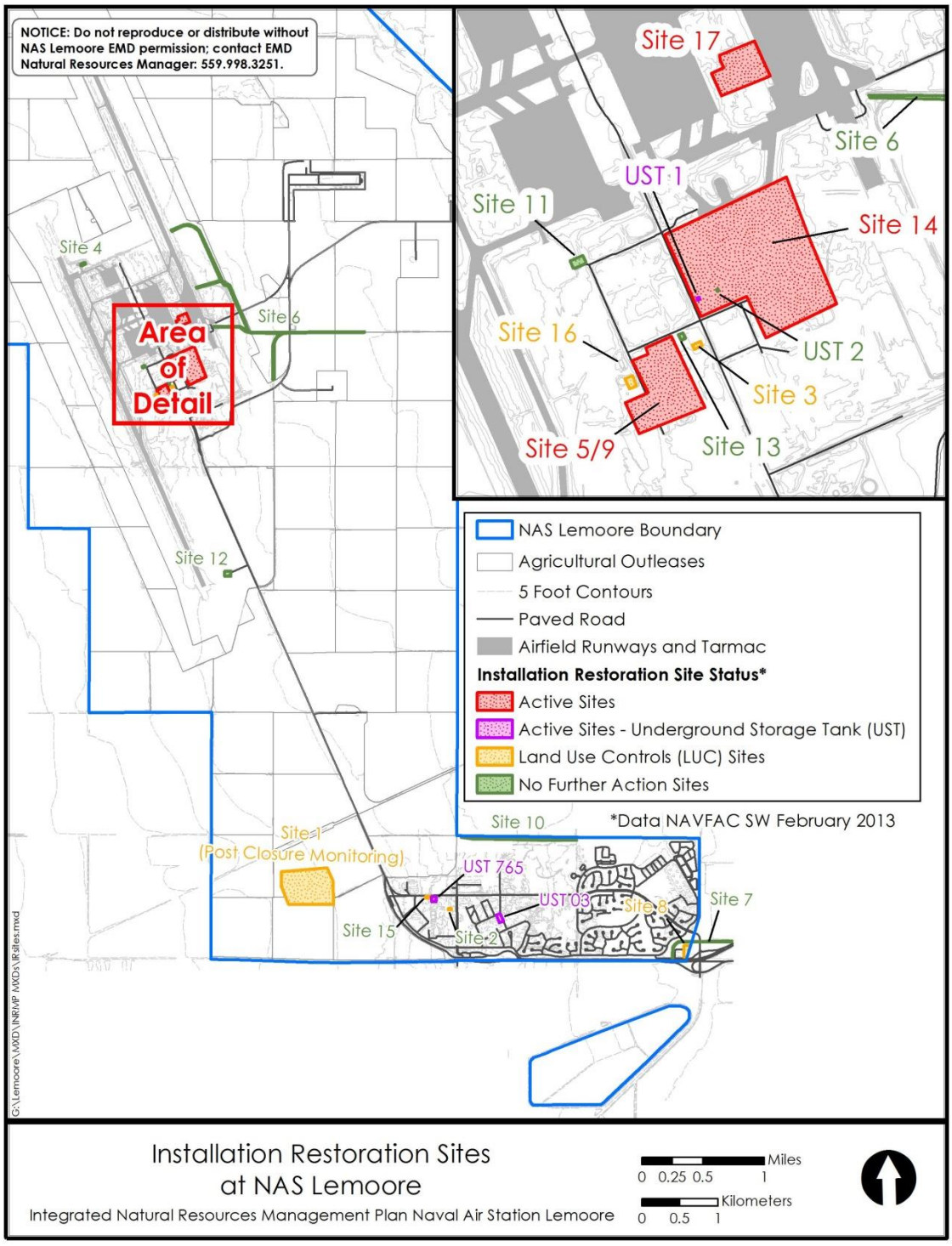
Funding from the IRP is designated for any studies needed prior to removal or remediation, removal actions, interim remedial actions, and remedial actions for known hazardous waste sites. Part of the remedial action may include restoring an area to include wildlife habitat so that the habitat features are compatible with remediation. The California Department of Toxic Substances Control and the California Central Valley Regional Water Quality Control Board (Central Valley Water Board) provide support to the Navy in implementing IRP activities at NAS Lemoore.

Table 2-5 provides a list of IRP sites and their current status. Map 2-6 shows the location of these sites.

*Table 2-5. Status of Installation Restoration sites at Naval Air Station Lemoore.*

| Name | Key Issue | Status | Projected Clean-Up Date and/or Any Land Use Controls |
|---|---|---|---|
| Site 1 - Landfill | Varied waste | Post Record of Decision | Landfill was capped in June 1997. Continued annual monitoring of landfill cap and monitoring wells for 30 years. Land Use Controls prohibit any permanent human occupancy |
| Site 2 - Pesticide Rinse Area, Bldg. 752 | Some contamination with pesticide rinsate | No Further Action | Site Closed with Record of Decision signed by NAS Lemoore Commanding Officer on Oct. 30, 2012 |
| Site 3 - Pesticide Rinse Area, Bldg. 50 | Low level arsenic in soil | Post Record of Decision Signed Dec. 6, 1998 | Land Use Controls for industrial use only |
| Site 4 - Old Fire Training Area | | No Further Action | Site Closed with Record of Decision signed by NAS Lemoore Commanding Officer on Oct. 30, 2012 |
| Site 5/9 - Fire Fighting School, Sludge Drying Ponds, and NEX Gas Station | Fuel. Chlorinated solvent plume | Remedial Investigation | No determination yet. Will have at least Land Use Controls for industrial use only |
| Site 6 - Operations Area Open Ditch | | No Further Action | Closed June 26, 2006 |
| Site 7 - Housing Area Open Ditch | | No Further Action | Closed June 26, 2006 |
| Site 8 - Housing Area Sludge Drying Beds | Chromium in soil and TCE in groundwater | Post Record of Decision Signed June 16, 1997 | Land Use Controls for industrial use only |
| Site 10 - Pesticide Application Landing Strip | | No Further Action | Closed Dec. 6, 1998 |
| Site 11 - Transformer Oil Spill, Bldg. 3 | | No Further Action | Closed June 26, 1997 |
| Site 12 - Transformer Oil Spill, Bldg. 468 | | No Further Action | Closed June 26, 1997 |
| Site 13 - Transformer Storage Area, Bldg. 50 | | No Further Action | Closed June 26, 1997 |
| Site 14 - Jet Engine Test Cell (Includes Underground Storage Tank [UST] 1, which is ongoing; and UST 2, which is closed) | Chlorinated solvents. Large amounts of groundwater and soil contamination | Remedial Investigation addendum | Remedy not selected yet. Land Use Controls will be implemented for industrial use only |
| Site 15 - Franklin Avenue Pesticide Rinse Area, Bldg. 756 | | No Further Action | Closed Dec. 6, 1998 |
| Site 16 - Sludge Beds, Blg. 65 | Chlorinated solvent (TCE) and molybdenum in groundwater | Post Record of Decision Signed June 16, 1997 | Land Use Controls for industrial use only |
| Site 17 - JP-5 Pipeline Fuel Leak | Fuel | Corrective Action Plan completed in May 2011 | As of 2012, removal of free product to the maximum extent practicable has been achieved and occasional monitoring will be continued to check for free product rebound |
| UST 3 - Administration Area NEX gas station | Leaked gasoline from older USTs under the current gas station | Investigation ongoing | Remedial Action Plan |
| UST 765 | Dissolved phase hydrocarbons | Monitoring completed | Regional Water Quality Control Board concurred with No Further Action assessment. RWQCB will grant closure after all groundwater monitoring wells are abandoned. Abandonment anticipated in 2013 |

*Source: R.M. Quesada, pers. com. 2012-2013; Navy 2012b.*




*Map 2-6. Installation Restoration Sites at Naval Air Station Lemoore.*[32]

[32] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.

## 2.4.4 Hazardous Materials

### Hazardous Materials and Hazardous Waste

Hazardous materials are used in various operations throughout NAS Lemoore in support of the military mission and are handled, stored, and transported in accordance to federal, state, and Navy requirements. Hazardous materials used on-Station include lubricants, degreasers, paint strippers, solvents, acids, and pesticides (Navy 1994). The majority of the materials are stored in Building 140 and are used for airfield operations and industrial support in the following locations:

- Buildings 217, 218, 247, 248, 277, 278, 307, 308, 337, and 338 (high speed refuelers);
- Building 170 (jet maintenance shop);
- Buildings 173 to 175 (turbo-jet engine test cells);
- Building 179 (grounds equipment maintenance facility);
- Building 188 (air frames shop); and
- Building 722 (drinking water treatment plant).

NAS Lemoore possesses an active Environmental Protection Agency generator number, and it generates approximately 280 tons (309 tonnes) of hazardous waste annually. Most hazardous wastes are generated from aircraft-related activities. At NAS Lemoore, they consist primarily of asbestos, contaminated soil, empty containers, waste asphalt, waste paint, contaminated jet fuel, spill residues, ethylene glycol, waste methyl alcohol, and waste cleaning compounds. The only extremely hazardous wastes generated regularly include polychlorinated biphenyl, from contaminated ballast fluids and waste mercury (Navy 1994, 2001b).

Hazardous wastes are collected daily from satellite accumulation areas throughout NAS Lemoore and are transferred to Building 45, where they are stored for up to 90 days. The wastes then are manifested and transported off-Station by a private contractor under agreement with the Defense Revitalization and Marketing Office.

### Storage Tanks and Fuel

Both underground storage tanks (UST) and above ground storage tanks are used to store hazardous substances and petroleum products at NAS Lemoore. There are approximately 25 USTs, ranging in capacities from 4,000 to 600,000 gallons (15,142 to 2,271,246 liters), and there are approximately 70 above ground storage tanks, ranging from 60 to 10,000 gallons (227 to 37,754 liters) (T. Schweizer, pers. com. 2013; Navy 2001b).

JP-5 jet aviation fuel is transported to NAS Lemoore via pipeline from the city of Fresno, California. The pipeline terminus is in the south Operations Area where the fuel is distributed to and stored in USTs located adjacent to aircraft parking aprons and hangars in the Operations Area. These USTs supply high-speed aircraft refueling stations in the Operations Area, two in each of the five hangars. Construction of above ground storage tanks to store JP-5 jet fuel is scheduled for 2015 (T. Schweizer, pers. com. 2012). Spill response equipment is stored at each fuel storage area, and the NAS Lemoore Fire Department responds to spills over 5 gallons (19 liters) on pavement and to any spills on soils or in water (Navy 1994).

## 2.4.5 Landscaping and Grounds

Landscaped areas on NAS Lemoore are located in the Administration and Housing Areas, comprising 294 acres (119 ha) and 532.6 acres (216 ha), respectively. The Housing Area is administered by Lincoln Military Housing (under Public-Private Venture with the Navy), which makes its own decisions regarding the type of

landscape plants and design. At present, the Housing Area maintains extensive cool season turf (hybrid fescue) along with trees and shrubs that are adapted to the frequent irrigation required to maintain the turf grass. This is typical of contemporary landscaped areas in the southern San Joaquin Valley.

Landscaped areas in the Administration and Operations Areas are overseen by NAS Lemoore PWD. While there are remnants of the water consumptive landscape plants described above, there is a clear movement toward a more xerophytic type of vegetation that uses much less water and is comprised of plants native to ecological regions similar to the ecoregional setting of NAS Lemoore. More detail on vegetation currently existing in landscaped areas at NAS Lemoore is presented in Chapter 3.

Karen Mechem Park, a 45-acre (18.2-ha) retired housing area, contains remnants of traditional San Joaquin Valley landscape plants and design. The physical structures were removed a decade ago, and it is used today for recreational activities of installation personnel. The Park has recently been upgraded with the addition of playground equipment for children, new lawn areas, and tree plantings. It is also home to the Station's horse stables (discussed below). A full report of the Park is included in Appendix E (TDI 2012), including a tree inventory and map. Recommendations for future horticultural development in both the Park and other built environment landscapes on the Station are provided in Appendix H.

Other grounds throughout the Station are mowed on a regular basis through a contract overseen by the PWD. The mowing is primarily to maintain vegetation height to discourage BASH concerns near the airfield and to combat invasive weeds in other strategic areas.

## 2.4.6 Outdoor Recreation

Outdoor recreational activities and facilities at NAS Lemoore include horse stables, Karen Mechem Park, a motocross track, and a 2.5-mile (4-km) jogging path. Wildlife viewing is also possible in the NRMAs (Map 2-2). Public participation in these activities on the installation is limited, as is subject to the NAS Lemoore Public Access policy (discussed below). The stables and motocross track are managed by the Morale, Welfare, and Recreation Department (MWR) at NAS Lemoore. The most current use regulations for MWR-managed areas can be requested from MWR.

Currently, the skeet and trap shooting range and a 7-mile (11.3-km) bicycle path on the Station are either inactive or in disrepair.

### Horse Stables and Karen Mechem Park

The Spur and Saddle Club stables are located at the Lexington Park Equestrian Center adjacent to Karen Mechem Park.[33] The club is independent of NAS Lemoore and is operated by volunteers. It is capable of boarding 36 horses. Riding occurs on nearby roadways, in agricultural areas, and on lands adjacent to the Station. As described above, Karen Mechem Park is used for recreational activities of installation personnel and includes a children's playground.

### Motocross Track

The motocross track is located northwest of the Administration and Housing Areas. It is open to installation personnel and their guests. It was relocated to retired agricultural land from NRMA 5 so that the latter could be dedicated to habitat management activities for the federally and state endangered San Joaquin kangaroo rat population.

Off-road vehicle use is not authorized on NAS Lemoore in any area outside of the motocross area.

[33] The construction and naming of the Lexington Park Equestrian Center stables preceded the renaming of Lexington Park to Karen Mechem Park in 2010.

### Jogging Path

The jogging path is 2.5 miles (4 km) in the shape of a figure eight near the gymnasium in the Administration Area. Several fitness stations are located along one loop of its 6-foot (1.8-m) wide course that is surfaced with decomposed granite. It is primarily used for squadron and physical fitness activities and is currently managed by the SeaBees, which also manages adjacent vegetation, as needed.

### Hunting Program

Limited hunting and wildlife viewing occur within the NRMAs. Hunting is permitted on the Station for active-duty or retired military personnel and civilian employees. Approximately 20 to 25 hunting permits are issued annually by the Pass and Decal Office. Hunting is only permitted concurrent with the opening dates established by the California Department of Fish and Wildlife. The current NAS Lemoore Hunting Instruction (NAS Lemoore Instruction 1710.13J, 13 May 2013) describes the rules and regulations of hunting opportunities on the Station and provides a map of restricted areas. Agricultural outlease holders may restrict hunting on their parcels by posting signs. The instruction is included in Appendix D. In the past, a falconry club has participated in hunting recreation on NAS Lemoore.

### Other Opportunities

Other outdoor recreational facilities include a running track, football and baseball fields, tennis and basketball courts, and picnic areas. These are all managed by the PWD and MWR. The Outdoor Activity Center is operated by MWR and rents out equipment to NAS Lemoore personnel primarily for off-Station activities, including skiing, fishing, camping, boating, and use of trailers.

### Inactive or Decommissioned Recreational Opportunities

The currently inactive San Joaquin Rod and Gun Club's skeet and trap shooting range is located north of the Administration Area and east of Reeves Boulevard. In the past, the club has been operated by volunteers. The PWD has occasionally assisted the club with mowing the area. Membership in the club has varied between 20 and 40 members and has included civilians, with the understanding that at least 50% of the club's members must be affiliated with the military.

A 7-mile (11.3-km) bicycle path used to extend from the Administration Area, proceeding north along 25th Avenue to Hanford Avenue and then west to the Operations Area, passing primarily through agricultural outlease areas. The path was 8 feet (2.4 m) wide and surfaced with asphalt. Currently it is in disrepair and almost inaccessible. Construction of a security fence in the recent past has cut off a large portion of the trail. There has been limited interest in having a bike path on the Station; thus, the idea for its repair and re-routing has not been revived. Currently, cyclists are not allowed on Reeves Boulevard between the Operations Area and the Administration and Housing Areas.

## 2.4.7 Public Access

Both the Sikes Act (as amended) and guidance documents (DoD Instruction 4715.03 and Chief of Naval Operations Instruction 5090.1C CH-1) state that the public may be allowed access to DoD lands as compatible with the military mission and ecosystem sustainability (Section 5.12 Public Access).

Public use restrictions at NAS Lemoore are primarily based on security and safety requirements given the mission of the installation and the capability of resources to withstand user impacts. Any individual wishing to gain access who is not DoD personnel must obtain a pass from the NAS Lemoore Security Office or be escorted onto the Station by a NAS Lemoore representative. Hunters with permits from the Pass and Decal Office are allowed in areas specified in the NAS Lemoore Hunting Instruction (Appendix D).

Access to the agricultural outlease area is for outlease holders only. The area is routinely patrolled by security to discourage unauthorized access and trespassing.

Public access is promoted during special events hosted by NAS Lemoore that target the public, such as the Station's air show. Non-DoD personnel attending special events are still required to pass through security to enter the Station.

## 2.5 Future Land Use and Airspace Patterns and Plans

NAS Lemoore continues to be a strategic facility for the Navy and is not slated for closure or partial realignment. It is reasonably foreseeable that NAS Lemoore will receive new missions in the future as technology, aircraft, and training needs change. Any new development will likely occur near existing facilities, which tend to be adjacent to agricultural lands. Development will be unlikely in any of the NRMAs or near sensitive resources due to physical constraints (e.g., high water table), incompatibility with flight operations (e.g., proximity to runways), and limited access (e.g., distance from developed roadways). Operation of NAS Lemoore will require that lands surrounding it remain open space (such as agricultural production) and that they be managed for compatibility with mission needs.

Anticipated projects at NAS Lemoore are included in Table 2-6.

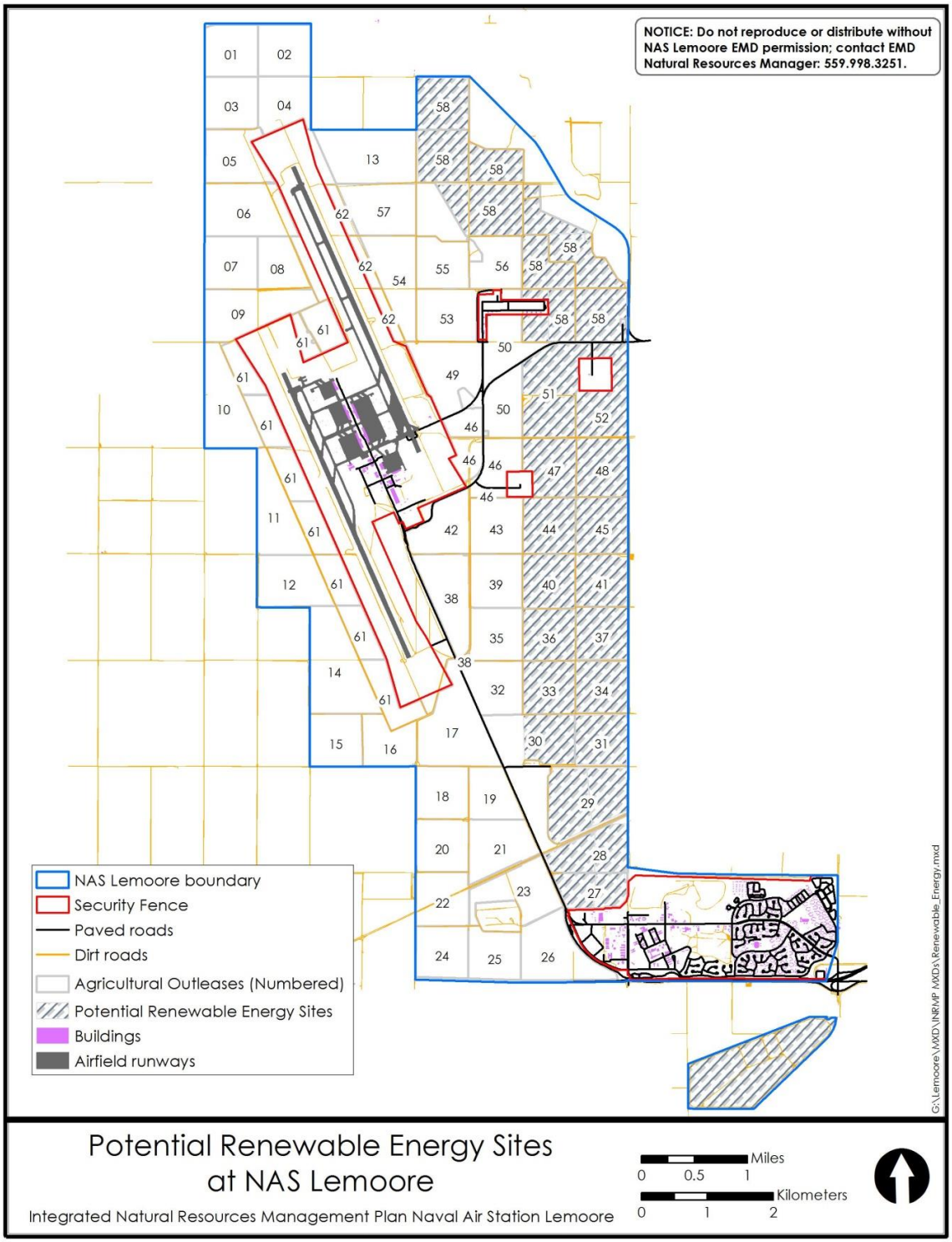
*Table 2-6. Projects anticipated at Naval Air Station Lemoore.*

| Project Name | Status | Description |
|---|---|---|
| Potential basing of F-35C, Joint Strike-Fighter aircraft | Currently undergoing an Environmental Impact Statement. | Joint Strike-Fighter aircraft may be based at NAS Lemoore in the future. Analysis of basing the Joint Strike-Fighter aircraft (F-35C) at NAS Lemoore is currently being analyzed in an Environmental Impact Statement. |
| Upgrading Facilities to Support F-35 Joint Strike-Fither Aircraft | Currently undergoing an Environmental Assessment | Upgrading of facilities and functions to support potential introduction of F-35 Strike-Fighter aircraft to NAS Lemoore. |
| Development of a third runway | Remains a feasible, but not immediate, possibility. | Addition of a third runway to be parallel to the western runway on land under agricultural production and open space mowed areas. |
| Construction of an additional hangar area | Anticipated within two to ten years. | With additional aircraft being deployed at NAS Lemoore, the Station eventually may need to build another hangar for maintenance. The hangar would be on undeveloped mowed grassland adjacent to existing hangars in the Operations Area. |
| Installation of renewable energy technology | Anticipated within two to ten years. | NAS Lemoore is looking into potential opportunities for renewable energy projects, such as photovoltaic or methane capture on the installation. It is likely that any renewable energy project would be introduced in a phased approach. Potential renewable sites are illustrated in Map 2-7. |
| Development of a rail line and/or station at NAS Lemoore | A potential project for the distant future. Pending development of California high speed rail. | In the event that high speed rail development occurs in the area of NAS Lemoore, stops are anticipated in the Visalia area and would include enhancement of the rail line in the area. In the event that this occurs, NAS Lemoore is considering developing a feeder rail line that connects with the high speed rail line in the far future. There is also potential for a rail station to be constructed at NAS Lemoore. |

*Source: Navy 2001b; J. Crane, T. Schweizer, and C. Dahlstrom, pers. com. 2011-2013*

## 2.6 Historical Overview of Land Use

The following sections provide an overview of land use in the southern San Joaquin Valley and at NAS Lemoore before and leading up to the establishment of the Station. Additional details of Native American and historical use of this area are provided in the NAS Lemoore 2012 Integrated Cultural Resources Management Plan (Navy 2012c).




*Map 2-7. Potential renewable energy sites at Naval Air Station Lemoore.*[34]

[34] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.

## 2.6.1 Native American Use of Natural Resources/Cultural Resources

### Prehistory

Human occupation of the San Joaquin Valley is thought to date back to at least 10,000 years before present. Hunter/gatherers were attracted to the lacustrine and marshland setting and their abundant resources. NAS Lemoore and the surrounding area was marshland in pre-European times (Bunn et al. 2007). In ancient times, even as today, the dry west side of the San Joaquin Valley was less advantageous for settlement, and the great bulk of the Yokut Native American population was concentrated in the better-watered eastern valley margin (Heizer and Elsasser 1980).

### Native American Resources

The Southern Valley Yokuts were the primary Native American group known to have used the southern San Joaquin Valley. The Tachi tribe occupied the territory encompassing the present-day NAS Lemoore. Villages were occupied nearly year-round, with families leaving for a few months to gather seeds and wild plants in the spring or summer. During these times, dispersed camps were occupied near resources (Kroeber 1925; Wallace 1978).

Subsistence practices of the Southern Valley Yokuts emphasized fishing, hunting waterfowl, and collecting shellfish, roots, and seeds. Antelope, elk, wolves, and bears were hunted from the lakeshores. Wild pigeons, rabbits, and squirrels also were consumed. Waterfowl included pelicans, cormorants, avocets, plovers, gulls, herons, terns, ducks, grebes, bitterns, geese, curlews, and snipe (Jones 1971). Large quantities of mussels were gathered, and turtles were commonly eaten. Tule roots and seeds were a staple, and the stems were used as construction materials for huts, balsas, and rafts (Jones 1971).

## 2.6.2 European Settlement

In 1772, Pedro Fages led the first Spanish expedition into the southern San Joaquin Valley on his way to San Luis Obispo. Active explorations began in 1802 with the second administration of Governor Jose Arrillaga, who was eager to gain a foothold in the California interior. During the period when Mexico ruled California (1822-1846), no rancheros were established within the southern San Joaquin Valley, and Mexican influence on the Southern Valley Yokuts was minimal (Gallegos and Associates 1997).

Following the annexation of California by the United States in 1845, settlers quickly occupied the San Joaquin Valley. Settlement in the Kings River area began in the 1850s in present-day Centerville Bottoms of Fresno County (El Rio Reyes 2010). The first community of Tulare County was Visalia, founded in 1852 (Gallegos and Associates 1997). In 1870, the Fresno Canal and the Lower Kings River Ditch were commissioned; the latter is now known as the Lemoore Canal (KRCD and KRWA 2009). The Fresno Canal brought water to previously uncultivated prairie, which turned out to be extraordinarily fertile, especially in combination with the hot, dry valley climate. An extensive canal and levee system was built over the next 100 years and changed the lower portion of the Kings River. The River was channeled to control flood waters, and more recent man-made additions help to control the Kings River hydraulic system (Kings County 2010; KRCD and KRWA 2009).[35]

The cities of Hanford and Lemoore were founded circa 1877 when the Southern Pacific Railroad was extended westward from the town of Goshen. By 1891, Lemoore was the largest wool shipping point in California

[35] These facilities capture snow melt run-off and allow for controlled water release during the summer months, enabling year-round irrigation and flood control protection to more than one million acres (404, 685 ha) of agricultural land, communities, and municipalities (Kings County 2010).

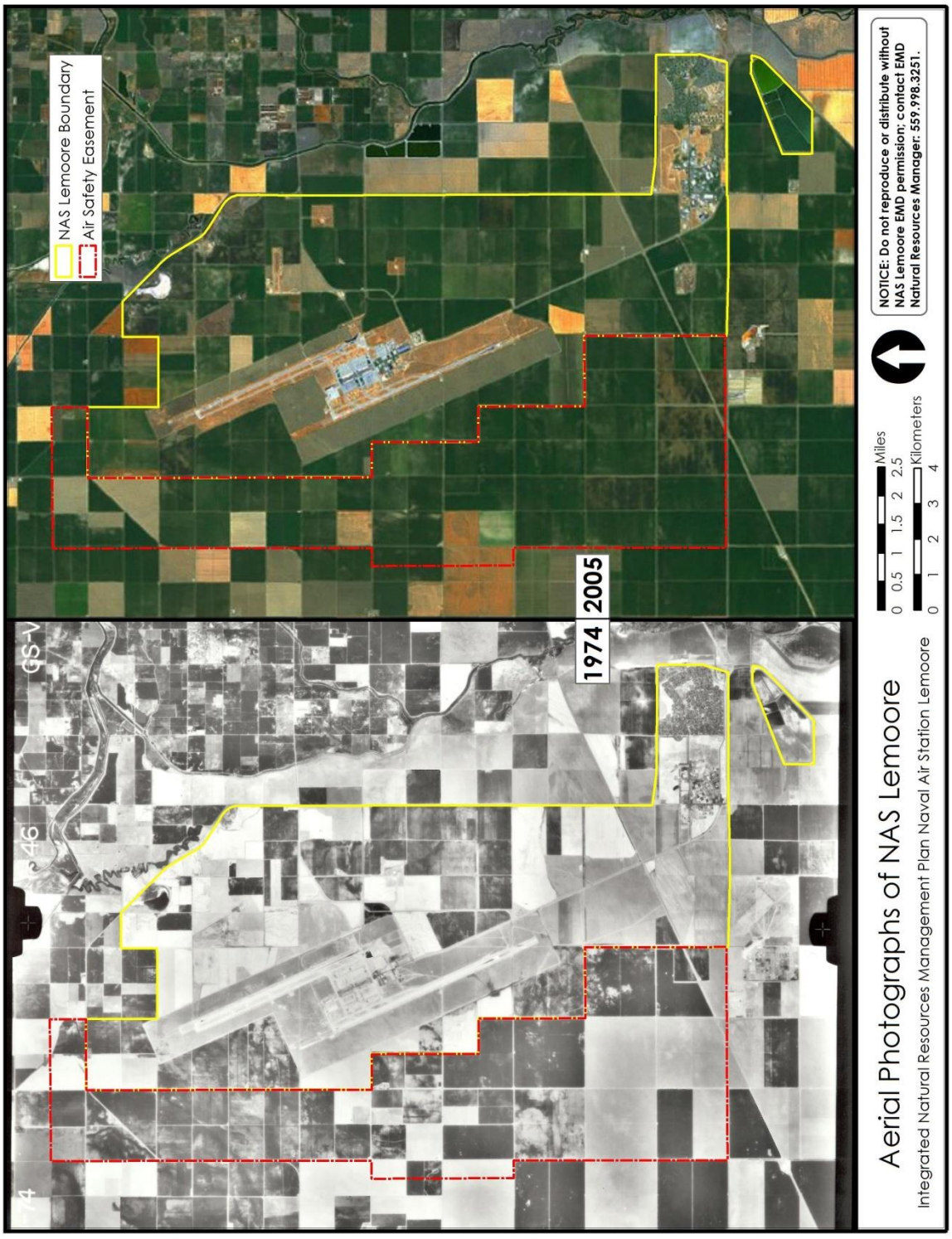
(Gallegos and Associates 1997). In 1891, Hanford was incorporated, and was later selected as the county seat in 1893 when the formation of a new county was approved by voters after a portion of western Tulare County was divided to form Kings County. In 1909, land was transferred from Fresno County to Kings County, expanding the boundary by 118 square miles (306 square kilometers) (Kings County 2010).

## 2.6.3 Historic Navy Land Use

NAS Lemoore was established in 1957 when the Navy acquired over 18,000 acres (7,290 ha) of agricultural land for Station operations. Land was purchased and easements were obtained for the construction of NAS Lemoore in 1958 (Photo 2-1). Construction of the Station began the same year. At that time, many existing farmhouses and outbuildings were razed. The Station was commissioned in 1961 and began operations during the height of the Cold War (Navy 1994). A full description of historic Navy use at NAS Lemoore is provided in the 2012 Integrated Cultural Resources Management Plan (Navy 2012c). Map 2-8 shows aerial images from 1974 and 2005.

Except for military housing constructed after 1995, extant post-1959 buildings and structures constructed by the Navy are approaching 50 years old and should be re-evaluated for their historic significance and National Register of Historic Places eligibility. These include approximately 140 buildings, structures, or objects such as the Central Union School District's Neutra Elementary School buildings (designed by noted architect Richard J. Neutra) and Akers Elementary School (Navy 2012c), which have not yet been formally recorded or evaluated for National Register of Historic Places eligibility.


*Photo 2-1. Naval Air Station Lemoore Main Gate during Station construction in 1958 (Left). Looking north at the Naval Air Station Lemoore Operations Area while under construction in January 1959 (Right).*




*Map 2-8. Aerial images of Naval Air Station Lemoore from 1974 and 2005.*[36]

[36] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.

**This Page Intentionally Blank**

# 3.0 Natural Resources Status and Condition

*This chapter describes the natural resources of Naval Air Station Lemoore and what is known about the status and condition of these resources, from the physical features and processes they depend on to their numbers and distribution. Their current and future management strategies are described in chapters to follow.*

## 3.1 Ecoregional Setting

Naval Air Station (NAS) Lemoore (also referred to as Station or installation) is located within the southwestern portion of the Central Valley of California. The Central Valley is approximately 450 miles (724 kilometers [km]) long, and averages 50 miles (80 km) wide. It contains three geographic subregions: the Sacramento Valley, the San Joaquin Valley, and the region of these two river's confluence at the Sacramento-San Joaquin Delta (Map 3-1).

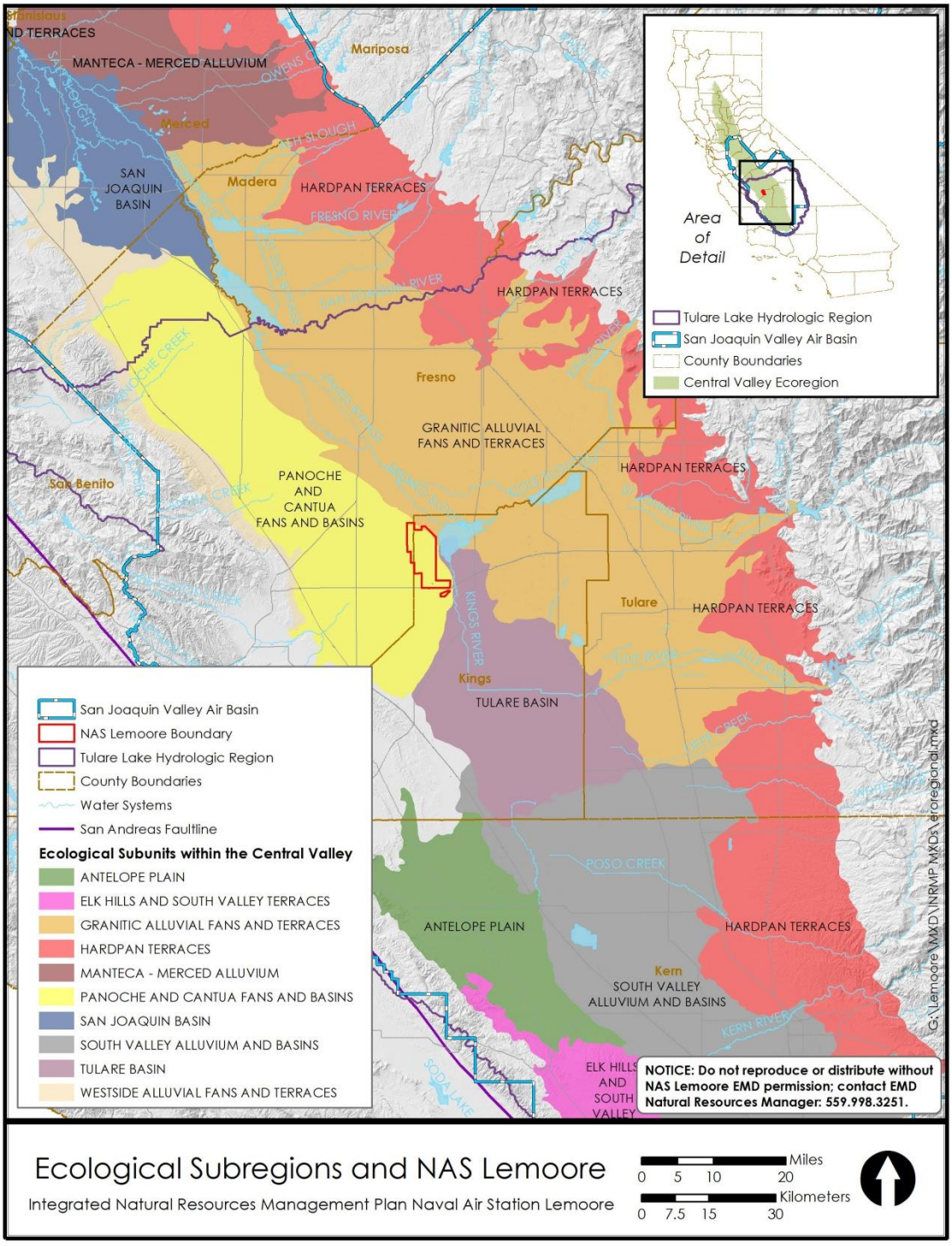
Hydrologically, the Central Valley is defined by three distinct overarching watersheds. Two of these watersheds (the Sacramento River and San Joaquin River) capture river water from the northern and central Coast Range and Sierra Nevada mountains and feed the Sacramento-San Joaquin Delta (Map 3-1). The southern and drier portion of the San Joaquin Valley, known as the Tulare Lake hydrologic watershed, is isolated from the ocean. Prior to agricultural diversions, water from the southern Sierra Mountains flowing from the Kings, Kaweah, Tule, and Kern Rivers fed the now dry Tulare, Buena Vista, and Kern Lakes (Map 3-1). Runoff during the wettest years will occasionally flood out of river channels and temporarily refill some of these lakebeds (Bunn et al. 2007).

Ecologically, NAS Lemoore is set within the Panoche and Cantua Fans and Basin eco-subregion (Map 3-2) within the Great Valley section of the California Dry Steppe Provinces (U.S. Forest Service 1995). This ecological subregion, with its native perennial needlegrass grasslands, is distinctive in geomorphology, soils, climate, and availability of surface water. These characteristics will be detailed in the sections below.

Prior to the agricultural development of the late 19th and 20th centuries, California's Central Valley encompassed a diverse array of perennial bunchgrass ecosystems, including prairies, oak-grass savannas, desert grasslands, as well as a labyrinthine assemblage of riparian woodlands, expansive freshwater marshes, and vernal pools (Map 3-3). Pre-development, the Central Valley supported one of the most diverse, productive, and distinctive grasslands in temperate North America. Despite the region's generally flat terrain, the combination of natural communities it encompassed was unique on the continent. Set in the rain shadow of the Coast Range, the more arid lands of the southern San Joaquin Valley contained vast alkali sink and saltbush shrublands (Bunn et al. 2007). At that time, Tulare Lake was large, covering as much as 1,000 square miles, and was surrounded by tule marshes and alkali scrub vegetation further out. Rivers along the valley floor provided habitat for native fish and invertebrates and sustained adjacent riparian, wetland, and floodplain habitats. The wetlands supported tule elk, pronghorn antelope, grizzly bears, wolves, fish-eating and wading birds, and huge numbers of breeding and wintering waterfowl. Upland communities beyond the reach of streams fed by mountain runoff occurred in a matrix based on soil texture, alkalinity, and rainfall.

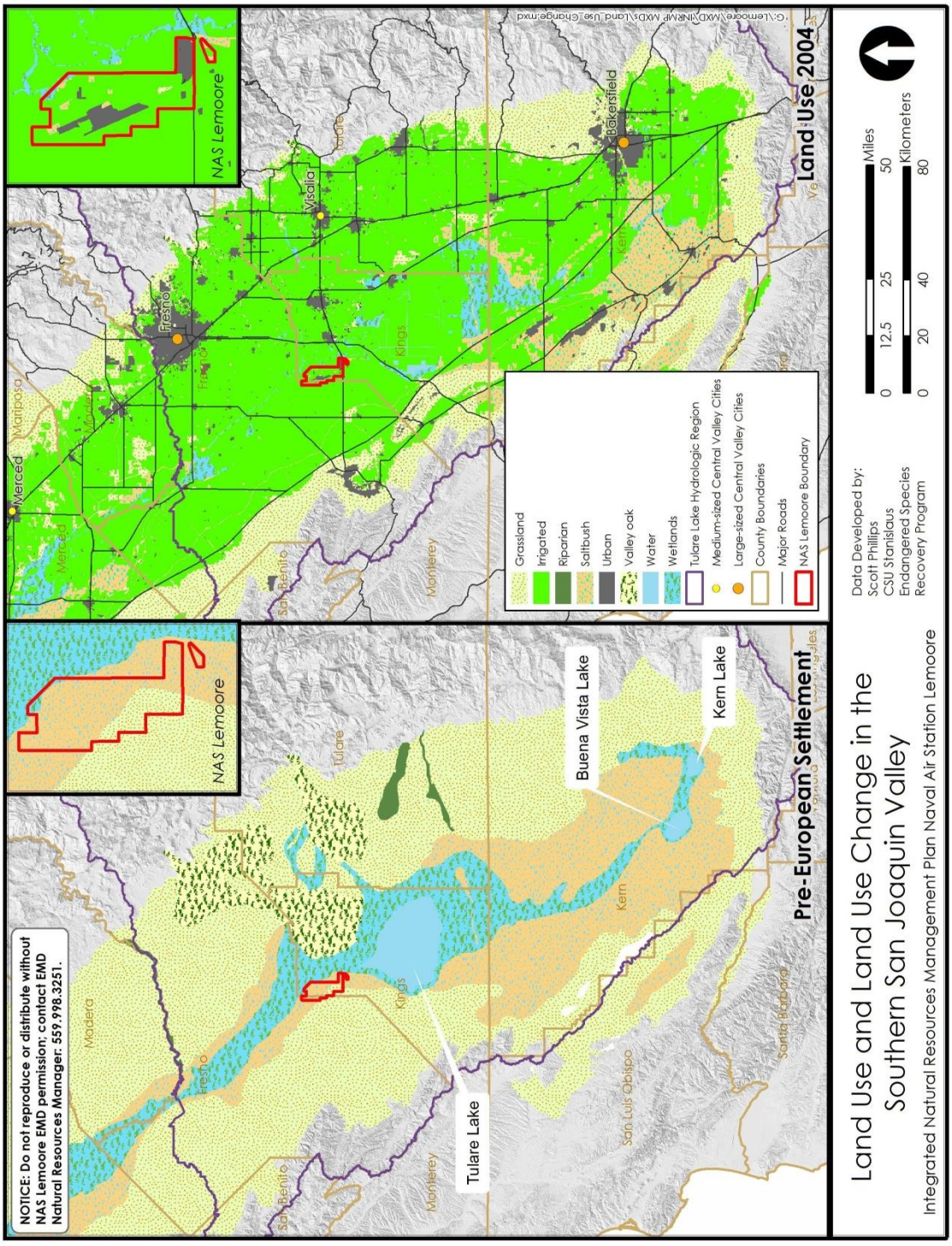

*Map 3-1. The Central Valley ecoregion of California.*[1]

[1] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.




*Map 3-2. Ecological subregions of the southern San Joaquin Valley.*[2]

[2] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.




*Map 3-3. Land use and land use change in the southern San Joaquin Valley.*[3]

[3] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.

Intensive agriculture now dominates land uses in the Central Valley (Map 3-3). Its rise has changed the fauna of the Valley's perennial grasslands; only very small and discontinuous undisturbed habitat remains and many of the larger species have been extirpated (U.S. Forest Service 1995). Agricultural production in the Central Valley (California's richest agricultural region) accounts for the State's annual No. 1 ranking with the greatest cash farm receipts (California Department of Food and Agriculture [CDFA] 2010a).[4] Fresno County, of which NAS Lemoore is a part, consistently ranks as the highest grossing county in California in terms of agriculture. Grapes, almonds, milk, poultry, and tomatoes are its main commodity crops, which combined generated $5.6 billion in 2008 (CDFA 2010a). The agricultural leases at NAS Lemoore contribute to one of the most productive agricultural regions in the world.

Despite the losses of over 98% of the original natural assemblages due to agricultural conversion, most of the original plant communities are still present in smaller areas. These natural lands and their native plants and wildlife are increasingly valuable natural resources. They now support and are ecologically connected with all of the agricultural and commercial productivity that have enabled this area of the Central Valley to rise to its position of world-wide prominence (Preston 1981; Griggs et al. 1992).

# 3.2 Climate

The climate of the San Joaquin Valley region is characterized by a typical Mediterranean regime of dry, hot summers and moderate winters with low precipitation. The southern San Joaquin is notably drier than the other portions of the Central Valley. During the warm summer season, humidities are characteristically low and occasionally readings may drop to below 10% (Western Regional Climate Center 2013). The rainy season is typically from the beginning of November to the end of March. On occasion, the southern San Joaquin Valley can experience transient monsoon storms from the Gulf of California from mid-July through September. Winters are mild, with very few snow storms but common morning frosts.

## 3.2.1 Temperature

Average monthly temperatures (Figure 3-1) in the summer range from 62 degrees Fahrenheit (°F) (16.7 degrees Celsius [°C]) to 92°F (33.3°C), with an average of 80°F (26.7°C). Winter monthly temperatures range from 34°F (1.1°C) to 55-60°F (12.8-15.6°C) (Data source: Western Regional Climate Center [Hanford weather station] 2013), and can fall to sub-freezing temperatures at times.

## 3.2.2 Precipitation

The Coastal Ranges (Santa Lucia, Diablo, and Temblor) west of NAS Lemoore cause a rain shadow for moist Pacific Ocean air moving east; consequently, precipitation on the leeward side of the mountain chains is relatively low. The annual precipitation at NAS Lemoore is highly variable, ranging from less than 4 inches to 15.5 inches (10–39 centimeters [cm]), with an average of 8.2 inches (20 cm) (Figure 3-2), most of which falls from December through March (Figure 3-3). On average, approximately 80% of the annual precipitation occurs from November through March. Compared to areas further north in the Central Valley, a greater portion of the Basin's annual precipitation falls later in the season, during January, February, and March.

[4] California, with its $36.2 billion (2008 U.S. Dollars) in revenue, represents 11.2% of the U.S. total.

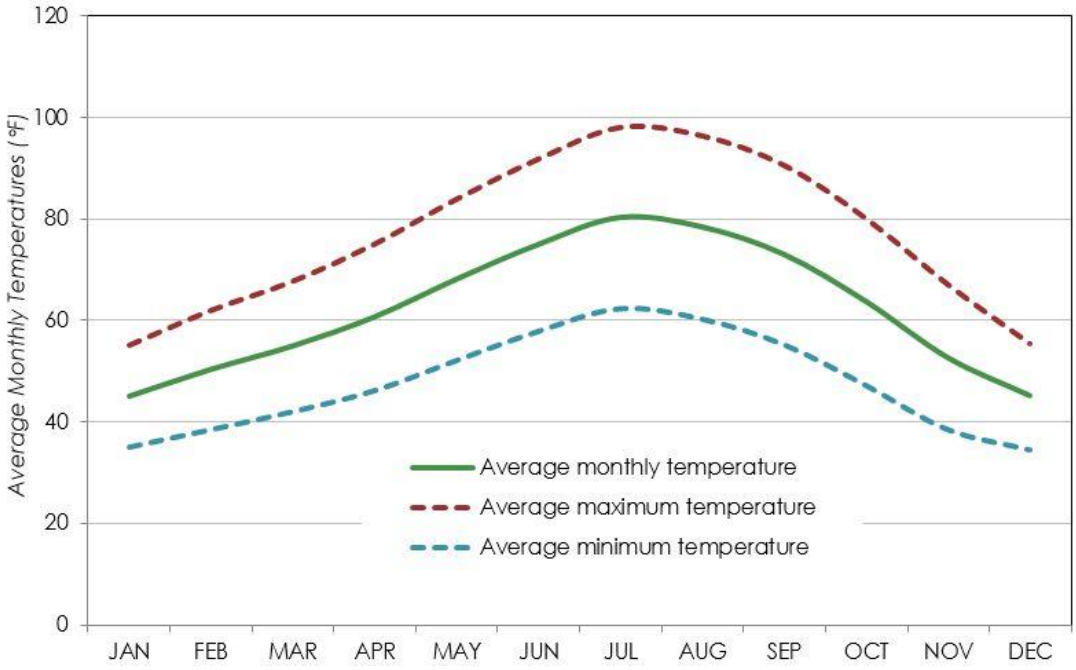



*Figure 3-1. Average monthly temperature regime at Naval Air Station Lemoore (Data source: Western Regional Climate Center [Hanford weather station] 2014).*

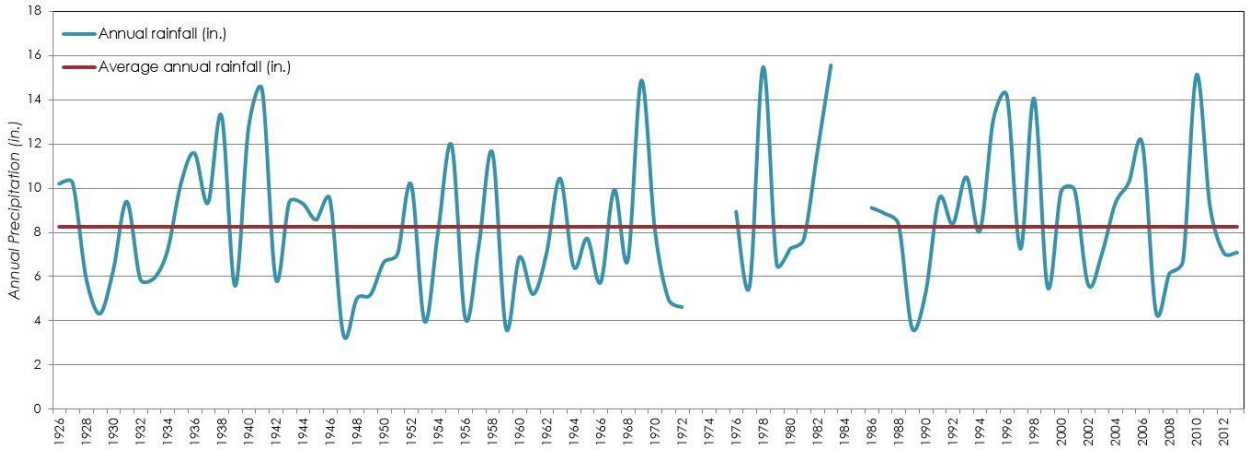



*Figure 3-2. Annual rainfall at Naval Air Station Lemoore from 1926 through 2012 (Data source: Western Regional Climate Center [Hanford weather station] 2014).*

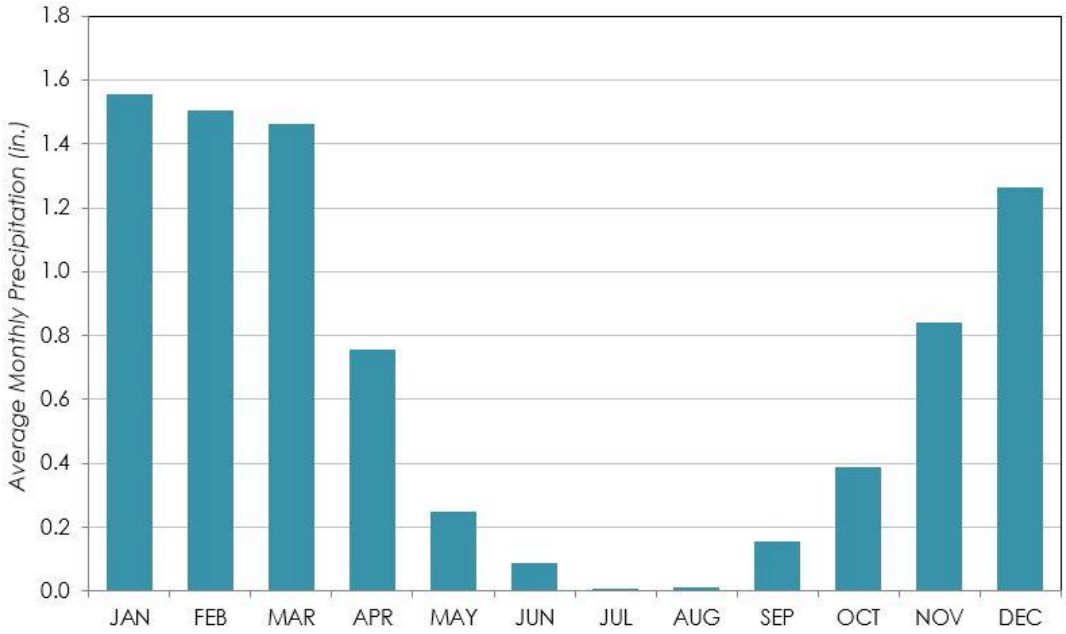



*Figure 3-3. Average monthly rainfall at Naval Air Station Lemoore based on data from 1926 through 2012 (Data source: Western Regional Climate Center [Hanford weather station] 2014).*

## 3.2.3 Wind

Prevailing winds in the San Joaquin Valley are from the northwest, averaging 6 to 8 miles per hour (9.5-13 kilometers per hour [kph]) (Table 3-1). High winds of 30 to 50 miles per hour (48-80 kph) are not uncommon, with occasional gusts exceeding 80 miles per hour (130 kph) having been recorded (Navy 1992).

*Table 3-1. Average monthly and annual wind speed (miles per hour) at Naval Air Station Lemoore (Western Regional Climate Center 2014).*

| Period | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1996-2014 | 6.1 | 7.6 | 8.5 | 9.8 | 9.9 | 9.3 | 8.5 | 8.0 | 7.5 | 7.3 | 6.7 | 6.9 | 8.0 |

## 3.2.4 Tule Fog and Inversion Layers

During the rainy season between November and March, heavy ground fog called 'tule fog' is a common winter occurrence in the San Joaquin Valley. This atmospheric phenomenon often requires aircraft to operate under instrument flight rules. The dense fog is the product of the both winter atmospheric conditions and geography (National Oceanic and Atmospheric Administration 2010). Due to the surrounding mountains to the west, south, and east, the San Joaquin Valley Air Basin (in which NAS Lemoore is located) is essentially closed (Map 3-2). Moisture and pollutants are not removed from the air basin unless pushed or lifted out by atmospheric processes. By the late fall, cool season storms bring rain to the valley floor, thereby adding low-level atmospheric moisture. High pressure building aloft behind these storms limits vertical air movement from the air basin. As the ground cools during long winter nights, it cools the adjacent air and forms fog as temperatures reach the dew point (National Oceanic and Atmospheric Administration 2010).

During inversions and associated periods of little net air movement, the San Joaquin Valley is subject to limitations in the vertical mixing of pollutants. This often results in concentrations of oxidants in excess of National Ambient Air Quality Standards. Moreover, the inversion layer exacerbates particulate levels in the ambient air, causing potential eye and respiratory irritation for several months out of the year.

## 3.2.5 Air Quality

The San Joaquin Valley Air Basin (Map 3-2) is managed and regulated by the San Joaquin Valley Air Pollution Control District (2011).[5] Regional and local air quality is impacted by topography, dominant airflows, atmospheric inversions, location, and season. The combination of topography and inversion layers generally prevents dispersion of air pollutants in this region, with pollutants recirculating around the San Joaquin Valley during periods of stagnation. While impacted by Central Valley and Bay Area pollution that is upwind, air quality research studies indicate that the San Joaquin Valley Air Basin generates its own pollutant emissions sufficient to exceed air quality standards.

Both the State of California and the federal government have established ambient air quality standards for the following six criteria pollutants: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, inhalable and fine particulate matter (PM10 and PM2.5),[6] and lead particles. Federal ambient air quality standards are set by the U.S. Environmental Protection Agency. State ambient air quality standards are set by the California Air Resources Board. State ambient air quality standards are applicable at NAS Lemoore through the waiver of sovereign immunity in the Clean Air Act Section 118 (42 USC § 7418).

An area, such as the San Joaquin Valley Air Basin, is designated as in 'attainment' by the California Air Resources Board when it is in compliance with the national and/or California ambient air quality standards. Although air quality has noticeably improved, San Joaquin Valley counties still experience unhealthy ozone concentrations on many days each year. This region also ranks high in unhealthy levels of particulate matter throughout the year.

Emission sources at NAS Lemoore include various stationary sources, aircraft, and motor vehicles. Stationary sources include aircraft engine test cells, portable engines for generators and compressors, fuel storage and handling facilities, boilers, solvents and coatings used for aircraft maintenance, and gasoline stations. In addition, NAS Lemoore periodically conducts open burning for habitat management in Natural Resources Management Area (NRMA) 5 and removal of invasive and non-native plant species as needed. While local governments address the mandatory reductions in emissions in their General Plans (and through California Environmental Quality Act compliance for projects), NAS Lemoore participates in emission reduction to meet schedules for achieving federal standards.

## 3.2.6 Climate Change

The U.S. Department of the Interior (2011) projects that by 2050 the southern Central Valley will experience annual precipitation decreases by as much as 5.3%; wintertime runoff increases and summertime runoff decreases; and over the whole of the 21st century, temperature increases by 5 to 6°F.

In the Tulare Lake Hydrologic Region (Map 3-1), February, March, and April are shown to have the largest temperature response (Paper No. 02153 of the Journal of the American Water Resources Association as cited in California Department of Water Resources [CDWR] 2009b) leading to milder winter temperatures, an earlier arrival of spring, and increased summer temperatures. Instead of deep winter snowpacks that feed San Joaquin Valley rivers through the summer, more of the precipitation will be winter rain that runs off quickly. For the San Joaquin Valley, this means more intense winter flooding, greater erosion of riparian habitats, and increased sedimentation in wetlands (Field et al. 1999; Hayhoe et al. 2004). Climate models by the U.S. Global Change Research Program, the State's water resources agency, and researchers at the University of California, Davis all point to decreasing Sierra Nevada snow

[5] Website: http://www.valleyair.org/Home.htm

[6] PM10 and PM2.5 define airborne particulates with less than 10 or 2.5 micrometers, respectively.

packs that supply California's water. This, combined with more frequent summer droughts, will likely lead to a future with less predictable surface water for agriculture and more extreme habitat conditions for wildlife. Altered precipitation regimes and temperatures can impact the distribution of species and timing of wildlife migrations. Ecological processes and food web support that sustain those species may also shift in response. Some species will likely adapt in place, more broadly-adapted species will probably emigrate to more suitable climates, and the rest will experience different rates of population or health declines. Movement to other habitats will be more challenging as the few remaining habitat patches shrink and the gaps between habitats grow (Bunn et al. 2007).

Warmer temperatures, leading to anticipated increases in evapotranspiration, combined with a general decline in soil moisture set the stage for slightly higher agricultural water requirements (Paper No. 02153 of the Journal of the American Water Resources Association as cited in CDWR 2009b). This is likely to increase future groundwater demands (U.S. Department of the Interior 2011). Changes in groundwater recharge will result from changes in effective rainfall, as well as a change in the timing of the recharge season (Paper No. 02153 of the Journal of the American Water Resources Association as cited in CDWR 2009b).

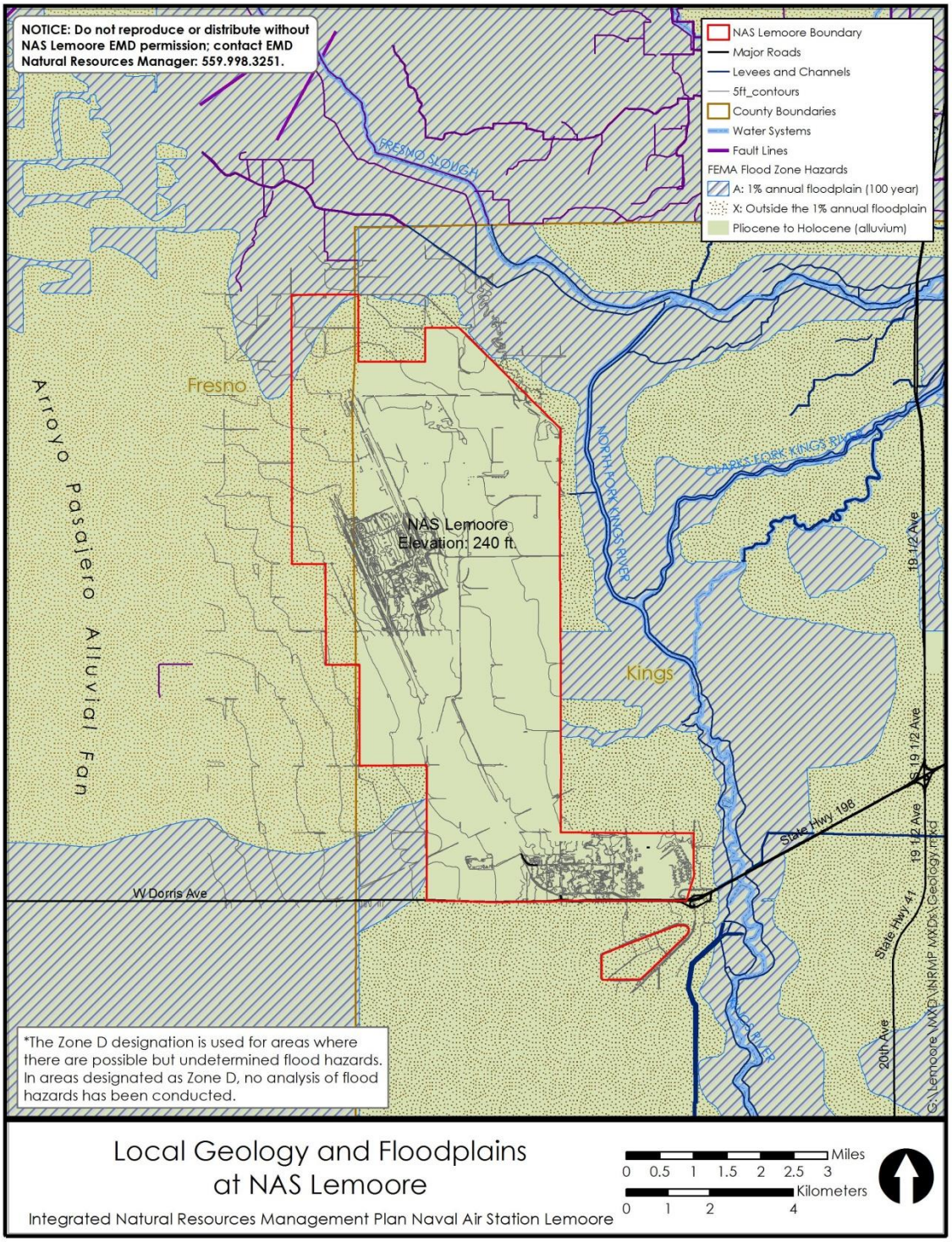
# 3.3 Physical Conditions

The topography of NAS Lemoore is typical of that of the center of an alluvium-based valley, as the Station lies at the intersection of two alluvial fans. The Arroyo Pasajero alluvial fan drains the foothills to the west of the Station (Map 3-4). To the east, the Kings River drains the Sierra Nevada mountain range and creates an alluvial fan or delta as the River's waters divide to go south to Tulare Lake or north to the Fresno Slough. As a result, NAS Lemoore is relatively flat. Elevations at the Station range from approximately 210 feet to 265 feet (64–81 meters [m]) above mean sea level. The land surface in the vicinity of the Station is relatively level and slopes toward the northeast at a rate of approximately 8 feet (2.4 m) per mile. In the past, surface runoff from the alluvial fan of the Arroyo Pasajero, which collects drainage from the hills west of Coalinga, has sometimes flowed across NAS Lemoore into the Kings River. While the California Aqueduct has now created a barrier to this flow (Navy 2001b), relief valves under the aqueduct can be opened in emergency situations to release flood flows into the Arroyo (J. Crane, pers. com. 2011).

## 3.3.1 Geology

The southern San Joaquin Valley is a broad southeast-trending structural trough that mainly drains internally. It is about 250 miles (402 km) long and about 55 miles (88.5 km) wide at the latitude of NAS Lemoore. The valley is bounded on the east by the igneous rocks of the Sierra Nevada that were intruded into the existing metamorphic rocks during the Mesozoic Era (225 million to 65 million years before present) and later uplifted during the late Tertiary Period (the Tertiary Period followed the Mesozoic Era and ended 1.8 million years ago, with the Pleistocene Epoch). These rocks slope southwestward and underlie the basin at great depth (about 15,000 feet [4,572 m] deep in the area of the Tulare Lake Bed) (Bartow 1991). The Coast Ranges (Diablo and Temblor Ranges) to the west consist mainly of folded and faulted consolidated marine and non-marine sedimentary rocks of Mesozoic Era to late Tertiary Period that dip to the east and overlie the Sierran basement rocks. In the southern (Bakersfield area) and western (Coalinga area) margins of the valley, these rocks are a reservoir for petroleum deposits. NAS Lemoore and its surrounds are entirely underlain by the easternmost extent of relatively recent Pliocene to Holocene alluvial fan deposits from the Coast Mountain Range, which are roughly five million years old and younger (Map 3-4).[7]

[7] Most of the valley fill sediments were carried into the valley by large streams that derived from melting of glacial ice that covered the Sierra Nevada. Smaller streams carried sediments from the Coast Ranges. Due to the differences in the parent rock and in depositional conditions, the sediments derived from the Sierra Nevada are generally coarser and contain few mineral salts, while the sediments that derive from the Coast Ranges are generally finer and contain more salts.




*Map 3-4. Regional geology and floodplains at Naval Air Station Lemoore.*[8]

[8] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.

### 3.3.1.1 Stratigraphy

The area of NAS Lemoore is underlain at the surface by floodplain deposits that are primarily clayey-silty (Section 3.3.2 Soils and Soil Condition). At depth, and overlying consolidated Tertiary rocks, is a thick sequence of unconsolidated, coarse-textured deposits (sands, gravels) derived from alluvium alternating with six clay lakebed (lacustrine and paludal) deposits of variable thickness.[9] The unconsolidated deposits date from the late Pliocene and form the principal aquifers of the San Joaquin Valley. The clay beds that separate and confine them define the aquifers as they restrict the flow of water, especially vertically. They are also associated with much of the subsidence seen in the area (Section 3.3.3.2 Groundwater Resources and Water Quality and Section 2.4.1.2 Agricultural Water Resource Supply and Use). These clay layers are referred to by Croft and Cordon (1968) as the A, B, C, D, E, and F clays. Of these, the F clay is considered of least hydrogeological importance, while the E, C, and A clays are the most aerially extensive (Croft 1972; Corbett et al. 2011) (Figure 3-4). The E Clay is commonly known as the Corcoran Clay and, more formally, as the Corcoran member of the Tulare formation. The E clay, which is 80 feet (24.4 m) thick on average and occurs at about 650 feet (198 m) beneath the NAS Lemoore area, is the most extensive aquitard[10] unit in the San Joaquin Valley (Corbett et al. 2011).

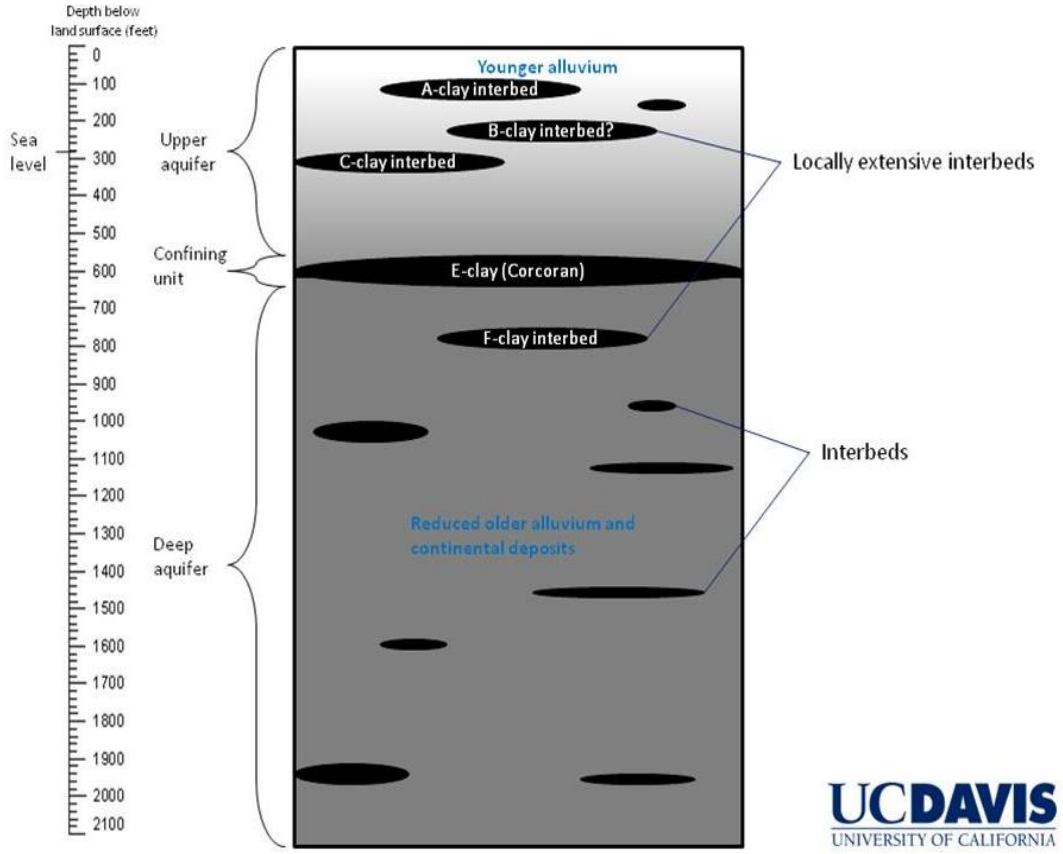



*Figure 3-4. Simplified study area stratigraphy of the Naval Air Station Lemoore area showing upper aquifer that confines with depth due to the A-C-Clay layers, and the deep aquifer (Corbett et al. 2011).*

[9] This is true of much of the area surrounding the Tulare Lake Bed (Corbett et al. 2011).

[10] An aquitard is a bed of low permeability adjacent to an aquifer; it greatly slows the vertical movement of groundwater from one aquifer to another and for that reason is also called a confining layer. It may serve as a storage unit for groundwater, although it does not yield water readily.

The great thickness of the basin fill is apparently a result of a continuous downwarping or subsidence of the basin that caused sediments to be retained rather than carried out to the Pacific Ocean (Bartow 1991). On at least three occasions since the Pleistocene (which ended 10,000 years ago), nearly the entire southern San Joaquin Valley was inundated by a single lake, which then shrank to form several separate lakes. What is now the Tulare Lake Bed, 10 miles (16 km) south of NAS Lemoore, is the core of one of the largest of these separate lakes and is underlain by more than 3,600 feet (1,097 m) of interbedded clays and silts (Page 1986).

#### 3.3.1.2 Seismicity

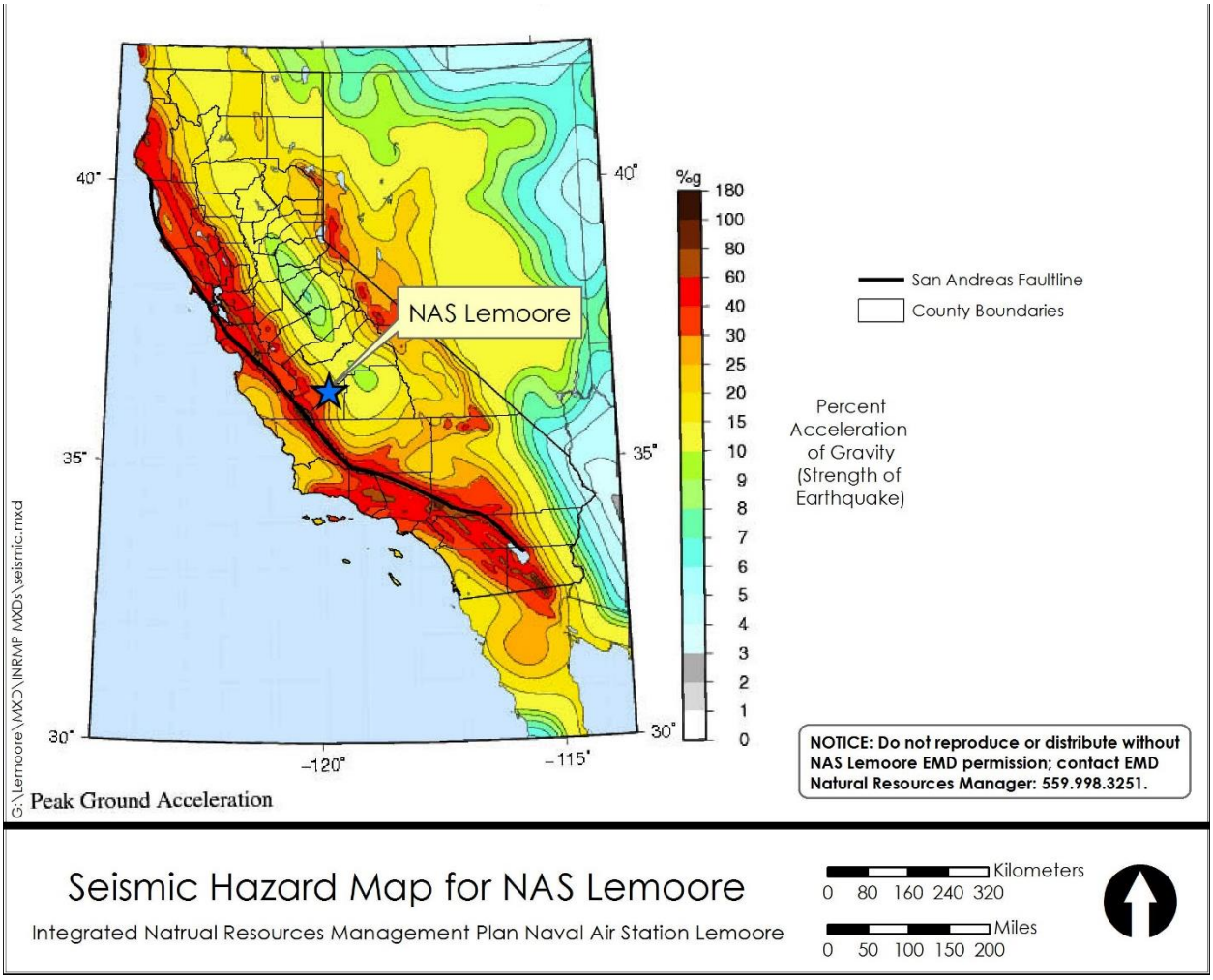
A large part of the Central Valley lies within one of the most seismically quiescent regions of California (Map 3-5). However, NAS Lemoore lies just to the east of an area heavily affected by the San Andreas Fault (a mere 40 miles [64 km] away). There are several very minor faults to the northwest of the Station (Map 3-4). The U.S. Geological Survey (2008) has estimated that there is about a 10% probability that an earthquake (on the San Andreas Fault or elsewhere) would be large enough, in the next 50 years, to cause peak ground acceleration between 0.20 to 0.25 the percentage of acceleration of gravity at NAS Lemoore (Map 3-5). The largest earthquake to affect the area in the last several decades was the Coalinga Earthquake of 1983. This magnitude 6.4 quake regionally damaged surface facilities, such as pumping stations, storage tanks, pipelines, and some subsurface facilities such as well casings (Saenz and Goss 2009).

### 3.3.2 Soils and Soil Condition

Soils in the area are generally saline-alkaline, with a perched water table in basins and on low alluvial fans, plains, and basin rims. Soils for NAS Lemoore are presented in Map 3-6, and soil classifications are discussed in Appendix I.

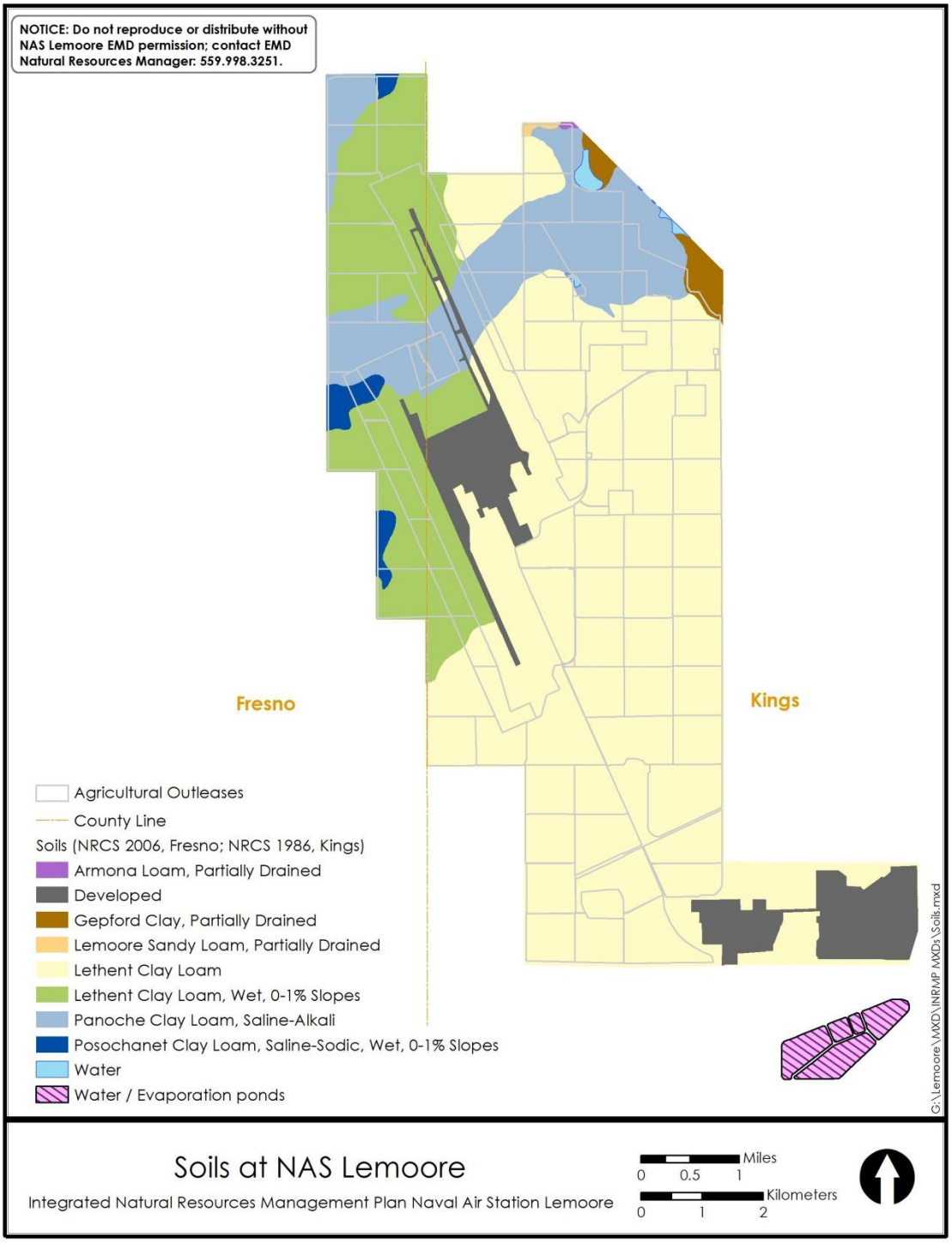
Constraints of saline-alkali condition and poor drainage affect soils locally and they generally require treatment or adjustment in crop practices. At over 18,000 acres, NAS Lemoore is underlain primarily by saline-alkali soils belonging to the Lethent series. Lethent soils are typical of lower alluvial fans and the rims of basins (such as the Tulare Lake basin) in the San Joaquin Valley. Soils of these associations typically have loam, clay loam, or sandy clay loam surface soils and clay, clay loam, or silt loam subsurface soils. Most of the horizons are alkaline and saline and have high corrosivity for steel and concrete. Some mapping units within this group of soils are calcareous. The permeability is moderate to very slow and runoff is slow or very slow. The soils are best suited for salt and alkali tolerant, drought resistant crops. The primary limitation, when present, is the droughty nature of these soils. Building site limitations are primarily high shrink swell potential and high corrosivity.

In the extreme northeastern corner of the Station, the soils are Armona Loam, Lemoore Sandy Loam, and Gepford Clay. These soils are not as well drained as the Lethent soils and are associated with a perched water table. They are found in northern and northeastern parts of the Tulare Lake Basin and Basin rim, and the lower part of the Kings River. The saline-alkali soils developed in areas of perched shallow groundwater. These soils are very deeply developed on nearly flat alluvial deposits and are typically somewhat poorly drained to poorly drained. The nearly level topography results in slow runoff and negligible erosion potential. The surface horizon is typically fine grained, ranging from fine sandy loam to clay. Subsurface horizons are also fine grained. The permeability is slow to very slow and shrink swell potential is high. The saline alkali soils cause high corrosivity to concrete and steel. The soils are best suited for salt and alkali tolerant, drought resistant crops. Most of the soils are Capability Class III with the primary limitation being shallow groundwater (Appendix I provides a description of the Land Capability Class system).




*Map 3-5. Seismic hazard at Naval Air Station Lemoore (U.S. Geological Service 2008).*[11]

[11] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.




*Map 3-6. Soils at Naval Air Station Lemoore.*[12]

[12] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.

The western side of the Station is underlain by soils of the Lethent, Panoche, and Posochanet series. These soils are very deep and well drained. NAS Lemoore is in an area rated with soil selenium concentrations of 0.10 to 0.13 parts per million (San Joaquin Valley Drainage Program 1990) and is located atop a shallow saline groundwater table (Navy 2001b; refer to Section 3.3.3.2 Groundwater Resources and Water Quality).

Many of the changes in soils that have been observed in the Central Valley are the result of agricultural practices that have modified natural soil profiles on a wide scale. These practices include land leveling, deep tillage, groundwater withdrawal, cultivation, irrigation, surface water diversion from natural drainages, application of soil amendments, and drainage of shallow groundwater. Table 3-2 lists some of the major effects that these practices have had on soils in the Central Valley generally, most of which are expected or are observed effects at NAS Lemoore.

In particular, the development of the plowpan, an artificial restrictive layer in soils with a higher clay content created from past agricultural operations, at NAS Lemoore impacts farming operations unless ripped to a depth of 24–60 inches (61–152 cm) (Natural Resources Conservation Service 2006) (refer to perched aquifer discussion in Section 3.3.3.2 Groundwater Resources and Water Quality).

*Table 3-2. Expected effects of agricultural practices on soil characteristics (adapted from Navy 2001b).*

| Agricultural Practice | General Effects |
|---|---|
| Land Leveling | ▪ Removes topsoil from high areas and places it in low areas, altering soil profile and structure. |
| Deep Tillage | ▪ Removes plowpans and stratification within depth of 24inches to more than 60 inches (61–152 cm).<br>▪ Reduces compaction.<br>▪ Increases downward mobility of salts. |
| Groundwater Withdrawal | ▪ Results in subsidence and incision of stream channels in fans at basin margin. |
| Cultivation | ▪ Alters soil structure in upper 1 foot (0.3 m).<br>▪ Reduces amount of organic matter.<br>▪ Increases erosion in some cases.<br>▪ Causes development of a compacted layer called “plowpan.” |
| Irrigation | ▪ Causes rise in perched water table.<br>▪ Compacts loosely consolidated soils.<br>▪ Changes in local climate, including increased fog (and local precipitation), higher humidity, lower air and soil temperatures. |
| Diversion of Surface Water | ▪ Reduces flooding and deposition of sediment on alluvial fans. |
| Application of Soil Amendments | ▪ Application of gypsum (up to 5 tons/acre) to sodic-saline soils leaches sodium from soil; changes soil structure and permeability; reduces pH. Other chemicals (sulfur, ammonium-nitrate/sulfate/phosphate also may affect pH) (T. Schwiezer, pers. com. 2012). |
| Shallow Groundwater Drainage | ▪ Where drainage is enhanced, reduces salinity and alkalinity of soils.<br>▪ Where drainage problems increase, salinity and alkalinity increase.<br>▪ Proportion of lands with saline-sodic soils increased from 30–45% of total lands in western Fresno County since 1985.<br>▪ Area of wet soils (where perched water table affects use and management) has increased at NAS Lemoore. |

# 3.3.3 Water Resources and Water Quality

## 3.3.3.1 Surface Water Resources and Water Quality

*Current condition of water as a natural resource, including groundwater resources, wetlands, jurisdictional waters, water quality, and floodplains, is addressed in Chapters 3 and 4. Water use and water use efficiency (including conservation actions) for all uses are addressed in Chapters 2 and 5.*

Natural watershed and water conveyance systems primarily consist of the higher slope areas of the Coast Ranges and water flow channels of the Kings River. Local annual surface supplies are determined by the amount of snow pack runoff from the Sierra Nevada Mountains, located to the east of NAS Lemoore (CDWR 2009b). Such systems serve to convey surface water to the local area and also provide some beneficial recharge to groundwater. As a result, the extent of natural watersheds is limited. The Kings, Tule, Kaweah, Kern, and White Rivers all flow into Tulare Lake Basin. No significant rivers or creeks drain into the San Joaquin Valley from the Coast Range.

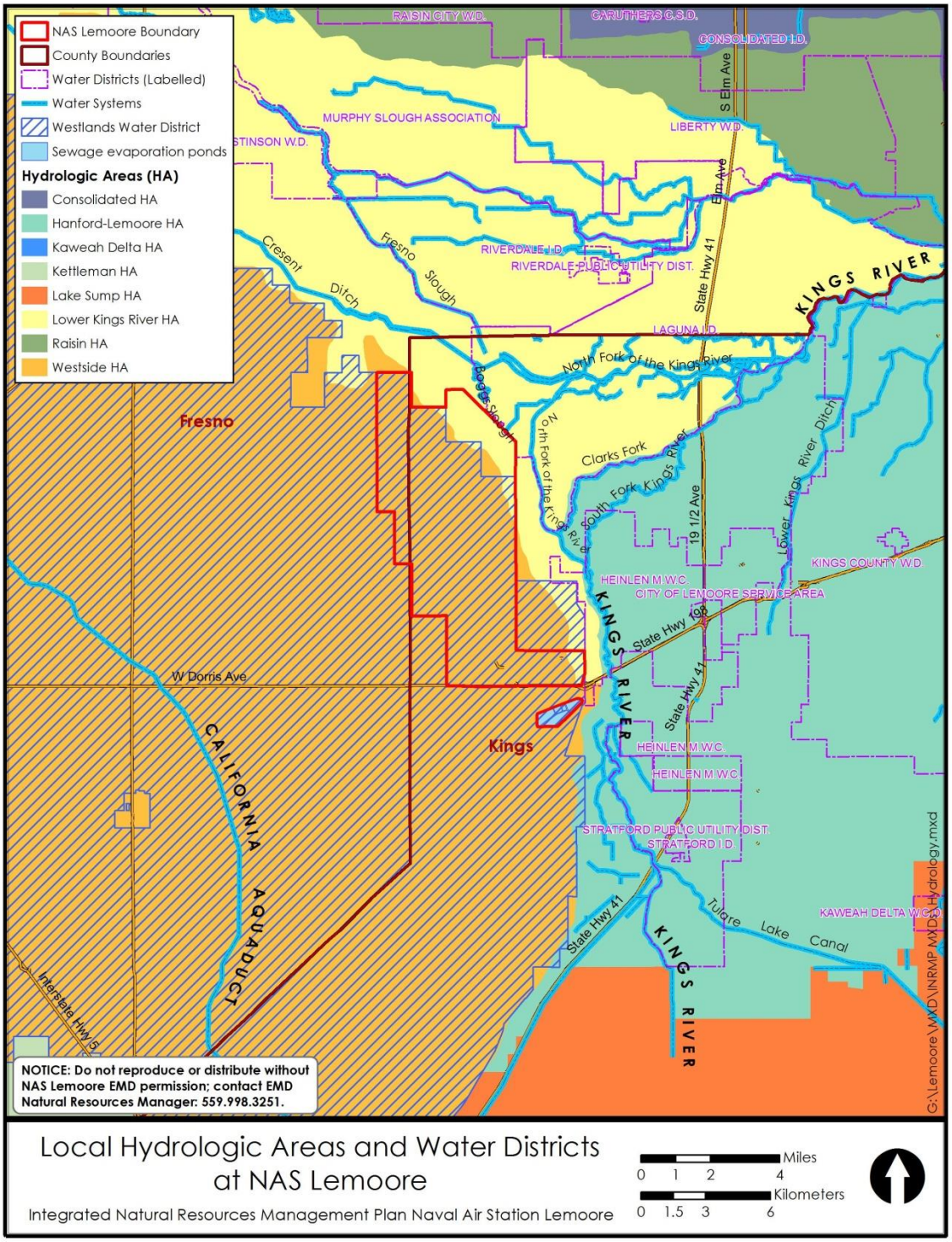
At the local level, NAS Lemoore is within the Westside hydrologic area, and the Lower Kings River hydrologic area to a lesser extent (Map 3-7). The Station is near where the Kings River diverges into the North Fork (from which the Fresno Slough branches off and heads northwest toward the San Joaquin River) and the South Fork (from which Clark's Fork branches off west of Highway 41) on the distal end of the alluvial fan of the Kings River. The divergence is approximately 1.5 miles (2.4 km) east of Highway 41. Both the South Fork and Clark's Fork drain southward along the eastern boundary of NAS Lemoore. Clark's Fork joins with the North Fork here, which has branched from the Fresno Slough. Together, they again join the South Fork and continue to drain to the south, terminating at Tulare Lake, which has no outlets (ACME Mapper 2011).

Present day flows in the Kings River are depleted by upstream irrigation diversions, so that during most of the year, there is little flow in the Kings River as it passes NAS Lemoore. Average precipitation within the Tulare Lake hydrologic region is 15.2 inches (39 cm) per year (ECORP 2007). However, due to its location in the Coast Range's rain shadow, the average annual rainfall at NAS Lemoore is only 8.2 inches (21 cm).

Surface drainage at NAS Lemoore is generally to the northeast, toward the Kings River. Drainage is poor in some areas, resulting in intermittent ponding. Wetlands in the northeast part of NAS Lemoore that lie along the North Fork of the Kings River are fed in part by stormwater runoff from the Station and agricultural subsurface drainage.

South of State Route 198 there are approximately 329 acres (133 hectares [ha]) of wastewater treatment facility evaporation ponds which receive treated sanitary and industrial wastewater, as well as stormwater from the Station. The Navy maintains a water quality monitoring program at the evaporation ponds for selenium. Since at least 1991, the Navy has conducted sampling quarterly. Test results have consistently been reported as non-detect for selenium; the minimum detection level is 0.01 milligram per liter.

In addition to the surface waters described above, imported surface water is delivered to the lowland Tulare Lake Basin, including NAS Lemoore. It derives from the San Joaquin and Sacramento Rivers and the Delta and is transported via the California Aqueduct. Generally, the quantity and movement of surface water in the lowland Tulare Lake Basin is determined by irrigation and other water supply requirements, such as moving water to groundwater recharge areas. In years of high winter rainfall and spring snow melt runoff, the movement of water is also influenced by flood control concerns, namely the export of water to the San Joaquin River or the California Aqueduct (ECORP 2007). Recently, imported surface water supply has been affected by regulations determining water set asides for sensitive species and habitats upstream of NAS Lemoore (CDWR 2009b) (Section 2.4.1.2 Agricultural Water Resource Supply and Use).




*Map 3-7. Local hydrology at Naval Air Station Lemoore.*[13]

[13] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.

Major water quality concerns for the Tulare Basin are provided in the Water Quality Control Plan for the Tulare Lake Basin (California Central Valley Regional Water Quality Control Board [Central Valley Water Board] 2004); in it, criteria were set for a number of pollutants and other water quality characteristics. In particular, the plan identifies the Lower Kings River, near which NAS Lemoore is located (from Peoples Weir to Stinson Weir on the North Fork and Empire Weir #2 on the South Fork), as a "Water Quality Limited Segment...because of high salinity. Studies indicate that the source of the salinity is either surface or subsurface agricultural drainage. Levels of boron, molybdenum, sulfates, and chlorides in the Lower Kings River are high enough to impact agricultural uses and aquatic resources."

The Central Valley Water Board and the California Environmental Protection Agency have developed a Long-Term Irrigated Lands Regulatory Program (California Environmental Protection Agency and Central Valley Water Board 2011, 2012) to regulate waste that leaves irrigated land and reaches groundwater or surface water. It applies to all irrigated lands and managed wetlands in the Central Valley. The definition of waste discharges under this program is sufficiently broad: "irrigation return flows, tailwater, drainage water, subsurface drainage generated by irrigating crop land or by installing and operating systems to lower the water table below irrigated lands (tile drains), stormwater runoff flowing from irrigated lands, and non-runoff discharges (e.g., aerial drift or overspray of pesticides...leaching of waste to groundwater, waste discharge to groundwater as a result of backflow of waste into wells...and irrigated agriculture waste discharged into unprotected wells and dry wells" (California Environmental Protection Agency and Central Valley Water Board 2011, 2012). As part of this program, growers are responsible for becoming part of a Coalition, or obtaining other regulatory coverage, conducting farm evaluations, making any necessary changes, and providing such information to the Coalition to report to the Board. NAS Lemoore is located in the Westlands Water District Coalition.[14]

### 3.3.3.2 Groundwater Resources and Water Quality

The Tulare Lake Hydrologic region (Map 3-1) is underlain by a thick sequence of clay sediments deposited in the large lakes that have covered the region in recent geologic time. The clay deposits overlie and confine several freshwater aquifers at relatively great depths (Section 3.3.1.1 Stratigraphy).

The unique hydrogeology of the southern San Joaquin Valley is illustrated in Figure 3-5. Six recognized layers of clay sediments underlie NAS Lemoore. These strata are named A-F, with the A-clay stratum being the shallowest and youngest. All of the clay sediments are highly compacted and are even cemented in areas where the clay is mixed with courser sediments and gravel. Because they are impervious to water, water moving vertically down into the soil profile accumulates above the clay strata (refer to Figure 3-4 and Figure 3-5). Water may also move at a slanted angle downward from the foothills of the mountain ranges to the east (more importantly) and west sides of the valley trough and accumulate between the deeper layers. As illustrated in Figure 3-4 and Figure 3-5, only the E-clay stratum (at about 600 feet [152-183 m] bgs and also known as the Corcoran Clay stratum), is widely continuous and underlies most of the southern San Joaquin Valley west of U.S. Route 99 (about 3,500 square miles).

The groundwater basin underlying NAS Lemoore and much of the Westlands Water District (WWD) is generally comprised of two water-bearing zones: (1) an upper zone located above the E-clay stratum contains the Coastal and Sierran aquifers and (2) a lower zone located below the E-clay stratum contains the Sub-Corcoran confined aquifer (Figure 3-4 and Figure 3-5) (Corbett et al. 2011). At NAS Lemoore, groundwater is pumped from both the upper and lower zones (Corbett et al. 2011). Accordingly, wells at NAS Lemoore pump freshwater from 600–1,200 feet (183–366 m) bgs.[15]

[14] More information available online at: http://www.swrcb.ca.gov/rwqcb5/water_issues/irrigated_lands/

[15] In the San Joaquin Valley sub-basins, aquifers are generally quite thick with wells commonly exceeding 1,000 feet (305 m) in depth. The maximum thickness of freshwater-bearing deposits (4,400 feet [1,341 m]) occurs at the southern end of the San Joaquin Valley.

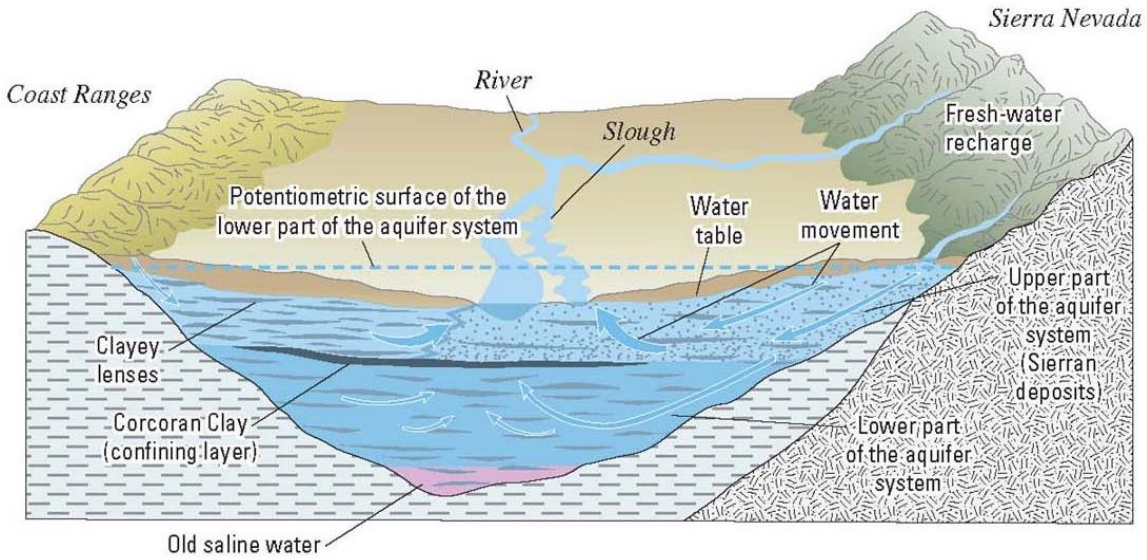



*Figure 3-5. Pre-development groundwater conditions in the San Joaquin Valley, showing generalized geology (from Corbett et al. 2011, citing Faunt 2009).*

Aquifers are recharged from natural precipitation, stream and creek flows, imported water, and subsurface inflow, which vary annually depending on hydrologic conditions. Recharge from the NAS Lemoore lands is estimated to be on the order of 7,500 acre-feet per year to 11,500 acre-feet per year, with most of the recharge being agricultural return flows (Corbett et al. 2011). As discussed above, clay sediments underlying the region are impervious to the vertical downward movement of water and prevent the efficient recharge of groundwater in the lower aquifers throughout most of the area. As a result, the local area relies on outlying areas to the east, west, and north for recharge of the lower aquifers. An important recharge area for the aquifer system is beneath the Kings River, upstream (east) of NAS Lemoore near Hardwick (Corbett et al. 2011). At the same time, however, areas to the east with larger metropolitan areas are located closer to the Upper Kings watershed and compete for water resources.

Groundwater depth at NAS Lemoore is highly variable spatially and temporally, influenced principally by demand as a function of available surface water or imported water for agriculture. Groundwater elevations were previously at about mean sea level, with groundwater flow generally toward the northeast. However, the Sub-Corcoran confined aquifer in the NAS Lemoore area has been highly exploited for agriculture, resulting in overdraft conditions, where net groundwater withdrawal exceeds recharge.[16] This has led to lower groundwater levels and land subsidence (Section 2.3.3.2 Water Resource Supply and Use).[17] At the end of droughts in 1991, 2003, and 2009, groundwater levels dropped to nearly 250 feet (76 m) bgs (Corbett et al. 2011). Current groundwater depth and water quality is available from CDWR (2010).

Overall, the hydrogeology of the San Joaquin Valley has been drastically changed by anthropogenic intervention. Development for agricultural purposes has led to much lower hydraulic heads in the confined aquifers, reversing the upward groundwater flow direction (artesian hydraulic heads)[18] that was

[16] A major portion of the region has been identified by the CDWR as having a critical groundwater overdraft condition. About 32% of the acre-feet of water used annually in the local region for all purposes is obtained from groundwater.

[17] Generally, subsidence, as referred to here, is the settling of the land surface as it shifts downward (relative to sea level). Subsidence has multiple causes (collapses from mining, earthquakes, natural gas extraction, and groundwater withdrawal, among others); the principal cause focused on here is from groundwater withdrawal.

[18] Artesian refers to a condition in which groundwater flows from a well without the aid of a pump or other artificial means. Artesian aquifers are confined (they are sandwiched between lower permeability aquitards).

a result of general groundwater flows from recharge points at the Valley margins (Sierra Nevada foothills) to beneath the center of the Valley trough where it would feed streams and other water bodies. The two aquifer systems (above and below the Corcoran Clay aquitard) have also become much more hydraulically connected, due to the large number of wells penetrating both aquifer systems (Corbett et al. 2011). Reductions in imported water supplies interfere with the carefully planned long-term water management strategies of many areas in the Tulare Lake Hydrologic region and result in more reliance on stressed groundwater supplies (CDWR 2009b).

## Perched Aquifer

The perched aquifer at NAS Lemoore is the most shallow aquifer, and is the result of water accumulating from surface streams, rainfall, and agricultural irrigation above the A-clay stratum, which underlies the Station at a depth of less than 10 feet to 70 feet (3-21 m) bgs, and has a thickness of 5–70 feet (1.5–21 m) (Figure 3-4; Corbett et al. 2011). The difference in soil texture between the A-clay stratum and the soils above it are what create the perched aquifer by preventing infiltration of water from the aquifer to below this level (Natural Resources Conservation Service 2006). Where the A-clay stratum is close to the surface of the soil, overlying soil may become marshy between the months of January and May. This restriction can also contribute to salt accumulating in the soil; thus it is referred to as the perched shallow saline aquifer at NAS Lemoore (Navy 2001b). On the Station, this aquifer usually ranges from approximately 5–10 feet (1.5–3 m) bgs in agricultural outlease areas and flows generally toward the northeast (Navy 1995, 2001b). In Karen Mechem Park, it is at approximately the same level.

Salinity increases in the perched aquifer due to concentration of mineral salts in irrigation water and is exacerbated by the accumulation of salts from agricultural fertilizers. The percolation of these salts into the perched aquifer threatens the health of plants that draw on that water. The salinity of the water also makes it unfit for irrigation or other purposes.

## Groundwater Quality

The primary constituents of concern in the Tulare Lake Hydrologic Region are salts, nitrate, arsenic, and organic compounds (commonly referred to in terms of total dissolved solids [TDS]).[19] The areas of high TDS content are primarily throughout the west side of the San Joaquin Valley and in the trough of the Valley (CDWR 2003). The naturally high TDS content of west-side water is due to recharge of stream flow originating from marine sediments in the Coast Range (CDWR 2003). Seleniferous deposits in the surrounding mountains, natural weathering processes, high rates of evaporation, and poor drainage also contribute to high levels of TDS in groundwater and surface water of the San Joaquin Valley (Presser 1994; Saenz and Goss 2009). In contrast to these regional trends, direct anthropogenic sources, such as fertilization and animal waste, contribute to high nitrate levels in some localized areas of the Valley floor.

The Central Valley Water Board described the condition of groundwater quality at NAS Lemoore thusly:

> *"The shallow-upper aquifer is not of high quality and not usable or used for municipal and domestic supply, or agricultural supply. The intermediate-upper aquifer is also not of high quality and not used, and possibly not usable, for domestic or agricultural supply. Hydraulic continuity between aquifers is restricted. The poor quality of groundwater in the shallow-upper aquifer has been and continues to be affected by uncontrollable sources of waste, and therefore attainment of water quality objectives is not reasonable. High quality water for all uses is extracted from below the E-clay or obtained from the California Aqueduct" (Central Valley Water Board 2002b).*

[19] "Dissolved solids" refers to any minerals, salts, metals, cations, or anions dissolved in water. This includes anything present in water other than the pure water molecule (H20) and suspended solids. TDS are the total amount of mobile charged ions, including minerals, salts or metals dissolved in a given volume of water, expressed as units of milligrams per unit volume of water (milligrams per liter), also referred to as parts per million.

The California Regional Water Quality Board's map-based 'Geotracker Gama' (State Water Resources Control Board 2010) depicts the current results of monitoring efforts at NAS Lemoore, including California Department of Health Services wells, water supply wells, and environmental monitoring wells.

### 3.3.4 Flooding and Floodplains

Channelization of the lower Kings River began in the 1880s through the late 1900s to control floodwaters. Efforts included construction of an extensive canal and levee system and more recent man-made additions (hydroelectric reservoirs and power plants), which provide year round irrigation and flood control protection. In particular, the Pine Flat Reservoir serves to capture a substantial amount of snow melt runoff and allows for controlled water release throughout summer months.

Flooding potential remains at NAS Lemoore due to the potential overflow of streams and rivers to the west and east that flow into Buena Vista Lake (southwest of Bakersfield) and Tulare Lake. During extremely heavy runoff, flood flows in the Kings River reach the San Joaquin River as surface outflow through the Fresno Slough. These flood flows represent the only significant outflows from the Tulare Lake Hydrologic Region (Central Valley Water Board 2004).

The natural floodplain for the streams to the west of the Station is known as the Arroyo Pasajero. In the past, floodwater from the Arroyo has crossed NAS Lemoore as it drains to the Kings River. The California Aqueduct San Luis Canal now crosses through the Arroyo, cutting off these flood flows; however, emergency relief valves under the aqueduct allow flood waters to drain into the Arroyo and potentially across NAS Lemoore (J. Crane, pers. com. 2011). Previous floods at NAS Lemoore occurred in 1962, 1963 (both prior to construction of the San Luis Canal), 1969, 1995, and 1997 (Soil Conservation Service 1966; J. Crane, pers. com. 2011).

Federal Emergency Management Agency Flood Insurance Rate Maps confirm that the part of the Station located in Fresno County contains High Risk (1% annual chance; 100-year), and Moderate-to-Low Risk (0.2% annual chance; 500-year) flood areas. Floodplain studies have not been conducted for the Station lands that lie within Kings County. However, floodplain studies conducted east of NAS Lemoore suggest that several areas of the Station in Kings County may be High Risk areas, including a portion between the Administration and Operations Areas (Map 3-4).

## 3.4 Vegetation Communities and Wildlife Habitat

The NAS Lemoore property is a combination of agricultural fields, maintained grasslands, and natural plant communities. Exotic grass and forb species occur throughout most of the Station, and in some cases they are the primary component of the vegetation community. Some of the exotics that are present are considered moderately aggressive by the California Invasive Plant Council (Cal-IPC) (2006). There are also shrublands, areas dominated by tree species, and alkali flats present on this diverse property.

Most of the land at NAS Lemoore is or has been under cultivation, is developed with buildings, roads, or runways, or is landscaped. Remnant native and non-native-dominated habitats occupy six NRMAs (Map 3-8).

### 3.4.1 Vegetation Communities and Habitats

The remnant natural vegetation of scrub and grasslands still reflects the landscape's position in relation to the Kings River and to the alkali sinks and former tule marsh that occurred locally during the Pleistocene Epoch. As described by Twisselmann (1967), poorly drained alkali soils occur most abundantly in the

southern and western sides of the San Joaquin Valley and the Carrizo Plain, which lack oceanic drainage. Bordering bare soil within the sinks, alkali-tolerant species, such as iodinebush (*Allenrolfea occidentalis*), rusty molly (*Kochia californica*; syn. *Bassia californica*), Parish's pickleweed (*Salicornia subterminalis*), and bush seepweed (*Suaeda moquinii*), occurred. Grasses, such as saltgrass (*Distichlis spicata*), dwarf barley (*Hordeum depressum*), and the bunchgrass alkali sacaton (*Sporobolus airoides*), characterize the wet alkali grasslands. With somewhat better drainage, saltbush (*Atriplex* spp.) dominates and the annual grassland species appear as an understory (Twisselmann 1967). Now crisscrossed by roads, canals, ditches, and sloughs, some riparian and wetland vestiges occur throughout the matrix of natural vegetation, agricultural fields, landscaped areas, and development at NAS Lemoore.

These fragments of remnant natural communities, often artificially supported with water and sometimes restoration work, are elevated in importance because they are all that is left for native plants and wildlife: ephemeral wetlands, including intermittent drainages and ponds, though likely man-made, create valuable habitat for various animal species while inundated; remnant cottonwood riparian forest, willow scrub, and valley saltbush scrub are also important (University of California at Santa Barbara 1998); and the alkali flats present on the Station contribute a unique natural resource. While valuable in the region's agriculture-dominated landscape, the ecosystem function of these communities is impeded by their small size; fragmentation; past land use that altered the soil, water, and other habitat conditions; and their adjacency to agricultural operations. The influence of agriculture is often seen through soil alteration, weed invasion, and direct and indirect effects of pesticides, particularly on beneficial pollinators and other invertebrates that perform key food chain and other ecosystem functions. In altering habitats, land development has also likely altered wildlife movement patterns and plant dispersal.

Vegetation communities within the six NRMAs and the landfill at NAS Lemoore were recently mapped by Tierra Data Inc. (TDI) in 2010-2011 (Table 3-3; Map 3-8; TDI 2012). Vegetation was mapped according to the California Native Plant Society (CNPS) methodology as presented in *A Manual of California Vegetation* (Sawyer et al. 2009). The vegetation mapping protocols and methodology laid out in this manual have been adopted by the California Department of Fish and Wildlife (CDFW) as the standard for the CDFW's Vegetation Classification and Mapping Program.[20]

Table 3-3 presents a summary of mapped vegetation alliances and associations. Details on each of the vegetation communities, including their presence and health across the Station, can be found in the most recent Biological Resources Survey Report for the Station (TDI 2012) (Appendix E).

## 3.4.2 Vegetation According to Management Unit

In this section, vegetation cover by alliance/association (17 categories) and by species cover are discussed in the framework of land management units at NAS Lemoore. These include the landfill and all six NRMAs. The discussion below complements the description of vegetation communities in the most recent NAS Lemoore Biological Resources Survey Report (TDI 2012; Appendix E) and provides managers a tool for understanding vegetation assemblages in each of the areas that are managed distinctly. This discussion ties directly to management assessment and strategies presented in Chapter 4.

[20] Refer to the most recent NAS Lemoore Biological Resources Survey Report (TDI 2012) in Appendix E, which provides a more in-depth discussion of vegetation community mapping at NAS Lemoore using this methodology.

G:\Lemoore\MXD\INRMP MXDs\Vegetation11x17_INRMP_common.mxd

NAS Lemoore Boundary
NRMA

**Vegetation Communities**

**Grass Dominated Alliances**
- Creeping Rye Grass
- Creeping Rye Grass-Foxtail Barley
- Foxtail Barley
- Foxtail Barley-Foxtail Brome
- Salt Grass
- Foxtail Brome
- Foxtail Brome-Soft Chess
- Foxtail Brome-Mixed Herb

**Forb Dominated Alliances**
- California Bulrush
- Bractscale
- Tumbling Saltweed
- Tumbling Saltweed/Saltcedar
- Tumbling Saltweed-Boccone's sandspurry
- Cooper's Rush
- Common Sunflower
- Fiddleneck Fields
- Boccone's sandspurry

**Shrub Dominated Alliances**
- Arrowweed (ditch)
- Big saltbush
- Big saltbush/Salt Grass
- Fourwing Saltbush
- Fourwing Saltbush/Soft Chess
- Spinescale Saltbush

**Tree Dominated Alliances**
- Goodding's Willow
- Red Gum (Eucalyptus)

**Other Land Cover Types**
- Disturbed/Maintained (non-native grassland)
- Recovering Grassland/Shrubland*
- Agricultural
- Evaporation ponds
- Developed

*Periodic burns are conducted for San Joaquin kangaroo rat habitat.

2
4
6 North
6 South
5
3
1
Landfill

# Vegetation at NAS Lemoore

Integrated Natural Resources Management Plan Naval Air Station Lemoore



2
6 North
6 South
1
Miles
0 0.25

5
3
Miles
0 0.25

Landfill
Miles
0 0.25

4
Miles
0 0.25

*Map 3-8. Vegetation communities identified on open areas of Naval Air Station Lemoore.*

**This Page Intentionally Blank**

*Table 3-3. Vegetation alliances and associations and other land cover types at Naval Air Station Lemoore in 2010-2011.*

| Vegetation Alliances and Associations | Acres | Location (greatest to least extent) |
|---|---|---|
| **Herbaceous Alliances: Grass Dominated** | **183.6** | |
| Creeping Rye Grass (*Elymus triticoides*) Alliance | 6.1 | NRMA 6N |
| Creeping Rye Grass-Foxtail Barley (*Hordeum murinum*) Provisional Association | 74.1 | NRMAs 6S, 1, 6N |
| Foxtail Barley Provisional Semi-Natural Stand | 62.9 | NRMAs 6N, 3, 5 |
| Foxtail Barley-Foxtail Brome (*Bromus madritensis*) Provisional Semi-Natural Stand | 6.1 | NRMA 5 |
| Saltgrass (*Distichlis spicata*) Alliance | 12.5 | NRMA 2 |
| Foxtail Brome (*Bromus madritensis*) Provisional Semi-Natural Stand | 18.7 | Landfill |
| Foxtail Brome-Soft Chess (*Bromus hordeaceus*) Provisional Semi-Natural Stand | 0.6 | NRMA 3 |
| Foxtail Brome-Mixed Herb Provisional Semi-Natural Stand | 2.6 | NRMA 3 |
| **Herbaceous Alliances: Forb Dominated** | **89.5** | |
| California Bulrush (*Schoenoplectus californicus*) Marsh Alliance | 39.3 | NRMA 2 |
| Bractscale (*Atriplex serenana*) Provisional Alliance | 16.4 | NRMAs 6N, 6S |
| Tumbling Saltweed (*Atriplex rosea*) Provisional Semi-Natural Stand | 16.5 | NRMAs 2, 6N |
| Tumbling Saltweed/Saltcedar (*Tamarix ramosissima*) Provisional Semi-Natural Stand | 0.3 | Landfill |
| Tumbling Saltweed-Boccone's Sandspurry (*Spergularia bocconii*) Provisional Semi-Natural Stand | 2.3 | NRMA 3 |
| Cooper's Rush (*Juncus cooperi*) Marsh Alliance | 7.2 | NRMA 4 |
| Common Sunflower (*Helianthus annuus*) Provisional Alliance | 2.3 | NRMA 6N |
| Fiddleneck Fields (*Amsinkia menziesii*) Provisional Alliance | 2.3 | Landfill |
| Boccone's sandspurry Provisional Semi-Natural Stand | 2.8 | Landfill |
| **Shrubland Alliances** | **127.6** | |
| Arrowweed (*Pluchea sericea*) Alliance | 0.8 | NRMA 5 |
| Big Saltbush (*Atriplex lentiformis*) Alliance | 27.3 | NRMA 2 |
| Big Saltbush/Saltgrass (*Distichlis spicata*) Provisional Association | 46.1 | NRMA 1 |
| Fourwing Saltbush (*Atriplex canescens*) Alliance | 2.5 | NRMA 2 |
| Fourwing Saltbush /Soft Chess (Bromus hordeaceus) Provisional Association | 32.6 | NRMA 1 |
| Spinescale Saltbush (*Atriplex spinifera*) Alliance | 18.3 | NRMA 4 |
| **Woodland Stands** | **24.6** | |
| Goodding's Willow (*Salix gooddingii*) Alliance | 2.5 | NRMA 2 |
| Red Gum (*Eucalyptus camaldulensis*) Provisional Semi-Natural Woodland Stands | 22.1 | NRMAs 2, 6S, 3 |
| **Other Landcover Types** | **18,284.8** | |
| Recovering Grassland/Shrubland [burned in ca. 2010] (NRMA 5) | 101.7 | NRMA 5 |
| Disturbed/Maintained Habitat (non-native grassland) | 2,521.5 | Station-wide |
| Agricultural Fields | 13,942.6 | Station-wide |
| Evaporation Ponds | 355.7 | South of Housing Area |
| Landscaped/Developed | 1363.3 | Station-wide |

Source: TDI 2012

Notes:

--Vegetation Associations are indented in the table to identify them as distinct from their 'parent' Alliances.

--Use of "provisional" in describing alliances and associations refers to TDI's application of the CNPS and CDFW vegetation rapid assessment methodology coverage rules (described in Sawyer et al 2009) to vegetation field observations; these alliances and associations are not yet published. Use of the term "provisional" is recognized and described in Sawyer et al (2009).

--Use of "semi-natural" indicates that the alliance or association is not native. Use of this term is recognized and described in Sawyer et al (2009), including: "Vegetation in which past or present human activities significantly influence composition or structure, but do not eliminate or dominate spontaneous ecological processes (Westhoff and Van der Maarel 1973)."

## Natural Resources Management Area 1

NRMA 1 is adjacent to agricultural outlease Parcel 4A58. It is surrounded by fencing to keep out off-road vehicles. The area consists of 90 acres (36 ha) of annual grassland, dotted with cottonwoods, willows, and saltbush. Two major vegetation types characterize this NRMA: Fourwing Saltbush (*Atriplex canescens*)/Soft Chess (*Bromus hordeaceus*) Provisional Association and Big Saltbush (*Atriplex lentiformis*)/Saltgrass Provisional Association. Within the Fourwing Saltbush/Soft Chess Provisional Association, soft chess, a non-native annual grass, accounted for about 60% of the coverage at ground level. Two other non-native grasses, foxtail barley (*Hordeum murinum*) and foxtail brome (*Bromus madritensis*), accounted for about 9% of coverage at ground level. Fourwing saltbush accounted for about

15% of the shrub cover, while narrowleaf goldenbush (*Ericameria linearifolia*) accounted for 14% of shrub cover. Other saline-adapted species were also found with smaller but significant (>1%) cover, including alkali seaheath (*Frankenia salina*), alkali mallow (*Malvella leprosa*), and fiddleneck (*Amsinckia intermedia*). Within the Big Saltbush/Saltgrass Provisional Association, there was noticeably higher cover at both the shrub level and herbaceous level of native plants. Big saltbush coverage was about 30% at the shrub level, while saltgrass coverage was about 35% at the herbaceous level. Non-native grasses and annual herbaceous plants accounted for about 23% of coverage. The Creeping Rye Grass (*Elymus triticoides*) Alliance accounted for an arc-like sliver in the northwest portion of the NRMA, bordering a much larger stand of the Alliance found in NRMA 6S. NRMA 1 appears to be mostly mid-sucessional in terms of the development/recovery of native vegetation, though a significant amount of non-native annual grasses continues to suppress recovery of native species.

Much of the area is also seasonally inundated and provides habitat for both alkali grassland and wetland wildlife species. In addition to the grassland vegetation described above, native grass and shrub species commonly found only in this area include common tarweed (*Centromadia pungens* ssp. *pungens*), a species endemic to California, Great Valley gumweed (*Grindelia camporum* var. *camporum*), common yarrow (*Achillea millefolium*), and alkali mallow. Non-native species include the CDFA noxious weeds yellow star thistle (*Centaurea solstitialis*), Russian knapweed (*Acroptilon repens*), and Indian hedgemustard (*Sisymbrium orientale*). Mourning doves (*Zenaido macroura*), California quail (*Callipepla californica*), and rabbits use this area. Reptiles observed here include the western fence lizard (*Sceloporus occidentalis*) and California kingsnake (*Lampropeltis getula californiae*). NRMA 1 is managed for native wildlife and plant species. Several artificial raptor roosting posts have been installed along the western edge of the area. Finally, several elderberry trees (*Sambucus nigra*) have grown and could potentially provide habitat for the federally threatened Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*).

A significant number of both fourwing saltbush and big saltbush were found to either be dead or mostly dead. Since both species are long-lived, it was suspected that pocket gophers (*Thomomys* sp.) were likely feeding on the roots of these shrubs. There was abundant observational evidence of pocket gopher mounds during the vegetation survey, confirmed by earlier observations of a wildlife ecologist (Smallwood 2010).

## Natural Resources Management Area 2

NRMA 2 is dominated by Sunset Lake, a seasonally flooded saline wetland. A substantial section east of the lake bed is dominated by big saltbush and saltgrass. Of all areas surveyed at NAS Lemoore, this area appeared to be a fully developed native stand of vegetation (climax). On the other hand, there are almost 12 acres (5 ha) of Red Gum (*Eucalyptus camaldulensis*) Provisional Semi-Natural Woodlands within this NRMA, which may provide valuable habitat to raptor species. Tumbling saltweed (*Atriplex rosea*), a non-native annual, also dominates the eastern corner of the NRMA (16.5 acres [6.8 ha]). Non-native annual grasses accounted for 20% of the herbaceous cover in the Tumbling Saltweed Provisional Semi-Natural Stand, while the saltweed itself accounted for about 60% of the cover. These non-natives are almost certainly preventing the recovery to native vegetation on these 16.5 acres (6.8 ha). Twelve and one-half acres (5.1 ha) were dominated by very thick stands of saltgrass. Associated with the saltgrass was the late-summer blooming narrowleaf goldenbush, which is an important late season food source for pollinators and other insects. The lake bed itself contained large clumps of California bulrush (*Schoenoplectus californicus*) and numerous saline dependent native species growing in or on the border of the salt flat. Still, only 1-2% of the land area of the salt flat contained any vegetation at all. On both the eastern and western sides of the lake, on slightly elevated terrain, was a well-developed big saltbush shrubland strongly associated with alkali seaheath and narrowleaf goldenbush, again in full bloom in early autumn. Less than 5% was recorded for non-native annuals. A small stand (2.5 acres [1 ha]) of fourwing saltbush was mapped in the north corner of the NRMA that appeared to have been planted. About 20% herbaceous

cover was accounted for by two species on non-native grass. Almost no native species were found within the Red Gum Provisional Semi-Natural Woodland Stand, while there was significant herbaceous cover of non-native grasses and forbs, dominated by ripgut brome (60%).

Though the lake appears to contain water only occasionally, its location adjacent to Boggs Slough (located just off Station lands to the northeast) makes the combination of these riparian and wetland areas valuable for wildlife, particularly bird species. A few western fence lizards were also observed here during the most recent surveys (TDI 2012).

## Natural Resources Management Area 3

NRMA 3, the smallest of the designated NRMAs, consists of two water retention basins. The total area is approximately 12 acres (5 ha). The northern basin appears to retain more water. Being ephemerally inundated, the open water can serve as a water source for resident and migratory wildlife. Small patches of saltgrass and alkali seaheath were found, but existing vegetation was largely non-native grasses, foxtail barley, foxtail brome, and soft chess dominated. The deepest area of the northern basin was dominated by Boccone's sandspurry (*Spergularia bocconi*) in association with tumbling saltweed.

## Natural Resources Management Area 4

NRMA 4, located on the northeast corner of the airfield, is approximately 50 acres (20 ha) and is composed of both native and non-native grassland. This area was formerly within agricultural outlease Parcel 4A62 alongside runway 14L/32R in the Operations Area. Fifty-nine acres (24 ha) formerly within this NRMA are now maintained as mowed grassland within the air traffic safety fence of the Operations Area. This area is relatively flat and dry, dominated by non-native grasses, and provides habitat for burrowing owls (*Athene cunicularia*) and migrating long-billed curlews (*Numenius americanus*) (Navy 1995). In 1982, kangaroo rats of an unidentified species were captured in this NRMA; however, they have not been observed in this area since (Navy 1995).

The remaining portion of the NRMA outside of the security fence was found to contain significant stands of native vegetation. The Spinescale Saltbush (*Atriplex spinifera*) Alliance was not encountered in any of the other NRMAs, though it was also found to be heavily invaded with non-native grasses and forbs. A smaller stand of another unique alliance, the Cooper's Rush (*Juncus cooperi*) Marsh Alliance, was found on about 7 acres (3 ha) to the north of the Spinescle Saltbush Alliance. The middle of the area was noticeably wet when mapped in mid-September. It appears that the water source may be agricultural runoff. However, given the progress in the development of Cooper's rush, the area appeared to have been wet for a number of years.

## Natural Resources Management Area 5

NRMA 5 (the old abandoned motorcycle race track) is approximately 116 acres (47 ha), and located north of agricultural Parcel 4A55 and east of Parcel 4A57. It contains the only known population of federally endangered San Joaquin kangaroo rat (*Dipodomys nitratoides*) at NAS Lemoore.[22] Previous off-road activities in this area enhanced the habitat for kangaroo rats and it was subsequently set aside for their management (including fencing around the area to keep out off-road vehicles). NRMA 5 is consistently managed for the species, including periodic prescribed burning, vegetation and soil clearing treatments, desired shrub species propagation, and monitoring to provide a habitat suitable for kangaroo rats.

[22] Studies to determine whether the species present on NAS Lemoore are Tipton or Fresno kangaroo rats (*Dipodomys nitratoides nitratoides* and *D. nitratoides exilis*, respectively) have been inconclusive; both are subspecies of the San Joaquin kangaroo rat. As a result, the species is referred to as San Joaquin kangaroo rat throughout this document.

The land cover identified as Recovering Grassland/Shrubland comprises approximately 101.7 acres (41.2 ha) of the entire NRMA. Currently, vegetation is generally described as annual grassland (following a couple years of exceptional vegetation growth forming tall, dense stands of herbaceous plants; K.S. Smallwood, pers. com. 2009) with some scattered shrubs present as a result of restoration projects. Patches of big saltbush and fourwing saltbush were evident after a prescribed burn in 2010, as well as patches of saltgrass and goldenbush (Photo 3-1). It is possible that the plant community previously resembled that of either the Big Saltbush/Saltgrass Provisional Association or the Fourwing Saltbush/Soft Chess Provisional Association, both of which are found elsewhere on Station property. During a recovery phase from the fire, various native species were observed, including common tarweed and narrow-leaf milkweed (*Asclepias fascicularis*). Their presence suggests that natural recovery of this area will result in native species diversity that is more functional as an ecological resource (Photo 3-2).

*Photo 3-1. Burned site within Natural Resources Management Area 5 at Naval Air Station Lemoore.*

*Photo 3-2. Natural Resources Management Area 5 at Naval Air Station Lemoore in recovery phase (May 2011).*

The southern portion of NRMA 5 contains Foxtail Barley and Foxtail Barley-Foxtail Brome Provisional Semi-Natural Stands, two exotic grasses abundant throughout most of the western United States. In addition, the combination of foxtail barley's tendency to thrive in areas somewhat wet and the presence of native creeping wild rye in a drainage ditch support the area's designation as Wetland Site #29 (Section 3.4.4 Wetlands and Jurisdictional Waters of the U.S.). The presence of fourwing saltbush, a native perennial shrub, is notable given that this species will likely become more prevalent and contribute to the potential ecological role of the Foxtail Barley-Foxtail Brome Provisional Semi-Natural Stand. In addition, common tarweed and narrow-leaf milkweed in this vegetation community provide food and material resources for various wildlife species that inhabit the area.

In addition to the San Joaquin kangaroo rat, NRMA 5 has provided habitat for species including the California side-blotched lizard (*Uta stansburiana elegans*) and California ground squirrel (*Spermophilus beecheyi*). In particular, California ground squirrel populations within NRMA 5 have fluctuated drastically in the last decade, from thousands of individuals to none at all. This change is most likely linked to changes in annual precipitation, which impacts vegetation growth, in addition to the installation of ground squirrel bait stations by agricultural lessees around this area to control ground squirrels foraging on crops.

### Natural Resources Management Area 6 North

While NRMA 6 North and NRMA 6 South comprise a single management unit, they are discussed separately due to their differing vegetation assemblages. In NRMA 6N, there is a meandering swale that was meant to conduct runoff water toward Sunset Lake that is now dominated by a well-developed stand of the native creeping wild rye. There is also significant cover of annual non-native grasses, though these are not seen to pose a threat to the vigorous creeping wild rye. Much of the remainder of the NRMA is dominated by foxtail barley (60% cover) and other non-native annual grasses. The native bractscale (*Atriplex serenana*) is also establishing itself in both the southeast and southwest corners of the NRMA. A large drainage ditch lines the southern border of this NRMA that is dominated by common sunflower (*Helianthus annuus*), which was still flowering profusely in late October 2010 and is a significant source of nectar for pollinators and other insects. Also present here is the native perennial Indianhemp dogbane (*Apocynum cannabinum*), which is a food source for several butterfly species.

### Natural Resources Management Area 6 South

This area is dominated by non-native annual grasses, though a light density of creeping wild rye was found throughout the area. A smaller stand of bractscale is found in the northeast corner adjacent to a stand of red gum eucalyptus.

### Landfill

The landfill area consists of three distinct sites. First, the banks of the landfill were dominated by fiddleneck (40% cover), followed by foxtail brome (30%). This is clearly a highly disturbed site, but could be revegetated with native plants with the control of the non-native grasses. Second, the landfill's flat area was dominated by Boccone's sandspurry and the soil surface was coated with a thin layer of craking salt. Both the presence of sandspurry and cracked salt indicate standing water during the rainy season. On the slightly better drained sites within the basin, Lost Hills saltbush (*Atriplex coronata* ssp. *vallicola*) was found. CNPS lists this as a 1B.2 species, threatened due to land conversion. It is typically found near alkaline vernal pools and is considered quite rare. Third, a small lowland depression on the north side of the landfill contained a mix of native and non-native species, including the aforementioned Lost Hills saltbush. Saltcedar (*Tamarix ramosissima*) was also present at this site and represents an invasion threat.

## 3.4.3 Other Landcover Types

There are a variety of other land cover types on the Station. Windbreaks, Disturbed/Maintained Habitat, as well as the Agricultural Outlease Areas and Developed or Landscaped areas, are important for a number of wildlife species on the Station.

### 3.4.3.1 Windbreaks

Past surveys (Navy 2001b) indicate that over 100 acres (40.5 ha) of windbreaks have been planted along roadways, railroad lines, and agricultural parcel boundaries throughout NAS Lemoore. Most of the windbreaks are planted with eucalyptus or oleander (*Nerium oleander*). In 2010, oleander leaf scorch, caused by the bacterium *Xylella* sp., was observed in all oleanders that were not regularly or heavily irrigated (TDI 2012).[23] Eucalyptus trees border the northwest edge of NRMA 2 and the tree-lined drainage canal along Grangeville Boulevard on the east side of the airfield. In some areas, windbreaks contain saltbush, tamarisk (*Tamarix* spp.), and willow (Salix sp.). Tamarisk, an invasive species, had been planted in one windbreak by the landowner prior to NAS Lemoore and it has also naturally established elsewhere, particularly along the Station perimeter where both species (athel [*T. aphylla*] and saltcedar [*T. ramosissima*]) can be found.

*The benefits of windbreaks in agricultural areas is well documented, and windbreaks have been a historical feature across California where agriculture has been the predominant land use.*

Windbreaks provide some cover and roosting for a variety of wildlife species. In particular, raptors use trees for nesting (Lang 2012), and hummingbirds, warblers, and finches are attracted to flowering trees' nectar. In general, bird populations benefit from the greater structural complexity provided by windbreaks on agricultural landscapes (Craighead and Craighead 1959; O'Connor and Shrubb 1986). Arnold and Weeldenburg (1990) found that bird species richness increased with increases in the width of roadside natural vegetation, the number of shrub species, and percent shrub cover. The understory of the windbreaks is not particularly dense but does provide some habitat for small mammals, such as jackrabbits, desert cottontails (*Sylvilagus auduboni*), and ground squirrels.

Windbreaks also have the potential for harboring beneficial wildlife, including pollinators such as native bees, and insectivorous birds and bats.

### 3.4.3.2 Disturbed/Maintained Habitat

Disturbed lands (2,521.5 acres) include those with histories of significant soil profile alteration, such as removal of topsoil or compaction of subsoil by the use of heavy equipment. These include the current motorcycle race track (adjacent to Reeves Boulevard) and non-native grassland areas that are regularly mowed. NRMA 5 and the landfill would generally be considered disturbed areas, however their vegetation communities are discussed above.

The new motorcycle track located along Reeves Boulevard is used intensively by off-road vehicles. Similar to the old motorcycle track, such use may provide more open habitat for kangaroo rats and other species. The new track is already attracting some wildlife.

Non-native grassland areas are mowed throughout the Station. Near the Operations Area, this is done to reduce the potential for harboring wildlife that pose a hazard for airstrikes. In other areas, it helps to maintain lands surrounding structures. Both mowed and unmowed grassland appear to contain similar plant species, but in different proportions given that the maintenance activities likely favor certain species over others. In addition, there are several smaller pocket areas that provide habitat for a number of native San Joaquin Valley species. Generally, the same species use both the mowed and unmowed grassland areas; however, there is typically a greater diversity and concentration of wildlife occupying unmowed areas.

[23] Oleander leaf scorch is rapidly infecting oleaders throughout southern California. It is particularly pronounced under extreme drought conditions. Infected plants usually die within several years; there is no cure.

Mammals associated with this habitat type at NAS Lemoore include black-tailed jackrabbit (*Lepus californicus*), desert cottontail, coyote (*Canis latrans*), skunk (*Mephitis* sp.), opossum (*Didelphis virginiana*), and a number of rodents, such as California ground squirrel and San Joaquin kangaroo rat. Reptiles associated with this habitat type include western whiptail (*Cnemidophorus tigris*), western fence lizard, California kingsnake, side-blotched lizard (*Uta stansburiana*), and gopher snake (*Pituophis catenifer catenifer*). Common bird species include loggerhead shrike (*Lanius ludovicianus*), common raven (*Corvus corax*), burrowing owl, and American kestrel (*Falco sparverius*).

### 3.4.3.3 Agricultural Outlease Areas

Agriculture at NAS Lemoore covers approximately three-quarters of total Station lands (12,843 acres [5,197 ha]).[24] A description of crops planted at NAS Lemoore is provided in Section 2.4.1.1 Agricultural Outlease Program Management.

There is very little natural vegetation in the agricultural areas as the fields are plowed or disked to the edge of roads and irrigation ditches. What natural vegetation does occur here primarily includes annual weeds with low moisture requirements. Plant species common to annual grasslands described above are also sparsely distributed along unpaved access roads and ditches near the agricultural fields. Some species common to the wetland areas can be found in the irrigation ditches or near well-heads.

In general, the resource benefits that the NAS Lemoore agricultural areas provide depend on the crop that is being grown. Many waterbirds and shorebirds have been observed, including a variety of herons, egrets, geese, ducks, plovers, sandpipers, and gulls (Navy 1995, 2001b; TDI 2012; Lang 2012). These birds are most numerous during the winter and spring and are most commonly associated with the agricultural and wetland areas, due to inundation from winter and spring rains. Raptors, including hawks and owls, have also been observed foraging in the agricultural areas at NAS Lemoore. Agricultural parcels support game birds, such as mourning dove and ring-necked pheasant (*Phasianus colchicus*), and a variety of other birds, including red-winged blackbird (*Agelaius phoeniceus*), tricolored blackbird (*Agelaius tricolor*), and yellow-headed blackbird (*Xanthocephalus xanthocephalus*). Some limited populations of reptiles and amphibians occur in agricultural lands, including the western whiptail, western fence lizard, side-blotched lizard, and gopher snake. Mammal species include house mouse (*Mus musculus*) and coyote. Reptiles, amphibians, and mammals found here include those associated with the disturbed grassland but at much lower population levels. They are also likely inhabited by various invertebrate species regardless of the crop, which may provide an important food source for wildlife.

In particular, during the 2009-2010 bird surveys (TDI 2012) and the NAS Lemoore Wildlife Hazard Assessment (Lang 2012), great egrets (*Ardea alba*), burrowing owls, peregrine falcons (*Falco peregrinus*), white-faced ibis (*Plegadis chihi*), and long-billed curlews were among those observed foraging in the alfalfa fields at NAS Lemoore. Several studies have found that alfalfa attracts more birds than do most field crops (Smallwood and Geng 1993; Smallwood 1995; Smallwood et al. 1996). For raptors, this may be the case as their prey species find suitable habitat in alfalfa fields, such as pocket gophers. As agriculture has spread and supplanted natural vegetation and habitats throughout the Central Valley, Swainson's hawks (*Buteo swainsoni*), in particular, have become dependent on it given its support of prey species.

### 3.4.3.4 Developed and Landscaped Lands

Developed and landscaped lands at NAS Lemoore (1,363 acres [552 ha]) include the Operations Area, Administration Area, and Housing Area. Very little property at NAS Lemoore is actually developed to the

[24] The 12,843 acre figure encompasses roads and maintenance areas in the agricultural outlease area. As a result, this number differs from the 12,776 acres provided in Chapter 2, which includes only those areas currently leased for farming.

point of no vegetation. Rather, the vegetation in these areas consist of ornamental trees, shrubs, and lawns near structures, roads and along some fences. Representative trees and shrubs found within the Operations Area include California and Mexican fan palms (*Washingtonia* sp.), honey locust (*Gleditsia triacanthos* ssp. *inermis*), black locust (*Robinia pseudo-acacia*), oleander, and pyracantha (*Pyracantha* sp.). The lawn areas are planted with Bermuda grass (*Cynodon dactylon*) or hybrid fescue.

Shrubs and trees planted in the Administration and Housing Areas are presented in Appendix J along with the 27 different species of tree and shrubs identified at Karen Mechem Park in 2010 (TDI 2012). There were a total of 672 individual trees and shrubs in the Park, the majority of which are non-native, and 15% of which were dead.

Wildlife found in these areas are typical of species that live in close proximity to humans and include the house mouse, roof rat (*Rattus rattus*), pocket gopher, and California ground squirrel. Feral dogs have occasionally been observed roaming in these areas, which pose a potential threat to native ground dwelling species, such as ground squirrels and burrowing owls. Bird species include mourning dove, house sparrow (*Passer domesticus*), house finch (*Carpodacus mexicanus*), European starling (*Sturnus vulgaris*), rock pigeon (*Columba livia*), barn swallow (*Hirundo rustica*), northern flicker (*Colaptes auratus*), American goldfinch (*Spinus tristis*), northern mockingbird (*Mimus polyglottos*), American crow (*Corvus brachyrhynchos*), American robin (*Turdus migratorius*), common raven, western meadowlark (*Sturnella neglecta*), brown-headed cowbird (*Molothrus ater*), black-chinned hummingbird (*Archilochus alexandri*), Anna's hummingbird (*Calypte anna*), and Brewer's blackbird (*Euphagus cyanocephalus*).

## 3.4.4 Wetlands and Jurisdictional Waters of the U.S.

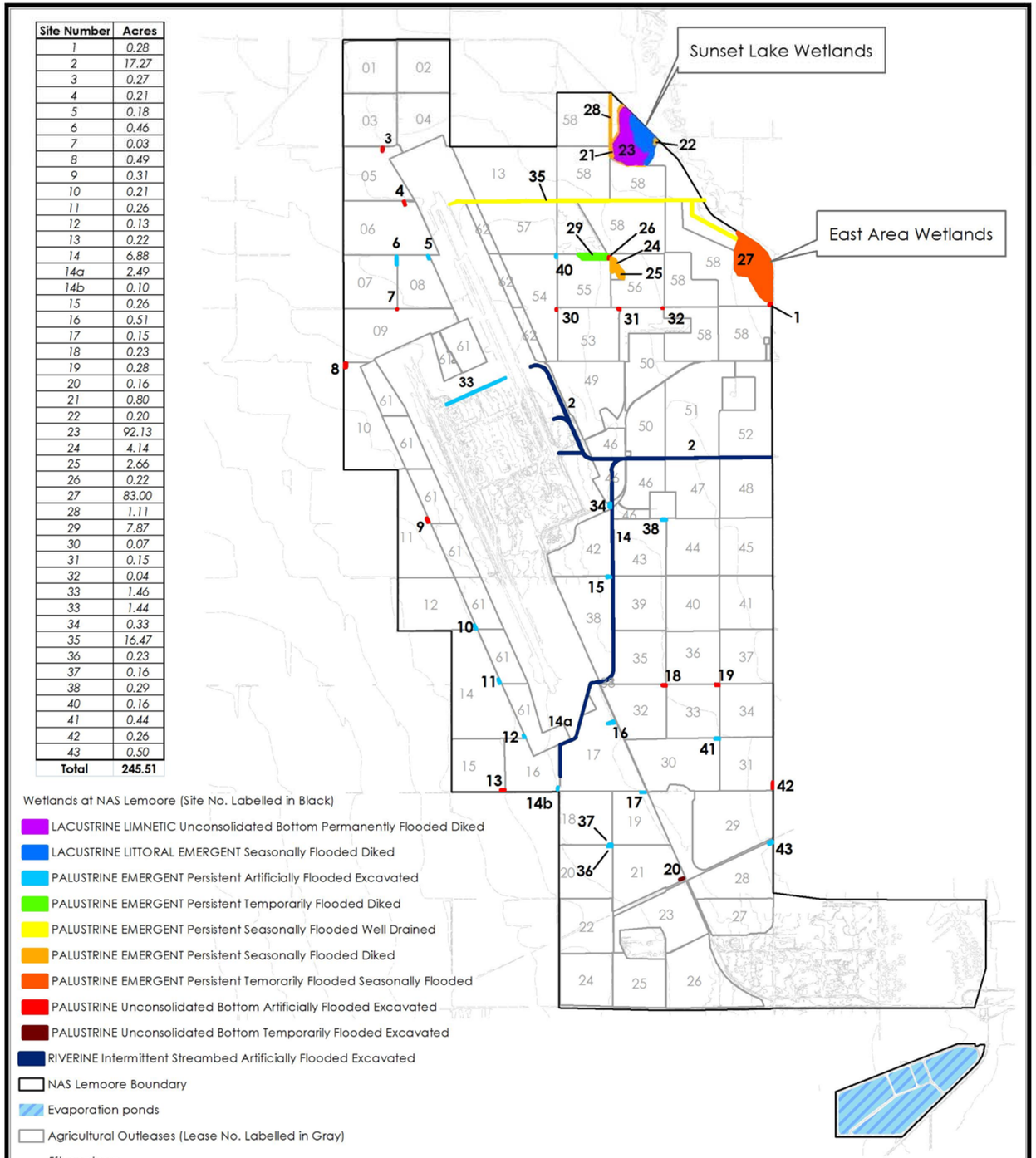
Wetlands are considered sensitive and declining resources by several regulatory agencies, including the CDFW and U.S. Fish and Wildlife Service (USFWS). Wetlands also provide for the movement of water and sediments, groundwater recharge, water purification, and storage of stormwater runoff. The U.S. Army Corps of Engineers defines wetlands as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Environmental Laboratory 1987).

### 3.4.4.1 Wetland Classification

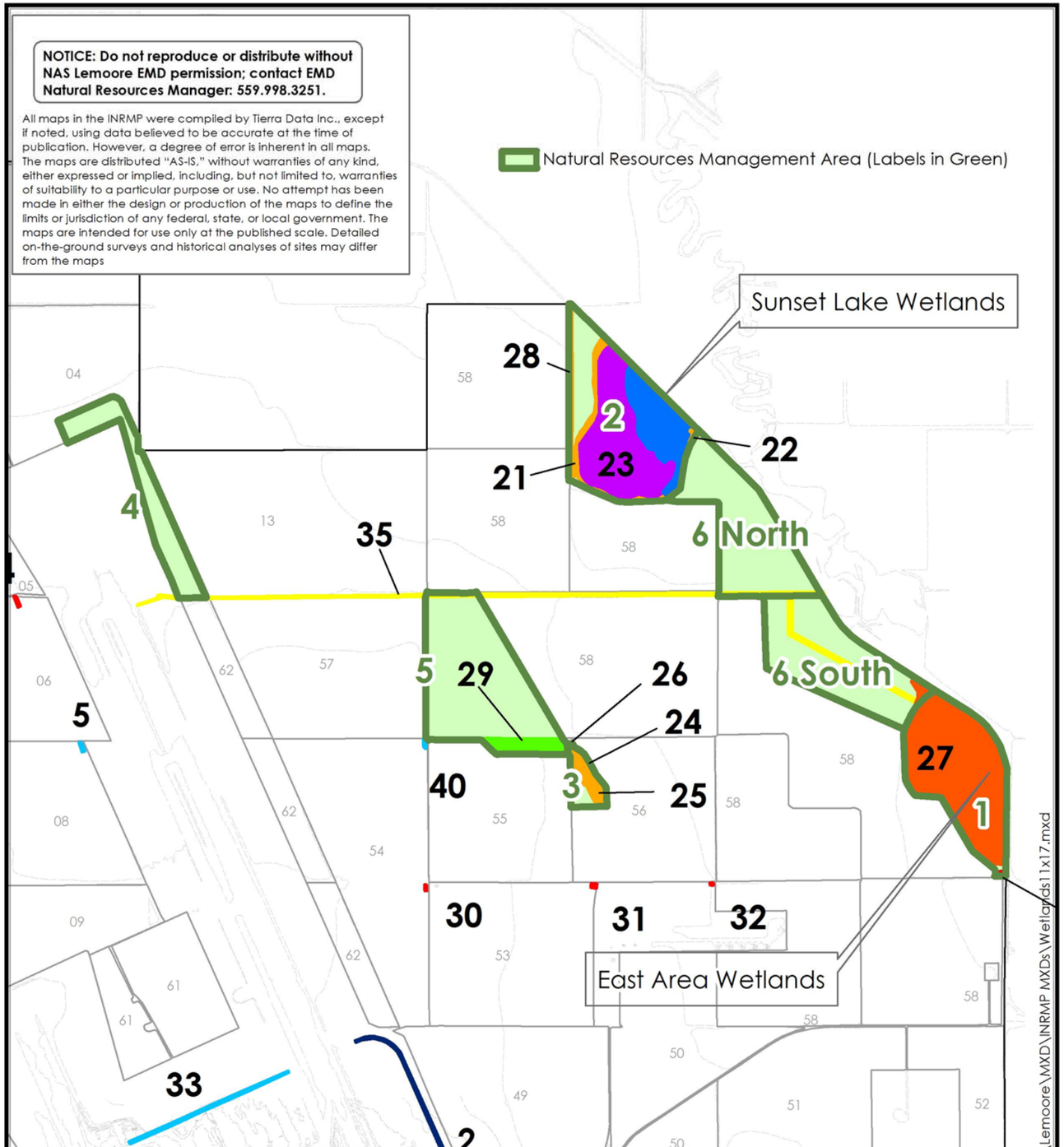
The Wetland Identification and Classification Report (Tetra Tech Inc. 1996; Appendix E) identifies 43 wetlands on NAS Lemoore (Map 3-9) and classifies them according to the USFWS's Classification of Wetlands and Deepwater Habitats (Cowardin et al. 1979), which is used by the National Wetland Inventory to map wetlands. The Cowardin classification system (1979) is a hierarchical system based on plants (hydrophytes), soils (hydric soils), and frequency of flooding. Wetlands and deepwater habitats at NAS Lemoore are represented by three systems at the highest level in the hierarchy: Lacustrine, Palustrine, and Riverine.

While this report did not assess jurisdictional status of the wetlands, the previous NAS Lemoore INRMP (Navy 2001b) does indicate likelihood that any of the identified wetlands would be jurisdictional. Jurisdictional wetlands are those that are regulated by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act. A wetland, drainage, or water body must exhibit characteristics from three categories: hydrology, plant hydrophytes, and hydric soils (Environmental Laboratory 1987). However, this evaluation was conducted prior to recent court cases that may change its jurisdictional suggestions and, as a result, they are not presented here.

| Site Number | Acres |
|---|---|
| 1 | 0.28 |
| 2 | 17.27 |
| 3 | 0.27 |
| 4 | 0.21 |
| 5 | 0.18 |
| 6 | 0.46 |
| 7 | 0.03 |
| 8 | 0.49 |
| 9 | 0.31 |
| 10 | 0.21 |
| 11 | 0.26 |
| 12 | 0.13 |
| 13 | 0.22 |
| 14 | 6.88 |
| 14a | 2.49 |
| 14b | 0.10 |
| 15 | 0.26 |
| 16 | 0.51 |
| 17 | 0.15 |
| 18 | 0.23 |
| 19 | 0.28 |
| 20 | 0.16 |
| 21 | 0.80 |
| 22 | 0.20 |
| 23 | 92.13 |
| 24 | 4.14 |
| 25 | 2.66 |
| 26 | 0.22 |
| 27 | 83.00 |
| 28 | 1.11 |
| 29 | 7.87 |
| 30 | 0.07 |
| 31 | 0.15 |
| 32 | 0.04 |
| 33 | 1.46 |
| 33 | 1.44 |
| 34 | 0.33 |
| 35 | 16.47 |
| 36 | 0.23 |
| 37 | 0.16 |
| 38 | 0.29 |
| 40 | 0.16 |
| 41 | 0.44 |
| 42 | 0.26 |
| 43 | 0.50 |
| Total | 245.51 |






# Wetlands at NAS Lemoore

Integrated Natural Resources Management Plan Naval Air Station Lemoore

Miles
0 0.5 1
Kilometers
0 1 2

Miles
0 1 2
Kilometers
0 1 2

*Map 3-9. Wetland areas identified on Naval Air Station Lemoore.*

**This Page Intentionally Blank**

Nearly all NAS Lemoore wetlands are associated with irrigated agriculture, primarily from WWD irrigation valves and ditches. The majority of them are in engineered excavations. Two wetland areas occur naturally: Sunset Lake wetlands and East Area wetlands. The wetlands within NRMAs 3 and 5 (sites 24, 25, 29) that are separated by a series of dikes were historically one natural wetland.

## Lacustrine

The only lacustrine habitats at NAS Lemoore are at Sunset Lake wetland, the largest naturally-occurring wetland at the Station. The entire Sunset Lake wetland, which includes two areas classified as lacustrine and one area classified as Palustrine (PEM1Ch, see below for definition and description), covers about 100 acres (40.5 ha). Although the wetland is naturally occurring, it is impounded by a dike on one side (Navy 1995).

### *Lacustrine, Limnetic, Unconsolidated Bottom, Permanently Flooded, Diked (L1UBHh)*

Includes a portion of site 23 (Sunset Lake, NRMA 2). This area is fed by seepage from croplands, which collects in a shallow depression where the water table is kept close to the surface by the influence of Boggs Slough and the North Fork of Kings River. Previous water quality tests conducted at NRMA 2 indicates the presence of minimal pesticide levels (Tetra Tech Inc.1999).

### *Lacustrine, Littoral, Emergent, Seasonally Flooded, Diked (L2EMCh)*

Includes a portion of site 23 (Sunset Lake, NRMA 2): an alkaline shore area on the eastern side of Sunset Lake.

## Palustrine

Most of the wetlands that were identified at NAS Lemoore are palustrine wetlands. Palustrine wetlands are typically vegetated wetlands that are commonly referred to as marshes, bogs, fens, or prairies (Cowardin et al. 1979).

### *Palustrine, Emergent, Persistent, Temporarily - Seasonally Flooded (PEM1A-C)*

Includes site 27 (NRMA 1, Parcel 4A58). This is the second-largest naturally occurring wetland at NAS Lemoore and includes a mosaic of wetland and upland habitats.

### *Palustrine, Emergent, Persistent, Seasonally Flooded, Well Drained (PEM1D)*

Site 35 (Habitat Linkage Corridor) was referred to as the "North Drainage Ditch Wetland" in Tetra Tech, Inc. 1996; it begins at the north end of the Operations Area and ends on the north side of NRMA 5. This drainage ditch has areas of open water and freshwater marsh.

### *Palustrine, Emergent, Persistent, Temporarily - Seasonally Flooded, Diked (PEM1Ah, PEM1Ch)*

Seven wetlands described here are fairly diverse and are often associated with larger wetland areas. All are diked.

Site 29 (south portion of NRMA 5) is considered temporarily flooded, except for the eastern portion of the wetland, which was inundated at the time of the classification survey (Tetra Tech Inc. 1996). The source of water is an irrigation drainage sump (site 26). The northern portion of the site is separated from the rest of NRMA 5 by a dike.

Sites 24 and 25 (NRMA 3) include a small alkaline pond and a small, ponded, salt panne. Depending on the severity and timing of the events that cause this area to be flooded, the location could be a valuable resource for plants and animals alike. Resident, as well as visiting, animals would likely take advantage of

the water availability. If prolonged inundation continues, in time the flooding events will probably start to favor native plants that have adapted to such environmental conditions.

Sites 21, 22, a portion of 23 and 28 are all wetlands adjacent to Sunset Lake. They include two drainage ditches, an outlet, and a grassland that have all been diked.

#### *Palustrine, Emergent, Persistent, Artificially Flooded, Excavated (PEM1Kx)*

Includes a total of 16 sites: 5, 6, 10, 11, 12, 14b, 15, 16, 17, 34, 36, 37, 38, 40, 41, 43. All of these wetlands are open water sump pump ponds except one, which is a pond at the end of a drainage ditch. They receive runoff from agricultural parcels and other areas and appear to be entirely artificial. Dominant vegetation in these areas includes cattails (*Typha* spp.), dallis grass (*Paspalum dilatatum*), tamarisk, bulrush (*Schoenoplectus* spp.), water smartweed (*Polygonum amphibium*), narrow-leaf milkweed, Mexican sprangle-top (*Leptochloa uninervia*), and blueweed (*Helianthus ciliaris*). Some of these wetlands have a few black willows (*Salix gooddingii*).

#### *Palustrine, Unconsolidated Bottom, Temporarily Flooded or Artificially Flooded, Excavated (PUBAx, PUBKx)*

Includes a total of 15 sites: 1, 3, 4, 7, 8, 9, 13, 18, 19, 20, 26, 30, 31, 32, and 42. These wetlands are very similar to the PEM1Kx wetlands but have less than 30% vegetation cover.

### Riverine

The three riverine areas as NAS Lemoore are ditches that were excavated and are artificially flooded.

Site 2 is a main drainage ditch that runs southeast to east along the northeast and east sides of Runway 14L/32R. This tree-lined ditch alternates between open water and freshwater marsh. It carries runoff from the Operations Area across NAS Lemoore toward the east to Kings River. Agricultural runoff is no longer permitted at NAS Lemoore, thus it is now functionally only a stormwater drainage ditch. It is heavily overgrown. This wetland has trapped sediments and heavy metal residuals from numerous years of aircraft washdowns and was declared a NAS Lemoore Installation Restoration site (Installation Restoration Site 6); it was subsequently addressed by the Installation Restoration Program, receiving a No Further Action determination and was considered closed as of 26 June 2002 (Section 2.4.3 Installation Restoration Sites).

Sites 14 and 14a are part of a long ditch that begins as part of the main drainage ditch-wetland (site 2), which then splits off at Gateway Road. The ditch runs south where it crosses Reeves Boulevard. This drainage ditch has both open water and freshwater marsh. The vegetation in the freshwater marsh includes cattails, curly dock, annual rabbitsfoot grass, and cocklebur.

Site 33 consists of the drainage ditch that runs between taxiways the two runways at the north end of the Operations Area. This wetland site alternates between open water and freshwater marsh. It transports runoff to the main drainage ditch (site 2).

### Unclassified Wetlands

#### *Constructed Wetlands*

A meandering watercourse has been constructed to connect the north drainage ditch (site 35) wetland with Sunset Lake, on the northeast edge of Parcel 4A58. It includes two sumps and a sediment trap. It provides an outlet for the north drainage ditch wetland and inflow into Sunset Lake. It is maintained to convey water; no wetland vegetation is present. It connects NRMA 1 and NRMA 2.

#### *Wastewater Treatment Facility Evaporation Ponds*

The wastewater treatment facility evaporation ponds were not surveyed or classified by Tetra Tech, Inc. (1996). However, they may provide valuable aquatic habitat. The ponds were found to have many water birds and may offer habitat to amphibians and reptiles as well (TDI 2012). Bullfrogs (*Lithobates catesbeianus*) were also observed here or in ponds near the evaporation ponds during the 2009-2010 surveys (TDI 2012).

### 3.4.4.2 Wetland Habitat Value

Seven of the 43 previously inventoried wetlands are of sufficient size and permanence to be of significance to wildlife in the area. These five wetlands are referred to as Sunset Lake wetland (site 23), NRMA 1 wetland (site 27), NRMA 3 and NRMA 5 wetlands (sites 24, 25 and 29), main drainage ditch wetland (site 2), and north drainage ditch wetland (site 35). In particular, wildlife species observed at NRMA 3 wetlands (sites 24 and 25) include the western spadefoot toad (*Spea hammondii*). Wintering migrants such as the white-crowned sparrow (*Zonotrichia leucophrys*) use this type of habitat to forage for seeds from grasses and small shrubs.

While the remaining wetlands have hydrophytes growing within them, the hydrology of the area does not naturally provide a sufficient water source for them to be of significance to wildlife. Standing water occurs in these locations due only to intermittently seeping irrigation pipes or pumped irrigation water.

Seasonally inundated areas, including in canals and in pools on agricultural area roads support a range of wildlife. Reptiles and amphibians persisting there include California toads (*Anaxyrus boreas halophilus*) and western spadefoot toads. Common reptile and amphibian species include California treefrog (*Hyla californiae*), bullfrog, western aquatic garter snake (*Thamnophis couchi*), and California kingsnake. Bird species commonly using the wetland areas include great blue heron (*Ardea herodias*), snowy egret (*Egretta thula*), American coot (*Fulica americana*), red-winged blackbird, and marsh wren (*Cistothorus palustris*). In addition, several of the irrigation ditches and tailwater sumps contain mosquitofish (*Gambusia affinis*), historically introduced to control the mosquito population.

Wildlife use of wetlands may occasionally also be a function of available food resources in the surrounding area. For example, the Wastewater Treatment Facility sludge ponds, near Parcel 4A26, have provided habitat for the tricolored blackbird in the past. At that time, Parcel 4A26 had a crop of winter wheat on it. The birds were often observed moving between the field and the sludge ponds (J. Crane, pers. com. 2011).

# 3.5 Flora and Fauna Populations

## 3.5.1 Flora

The list of observed plant species is included in Appendix J. The current plant list identifies 280 unique taxa. Total native taxa identified are 125, compared to 150 non-native. Five that could only be identified to the level of genus have an undetermined native status as there are both native and non-native plants within the genus. A total of 672 individuals representing 27 different species of tree and shrub were identified at Karen Mechem Park (TDI 2012). Of these, only three species are native, and 15% of the individuals were dead. Species observed in the Administration and Housing Areas are also noted.

### 3.5.1.1 Special Status Plants

Five plants known to occur at NAS Lemoore have been called out by the CNPS[26] as rare or potentially rare: vernal barley (*Hordeum intercedens*) because of its limited distribution, crownscale (*Atriplex coronata* var. *coronata*), Cooper's rush, San Joaquin spearscale (*Atriplex joaquinana*), and Lost Hills crownscale (*Atriplex coronata* var. *vallicola*). Special status and rare plants occurring (confirmed sighting) or with the potential to occur at NAS Lemoore are presented in Appendix G.

### 3.5.1.2 Invasive Plant Species

Lists of noxious or invasive weeds are maintained by federal and state agencies and a private nonprofit organization. The U.S. Department of Agriculture noxious weed program and the CDFA noxious weed program emphasize weeds that are threats to agriculture, including grazed rangeland. A few species on the CDFA noxious weed lists are native species that are considered agricultural pests (CDFA 2010b). The Cal-IPC maintains lists that emphasize non-native plants that are considered threats to wildlands and native ecosystems (Cal-IPC 2006).

Appendix J presents invasive or noxious weeds that have been recorded on NAS Lemoore lands; there are a total of 45 species. None are on the federal noxious weed list. The CDFA list includes 15 species that have been observed at NAS Lemoore. Blueweed is the only species on CDFA's List A, identifying it as a species for which CDFA policies call for its eradication, containment or entry refusal. Thirty-four species found at NAS Lemoore are on the Cal-IPC List; red brome (*Bromus madritensis* spp. *rubens*), yellow star thistle, perennial pepperweed (*Lepidium latifolium*), and saltcedar are considered "High" invaders by Cal-IPC, indicating that they have severe ecological impacts, moderate to high dispersal rates and a widespread distribution.

Noxious or invasive species that may be of concern at NAS Lemoore include the following: Chufa flatsedge (*Cyperus esculentus*) frequently occurs around the margins of agricultural fields and is a potential problem species for agricultural operations. Yellow star thistle and to a lesser degree, Maltese star thistle (*Centaurea melitensis*), are relatively abundant in NRMA 1. Russian knapweed, a perennial that spreads from rhizomes and seed, is relatively abundant in NRMA 1 and may be spreading rapidly there. It has been observed that Russian knapweed is encroaching onto the Station from levees by the Kings River (to the northeast), where it is a major concern. Russian thistle (*Salsola tragus*) can be a problem around the Operations Area if it is not treated quickly and properly. Two species of tamarisk, athel tamarisk and saltcedar, comprise a number of windbreaks along the perimeter of the Station where they have established naturally. Saltcedar is much more invasive than athel tamarisk. Both species tend to spread in moist low-lying areas, such as portions of NRMAs 1, 2 and 3, as well as along canals and ditches and by agricultural tailwater sumps. Invasive weeds at NAS Lemoore generally tend to be worse along drainage ditches and under windbreaks in the agricultural outlease area.

While there are a number of windbreaks and woodland stands with eucalyptus on the Station, they generally function well as windbreaks and provide habitat for raptors and other birds. Those in NRMA 2 were originally planted to absorb saline subsurface tile water from an adjacent agricultural parcel (Appendix K discusses recommended plant species for agricultural windbreaks and hedgerows in natural areas.) Recent weed treatments at NAS Lemoore concentrated on treating saltcedar in NRMA 3, the landfill, and the Administration Area; and perennial pepperweed in NRMA 1 (Innovative Inclosures 2010).

[26] CNPS is a non-profit organization dedicated to the understanding and appreciation of California's native plants and how to conserve them and their natural habitats and is dedicated to the preservation of California native plants. The CNPS has a website dedicated to sensitive and rare plants with a rating system ("California Rare Plant Rank") that has been adopted by the CDFW. The California Natural Diversity Database, which is produced by the CDFW, has incorporated the rating system of the CNPS.

Invasive plant (and animal) species continue to be an important stressor on wildlife in this region, just as they are in other regions throughout the State (CALFED 2000; Cal-IPC 2006; California Department of Fish and Game [CDFG] 2005; Goals Project 1999; Hickey et al. 2003; Jurek 1994; Lewis et al. 1993; Riparian Habitat Joint Venture 2004).

## 3.5.2 Fauna

Wildlife found at NAS Lemoore consists of both resident and migrant species common to the San Joaquin Valley (Appendix J). Wildlife communities on the Station are influenced by both the availability of wildlife habitat and management practices. Previous species lists for small mammals, birds, reptiles and amphibians (including Navy 2001b) have been updated with recent survey data (including Rosenberg and Gervais 2009, TDI 2012, and Lang 2012). No invertebrate baseline survey has been conducted at NAS Lemoore; the invertebrate species list is based on records from the previous INRMP (Navy 2001b) and additional incidental sightings.

### 3.5.2.1 Invertebrates

The only baseline or focus survey for invertebrates was conducted in 1999 (Tetra Tech Inc. 1999) and focused on aquatic invertebrates in seasonal pools ("rain-filled depressions") in NRMA 1, NRMA 5 and the Habitat Linkage Corridor. A total of thirty-two invertebrate taxa were documented, many which could only be identified to the level of family or genus (Appendix J). While none of the rain-filled-depressions were considered vernal pools (for lack of characteristic vegetation and the disturbed nature of the habitat), several of the invertebrates encountered are commonly found in vernal pools. In at least one pool, eighteen different species of aquatic invertebrates were found. No listed species of vernal pool invertebrates were encountered in any of the pools. Lindahl's fairy shrimp (*Branchinecta lindahli*) was present; this species is very widely distributed and is found in a number of very ephemeral and highly disturbed aquatic habitats.

Additional invertebrates previously recorded at NAS Lemoore include the monarch butterfly (*Danaus plexippus*), sulpher butterfly (*Colias* sp.), buckeye butterfly (*Vanessa* sp.), and hairstreaks (*Strymon* sp.). Incidental sightings during the 2009-2010 bird and small mammal surveys (TDI 2012) included the western pygmy-blue butterfly (*Brephidium exilis*) north of the airstrip in NRMA 4, black widow spider (*Latrodectus mactans*) near NRMA 1, and carabid beetle (unidentified sp.) and cricket (unidentified sp.) in NRMA 2.

Invertebrates are important as pollinators and are essential constituents of the food chain. At NAS Lemoore, they are particularly important for both the Agricultural Outlease Program and for insectivorous birds and bats. Pollinator communities on the Station have not been surveyed; however, apiaries are located in the agricultural parcels and are managed by agricultural lessees. Changes in numbers and diversity of insects and other invertebrates on NAS Lemoore could influence bird and bat species' use of the Station for foraging and could potentially influence migrations.

### 3.5.2.2 Fishes

NAS Lemoore lacks aquatic habitat for sustainable fisheries resources. This includes Essential Fish Habitat as defined by the Magnuson-Stevens Fishery Conservation and Management Act, and Critical Habitat as defined under the Endangered Species Act (ESA).

### 3.5.2.3 Amphibians and Reptiles

The 2009 to 2010 amphibian and reptile surveys at NAS Lemoore (TDI 2012) included both day and nighttime observations using wandering transects in wildlife areas and other various features on the Station, including wells and along the edges of agricultural fields. Pitfall traps were placed in key locations. All areas

with any amount of water were examined. An aggregate list of amphibians and reptiles that includes both previous and recent sightings is presented in Appendix J. Five species of amphibian and seven species of reptile have been observed at NAS Lemoore during the course of the past 15 years.

When present, pools of water in the NRMAs and in the ditches and drains in the agricultural fields attract amphibians and reptiles. At NAS Lemoore, bullfrogs were observed in both a pond at the south end of NRMA 1 and by the wastewater treatment facility evaporation ponds. Bullfrogs are an introduced species that has displaced native frogs. Their competitive advantage derives from having evolved in other habitats having many predators, unlike many California native frogs (caherps.com; NatureServe 2013). Near Sunset Lake, Pacific treefrogs (*Pseudacris regilla*) and California toads were either seen or heard. NRMA 3 had been managed in the past to maintain suitable habitat for western spadefoot toads, a California Species of Special Concern (SSC). While currently not as abundant on the Station, they have been observed in small pools between agricultural fields and in ditches near NRMAs, particularly NRMA 1, NRMA 2, and NRMA 3. Threats to amphibians at NAS Lemoore include predation by visiting migratory birds, vehicle traffic and open wells in the agricultural areas. California toads, for example, are slow-moving and are frequently run over as they cross roads at night during their breeding migrations (caherps.com). Dead California toad roadkill was observed on roads between agricultural parcels at NAS Lemoore.

Reptiles were often found taking cover under vegetation in both the NRMAs and agricultural parcels. Western fence lizards were observed in both NRMA 1 and NRMA 2 among wood piles. The California side-blotched lizard was found in multiple NRMAs. In NRMA 5, the side-blotched lizard seemed confined to relatively small areas under brush piles. The expanding grass areas here may present an obstacle, leading them to travel only very short distances from such cover.

### 3.5.2.4 General Birds

Annually, NAS Lemoore provides nesting, roosting, and foraging habitat for 170 species of birds (Appendix J). Of these, 39 have some special status assigned by an international convention and governmental agencies (Convention on International Trade in Endangered Species of Wild Fauna and Flora [CITES], ESA, California Endangered Species Act [CESA], USFWS, CDFW). The latest bird surveys were conducted from 2009 to 2010 (TDI 2012) and from 2010 to 2011 in the Operations Area (Lang 2012).[27]

#### Resident Birds

Resident bird species at NAS Lemoore are defined as such dependent upon the amount of time the species spends on Station lands. They are typically present year-round and breed at NAS Lemoore. In total, 54 species are potential NAS Lemoore residents (year-round residents with possible or unknown breeding). Few breeding bird surveys have been conducted at the Station. However, Swainson's hawk, great-horned owl (*Bubo virginianus*), house sparrow, and the burrowing owl have been identified as breeding residents at NAS Lemoore. Swainson's hawk and burrowing owl abundance and distribution are covered further under Section 3.6 Special Status Wildlife. Currently, NAS Lemoore conducts regular population assessments for burrowing owls on the Station. Red-tailed hawks (*Buteo jamaicensis*) were previously reported to nest in two older willow trees in NRMA 1; after a tornado removed those trees in the late 1990s, artificial nesting platforms were installed as an alternative roosting source. However, they were never fully accepted and utilized by the hawks (J. Crane, pers. com. 2011). Loggerhead shrike and northern harrier (*Circus cyaneus*) are suspected breeders at NAS Lemoore.

[27] In the following sections and throughout the INRMP the nomenclature used for bird species is consistent with the American Ornithological Union, except that bird names are not capitalized (to be consistent with naming conventions for other species groups in this INRMP).

### Migratory Birds

Migratory bird species using NAS Lemoore habitats as a stop-over during their annual migrations may be doing so in combination with other suitable habitats in the region. For example, NAS Lemoore is located 62 miles (100 km) to the northwest of Kern National Wildlife Refuge which is a major stop-over site for many migrating bird species using the Pacific Flyway.[28] West Hills College Lemoore (approximately 2 miles [3.2 km] east of NAS Lemoore) also has a managed wetland while several other areas to the east and south of the Station provide suitable habitat for migrating birds, especially shorebirds, marshbirds, and waterfowl (Cole 2012).

For migrating birds, water and a resting place are of essential importance. Suitable areas for resting and foraging on the Station include NRMA 2 (Sunset Lake) and the wastewater treatment facility evaporation ponds to the south of NAS Lemoore. In particular, Sunset Lake is adjacent to Boggs Slough and the North Fork of the Kings River, which together provide water and valuable riparian habitat for migrants and nesting birds. Due to this regional matrix of wetland habitats, NAS Lemoore receives a number of migrating species such as Swainson's hawk and American white pelican and serves as wintering ground for some including the white-crowned sparrow and the yellow-rumped warbler (*Dendroica coronata*). In addition, white-faced ibis was observed nesting during June 2009 and short-eared owl (*Asio flammeus*) is a suspected breeder at NAS Lemoore.

### Game Species

There are a limited number of game birds to hunt at NAS Lemoore. These are primarily mourning dove and ring-necked pheasant. The majority of game birds are found in the NRMAs, though some agricultural parcels support them as well. In the past, when there was more water available in wildlife habitats and for general habitat use, game species populations were greater.

### Birds Species by Habitat Use at NAS Lemoore

A diversity of bird species use a range of habitats on the Station. Generally grouped, they include landbirds, shorebirds, marshbirds, seabirds and waterfowl (Table 3-4).

## 3.5.2.5 Mammals

Mammals observed at NAS Lemoore are presented in Appendix J. The list includes previous INRMP sightings (2001b), recent small mammal trapping results (TDI 2012), as well as incidental sightings during small mammal, bird and amphibian and reptile surveys at the Station. Small mammals were trapped four times in 2009 to 2010 concentrating on NRMA 1, NRMA 2, and NRMA 3, as well as near the wastewater treatment facility evaporation ponds (TDI 2012). Special trapping was also conducted for the federally endangered Buena Vista Lake shrew (*Sorex ornatus relictus*) in NRMA 1 and NRMA 2 (TDI 2012).

Over the course of previous and recent surveys, 28 mammal species have been observed at NAS Lemoore, including seven species of bat.

[28] This region was a vast wetland prior to the 1900s where millions of birds could be found thriving in the appropriate season. Starting in the 1850s and ending in the early 1950s most of the wetlands were drained and reclaimed for agriculture. The 11,249-acre (4,552-ha) Kern National Wildlife Refuge restores a small segment of extremely valuable waterfowl habitat and plays an important role in the success of avifauna using the Pacific Flyway.

*Table 3-4. Bird species by habitat use at Naval Air Station Lemoore*

| Group | No. Species at NAS Lemoore | Special Status Species* | Habitat Use at NAS Lemoore | Description |
|---|---|---|---|---|
| **Landbirds** | 102 species. Includes 15 raptor species. | 25 species. Includes burrowing owl, state threatened Swainson's hawk and state endangered willow fly-catcher (most likely the little willow flycatcher [*Empidonax traillii brewsteri*]). All raptors are CITES-listed. | Prefer grassland habitats, agricultural fields and developed areas to roost and forage, sometimes visiting seasonal wetlands.<br>Raptors roost in windbreaks and hunt over the grasslands, wetlands and agricultural fields. Their prey includes pocket gophers, ground squirrels and other small mammals. | Diverse group of bird species requiring terrestrial habitats for most of their lifecycles. Some are year-round residents, some are short- distance migrants, and others are long-distance migrants. |
| **Shorebirds** | 27 species. Includes sandpipers, snipes, plovers, yellowlegs, stilts, dowitchers, and phalaropes. Many are migratory. | 4 species. | Wastewater treatment facility evaporation ponds, inundated agricultural areas and NRMAs near Sunset Lake provide foraging habitat for shorebirds observed on the Station. White-faced ibis have been observed nesting on the Station. | Long-legged wading birds associated with wetland and coastal environments. Use estuaries, wetlands, coastal dunes, and mudflats for nesting, foraging, and as stopover sites during migrations. Use their bills to extract prey (small invertebrates) from mud or exposed soil. |
| **Marshbirds** | 10 species. 5 of these species were last confirmed present during surveys in 1999: black-crowned night heron, cattle egret, green heron, sora, and Virginia rail. | 2 species: Greater sandhill crane is state threatened and was first confirmed at NAS Lemoore during surveys in 2009-2010. Cattle egret is CITES-listed. | Forage in agricultural areas, especially green alfalfa fields, in NRMA wetlands and near the wastewater treatment facility evaporation ponds. | Associated with marsh and wetland habitats. Prey often include small fish, arthropods, aquatic insects and other aquatic animals including amphibians and some reptiles. Larger species often prey on small birds, reptiles, amphibians and small crustaceans. Nest in trees or in bushes and reeds on the ground. |
| **Seabirds** | 10 species. The double-crested cormorant is the only non-migratory species. | 3 species. The California least tern is both federally and state endangered, though it does not reside or breed at NAS Lemoore (Section 3.6 Special Status Wildlife). | Almost exclusively visit the wastewater treatment facility evaporation ponds in the late spring and summer. | Spend large portions of their life at sea. Live much longer than landbirds, delay breeding and have fewer young. Many undertake long annual migrations. Some also spend time away from the sea, breeding inland and returning to the sea to feed. Some cormorant, pelican, gull, and tern species have individuals that may never visit the sea at all, spending their lives on lakes, rivers, swamps, and in the case of some gulls, on agricultural land. |
| **Waterfowl** | 21 species. | 5 species: Redhead is a USFWS Bird of Conservation Concern. Tule greater white-fronted goose is a California SSC. Others are CITES-listed. | Observed frequently at the wastewater treatment facility evaporation ponds, some in large flocks, including northern shoveler and American coot. | Highly adapted for aquatic habitats at the water surface, while some have the ability to dive. |

*Refer to Appendix J. Includes species observed in bird surveys over the last fifteen years at NAS Lemoore.

Source: Navy 2001b; TDI 2012; Lang 2012; Rosenberg and Gervais 2009; T. Schweizer pers. com. 2013; NAS Lemoore in-house ongoing wastewater treatment facility evaporation pond surveys 2009-2010.

Mammals commonly observed in the NRMAs include black-tailed jack rabbit, Botta's pocket gopher (*Thomomys bottae*), desert cottontail, and deer mouse (*Peromyscus maniculatus*). Understory vegetation that is not particularly dense is good habitat for the cottontails, jackrabbits and California ground squirrels. Coyotes were observed frequently throughout the Station, both in the NRMAs and agricultural fields. In addition, a gray fox (*Urocyon cinereoargenteus*) was sighted near NRMA 1—a species not previously recorded at NAS Lemoore. In 2011, a fox den of an unknown species was reported in NRMA 2. Evidence of an unknown number of American badgers (*Taxidea taxus*) in NRMA 1 included burrows and tracks, while badger roadkill was identified a quarter mile east of the Station's east gate. Multiple sightings of American badger have been made inside the Operations Area in addition to roadkill on Gateway Road just outside of the Operations Area (T. Schweizer, pers. com. 2014). Species commonly associated with developed areas were also observed, including house mouse, roof rat, and raccoon (*Didelphis virginiana*). In particular, several striped skunks were reported in past years in NRMA 2 and have been removed from the area between Karen Mechem Park and Akers School in the last year (J. Crane, pers. com. 2011). Feral dogs have occasionally been observed roaming the residential areas. The presence of feral dogs represents a potential threat to native ground dwelling species, such as ground squirrels and burrowing owls.

No Buena Vista Lake shrews were captured during recent trapping surveys (TDI 2012). Potential habitat for this species at NAS Lemoore includes tule marshes, sloughs and seasonal floodplains. More information is included in Section 3.6.1.6 Buena Vista Lake Shrew (Federally Endangered).

NRMA 5 contains the only known population of federally and state endangered San Joaquin kangaroo rat on NAS Lemoore.[29] It may be genetically intermediate between two subspecies: Tipton kangaroo rat (*D. n. nitratoides*) and Fresno kangaroo rat (*D. n. exilis*), though recent tests have been inconclusive. Both subspecies are listed as federally and state endangered. It is also important to note that the Fresno kangaroo rat is endemic to the region. More information on the San Joaquin kangaroo rat and its habitat at NAS Lemoore is presented in Section 3.6.1.5 San Joaquin Kangaroo Rat (Federally and State Endangered).

Bat habitat on NAS Lemoore includes several artificial bat boxes installed near developed areas and other existing human-made structures. Two species of bats have been observed to roost within developed areas on NAS Lemoore: the Mexican freetail bat (*Tadarida brasiliensis*) and western pipistrelles (*Pipistrellus hesperus*) have been observed roosting in buildings in the Housing, Administration, and Operations Areas. In surveys spanning November 2009 through May 2010, acoustic monitoring detected four bat species: the Mexican freetail bat, hoary bat (*Lasiurus cinereus*), western red bat (*L. blossevilii*), and the Yuma myotis (*Myotis yumanensis*). The most numerous records were of the Mexican freetail bat and the western red bat (TDI 2012).

## 3.6 Special Status Wildlife

Special status wildlife species presented in more detail below include both federally listed and state listed, as well as other sensitive species identified by CITES, the USFWS, CDFW, and California Natural Diversity Database (CNDDB) as requiring management consideration (see also Appendix G). Federally listed species include those that occur (confirmed sighting) or have potential to occur at the Station (Table 3-5).[30] State threatened, state endangered, USFWS Birds of Conservation Concern (BCC), and amphibians and mammals that are California SSC which have been documented on the Station are described below (Table 3-6). No Critical Habitat has been designated on the installation.

[29] In 1982, kangaroo rats of an unidentified species were captured in NRMA 4; however, they have not been observed there since (Navy 2001b).

[30] Federally listed species that have potential to occur at NAS Lemoore, but have not been documented on the Station, are important to discuss since critical habitat for any given federally listed species can be designated in areas with suitable habitat but where individuals may not have been documented (Section 4.5 Special Status Species Protection).

## 3.6.1 Federally Listed Species

The only federally listed species documented at NAS Lemoore are the San Joaquin kangaroo rat (federally and state endangered) and the California least tern (*Sternula antillarum brownii*) (federally and state endangered). The latter was observed as a transient and does not breed on NAS Lemoore.

Currently, there is no Critical Habitat designated at NAS Lemoore. In addition to the San Joaquin kangaroo rat and California least tern, five federally listed species with potential to occur on NAS Lemoore are discussed below (Table 3-5). Four of these species have Critical Habitat designated for them in California. The Buena Vista Lake shrew has Critical Habitat designated approximately 1.25 miles (2 km) east of NAS Lemoore.

Section 4.5.1 Threatened and Endangered Species and Critical Habitat and Appendix L provide additional details regarding the role of INRMPs and their stated purpose in precluding the need for Critical Habitat designation on the installation.

*Table 3-5. Federally listed species that occur or have potential to occur at Naval Air Station Lemoore.*

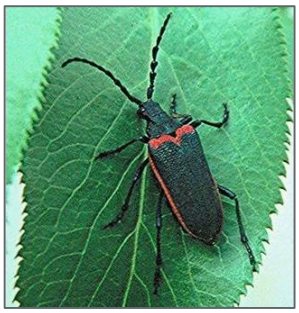
| Common Name | Scientific Name | Federal/State Status | Presence at NAS Lemoore | Management Discussion | Critical Habitat Designation? |
|---|---|---|---|---|---|
| Valley elderberry longhorn beetle | *Desmocerus californicus dimorphus* | FT (PD)/na (endemic to California Central Valley) | Has Potential to Occur on the Station. | Section 4.5.1 Threatened and Endangered Species and Critical Habitat; and Section 4.5.1.4 Other Federally Listed Species Potentially Present at NAS Lemoore. | Small locations in Sacramento, California. |
| California tiger salamander | *Ambystoma californiense* | FT/ST (PE) | Has Potential to Occur on the Station. | Section 4.5.1 Threatened and Endangered Species and Critical Habitat; and Section 4.5.1.4 Other Federally Listed Species Potentially Present at NAS Lemoore. | Central population: just northwest of Visalia and north of Fresno near Millerton Lake, among others. |
| Blunt-nosed leopard lizard | *Gambelia sila* | FE/SE (endemic to San Joaquin Valley) | Has Potential to Occur on the Station. | Section 4.5.1 Threatened and Endangered Species and Critical Habitat; and Section 4.5.1.4 Other Federally Listed Species Potentially Present at NAS Lemoore. | None. |
| California least tern | *Sternula antillarum browni* | FE/SE | Non-breeding transient. | Section 4.5.1 Threatened and Endangered Species and Critical Habitat; and Section 4.5.1.4 Other Federally Listed Species Potentially Present at NAS Lemoore. | None. |
| San Joaquin kangaroo rat * | *Dipodomys nitratoides* | FE/SE | NRMA 5. | Section 4.5.1 Threatened and Endangered Species and Critical Habitat; and Section 4.5.1.1 San Joaquin Kangaroo Rat (Federally and State Endangered). | Fresno kangaroo rat: Near Mendota, California (Alkali Sink Ecological Preserve and Mendota Wildlife Management Area), northwest of the Station.<br>Tipton kangaroo rat: None. |
| Buena Vista Lake shrew | *Sorex ornatus relictus* | FE/na | Pitfall trap surveys in 2009-2010 (TDI 2012) yielded no confirmed presence on the Station. | Section 4.5.1 Threatened and Endangered Species and Critical Habitat; and Section 4.5.1.2 Buena Vista Lake Shrew (Federally Endangered). | Lemoore Wetland Reserve Unit (Unit 7), 97 acres located approximately 1.25 miles (2 km) east of NAS Lemoore between Highway 198 and Idaho Avenue (the northernmost occurrence of the shrew); among others elsewhere in the San Joaquin Valley. |

| Common Name | Scientific Name | Federal/State Status | Presence at NAS Lemoore | Management Discussion | Critical Habitat Designation? |
|---|---|---|---|---|---|
| San Joaquin kit fox | *Vulpes macrotis mutica* | FE/ST | Has Potential to Occur on the Station. | Section 4.5.1 Threatened and Endangered Species and Critical Habitat; and Section 4.5.1.3 San Joaquin Kit Fox (Federally Endangered and State Threatened). | None. |

Codes: FE = Federally Endangered, FT = Federally Threatened, SE = State Endangered, ST = State Threatened, PE = Proposed Endangered, PD = Proposed Delisting, na - Not Applicable

Sources:
Navy 2001b, TDI 2012
Fresno kangaroo rat Critical Habitat: USFWS 30 January 1985.
Buena Vista Lake shrew Critical Habitat: USFWS: 02 July 2013.
California tiger salamander Critical Habitat: USFWS 23 August 2005.
Valley elderberry longhorn beetle Critical habitat: USFWS 08 August 1980.
* = Prior to March 2013, there was no USFWS protocol survey methodology for this species. 2013 surveys at NAS Lemoore were conducted prior to the protocol being published; those surveys relied on specific trapping guidelines outlined in individual permits that primarily concentrated on ensuring animal safety and welfare. Future surveys for the kangaroo rat will use the published protocol (USFWS 2013).

### 3.6.1.1 Valley Elderberry Longhorn Beetle (Federally Threatened, Endemic to California Central Valley)



Copyright: USFWS.

The Valley elderberry longhorn beetle has not been observed at NAS Lemoore to date. Several potential host elderberry trees are established along the perimeter fence in NRMA 1 and NRMA 2 and may provide habitat for the beetle. Boggs Slough, to the northeast, is a riparian area and, in conjunction with the elderberry plants at NAS Lemoore, it may provide suitable habitat, though no known surveys for elderberry plants or the beetle have been conducted there. CNDDB lists the beetle as potentially being present in riparian areas along Murphy Slough and the Kings River northeast of NAS Lemoore (CNDDB online quickviewer). Critical Habitat for the species was designated at the time of its listing in 1980 in several small locations in Sacramento, California (USFWS 08 August 1980). The species has been proposed for delisting (USFWS 02 October 2012), a final rule for which is pending an extended comment period (USFWS 23 January 2013). Focused surveys for the species at NAS Lemoore have not been conducted, but are programmed as part of general invertebrate surveys.

More information on the Valley elderberry longhorn beetle is presented in Appendix G.

### 3.6.1.2 California Tiger Salamander (Federally and State Threatened, State Proposed Endangered)

Copyright: John Cleckler, USFWS 2009.

No California tiger salamanders (*Ambystoma californiense*) have been observed at NAS Lemoore. However, the Station is located within the species' range (according to the CDFW species range maps) and contains suitable habitat, particularly in the grassland NRMAs. Boggs Slough, to the northeast of the Station, with its series of streams and possible pools, could provide suitable breeding grounds for the salamanders, particularly in absence of inundated areas on the Station. Tiger salamanders have a long larval stage in the water, and after metamorphosing the adult searches for nearby upland habitat in an abandoned rodent burrow or loose moist soil. In light of the slough's proximity, it is possible that NAS Lemoore may provide habitat for salamander estivation. The species

was listed as federally threatened in 2004 and state threatened in 2010. Critical Habitat for the Central population was designated in 2005 in a number of areas throughout California, including just northwest of Visalia and north of Fresno near Millerton Lake. Focused surveys for the species at NAS Lemoore have not been conducted, but are programmed for the near future.

More information on the California tiger salamander is presented in Appendix G.

### 3.6.1.3 Blunt-Nosed Leopard Lizard (Federally and State Endangered)

Copyright: Steve Layman, USFWS.

The blunt-nosed leopard lizard is endemic to the San Joaquin Valley, but has not been documented at NAS Lemoore. The existing CDFW range map for the species does not include the Station; however, the USFWS points out that there has never been a comprehensive survey of the species' entire historic range (USFWS 2010e). Most populations currently identified are presumed extant; those closest to NAS Lemoore are located in southwestern Kings County and southwestern Tulare County (USFWS 2010e). Potentially suitable habitat for the blunt-nosed leopard lizard at NAS Lemoore would most likely be within the NRMAs where there is relatively open, sparsely vegetated scrub (e.g., alkali sink scrub and saltbush scrub) and grasslands (native and non-native). Vacated small mammal burrows (e.g., ground squirrel and kangaroo rat) are also important for shelter from predators and temperature extremes, as the species does not dig its own (USFWS 2010e). Focused surveys for the species have not been conducted; however, a focused habitat assessment for the blunt-nosed leopard lizard at NAS Lemoore is programmed as part of general herpetological surveys.

The blunt-nosed leopard lizard was listed as federally endangered in 1967 and state endangered in 1971. No Critical Habitat has been designated for this species. More information on the blunt-nosed leopard lizard is presented in Appendix G.

### 3.6.1.4 California Least Tern (Federally and State Endangered)

Copyright: USFWS.

While no California least terns were observed on the most recent surveys undertaken by TDI (2012), this species was included in the previous INRMP species list as having been observed on two occasions at the wastewater treatment facility evaporation ponds in the southeastern portion of the Station (Navy 2001b). NAS Lemoore contains no suitable breeding habitat for the species, and individuals would only be found in the area as transients during migration. During these times, least tern visits to the area would most likely be restricted to the evaporation ponds, where other tern species have been recorded previously. The species was listed as state endangered in 1971 and federally endangered in 1970. No Critical Habitat has been designated for this species. More information on the California least tern is presented in Appendix G.

### 3.6.1.5 San Joaquin Kangaroo Rat (Federally and State Endangered)

Copyright: David Germano, CSUB.

The San Joaquin kangaroo rat present in NRMA 5 at NAS Lemoore might be genetically intermediate between the subspecies Tipton kangaroo rat and the Fresno kangaroo rat, though recent tests have been inconclusive (Map 3-10). Both subspecies are listed as endangered under the California and Federal Endangered Species Acts (federally listed in 1988 and 1985, respectively; state listed in 1989 and 1980, respectively).

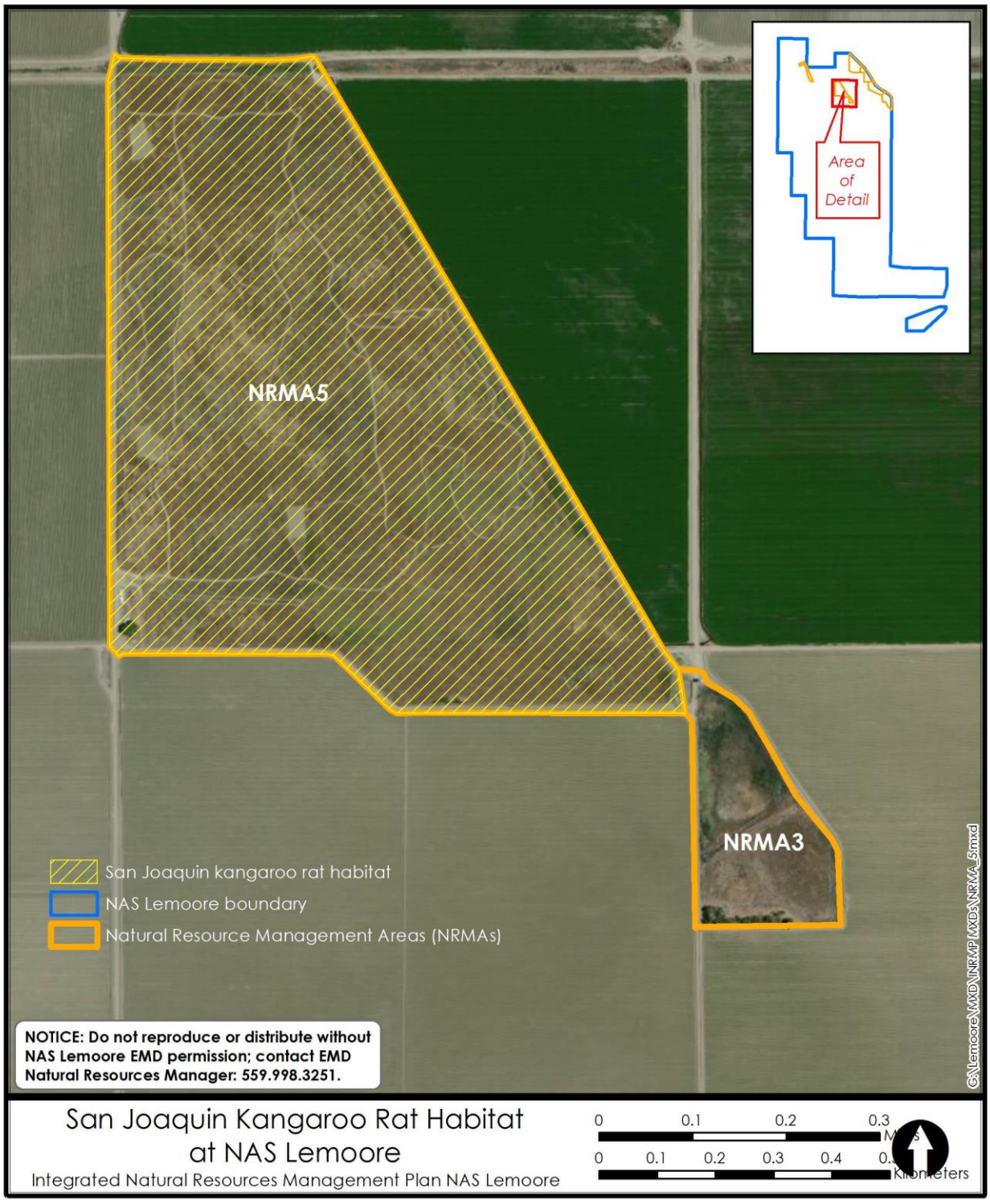
An unidentified subspecies of the kangaroo rat was first documented at NAS Lemoore in NRMA 4, just northeast of runway 14L/32R (O'Farrell and Sauls 1982). Since then, no kangaroo rats were detected in NRMA 4 during surveys conducted in 1993 (Morrison et al. 1996), 1998-1999 (Tetra Tech Inc. 1999), November 2001 (Smallwood and Morrison, unpubl. data), April 2003 (Morrison and Smallwood 2003b), and May 2004 (Morrison and Smallwood 2004). The kangaroo rats found in NRMA 4 occupied an isolated patch of sandy soil (O'Farrell and Sauls 1982), dominated by bare ground and short-stature stands of foxtail brome, soft chess, fescue grasses (*Festuca* spp.), red stemmed filaree (*Erodium cicutarium*), goldfields (*Lasthenia* sp.), fiddleneck, Russian thistle, burclover (*Medicago* sp.), prickly lettuce (*Lactuca serriola*), pygmy weed (*Crassula connata*), plantain (*Plantago* sp.), pepperweed (*Lepidium* sp.), spinescale saltbush, common yarrow, and Mt. Diablo milkvetch (*Astragalus oxyphysus*). The vegetation in the NRMA was very dense by November 2001 and most of it was much taller than depicted in 1982 photos.

O'Farrell and Sauls (1982) found no kangaroo rats during a search of "a motocross site," which presumably was NRMA 5. However, the search intensity was not described, and it is possible O'Farrell and Sauls obtained a false negative result. Kangaroo rats were first documented in NRMA 5 in 1988 (California State University Fresno 1990 cited in Kelly et al. 2000). During that time and since about 1965, NRMA 5 had been used for off-road vehicle (ORV) recreation, including two dirt tracks. The kangaroo rats occurred mostly along the borders of the ORV tracks. In 1992, unauthorized persons brought a tractor into NRMA 5 and disked the soils adjacent to the motocross track in an effort to widen it. This action likely killed some kangaroo rats, and certainly destroyed burrow systems (Morrison et al. 1996). In September 1992, the USFWS ordered the Navy to discontinue ORV use of NRMA 5 and to fence its perimeter due to concerns about the kangaroo rats (Uptain et al. 1998; J.Crane, pers. com. 2011).

NRMA 5 was not managed for the species until 1995, when the Endangered Species Recovery Program initiated experimental treatments intended to identify and improve habitat for the San Joaquin kangaroo rat (Uptain et al. 1998, 2000; Kelly et al. 2000). Between 1992 and 1995, exotic annual grasses had encroached into areas previously kept barren due to motocross activity. The dense growth of grasses constrained kangaroo rats to shrinking habitat patches. The Endangered Species Recovery Program used grazing, handheld weeders, a skip-loader, and burning to reduce vegetation in experimental plots, but the experiments were mostly ineffective due to pseudoreplication (Hurlbert 1984) and insufficient scale.

Smallwood and Morrison (2009) began monitoring the San Joaquin kangaroo rat in fall 2000. Beginning in 2001, Smallwood and Morrison removed vegetation experimentally using handheld weeders, tractor-drawn disking assemblies, and prescribed burning. They created experimental plots in which soils were disked or dragged, desired plant seed was broadcast, wood pallets were placed for cover, and irrigation was applied to planted seedlings of desired shrub species. The kangaroo rat population responded favorably to treatments until 2005, which was the first of two years of dense stands of herbaceous plants covering most of NRMA 5. After these two years of extreme plant growth, drought limited growth from 2007 through 2009. San Joaquin kangaroo rat numbers declined substantially from 2005 through 2009 (Smallwood and Morrison 2009). They stabilized by 2009 and 2010, but declined again in 2011 (Smallwood and Morrison 2011; Figure 3-6).[31]

[31] Prior to March 2013, there was no USFWS protocol survey methodology for this species. 2013 surveys at NAS Lemoore were conducted prior to the protocol being published; those surveys relied on specific trapping guidelines outlined in individual permits that primarily concentrated on ensuring animal safety and welfare. Future surveys for the kangaroo rat will use the published protocol (USFWS 2013).




*Map 3-10. Location of current San Joaquin kangaroo rat habitat at Naval Air Station Lemoore.*[32]

[32] All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps.

Although the species is disturbance-adapted, Smallwood and Morrison (2009) documented negative responses to excessive disturbances, such as habitat loss caused by intense ORV activity at the southeast corner of Highway 41 and Jackson Avenue, several miles southeast of NAS Lemoore. However, Smallwood and Morrison (2011) maintain that habitat management is important to conserve this species, and has become even more important as the population size in NRMA 5 has declined.

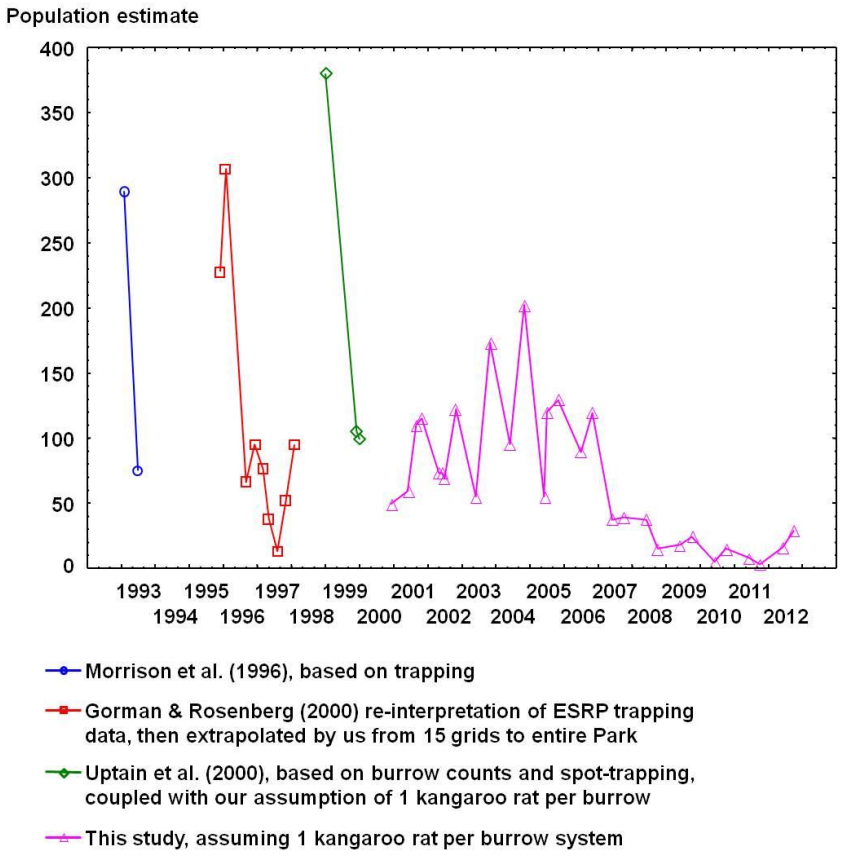



*Figure 3-6. Estimated San Joaquin Kangaroo rat population in NRMA 5 from 1993 to 2012 (Smallwood and Morrison 2012).*

Management of the San Joaquin kangaroo rat contributes to the recovery goals and downlisting criteria outlined by the USFWS in their 5-Year Review for the Tipton kangaroo rat (USFWS 2010g; in which the kangaroo rat population at NAS Lemoore is discussed). They include: protecting occupied habitat, an approved and implemented management plan that includes the survival of the kangaroo rat as an objective, and stable or increasing populations. NAS Lemoore's protection and management of NRMA 5 expressly for the San Joaquin kangaroo rat contributes to the first and third goals. To promote a stable population in NRMA 5, the current management approach is to continue determining the most suitable habitat management actions necessary for supporting the population there. The approval of this INRMP and the proposed development of an updated management plan for the San Joaquin kangaroo rat in NRMA 5 (in consultation with the USFWS) would contribute to the second goal.[33]

[33] While NAS Lemoore is helping to contribute to the recovery goals outlined by the USFWS, the Station is not single-handedly able to satisfy the requirements described for each of these goals that are necessary for downlisting of the species. Other regional preserves and habitat areas identified by the USFWS as important for this species must also be managed and protected in a way to contribute to recovery plan goals. In this way, a cumulative effort to achieve thresholds specified in each goal is necessary to enable the USFWS to consider downlisting.

Additional recommendations from the 5-Year Review include metapopulation viability analysis and a genetic profile of the population (USFWS 2010g).

Critical Habitat for the Fresno kangaroo rat was designated in 1985 near Mendota, California at the Alkali Sink Ecological Preserve and Mendota Wildlife Management area, located northwest of NAS Lemoore (USFWS 30 January 1985). No Critical Habitat has been designated for the Tipton kangaroo rat. More information on this species is presented in Appendix G.

### 3.6.1.6 Buena Vista Lake Shrew (Federally Endangered)

Copyright: USFWS.

Potential habitat for the Buena Vista Lake shrew includes tule marshes, sloughs, and seasonal flood plains found in the lake basins where there is moisture, abundant insect prey, and sufficient vegetative cover (Appendix G and Appendix L). At NAS Lemoore, suitable habitat could include both natural and artificial wetlands in NRMAs or drainage ditches. Buena Vista Lake shrews have also been captured in retired farmland areas (Atwell Island site, 2 miles [3.2 km] south of Alpaugh in Tulare County) where it is believed the shrews persisted due to relatively localized deep cracks in clay soils and the abundance of rodent burrows (which may provide additional moisture, invertebrate prey, and cover). The USFWS has been unable to determine the long-term suitability of this habitat type for the species (USFWS 10 July 2012).

The species was listed as federally endangered in 2002. It is endemic to the Tulare Basin, having historically occupied seasonal and permanent wetlands and riparian communities (Williams and Harpster 2001). The most recent surveys at NAS Lemoore did not observe any Buena Vista Lake shrews (TDI 2012). Although the effort to install pitfall traps was greater than the effort towards conventional small mammal trapping, this effort was regarded as minimal and the negative findings unconvincing that shrews are not present (TDI 2012). Additional focused surveys for the species at NAS Lemoore are programmed for the near future.

Critical Habitat has been designated for this species on a total of 2,485 acres (1,006 ha) in the San Joaquin Valley (USFWS 02 July 2013). This is an increase from the previous Critical Habitat designation for the shrew (USFWS 24 January 2005) that included 84 acres (34 ha) at Kern Lake Preserve located 16 miles (26 km) south of Bakersfield. One of the new areas is the Lemoore Wetland Reserve Unit (Unit 7), which comprises 97 acres (39 ha) located approximately 1.25 miles (2 km) east of NAS Lemoore between Highway 198 and Idaho Avenue. Unit 7 is managed by the Natural Resources Conservation Service for waterfowl enhancement. The Buena Vista Lake shrew was identified there in April 2005 and the location is considered the northernmost occurrence of the species (USFWS 10 July 2012). More information on this species is presented in Appendix G.

### 3.6.1.7 San Joaquin Kit Fox (Federally Endangered and State Threatened)

Copyright: Heather Bell, USFWS.

Currently, there is virtually no information available on San Joaquin kit fox (*Vulpes macrotis mutica*) presence and abundance in the NAS Lemoore area. Though, the CNDDB suggests that they may be present (CNDDB online quickviewer). With the potential expansion of kit fox habitat in the near future, there may be a greater chance of kit foxes utilizing habitats on the Station, especially the NRMAs (where prey are available). The species was listed as federally endangered in 1967 and state threatened in 1971. Focused surveys to assess the kit fox's use of NAS Lemoore have not been conducted, but are programmed for the near future.

No Critical Habitat has been designated for this species. More information on the San Joaquin kit fox is presented in Appendix G.

## 3.6.2 Other Special Status Species

Other than the San Joaquin kangaroo rat and California least tern discussed above, there are 45 species with special status designation that occur at NAS Lemoore, including those with designations under CITES, USFWS BCC, as well as state listed species and California SSC. A number of species documented at NAS Lemoore have more than one special status designation.

Species discussed in detail in this section include birds documented at NAS Lemoore that are identified as BCC or are state listed, and other animals documented on the installation that are identified as California SSC (currently does not include any invertebrates, fishes, or reptiles) (Table 3-6). Species with only a CITES designation or birds listed only as California SSC[34] are not treated in detail here; however, they are listed below as part of the definitions for the various special status designations. All special status species are presented in Appendix G and Appendix J.

Lists of Species of Special Concern created for use by other agencies and organizations (e.g., CITES, Bureau of Land Management, U.S. Forest Service, National Audubon Society, USFWS, and CDFW) serve as watch lists for species that are worthy of conservation effort and that may potentially deserve formal listing.

The lists used in this INRMP and the special status species identified at NAS Lemoore, include:

***CITES*** *designation is applied to roughly 5,000 animal and 29,000 plant species to protect their continued survival from the impacts of international trade, whether traded as live specimens, food (including dried herbs), or integrated into products (e.g., clothing, jewelry). CITES is an international agreement to which countries adhere voluntarily. Though it is legally binding and signatory countries are required to implement the Convention, it does not take the place of national laws.*

*The* ***BCC*** *designation is applied by the USFWS to migratory and non-migratory birds that, without additional conservation actions, "are likely to become candidates for listing under the ESA of 1973" (Fish and Wildlife Conservation Act, amended 1988; USFWS 2008). BCC species are considered all nongame birds, gamebirds without hunting seasons, subsistence-hunted nongame birds in Alaska; and ESA candidates, proposed endangered or threatened, and recently delisted species.*

***California SE*** *and* ***ST*** *species designated by the CDFW have specific state-driven legal protection as described in the CESA (as amended in 1984).*

***California SSC*** *designation is applied by the CDFW to species that are not listed under the ESA or CESA, but which, nonetheless (1) are declining at a rate that could result in listing, or (2) historically occurred in low numbers and known threats to their persistence currently exist (CDFG 2011).*

**Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).** Twenty-three CITES-listed species have been documented at NAS Lemoore. Those species with only a CITES designation include: Anna's hummingbird, black-chinned hummingbird, American kestrel (*Falco sparverius*), barn owl (*Tyto alba*), Cooper's hawk (*Accipiter cooperii*), great horned owl, prairie falcon (*Falco mexicanus*), red-shouldered hawk (*Buteo lineatus*), red-tailed hawk, sharp-shinned hawk (*Accipiter striatus*), western screech-owl (*Megascops kennicottii*), white-tailed kite (*Elanus leucurus*), cattle egret (*Bubulcus ibis*), green-winged teal (*Anas crecca*), northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), and red fox (*Vulpes vulpes*). NAS Lemoore species with other special status designations (discussed below) in addition to CITES include: burrowing owl, northern harrier, peregrine falcon, short-eared owl, Swainson's hawk, and greater sandhill crane (*Grus canadensis tabida*).

[34] The USFWS no longer maintains Species of Special Concern lists for any species groups other than birds. As a result, the USFWS BCC list and California State Threatened and Endangered list is used for birds, while the CDFW SSC lists are used for other species groups to determine those species addressed in detail in this section.

*Table 3-6. Naval Air Station Lemoore other special status species (discussed in detail).*

| Common Name | Scientific Name | Status Intl/Fed/State | Presence at NAS Lemoore | Management Discussion |
|---|---|---|---|---|
| Western spadefoot toad | *Spea hammondii* | NA/ NA/ SSC | NRMA 3 in the past. Currently, occasional sightings near areas of open or ponded water. | Section 4.5.2 Other Special Status Species; and Section 4.5.2.1 Western Spadefoot Toad (California SSC). |
| Tricolored blackbird | *Agelaius tricolor* | NA/BCC/ SSC | Administration and Housing Area, Operations Area and adjacent agricultural fields. | Section 4.5.2 Other Special Status Species. |
| Burrowing owl | *Athene cunicularia* | CITES/ BCC/ SSC | Natural and mowed grasslands in the Operations Area and NRMAs. | Section 4.5.2 Other Special Status Species; and Section 4.5.2.2 Burrowing Owl (USFWS BCC, California SSC). |
| Swainson's hawk | *Buteo swainsoni* | CITES/ NA/ ST | Forages over agricultural fields, preying on small mammals. Nests in trees on the installation. | Section 4.5.2 Other Special Status Species; and Section 4.5.2.3 Swainson's Hawk (State Threatened). |
| Mountain plover | *Charadrius montanus* | NA/ BCC/ SSC | Operations Area and adjacent agricultural fields. | Section 4.5.2 Other Special Status Species. |
| Snowy plover[1] | *Charadrius nivosus* | NA/ BCC/ SSC | Evaporation ponds. | Section 4.5.2 Other Special Status Species. |
| Olive-sided flycatcher | *Contopus cooperi* | NA/ BCC[2]/ SSC | NRMAs | Section 4.5.2 Other Special Status Species. |
| Willow flycatcher[3] | *Empidonax traillii* | NA/ BCC/ SE | Documented during surveys for the 2001 INRMP. Not observed since then. | Section 4.5.2 Other Special Status Species. |
| Peregrine falcon | *Falco peregrinus* | CITES/ BCC/ (DL*) | Foraging in agricultural fields. | Section 4.5.2 Other Special Status Species. |
| Greater sandhill crane | *Grus canadensis tabida* | CITES/ NA/ ST | Observed flying over the Operations Area. | Section 4.5.2 Other Special Status Species. |
| Loggerhead shrike | *Lanius ludovicianus* | NA/ BCC/ SSC | Throughout the Station: motocross track, Operations Area, NRMAs, Landfill, Karen Mechem Park, evaporation ponds. | Section 4.5.2 Other Special Status Species. |
| Long-billed curlew | *Numenius americanus* | NA/ BCC/ NA | NRMAs and agricultural fields | Section 4.5.2 Other Special Status Species. |
| Whimbrel | *Numenius phaeopus* | NA/ BCC/ NA | Throughout the Station. | Section 4.5.2 Other Special Status Species. |
| Western mastiff bat | *Eumops perotis* | NA/ NA/ SSC | Primarily NRMAs. | Section 4.5.2 Other Special Status Species. |
| Western red bat | *Lasiurus blossevillii* | NA/ NA/ SSC | Recorded near agricultural area by a ditch and along a tree-lined canal. | Section 4.5.2 Other Special Status Species. |
| Tulare grasshopper mouse | *Onychomys torridus tularensis* | NA/ NA/ SSC | Documented as present in the 2001 INRMP. Not observed since then. | Section 4.5.2 Other Special Status Species. |
| American badger | *Taxidea taxus* | NA/ NA/ SSC | Burrows and tracks in NRMA 1; NRMA 5. | Section 4.5.2 Other Special Status Species. |

Codes:
International: CITES = species is included on a list maintained by the Convention on International Trade in Endangered Species of Wild Fauna and Flora.
Federal: BCC = USFWS Bird of Conservation of Concern;
State: SE = State Endangered; ST = State Threatened; SSC = CDFW Species of Special Concern.
NA = Not Applicable.
Sources: Navy 2001b, TDI 2012, Lang 2012, USFWS 2008, CDFW 2013a, CDFG 2011, Smallwood 2010, Smallwood and Morrison 2011, Rosenberg and Gervais 2009, T. Schweizer per. com. 2013, NAS Lemoore bi-monthly bird counts at the evaporation ponds.
1 = The Federally Threatened status of the western snowy plover applies only to the Pacific coast population. "The Pacific coast breeding population of the western snowy plover extends from the State of Washington to Baja California, Mexico, with the majority of breeding birds found in California" (USFWS 05 March 1993). Snowy plovers at NAS Lemoore are likely part of the San Joaquin "interior" population identified by the USFWS (USFWS 21 April 2006) and are not federally protected. Moreover, a final rule on critical habitat was published (USFWS 29 September 2005) including only those areas along the coast of California, Oregon, and Washington. An updated final rule doubles the critical habitat acreages for the snowy plover, but still only in coastal areas of those states (USFWS 19 June 2012).
2 = Olive-sided flycatcher is a BCC for USFWS Region 8, which includes California and Nevada.
3 = The willow flycatcher was recorded as present at NAS Lemoore in the previous INRMP (Navy 2001b); no subspecies was identified. As discussed in Section 3.6.2.8 Willow Flycatcher (State Endangered, USFWS BCC), the subspecies most likely to occur on the property is the little willow flycatcher (*Empidonax traillii brewsteri*), which likely does not breed due to the lack of large amounts of riparian habitat, but which may move through the area during its migration to its Mexican wintering grounds.
DL* = The peregrine falcon was delisted from its State Endangered status on November 4, 2009.

**USFWS Birds of Conservation Concern (BCC).** NAS Lemoore is located within Bird Conservation Region 32 (Coastal California) and USFWS Region 8 (California and Nevada). There are ten BCC birds documented at NAS Lemoore (Table 3-6; Appendix G and Appendix J).[35]

**California Species Listed Endangered (SE) or Threatened (ST).** Per CESA, there are two state threatened species and two state endangered species documented at NAS Lemoore (Table 3-6; Appendix G and Appendix J). California least tern is not included here as it is discussed above in Section 3.6.1.4 California Least Tern (Federally and State Endangered).

**California Species of Special Concern (SSC).** There are 21 SSC species documented at NAS Lemoore, six of which are also BCC (Appendix J): western spadefoot toad, northern harrier, short-eared owl, burrowing owl, loggerhead shrike, yellow-breasted chat (*Icteria virens*), American white pelican (*Pelecanus erythrorhynchos*), black tern (*Chlidonias niger*), Vaux's swift (*Chaetura vauxi*), olive-sided flycatcher (*Contopus cooperi*), tricolored blackbird, yellow warbler (*Dendroica petechia*), mountain plover (*Charadrius montanus*), snowy plover (*Charadrius nivosus*), yellow-headed blackbird, redhead (*Aythya americana*), Tule greater white-fronted goose (*Anser albifrons elgasi*), American badger, Tulare grasshopper mouse (*Onychomys torridus tularensis*), Western mastiff bat (*Eumops perotis*), and Western red bat (*Lasiurus blossevillii*).

Protection of non-federally listed species is not mandatory on federal installations, with the exception of species protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Management of non-federally listed species through the INRMP contributes to the overall maintenance of their natural populations and reduces the likelihood that these species will be given additional legislative protection in the future.

### 3.6.2.1 Western Spadefoot Toad (California SSC)

Copyright: Patrick Briggs.

Western spadefoot toads are generally found near wetland habitats. During the most recent herpetological surveys at NAS Lemoore (TDI 2012), one Western spadefoot toad was identified in a pool of standing water created by agricultural operations, as well as in a ditch near Sunset Lake. Observations of toads are not as frequent as in the past, unless there is a substantial amount of standing water on the Station (J. Crane, pers. com. 2011). Previously, NRMA 3 had been managed as Western spadefoot toad habitat. Currently, that area does not retain much water year-round. As a result, its value as toad habitat and for other wetland species has decreased and no specific management actions in NRMA 3 or elsewhere target habitat maintenance or enhancement for the species on the Station. Particular threats to amphibians in general at NAS Lemoore include predation by visiting migrating birds, vehicle traffic, and open wells in the agricultural areas. More information on this species is presented in Appendix G.

[35] The USFWS BCC list was last published in 2008. It has been noted that there are differences between this USFWS published list and birds identified as BCC in other lists maintained by the CDFW and an interactive map on the DoD-PIF website (though the DoD-PIF website also maintains a link to the 2008 USFWS BCC list). This INRMP relies on the 2008 USFWS published BCC list as the source of BCC designations. The bird species identified as BCCs for NAS Lemoore will be updated at the time that the USFWS publishes an updated BCC list.

### 3.6.2.2 Tricolored Blackbird (USFWS BCC, California SSC)


Copyright: Dave Menke, USFWS.

The prior surveys that documented the presence of tricolored blackbirds at NAS Lemoore (Navy 2001b; Rosenberg and Gervais 2009) did not specify where on the Station they were observed. However, the species would likely be found in the agricultural outlease area as its modern habitats include upland and agricultural areas. Historically they nested in freshwater marshes throughout the Sacramento and San Joaquin Valleys where cattail and bulrush dominated. Edges of agricultural areas on the Station would provide them suitable habitat as the species requires nearby water and prefers protected nesting sites that are flooded or surrounded by thorny vegetation. They are opportunistic foragers of any available insect source and have been known to depredate local crops; their diet switches to seeds and grains during the winter (Beedy and Hamilton III 1999). More information on this species is presented in Appendix G

### 3.6.2.3 Burrowing Owl (USFWS BCC, California SSC)


Copyright: Smallwood and Morrison 2008.

The large number of burrowing owls at NAS Lemoore suggests that this population is important regionally due to the few other known populations of burrowing owls in the San Joaquin Valley. In 1997, there were 63 burrowing owl nests on the Station. This increased to 85 by 1999 (due partly to artificial nest construction), but then declined to 43 in 2008 (Rosenberg et al. 2009).

The 43 burrowing owl nests found during the NAS Lemoore burrowing owl population assessment in 2008 was the lowest recorded at NAS Lemoore since initial surveys in 1997 (Rosenberg et al. 2009). These were distributed almost entirely within the Operations Area, with the highest density of nests in the North airfield. The remaining nests were mostly in the South airfield (Figure 3-7). Only two nests were found in areas outside of the Operations Area or their adjacent grassy areas. One of these nests was in the Transmitter site, where there were a large number of ground squirrels, and the other nest was found at the edge of a paved road bordering the motocross recreation area. Within the security fence of Operations Area, several nests were found in recently fallowed areas. None of the nests located were in the artificial nest boxes, even though some nests were in natural burrows very close to the boxes.

Within NRMA 5, where no artificial burrows were installed, burrowing owl burrows declined between 2001 and 2009; though, the inclusion of Rosenberg et al.'s (2009) estimates suggest the population is highly variable in NRMA 5 (Smallwood and Morrison, unpublished data).

Based on the apparent availability of habitat and the drought in the San Joaquin Valley, it is speculated that this is a temporary reduction of burrowing owls and not a systemic decline or due to changes in management. However, given long-term drought and the anticipated response of burrowing owls to reduced prey abundance, the lower numbers of nesting owls could be part of a regional decline. The population was greater than the threshold number of 32 nests identified in the 2008 management plan that was intended to trigger additional research to understand declines (Rosenberg et al. 2009). Further, the amount of suitable habitat had been increased by retirement of agricultural land due to the installment of the security fence that secures the perimeter of the Operations Area. Two active burrowing owl nests found within this area (at the time, approximately 850 acres) demonstrated that recently fallowed agricultural fields can be used as nesting habitat. In general, the owls' use of the Operations Area is likely due to the large area of mowed grass. Vegetation in this area is continually managed to maintain low height, and this may facilitate their hunting and vigilance for predators.

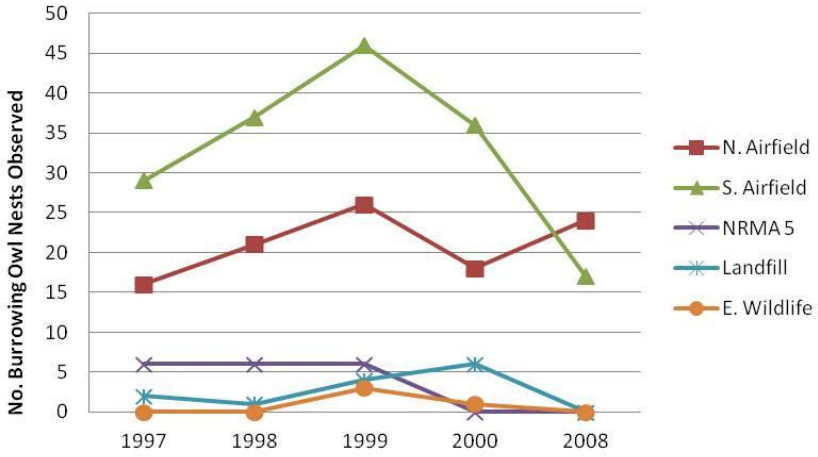



*Figure 3-7. Number of Burrowing Owl nests observed at Naval Air Station Lemoore at sub-sites for each year 1997-2008 (adapted from Rosenberg et al. 2009).*

The large population of burrowing owls at NAS Lemoore is due in part to increased prey availability that accompanies irrigated agriculture. If extensive areas become fallow, there may be a decrease in the burrowing owl population to densities that are similar to non-irrigated grasslands. Likewise, prey distribution could be a factor in the reduced total number of nesting owls, and their recent absence at the landfill and at NRMA 5. Based on previous studies at NAS Lemoore, the number of nesting owls can increase dramatically during a year of high prey abundance due to increased reproduction and recruitment, and decline just as quickly from reduced reproduction and survival when prey are scarce (Gervais et al. 2006).

Most of the artificial nest burrows that had been constructed and installed at NAS Lemoore in 1998 were in disrepair. The disrepair noted by Rosenberg et al. (2009) had been documented at many of the artificial burrows in 2004 and early 2005 by Smallwood and Morrison (2009) (destruction of artificial burrows in NRMA 4 had been observed as early as 2003). Smallwood and Morrison had visited the burrows on the landfill, in NRMA 2, NRMA 4, and in the Operations Area, finding most of the artificial burrows destroyed and unusable within six years of construction.

More information on this species is presented in Appendix G.

### 3.6.2.4 Swainson's Hawk (State Threatened)

At NAS Lemoore, the Swainson’s hawk is known to breed, especially preferring tall trees for their nesting. They were observed during the most recent bird surveys (TDI 2012 and Lang 2012). This species hunts over the open grasslands and agricultural fields at the property and was seen during most times of the year, with the exception of the January surveys (TDI 2012). Swainson's hawks often congregate near alfalfa fields at NAS Lemoore, where they prey on small mammals. Swainson’s hawks have also recently been involved in several Bird/Animal Aircraft Strike Hazard incidents at the Station, given their proclivity to glide on the thermal columns near the airfield. More information on this species is presented in Appendix G

Copyright: USFWS.

### 3.6.2.5 Mountain Plover (USFWS BCC, California SSC)

Copyright: Doug Chapman, USFWS.

The mountain plover was documented for the first time at NAS Lemoore in November and December 2010 in flocks of up to 150 individuals foraging in the Operations Area infield approximately 100-200 yards northeast of runway 14L/32R (Lang 2012). This species comprised the highest numbers within the shorebird guild (40%) in these two months during surveys at the NAS Lemoore airfield (Lang 2012). The species has a fondness for barren agricultural fields and short-mowed grasslands in addition to the low, xeric grasslands that comprise the plover's prime wintering habitat in the southern Central Valley. The San Joaquin Valley (including Kings and Fresno counties) provides important wintering grounds for this species (Hunting and Edson 2008). The plover is listed as a BCC only for its non-breeding season in these areas. More information on this species is presented in Appendix G.

### 3.6.2.6 Snowy Plover (USFWS BCC, California SSC)

Copyright: Mike Baird, 2007.

At NAS Lemoore, snowy plovers were most recently documented at the Station's wastewater treatment facility evaporation ponds during the twice-monthly bird counts that occur there (record from 2009-2010; surveys conducted per the Station's Waste Discharge Requirements Order). The individuals observed there are part of California's interior population that is genetically isolated from the Pacific coast population, the latter being federally threatened (USFWS 05 March 1993). Historically, the interior population nested at large, terminal lakes of the southern San Joaquin Valley; however, with the demise of these lakes, snowy plovers began nesting at human-made agricultural wasteponds (Page et al. 2009). More information on this species is presented in Appendix G.

### 3.6.2.7 Olive-Sided Flycatcher (USFWS BCC, California SSC)

Copyright: Dominic Sherony.

Olive-sided flycatchers were observed at NAS Lemoore only in July and August of the latest general bird surveys (TDI 2012). The species is most associated with montane and northern coniferous forests, but may be found in nonconiferous forests and riparian habitat during migration. At NAS Lemoore, the species is most likely a migrant and does not breed, even though it was observed on the Station in July. It was observed primarily in the NRMAs that offer vegetation structural diversity. More information on this species is presented in Appendix G.

### 3.6.2.8 Willow Flycatcher (State Endangered, USFWS BCC)

Copyright: Michael J. Hopiak, Cornell Lab of Ornithology.

No individuals of the willow flycatcher (*Empidonax traillii*) were seen during the most recent general bird surveys performed by TDI (2012), though this species has been recorded from NAS Lemoore during bird surveys in the past (Navy 2001b). The subspecies most likely to occur on the property is the little willow flycatcher (*E. traillii brewsteri*), which likely does not breed due to the lack of large amounts of riparian habitat, but which may move through the area during its migration to its Mexican wintering grounds. The most likely areas for this species to occur would be in the NRMAs and along windbreaks, where large trees are present. More information on this species is presented in Appendix G.

### 3.6.2.9 Peregrine Falcon (USFWS BCC)

Copyright: Gerald and Buff Corsi, 2002, California Academy of Sciences.

The peregrine falcon has been observed at NAS Lemoore on multiple occasions in the recent past in an alfalfa field in the agricultural outlease area (K.S. Smallwood, pers. com. 2009), perched on a power line west of Sunset Lake (TDI 2012), and near the Operations Area (Lang 2012). It is a migratory species and is not expected to breed at NAS Lemoore. Rather, it likely hunts over the agricultural fields and NRMAs at the Station in search of prey, which primarily includes other birds, and occasionally invertebrates and mammals (White et al. 2002). More information on this species is presented in Appendix G.

### 3.6.2.10 Greater Sandhill Crane (State Threatened)

Copyright: Bill Schmoker.

The greater sandhill crane was observed flying over the NAS Lemoore Operations Area in January 2010 during recent general bird surveys (TDI 2012). The Station lies within the middle of this species' wintering range. No large concentrations of this species have been noted on the property, however, indicating that habitat conditions on the Station may be lacking a key attribute that the species requires. The prevalence of alfalfa and cotton agriculture on the Station, at the expense of grain crops, probably limits the population of this species wintering at NAS Lemoore. However, areas where corn, wheat, and other grain crops are grown would provide forage for the greater sandhill crane, especially when the fields are flooded during wet years. More information on this species is provided in Appendix G.

### 3.6.2.11 Loggerhead Shrike (USFWS BCC, California SSC)

Copyright: Dick Daniels, 2013.

Loggerhead shrikes were observed at NAS Lemoore throughout the year during the latest general bird surveys (TDI 2012) and most recently in the Operations Area (Lang 2012). The species occupies habitats dominated by shrublands and open woodlands with a fair amount of grass cover and areas of bare ground. Shrikes were observed in multiple areas of the Station that fit this description: various NRMAs, the new motocross track, Karen Mechem Park, and around the runways in the Operations Area. Small numbers of individuals were often seen in the same general areas. The species is a suspected breeder at NAS Lemoore. More information on this species is presented in Appendix G.

### 3.6.2.12 Long-Billed Curlew (USFWS BCC)

Copyright: Mike Baird, 2008.

The long-billed curlew is a common visitor to NAS Lemoore during its non-breeding season. The species winters throughout the Central Valley and was noted as present from all prior surveys conducted at NAS Lemoore. In July 2009, 350 individuals were observed using the agricultural fields on the northeast side of the Station (TDI 2012). They were also noted foraging in large numbers near the airfield (Lang 2012), and were noted within the NRMAs and the wastewater treatment facility evaporation ponds (TDI 2012). More information on this species is presented in Appendix G.

### 3.6.2.13 Whimbrel (USFWS BCC)

Copyright: Andreas Trepte 2011.

The whimbrel (*Numenius phaeopus*) was documented throughout NAS Lemoore during a number of surveys in the recent past (Navy 2001b, Rosenberg and Gervais 2009, Lang 2012). The whimbrel is a long-range migratory species and was most often observed at the Station during the early summer. In California, it primarily overwinters in tidal flats and shorelines, though occasionally visits inland habitats, such as those at NAS Lemoore (Skeel and Mallory 1996; Cornell Lab of Ornithology 2013). It was likely either on its way to or returning from its breeding grounds. More information on this species is presented in Appendix G.

### 3.6.2.14 Western Mastiff Bat (California SSC)

Copyright: Bureau of Land Management.

Western mastiff bats were documented at NAS Lemoore during acoustic surveys conducted for the 2001 INRMP (Tetra Tech Inc. 1999, Navy 2001b) in NRMA 1, NRMA 3, and over cotton fields just south of NRMA 1. The bats were never detected near observed roosts sites on NAS Lemoore, suggesting the species roosts off the Station (Tetra Tech Inc. 1999). This species was not detected during the most recent acoustic surveys at the Station (TDI 2012). More information on this species is presented in Appendix G.

### 3.6.2.15 Western Red Bat (California SSC)

Copyright: CDFW.

The western red bat was the second-most common bat species recorded at NAS Lemoore during recent acoustic surveys (TDI 2012). It was abundant both over ditches in the agricultural outlease area where recording stations were placed, as well as foraging over the adjacent alfalfa fields. The species is primarily a tree-roosting species, though close relatives have also been known to roost in leaf litter on the ground (Moorman et al. 1999; Saugey et al. 1998). More information on this species is presented in Appendix G.

### 3.6.2.16 Tulare Grasshopper Mouse (California SSC)

Copyright: B. Moose Peterson.

The Tulare grasshopper mouse was documented at NAS Lemoore in the 2001 INRMP (Navy 2001b), though there is no discussion of where it was observed. It is likely that this species would use NRMAs and other areas where there are abandoned rodent burrows, which it uses to construct nests. The subspecies is generally associated with San Joaquin kangaroo rats, California pocket mice, deer mice, and western harvest mice in low, open scrub and semiscrub habitats, favoring compact soils with sparse growth of perennial grasses (Endangered Species Recovery Program 2013; Collins 1998). It was not observed during the most recent surveys at NAS Lemoore (TDI 2012). More information on this species is presented in Appendix G.

### 3.6.2.17 American Badger (California SSC)

Copyright: Gerald and Buff Corsi, 1999, California Academy of Sciences.

The American badger was documented at NAS Lemoore during surveys conducted for the 2001 INRMP (Navy 2001b); though, this was not based on positive identification, but rather a supposition that one of four identified burrows could have been used by a badger. The 2001 INRMP notes that this species' prey includes burrowing owls and kangaroo rats, as well as pocket gophers, ground squirrels and voles. Smallwood and Morrison (2011) observed an American badger in NRMA 5 during San Joaquin kangaroo rat surveys in 2003; the badger persisted until 2008, disappeared and then reappeared in 2010. During the most recent surveys (TDI 2012), surveyors incidentally identified badger burrows, tracks and roadkill within and near NRMA 1. Multiple observations of American badger were made in the Operations Area during 2012, while multiple roadkill were observed along Gateway Road, just outside of the Operations Area during 2011 and 2012 (T. Schweizer, pers. com. 2014). More information on this species is presented in Appendix G.

**This Page Intentionally Blank**

# 4.0 Natural Resources Management Strategy and Prescriptions

*This chapter spells out management strategies for NAS Lemoore's natural resources viewed in an ecosystem context. Ecosystem-based management considers the environment as a complex system functioning as a whole, not as a collection of parts, and recognizes that people and their social and economic needs are a part of the whole. The Department of Defense directs that Integrated Natural Resources Management Plans will foster long-term sustainability of ecosystem services, which are the benefits obtained from ecosystems. By identifying the physical, chemical, and biological roots of these benefits, there is a better chance of conserving them.*

## 4.1 Managing with an Ecosystem Approach

### Core Ecosystem Values/Services at NAS Lemoore

The Sikes Act (as amended) states that the Integrated Natural Resources Management Plan (INRMP or Plan) goals "shall be to maintain or develop an ecosystem-based conservation program..." Therefore, U.S. Department of Defense (DoD) installations "shall follow an ecosystem-based management approach to natural resources-related practices and decisions, using scientifically sound conservation procedures, techniques, and data" (DoD Instruction [DoDI] 4715.03 Natural Resource Conservation Program [18 March 2011]). The guidance provides a definition of ecosystem management as described in Section 1.10 Management Approaches.

Core ecosystem attributes at Naval Air Station (NAS) Lemoore (also referred to as Station or installation) include:

- Remnants of the natural communities that existed before agricultural development of the western San Joaquin Valley: alkali sink, saltbush shrublands, and the riparian-wetland-floodplain complexes of the valley floor. These support Species At Risk (SAR),[1] as well as declining migratory birds.
- Large acreage of land and airspace use that is compatible with the military mission, providing: sufficient unencumbered airspace; clear air; controls on urban development including height limits; and adequate safety, security, and noise buffers.
- Agricultural infrastructure and work force that contributes to the economy of the San Joaquin Valley, one of the richest agricultural regions in the world by production and income (California Department of Food

[1] SAR is defined in DoDI 4715.03 as: "species on lists maintained by USFWS, NOAA Fisheries Service, and state agencies as threatened or endangered or candidates for such lists. SAR also includes species whose designation as threatened or endangered may require conservation efforts significantly impacting a military mission." DoDI 4715.03 goes on to state: "To the extent practicable, all DoD Components shall establish policy and procedures for the management of species at risk (SAR) to prioritize proactive management of those species that, if listed, could adversely impact military readiness. Program objectives shall focus on efforts that have the greatest potential to prevent the listing of SAR (e.g., habitat conservation, planning level surveys, monitoring). Protecting these species is critical; therefore, the installation INRMP should consider funding for SAR protection a high priority."

and Agriculture 2010a). Agricultural infrastructure includes: access to imported water; groundwater of a quality appropriate for crops; and food/fiber processing, packing, and transportation systems.

- Abundant solar resources and degree-day growing temperatures that allow for multiple cropping system flexibility (Nottrott and Kleissl 2010).

## Core Ecosystem Values/Services at NAS Lemoore

- Structures and highly-managed areas that support infrastructure also provide an opportunity for secondary, but important, functions in support of habitat and biodiversity. Examples include roadsides, windbreaks, canals, dikes, levees, power lines, tailwater sumps, airfield buffer habitat areas, groundwater remediation areas, rooftops, road medians, landfill area, wastewater treatment area, residential parks, and landscaped grounds. They can impede or facilitate movement of animals or invasive plants, depending on how they are treated. They can provide functions, such as a biosecurity buffer, for climate change, flood control, non-native species invasion, and reduce the threat of mortality due to roadkill, powerline kill, or agricultural or mowing practice.
- Invasive species are a predominating habitat challenge at NAS Lemoore, which is best tackled with a longer-term ecosystem strategy that includes restoration rather than an annual spray program alone, in order to ensure progress.
- With scarce budgets, it is possible that work on adjacent lands can provide more regional benefit to habitat, federally listed species, and other at-risk species than the same investment on Station lands. There is opportunity to strengthen regional partnerships that could identify and prioritize such conservation work.
- The property should be treated as a whole and not piecemeal, as effort in one habitat or addressing a single concern may preclude or cause trade-off with other effort.
- Ecosystem metrics and benchmarks specific to NAS Lemoore are not identified; they could be used in annual interagency Metrics Meeting to support the U.S. Department of the Navy's (Navy) year-by-year contribution to its Annual Report to Congress. The Ecosystem Integrity Metric to be reported by DoD asks: (1) To what extent are the installation's native ecological systems currently intact? (2) In what ways are an installation's various habitats susceptible to change or damage from different stressors? (3) What stressors affect each habitat type?
- Management focus species[2] monitoring is a way to discern habitat quality and health. It is an effective approach that NAS Lemoore has not yet taken advantage of.
- A long-term monitoring program that tracks ecological integrity, soil and water status, and military use sustainability will allow the Navy to identify concerns that have longer time horizons, be adaptive in management approach, and respond to management and regulatory challenges in a timely and science-based manner. Monitoring allows installation managers to learn about the resources they are managing, test the assumptions they have made, and determine the effectiveness of the management actions they have taken.

## Current Management

Current management of natural resources at NAS Lemoore emphasizes avoidance measures and mission-critical, short-term response to emerging issues. It generally is planned within annual to three-year budget cycles. Projects at NAS Lemoore include, but are not limited to, the following:

1. National Environmental Policy Act (NEPA) and water resources planning support
2. Agricultural outlease support

[2] Management focus are those identified in this INRMP and by NAS Lemoore for which there is a special management focus.

3. Groundwater studies
4. Invasive species control—on an as-needed, localized basis
5. Habitat and species surveys to support INRMP updates
6. Habitat enhancement for the federally listed San Joaquin kangaroo rat (*Dipodomys nitratoides*)
7. Burrowing owl (*Athene cunicularia*) population assessments and habitat management

## Assessment of Current Management

The NAS Lemoore Natural Resources Management Program has already adopted many elements of an ecosystem approach. It continues to conserve and protect plant and wildlife habitat quality through the use of avoidance measures, fencing, and education.

The art of ecosystem management at NAS Lemoore is to maximize the functions of resources for ecologically-based, desired future conditions or ecosystem services that can focus management decisions and support sustainment of the military mission. At NAS Lemoore, this includes agriculture and other highly modified natural communities.

A premise of this INRMP is that project-by-project management is inadequate to ensure ecosystem integrity because bigger-picture planning is needed to consider all the resources, processes, interdependences, and trade-offs that may be affected. This is especially true in Station's highly modified natural communities, and requires a habitat-by-habitat vision of desired outcomes. The Annual Metrics meeting with partner agencies contains questions on both general ecosystem health and the status of management focus species. NAS Lemoore-specific metrics could help to answer these questions and to recognize progress from year to year. One goal should be to prevent species and processes that are currently healthy from becoming threatened and unbalancing the ecosystem. Habitat management to support wildlife is especially important in the agriculture-dominated landscape of the region.

The challenge for managers is to determine which ecosystem-based indicators characterize the system, and yet are simple enough to be effectively monitored at low cost since it is not affordable to measure everything. The most efficient and informative monitoring approach is one that occurs at a small scale but consistently over time. Methods that can be integrated with in-the-field verification and regional programs provide the most power for interpretation of cause-and-effect. Tailoring a monitoring program for adaptive management requires a conceptual model of how the ecosystem and land use interplay (based on scientific literature), and identification and use of indicators of ecosystem health.[3] A strong science base is necessary for technical success, public credibility, and legal defensibility; such a program should incorporate a long-term view of human activities, military uses, and natural resources as part of the same environment.

## Management Strategy

***Objective:*** *Maintain and enhance the natural health and integrity of the NAS Lemoore ecosystem by conserving whole, native ecological processes, as well as the parts, and by recognizing the connection among all the components. Ensure the full achievement of present and future military mission requirements.*

**I.** Protect basic components of the ecosystem's sustainability and resilience to disturbance. Maintain ecological processes, such as disturbance regimes, intact soil and hydrological process, nutrient cycles, habitat size, and connections, to the extent practicable.

[3] Adaptive management recognizes that there is incomplete data when dealing with natural resources and that through continued research, monitoring, and witnessing the effects of management practices, new information will be developed. This information can be reevaluated and incorporated into the management plan, and practices can be improved accordingly. DoDI 4715.03 states that "Ecosystem-based management will...Use the best available scientific information in decision-making and adaptive management techniques in natural resource management."

**II.** Consider the military mission and agricultural sustainability as ecosystem services to be provided along with habitat conservation. Consider beneficial pollinators as part of a broader ecosystem approach.

*Biodiversity conservation on DoD lands and waters should be followed whenever practicable to: (1) Maintain or restore remaining native ecosystem types across their natural range of variation. (2) Maintain or reestablish viable populations of native species on an installation, when practical. (3) Maintain ecological processes, such as disturbance regimes, hydrological processes, and nutrient cycles, to the extent practicable. (4) Manage and monitor resources over sufficiently long time periods to allow for adaptive management and assessment of changing ecosystem dynamics (i.e., incorporate a monitoring component to management plans) (DoDI 4715.03).*

**III.** Develop an integrated habitat management plan for multiple species. Integrate agricultural tailwater, stormwater, roadside management, invasive species control, and ecological indicators to restore wetland, grassland, and habitat for Species At Risk.

**A.** Set objectives for habitat restoration and processes that link them. These objectives should be as quantitative as possible and based on the historic record of ecosystem processes, such as fire and plant community composition, especially of wetlands.[4]

**B.** Treat roadsides as a separate focus of land management. Roads act as invasive species vectors and process water differently from the natural environment. They are also necessary for access and fire management.

**C.** Maintain or re-establish viable populations of native species on NAS Lemoore when practical (DoDI 4715.03). In particular, ensure that habitats are able to sustain viable populations of special status species present.

*DoD shall restore or rehabilitate altered or degraded landscapes and associated habitats to promote native ecosystems and land sustainability when such action is practicable and does not conflict with the military mission or capabilities consistent with Executive Order 13514 "Federal Leadership in Environmental, Energy, and Economic Performance" 08 October 2009.*

**D.** Ensure habitats have all essential elements to maintain productivity and soil stability. Habitats and ecosites should sustain a level of biodiversity appropriate for the area and conducive to appropriate uses. Habitat or ecosite indicators include vegetation composition, structure, distribution, and productivity.

**E.** Avoid habitat fragmentation and additional road proliferation. Avoid and minimize road or traffic characteristics that promote plant invasions or result in significant habitat fragmentation for animals.

**F.** Control invasives through habitat management and restoration that prevents their establishment; maintain healthy soils and native perennials that resist invasion; maintain intact hydrology, and disturbance regime within a range so that vegetation is resilient; enhance the condition for establishment of natives along roadsides. Use early detection and effective partnerships.

**G.** Apply sustainability principles to the management of habitats, species, and ecological functions of NAS Lemoore. Identify resource-specific best practices.

*Supporting sustainable uses is a guiding principle of ecosystem management for federal agencies (DoDI 4715.03).*

**IV.** Address stressors and threats, such as invasive species and climate change, in cooperation with partners. Conduct vulnerability assessments for habitats and species in relation to climate change in cooperation with partners. Monitor "sentinel" indicator species of climate change.

**V.** Ensure that biologically or geographically significant or sensitive resources are monitored and are managed for their protection and long-term sustainability (DoDI 4715.03).

[4] Setting priorities and reconciling conflicts are guiding principles of ecosystem management for federal agencies. This must be done because of scarce funding.

**A.** Adopt a set of Management Focus Species for NAS Lemoore that can provide insight into habitat conditions, structure, and function to ensure management decisions are achieving the desired outcome.[5] These should include: those natural resources considered to be significant or SAR, as defined in DoDI 4715.03; sentinel species that may be regional indicators of climate change; beneficial pollinators; endemic species to the San Joaquin Valley; and specific avian species, particularly the USFWS Birds of Conservation Concern. Reporting on ecosystem integrity at the annual metrics meeting for NAS Lemoore can draw on insight provided from monitoring these species; they should be consistent from year to year to support continuity of reporting and on-the-ground measures to show progress.

*Many special status species are plants and animals (including invertebrates) that have highly restricted distribution or are few in number and occur in the NAS Lemoore area. Special status species are an integral part of the natural ecosystem, contributing to the productivity and diversity of the natural world, upon which people depend for resources and amenities. They are good indicators of the region's overall environmental health.*

**B.** Monitor for specific avian species every three to five years on permanently established walking transects in the appropriate habitat. Management focus species should be able to sustain viable populations as an indication that they have sufficient habitat conditions.

**VI.** Develop coordinated approaches toward ecosystem health and public awareness initiatives through partnerships to address cross-boundary concerns. Evaluate and engage in the formation of local or regional cooperative partnerships that benefit the goals and objectives of the INRMP, while providing for military mission requirements. Actively participate in interagency and regional partnering efforts, including Navy and USFWS.[6]

*Coordinating with partner agencies is a guiding principle of ecosystem management for federal agencies (DoDI 4715.03).*

**VII.** Increase the level of interpretive education and outdoor recreational opportunities derived from natural resources.

***Objective:*** *Implement a robust and scientifically defensible monitoring program to identify species' population and habitat health trends, evaluate success of enhancement activities, detect long-term trends and changes in ecosystem dynamics, and contribute to reporting requirements, adaptive management, and regional data sharing where appropriate.*

**I.** Develop the best available scientific and field-tested information for use in land management decisions in order to report on the health of NAS Lemoore lands, and which can be scaled up to the work of other agencies.

**A.** Continue to conduct baseline surveys as part of INRMP updates and as otherwise needed, particularly for protected and sensitive species.

**B.** Provide for an institutional database that may be used to orient future resource managers.

*INRMP Guidance for Navy Installations (18 April 2006) indicates that establishment of an effective monitoring program is a means to demonstrate progress and identify achievement of the final objective, which is important for INRMP success. In addition, DoDI 4715.03 emphasizes monitoring for long-term sustainability of sensitive resources and the use of scientifically defensible monitoring techniques.*

[5] Selection criteria for an indicator or management focus species vary depending on the objective, but typically those selected are: (1) species representing important habitat types and are believed to be functionally equivalent to many other species with similar habitat/ecological needs; (2) flagship or umbrella species that range widely (e.g., a migratory bird or fish), under the assumption that their broad habitat and areas needs will also provide for all other species in those habitats (Ruckelshaus and Hays 1998).

[6] Due to policy and fiscal implications, partnerships involving external stakeholders or multiple Military Services require proper advanced coordination through DoD Component chains of command. Natural resources personnel must be included in the planning and implementation phases of all resulting agreements.

**C.** Ensure that proven and scientific data collection methods and sampling techniques are used to develop and update natural resources inventories in accordance with the Office of Management and Budget Guidelines and to conduct monitoring of all appropriate INRMP actions (DoDI 4715.03).

**II.** Adopt a cost-effective, simplified, long-term monitoring program to support natural resources adaptive management that can also contribute to reports on compliance, risks, vulnerabilities, and an assessment of the condition and trends of the land, as well as changing ecosystem dynamics (DoDI 4715.03).

**A.** Identify ecosystem monitoring needs and develop a range of defensible monitoring protocols and activities directly related to addressing metrics objectives, and providing insight into ecological integrity of the installation's natural resources base as a measure of military mission sustainability.

**B.** Use benchmarks to evaluate the success of enhanced areas and the recovery of restored areas. Include a monitoring component in future habitat enhancement and invasive species control activities that standardizes methods across habitats.

*Using benchmarks, such as the status of management focus species, to monitor and evaluate outcomes is a principle of ecosystem management for federal agencies (DoDI 4715.03).*

**C.** Measure success of natural resources management actions by how well they are meeting the purpose and objectives of the INRMP. This can be either qualitative or quantitative (Navy 2006a). Adapt monitoring and management actions based on results.

**D.** Participate in or ensure consistency with regional ecosystem initiatives and monitoring protocols, including DoD partnerships, in order to derive additional interpretive power from Navy data sets. Partner with other regional land management organizations to standardize data collection and share results across the population range of species.

**III.** Identify research needs and projects that the natural resources management program would welcome from outside researchers through Cooperative Agreements and other partnerships (Appendix M).

# 4.2 Managing the Physical and Chemical Environment

## 4.2.1 Soil Resources

### Background

Federal agencies must manage lands to control and prevent soil erosion and preserve natural resources by conducting surveys and implementing soil conservation measures. The Sikes Act (as amended), Soil Conservation sections of the U.S. Codes [USC] (16 USC §§ 590a-590q3), Clean Water Act (CWA), Erosion Protection Act, Public Law (PL) 86-645, as amended (33 USC §§ 426-426-3), Farmland Protection Policy Act, DoDI 4715.03, and Chief of Naval Operations (CNO) Instruction 5090.1C CH-1 (hereinafter referred to 5090.1C CH-1) require best management practices (BMPs) for soil and water resources on federal lands. For wind erosion, Clean Air Act implementing regulations also restrict particulate matter emissions that result from soil disturbance. The Conservation Districts of the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) are responsible for helping practitioners implement soil conservation and management programs. These organizations encourage maintenance of prime soil productivity along with implementation of BMPs.

The guidance for INRMPs requires the reporting of soils inventory at least to the association level; Chapter 3 includes more site-specific soil identification and mapping to series level for NAS Lemoore. Soils mapping is a function of the federal government under the NRCS, but characterization of soils also occurs through vegetation classification and mapping protocols, wildlife habitat values mapping, and in engineering studies associated with construction projects.

The primary goals of soil conservation and management at NAS Lemoore are to protect soil resources, identify areas and/or conditions prone to soil erosion, and prevent soil erosion and its subsequent impact on air quality, visibility, and on wildlife habitat quality. Due to the predominantly flat terrain on NAS Lemoore (natural grades are less than 2%) the majority of soils located on NAS Lemoore are considered minimally susceptible to waterborne erosion (Navy 1995). Still, soil erosion from wind exists and often occurs in areas where vegetation has been removed or is severely degraded (such as in irrigation ditches and agricultural staging areas), and at the evaporation ponds when they are dry.

#### 4.2.1.1 Soil Quality

### Specific Concerns

- Generally, soils in the San Joaquin Valley are alkaline in nature, affecting both Natural Resources Management Areas (NRMAs) and irrigated lands. Soils with impeded drainage also tend to have increased salinity. In the NRMAs, this often determines the vegetation communities present, favoring plants that can tolerate alkaline and saline soils. In the agricultural outlease areas, the amount and type of salts varies depending on the type of soil and the amount of irrigation water used. Generally speaking, the presence of salt in soil decreases the availability of water to a plant, though some plants can tolerate more salts than others. Knowledge of salt-tolerant plants is useful to match crops with growing conditions. Leaching is probably the best method used to control salt build-up; however, it is not a recommended practice in the Tulare Lake Basin since the region's groundwater is already afflicted by high salinity.
- High concentrations of selenium, arsenic, boron, and asbestos in the soils at NAS Lemoore can affect vegetation (i.e., cottonwood trees with "boron burn"). Some of these naturally occurring contaminants come from the coast range to the west of NAS Lemoore, where past flood events have transported sediments toward the Station.
- The development of clay plowpan soils in the agricultural outlease areas can impact farming activities unless ripped to a depth of 24 to 60 inches (61–152 centimeters) (NRCS 2006).

### Current Management

Soil quality for the agricultural outlease area is managed through the Soil and Water Conservation Plan of each lease. The Installation Restoration Program (IRP) at NAS Lemoore also manages soil quality for those areas contaminated with hazardous materials from previous uses.

Current agricultural leases require soil testing every other year, beginning the first year of the lease.[7] At minimum, this must include one sample every 40 acres (16 hectares) at both the 1-foot and 2-foot (0.3- and 0.6-meters [m]) depth. Since the majority of parcels at NAS Lemoore are approximately 160 acres (65 hectares), this yields about four to five samples per parcel. The goal of the testing is to monitor the productivity of soils and to ensure that agricultural lessees adjust for alkalinity or any other soil needs that the tests call attention to. Analytical reports for soil test results include narrative evaluations and recommendations for gypsum requirements (for the effective replacement of sodium with calcium, which

[7] The soil samples are tested for: pH, electromagnetic conductivity, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sulfur, Sodium, Chloride, soil organic matter, and Exchangeable Sodium Percentage or Sodium Absorption Ratio.

improves drainage) and other soil amendment requirements, which are compiled by a Certified Crop Advisor. In some cases, lessees are permitted to use a sulfur equivalent instead of gypsum, making nutrients more available to plant life.

Some agricultural lessees at NAS Lemoore have periodically used satellite imagery to identify soil needs in their parcels. The technology allows them to achieve better accuracy in identifying "hot spots" in order to implement more precise management actions; however, they do not depend heavily on it. Some lessees have also periodically tilled their parcels at depth to address the plowpan soils that form as a result of past agricultural practices. The tilling is conducted irregularly and at the volition of the agricultural lessee, as it can be expensive for moderately and small-sized parcels.

Compliance with NAS Lemoore's Integrated Pest Management Plan (IPMP) (Naval Facilities Engineering Command [NAVFAC] Southwest 2010) helps maintain soil quality by managing pesticide use both in terms of quantity and type of pesticide administered (Section 5.7.2 Integrated Pest Management).

There is no current management strategy focused on soil quality in the NRMAs. Other than monitoring trace concentrations of selenium in the evaporation ponds and potentially in other water resources on the Station (Section 4.2.2.1 Water Quality), there are no prescriptions for addressing accumulations of arsenic, selenium, boron, and asbestos in the soil.

## Assessment of Current Management

For agricultural areas, it remains unclear whether the current soil sampling regime is adequate to assess the spatial distribution of soil salinity, as well as other factors across the Station, including alkalinity. Using satellite imagery to periodically assess soil conditions in the agricultural outlease areas could complement soil sampling to facilitate more precise prescriptions for soil amendments, irrigation, and fertilizers. NAS Lemoore should continue to encourage necessary crop rotation, subsurface drains, and current soil amendments on agricultural parcels.

## Management Strategy

***Objective:*** *Conserve soil productivity and nutrient functioning through effective implementation of BMPs as part of natural resources and agricultural management, while maintaining the military mission.*

**I.** Where feasible, improve knowledge of soils on a finer scale. Use it to tailor habitat enhancement goals and activities in the NRMAs, cropping practices in the agricultural outlease area, and landscaping strategies in developed areas.

**II.** Develop a strategy to monitor the concentrations of selenium, boron, and arsenic in soils at NAS Lemoore.

**III.** Maintain soil quality in the NRMAs and landscaped areas through beneficial vegetation/habitat management and landscaping practices.

- **A.** Analyze the soils of the Sunset Lake bed in NRMA 2 for possible contaminants from adjacent lands. Based on the results, determine the best actions to improve habitat value and if remediation may be appropriate (Section 4.3.1 Vegetation Communities and Habitats).

**IV.** Maintain soil quality through testing and use of soil amendments in the agricultural outlease areas.

- **A.** Continue to require agricultural lessees to monitor soil productivity. Ensure the delivery of any and all soil test results to NAS Lemoore Environmental Management Division (EMD). Incorporate the data into a geographic information system (GIS) database.
- **B.** Lessees should continue managing soils according to the Soil and Water Conservation Plan of the agricultural outlease agreement, including use of soil amendments based on testing and crop

rotation practices to protect fertility. Ensure soil conservation measures are current, and encourage lessees to use state-of-the-art precision agricultural practices where possible.

**C.** Encourage lessees to conduct deep tilling to break up the plowpan soils in the agricultural outlease area. Investigate incentives to promote occasional deep tilling, as appropriate. Coordinate with cultural resources staff beforehand to avoid any issues.

**D.** Investigate opportunities and/or partnerships to encourage agricultural lessee's periodic use of satellite imagery or other tools and technology to enhance soil survey precision and the identification of "hot spots" requiring special attention.

**E.** Minimize pesticide application by adhering to the recommendations and management measures outlined in the IPMP and to the State of California and DoD pesticide application requirements (Section 5.7.2 Integrated Pest Management).

#### 4.2.1.2 Soil Erosion and Dust Abatement

### Specific Concerns

- Wind erosion poses a problem along the west side of the Central Valley and can lead to topsoil loss and air quality issues in the form of dust. These conditions contribute to the loss of crops, damage to public health including the dissemination of fungal spores causing Valley Fever, automobile accidents, damage to public facilities, and threats to flight training at NAS Lemoore.
- The largest contributor to dust is use of dirt roads on the Station. Pole Line Road, along the Station's eastern perimeter, is the only heavily and consistently traveled dirt road throughout the year. Agricultural use of dirt roads is heaviest in the fall during harvesting season. In general, dirt tends to accumulate at the interface of the dirt and paved roads, causing concern for wind erosion.
- The most common air quality complaints at NAS Lemoore relate to construction and maintenance work on the Station (J. Crane, pers. com. 2011).
- The evaporation ponds can be a source of dust when they are dry; which can cause hazardous driving conditions and traffic accidents on nearby county roads. Airborne alkali from the ponds is also a health concern. The Waste Discharge Requirements for NAS Lemoore (California Central Valley Regional Water Quality Control Board [Central Valley Water Board] 2002b) requires that the ponds remain either completely dry, or that they have at least 2 feet (0.6 m) of water; the goal is to discourage use by wading birds, which could be susceptible to adverse impacts from possible selenium concentrations there. In dry years, management of the ponds faces competing natural, legal, and safety concerns. Providing flight training safety and protecting public health requires, at a minimum, some marginal amount of water to preempt dust storms from the ponds.

### Current Management

Due to visibility concerns, wind-blown soil is a mission critical issue. NAS Lemoore continues to address the dust issue through managing agricultural practices, the evaporation ponds, roads, and ensuring adequate water supply. While habitat enhancement in the NRMAs primarily targets improved native condition of vegetation communities, it also contributes to reducing dust.

NAS Lemoore's primary strategy for reducing dust is to maintain an agricultural "greenbelt" around the Operations Area, which also serves to minimize wildfire potential near mission-critical facilities and reduces bird attraction to manage Bird/Animal Aircraft Strike Hazard (BASH). Agricultural lessees are required to control excessive dust generated by farming activities; they achieve this primarily by spraying water on dirt roads and exposed soil by their parcels, particularly when it poses the greatest threat to crop production (usually March through June) and during the agricultural harvest season. During periods when there is no

cropping, lessees are encouraged to leave crop residue/stubble to prevent dust. To be effective, the suggested stubble height is two to four inches. In addition, NAS Lemoore has reduced the number of dirt roads around agricultural parcels (absorbing them into the parcels) to reduce redundancy and help control dust. Closing any additional roads is not possible due to the need for emergency access in case of downed aircraft.

Securing sufficient water for the above activities is a primary concern. The Station is pursuing an initiative with the Bureau of Reclamation to secure an annual baseline allocation of water. The water would be used primarily for maintaining the agricultural greenbelt: it would make up for any shortfall in the normal Westlands Water District (WWD) allocation in order to prevent agricultural fallowing. NAS Lemoore has estimated its target baseline allocation as 24,000 acre-feet of water (Section 5.1.2 Sustainable Water Resources Management).

Other efforts, such as windbreaks, have been not been noticeably effective at mitigating dust spread on the Station (J. Crane, pers. com. 2011). EMD has investigated spraying binding chemicals on dirt roads to stabilize the dust. Staff concluded that this approach would be inefficient as binding chemicals wash away during rains and are disturbed by traffic and other agricultural activities.

To control dust at the evaporation ponds, NAS Lemoore has transferred water from wet ponds into dry ponds on an as needed basis. The Station avoids spraying water over the dust/alkali in the ponds as a management technique, since the saturated soils would then pose a risk to the water trucks.

To prevent the minimal waterborne erosion that may occur on the Station, the EMD encourages the installation of concrete sumps on agricultural parcels as they take up less space than earthen sumps and contribute to slightly less soil erosion. Otherwise, NAS Lemoore continues to ensure implementation of BMPs for soil erosion related to construction activities as required in their stormwater management plan and other relevant permits (Section 5.3 Construction and Facility Maintenance; Section 5.5 Stormwater and Nonpoint Source Pollution Management).

## Assessment of Current Management

Soil loss as a result of wind erosion associated with agricultural and construction activities will continue to be an ongoing concern requiring active management. Generally, current dust control approaches required of or practiced by agricultural lessees are effective. They should be updated as needed. BMPs to control both waterborne erosion and dust should be required and encouraged at construction sites and contractor vehicles should be required to use paved roads when possible.

Dust emanating from dry evaporation ponds remains a management issue, given the strictures of the current permit and the large, often unavailable volume of water needed to meet the 2-foot (0.6-m) depth standard in all of the ponds. Competing concerns for evaporation pond management are not properly addressed under the current management regime.

In general, soil can be protected from wind erosion by maintaining adequate growing vegetation, depositing crop residues to cover the soil, and maintaining adequate soil moisture from irrigation and tillage to keep the soil stable.

## Management Strategy

***Objective:*** *Implement BMPs to prevent and control soil erosion related to construction, agriculture, or other uses of natural resources in order to conserve water quality, air quality, and wildlife habitat, and to sustain the military mission.*

**I.** Research and implement management methods to reduce soil loss from waterborne erosion. Eliminate current outfall erosion areas by installing control structures on the terminus of agricultural drainage discharges.

**II.** Minimize wind erosion at NAS Lemoore through dust abatement and other measures.

- **A.** Develop and implement a long-term dust abatement plan. Incorporate strategies to reduce dust from multiple sources (construction, agriculture, evaporation ponds, etc.).
- **B.** Educate NAS Lemoore staff and contractors/lessees on the importance of dust abatement and associated BMPs. Make Air Quality District notifications and regulations available as appropriate.
- **C.** For construction and maintenance activities, dust control BMPs should stabilize exposed surfaces and minimize activities that suspend or track dust particles.
  1. Prevent dust emissions. Measures include confining the surface area to be disturbed, scheduling activities to minimize exposed areas, stabilizing soils,[8] restricting vehicle activity to paved roads when possible, limiting vehicle traffic to 15 miles per hour on dirt roads, and controlling the number and activity of vehicles on a site at any given time.
  2. Adopt specifications for planting techniques and types of plants (such as native species that easily establish) to help reduce dust; this includes establishing vegetation islands, windbreaks, and protecting volunteer plants.
- **D.** Revise BMPs for the prevention of dust from agricultural activities as necessary.
  1. Continue to encourage lessees to avoid disking fallowed fields and to leave crop residue and stubble to prevent dust accumulation. Recommended stubble height is between 2 and 4 inches (5–10 centimeters).
  2. Continue to adjust agricultural lease language to specify new BMPs for dust abatement so that these measures become standardized.
  3. Encourage agricultural lessees to conduct soil disturbing farm work when wind speeds are low.
  4. Implement methods of vegetating barren areas as appropriate. In particular, revegetate areas that are no longer in agricultural production.
- **E.** Consider the use of treated water from the water treatment facility for dust abatement spraying.
- **F.** Develop measures to minimize dust from the evaporation ponds. Given the substantial health and mission-related liabilities, investigate the possibility for alterations to the Waste Discharge Requirements Order to include a protocol for the emergency release of water into the ponds.
- **G.** Incorporate dust abatement into strategic roadside management strategies by promoting plants that effectively trap dust (Section 5.3.1 Roadside Management).

**III.** Consider soil conservation in all site feasibility studies and project planning, design, and construction. Include appropriate conservation work and associated funding in project proposals, and construction contracts and specifications.

- **A.** Consider using specifications from local agencies for wind and water erosion control, such as Kings County Agricultural Commissioner, the USDA Agricultural Research Service and other federal agencies. Incorporate into project planning and scopes of work.
- **B.** Continue to coordinate with and draw on the expertise of the NRCS to conserve soils and soil quality at NAS Lemoore.

[8] Recently improved products and methods in hydro-mulching for surface soil stabilization are available. The U.S. Forest Service has evaluated in depth various products for hydro-mulching for post-fire treatments (Robichaud et al. 2010).

**C.** Ensure incorporation of BMPs in the preliminary engineering, design, and construction of facilities involving ground disturbance (5090.1C CH-1).

**D.** Incorporate responsibilities for BMPs and sensitive resource protection in all real estate agreements (leases and easements) when they come up for renewal.

**E.** Monitor the effectiveness of soil conservation measures and BMPs.

**IV.** Stabilize disturbed sites using native plants or protective materials.

## 4.2.2 Water Resources

### Background

*Water as a natural resource, including groundwater resources, wetlands, jurisdictional waters, water quality and floodplains is addressed here and in Chapter 3. Water use and water use efficiency (including conservation actions) for all uses of water at NAS Lemoore are addressed in Chapters 2 and 5.*

The primary federal laws governing water resources at NAS Lemoore are the CWA and the Safe Drinking Water Act. 42 USC § 300f et seq. Soil Conservation sections of the USC (16 USC §§ 590a-590q3), the Watershed Protection and Flood Prevention Act, PL 92-419 (16 USC §§ 1001-1011, 33 USC 701), and the watershed approach included in DoDI 4715.03 are also important.

The primary state agencies charged with regulating water resources are the Health and Welfare Agency, the California Environmental Protection Agency, and the Resources Agency. Within the Health and Welfare Agency, the Department of Health Services, Division of Drinking Water and Environmental Management regulates public drinking water supplies and implements provisions of the federal Safe Drinking Water Act.

Maintaining water resources for habitat management purposes is strongly emphasized in the Migratory Bird Treaty Act (MBTA) and the California Wildlife Action Plan (WAP); should be ensured for any relevant federally listed species on the Station (ESA); and is supported by DoDI 4715.03.

### Specific Concerns

- Heavy dependence on groundwater for agriculture has resulted in overdraft conditions of the confined aquifer in the Tulare Lake Hydrologic region, leading to four to 20 feet (1.2-6 m) of land subsidence (Corbett et al. 2011). Substantial land subsidence at NAS Lemoore could impact the agriculture program and potentially jeopardize some uses of the Station (Section 5.1.2 Sustainable Water Resources Management).
- There is a perched shallow saline aquifer on NAS Lemoore agricultural lands. Managing it has included the use of specific plants. Efficient irrigation practices can also lower the perched aquifer and have a positive effect (K.D. Arroues, pers. com. 2012).
- Water available for habitat and to support restoration is currently the lowest priority water use at NAS Lemoore, especially when water is scarce for agricultural and other uses. In low rainfall years, there is often very little to no water available for such activities.

### Current Management

Water resource management at NAS Lemoore prioritizes uses for the military mission, municipal and industrial use, and agricultural use ahead of uses for wetland/aquatic habitats or habitat enhancement activities. This is also true of landscaped areas (not including the Military Housing Area, which is managed by a Public Private Venture that is not currently subject to Station water management actions). Traditionally, water for landscaping and other habitat enhancement activities has been drawn from the Municipal and Industrial allocation that NAS Lemoore receives from the WWD.

Habitat management in NRMA 5 has drawn on treated water from the water treatment plant at NAS Lemoore in past years to establish native vegetation. This water is stored in two 5,000 gallon tanks near the NRMA. Treated water is also used to support plants at the NAS Lemoore greenhouse.

Groundwater management at NAS Lemoore has historically been tied to the Agricultural Outlease Program (refer to Section 5.1.2 Sustainable Water Resources Management; Section 5.2.1 Agricultural Outlease Management). The Station also has about 90 monitoring wells installed to monitor the elevation and water quality of the groundwater aquifer. Some of these wells are located on lands adjacent to the Station in order to evaluate what is entering from off-site locations (Section 4.2.2.1 Water Quality).

A number of studies are being conducted on groundwater resources, groundwater wells, and hydrology at NAS Lemoore (including land subsidence). The results of these studies are expected to help define future actions for groundwater use and management at the Station, particularly for agriculture (Section 5.1.2 Sustainable Water Resources Management). For example, NAS Lemoore has conducted a study of the perched saline aquifer via a Cooperative Agreement with the California State University Fresno.

Prior management of the perched saline aquifer and the tailwater from adjacent agricultural parcels has included planting eucalyptus trees, which take up the salt water (e.g., a stand in NRMA 2, near parcel 4A58).

## Assessment of Current Management

Employing a watershed management approach at NAS Lemoore is intended to preserve soil and water productivity and related functions. Erosion and water quality management approaches should be consistent with the BMPs approved by the State of California under the Non-Point Source Pollution Control Plan, including those for agriculture, construction, and project planning. The impact of altered water flows, degraded wetland vegetation, nonpoint source pollution, and water supply needs to be continuously assessed. Watershed protection can also be achieved through fire management, erosion control programs, and assessing the impacts of surface runoff.

*The DoD requires a watershed approach to management. DoDI 4715.03 states "Components shall use a watershed-based approach to manage operations, activities, and lands to avoid or minimize impacts to wetland, groundwater, and surface waters on or adjacent to installations in accordance with the guidelines and goals established in the Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management, pages 62565 through 62572 of Volume 65, Federal Register and Executive Order 13508."*

Given the possibility of a scarce water future for the Central Valley, NAS Lemoore should diversify water resources used for habitat enhancement and landscape management (Section 5.4 Landscaping and Grounds Maintenance), particularly for wetlands and the species dependent upon them. There are opportunities for using treated water from the NAS Lemoore wastewater treatment facility if the Station could invest in installing appropriate distribution infrastructure. Groundwater resources (via repurposing wells currently unused by the Agricultural Outlease Program) and channeling stormwater along drainage ditches are also potential sources of water for habitat enhancement activities in the NRMAs.

Groundwater management activities will depend on the results of groundwater studies currently being conducted (Section 5.1.2 Sustainable Water Resources Management).

With recent measures to prohibit runoff from agricultural parcels (resulting in an overall decrease in overwatering and the installation of tailwater return pipes), there is less of a role for eucalyptus trees to mitigate agricultural tile drain water and tailwater. Instead, there is an opportunity to diversify plants used in managing the perched saline aquifer.

## Management Strategy

***Objective:*** *Conserve and enhance surface water resources available to habitats. Proactively manage the distribution of water resources to support natural resources management goals.*

**I.** Conserve habitats and water resources. Ensure the availability of adequate water to meet natural resources management objectives, including habitat enhancement and the re-establishment of native habitats and management focus species (Bunn et al. 2007).

- **A.** Whenever possible, reclaim, recover, or utilize available water to achieve the above objectives.
- **B.** Maintain or promote the physical and biological conditions necessary for optimizing water resource use in achieving the desired natural plant community, and other necessary conditions for supporting special status species and biodiversity. This could include, but is not limited to: controlling invasive species, determining water needs for native habitats and species to achieve management objectives for them, and promoting low water-use plant species in landscaped areas (Section 5.4 Landscaping and Grounds Maintenance).
- **C.** Develop a policy to reduce conflict between water use for agricultural activities and water that can be recovered or reclaimed for aquatic and wetland habitats that exist or are developed adjacent to agricultural parcels. Ensure adequate water for agricultural purposes without sacrificing the integrity of important wetland and aquatic habitats. This policy should be reflected in lease agreements when renewed, as needed.
- **D.** Investigate the use of treated water for landscape management and habitat enhancement purposes, and the installation of a distribution system to facilitate this.
- **E.** Investigate opportunities to secure groundwater for habitat enhancement use in the NRMAs.
- **F.** Seek opportunities to repurpose currently unused portions of the municipal and industrial water distribution system at NAS Lemoore for habitat enhancement and landscape management activities.

***Objective:*** *Manage groundwater resources to benefit both the NAS Lemoore Agricultural Outlease Program and native vegetation and habitats, where practicable. Reconcile conflicting water management approaches.*

**I.** Continue to monitor the level and quality of groundwater resources on the Station to comply with existing agreements with State regulatory agencies (California Department of Water Resources [CDWR], State Water Resources Control Board) (Section 5.1.2 Sustainable Water Resources Management; Section 5.2.1 Agricultural Outlease Management).

**II.** Incorporate the results of groundwater studies into management actions that conserve groundwater resources and help prevent land subsidence at NAS Lemoore.

- **A.** Maintain groundwater levels so as to not exceed depths reached during previous drought periods, when spring water levels reached 250 feet (76 m) below ground surface. This will help to avoid long-term, massive land subsidence (Corbett et al. 2011).
- **B.** Maximize the recharge of high quality surface water to the aquifer while minimizing the amount of groundwater pumping.
- **C.** Incorporate updates into the agricultural outlease agreement's Soil and Water Conservation Plan, as appropriate.

**III.** Monitor the perched aquifer underlying agricultural parcels on NAS Lemoore and implement measures to control or lower its elevation where necessary.

**A.** Incorporate results of the Cooperative Agreement study on the perched saline aquifer into a management plan.

**B.** Develop a plant list (in combination with the restoration plant list in Appendix K) to direct vegetation plantings in strategic areas (including windbreaks, as appropriate) that would help to manage the perched saline aquifer.

**C.** Encourage efficient irrigation practices as a way to lower and manage the perched saline aquifer.

**IV.** Use water efficiently and improve the sustainable use of water in the agriculture program, landscaped areas, and the interface between the built and natural environment, and as part of an Environmental Management System, as required under Executive Order (EO) 13514 on Federal Leadership in Environmental, Energy, and Economic Performance [05 October 2009]. This could include developing a Water Resources Management Plan to look at Station-wide water retention and use (Section 5.1.2 Sustainable Water Resources Management).

**V.** Research the feasibility of converting appropriate agricultural leases to grazing leases in light of reduced irrigation water availability.

## 4.2.2.1 Water Quality

### Specific Concerns

- Groundwater is not necessarily renewable and, in the Central Valley region, has been growing increasingly contaminated with synthetic nitrates and pesticide residues. Groundwater concentrations of nitrates and pesticide residues peak in the portion of the Central Valley that includes NAS Lemoore.
- According to the Tulare Lake Basin Plan (Central Valley Water Board 2004), the greatest long-term problem facing the entire Tulare Lake Basin is the increase groundwater salinity, which has accelerated due to irrigated agriculture's intensive use of soil and water resources. The Basin Plan recognizes that degradation is unavoidable until a Valley-wide drain is constructed to carry salt out of the Basin. Until the drain is available, it provides a number of salt management recommendations and requirements.
- Selenium concentrations in the soils at NAS Lemoore continue to be a source of concern, especially as they are transferred to water resources. Currently, there are trace concentrations of selenium in the evaporation ponds (detected using surface water testing); levels continue to remain below U.S. Environmental Protection Agency reportable levels (Central Valley Water Board 2002a, 2002b, 2013).

### Current Management

Maintaining high quality standards for all water bodies located on NAS Lemoore is a priority of the NAS Lemoore EMD, and is reinforced by several state and federal water quality regulations. NAS Lemoore does not have an integrated water quality management program independent from this INRMP. However, primary objectives include protecting the quality of water bodies and resources by identifying and managing aquatic habitats, reducing pollutant loading from agricultural practices and any construction activities, and promoting conservation measures.

The Station has managed and enforced several programs for water quality monitoring. The Navy monitors water quality at the wastewater treatment facility evaporation ponds for selenium, per the Central Valley Water Board's Waste Discharge Requirements Order for NAS Lemoore (Central Valley Water Board 2002a, 2002b, 2013). Since 1991, wastewater sampling has been conducted there quarterly, and test results have consistently been below reportable levels for selenium. The installation has also tested avian eggs collected at the evaporation ponds in 2011; results demonstrated that selenium concentrations are such that they do not pose a risk to wildlife (Central Valley Water Board 2013; T. Schweizer, pers. com. 2013). In 2012, NAS Lemoore requested termination of wildlife monitoring requirements and the Central

Valley Water Board in turn revised the Monitoring Reporting Program (Central Valley Water Board 2013). As part of the revised Monitoring Reporting Program, "if the pond water selenium concentrations (all ponds averaged) remain below a quarterly average of 2 parts per billion (ppb), then only dead bird monitoring (per Waste Discharge Requirements Order) should occur to avert any botulism outbreak. If the quarterly average exceeds 2 ppb, then nest surveys should be conducted during the breeding season (March to August) in accordance with the revised monitoring and reporting program" (Central Valley Water Board 2013; Appendix D).

Agricultural lessees are required to test water quality at agricultural groundwater wells at least twice per year. Some lessees have installed filtration systems at water meters to remove particulates from the water before it is applied to their parcel, which helps to minimize impacts to the perched saline aquifer.

Regular monitoring is also performed by the IRP for water quality (along with any necessary remediation actions) at all relevant IRP Sites on NAS Lemoore.

## Assessment of Current Management

Water quality monitoring of surface and groundwater resources (including at IRP Sites) has allowed NAS Lemoore to address water quality issues as they arise. Ongoing groundwater studies (Section 5.1.2 Sustainable Water Resources Management) should contribute further insight into quality of groundwater resources at NAS Lemoore and necessary actions to safeguard it.

In light of the Long-Term Irrigated Lands Regulatory Program (California Environmental Protection Agency and Central Valley Water Board 2011, 2012), NAS Lemoore agricultural lessees may need to update their management and monitoring of waste discharges to remain in compliance. The Program applies to all irrigated lands and managed wetlands in the Central Valley, expands regulation to any waste discharge into groundwater as well as surface water, broadens the definition of waste to include non-runoff discharges (such as aerial drift or overspray of pesticides, among others), and proposes additional monitoring and management requirements for growers in the Central Valley (Section 3.3.3.1 Surface Water Resources and Water Quality).

NAS Lemoore should continue to implement BMPs in agriculture, as well as construction and project planning, to avoid impacts to water quality of important aquatic/wetland habitats and other water resources on the Station. In addition to the Long-Term Irrigated Lands Regulatory Program, there is opportunity for NAS Lemoore to implement appropriate recommendations provided in the Tulare Lake Basin Plan (Central Valley Water Board 2004) to help protect groundwater resources on the Station and in the region. Some of these include management practices to reduce agricultural drainage, which can impact quality of water resources.

## Management Strategy

***Objective:*** *Maintain the quality of waters in compliance with state and/or federal water quality standards, including benefits for wildlife. Improve the quality of waters found to be in noncompliance.*

**I.** Protect the water quality of NAS Lemoore waters, including the benefit they provide to the wildlife that use them.

**II.** Continue to monitor surface water and groundwater quality—including chemical, physical, and biological constituents—on the Station so that water quality standards identified in the Tulare Lake Basin Plan are not exceeded. Monitor water quality using regionally consistent methods. Use trend analysis to anticipate and implement necessary management actions.

**A.** Comply with water quality permit requirements, including when required by project site size or if a project may affect wetlands or watercourses. Continue to conduct regular water quality testing at the evaporation ponds in compliance with the Waste Discharge Requirements Order for NAS Lemoore (Central Valley Water Board 2002a, 2002b, 2013).

**B.** In areas of the Station where surface water is present for a sufficient period of time that it may serve as wildlife habitat, test water for selenium and other contaminants that may adversely impact wildlife, as needed. If contaminants are detected, and if warranted, develop monitoring and/or management actions.

**C.** As part of normal operations, monitor quality of "first flush" water from a 24-hour rain event, both before it comes onto the installation and as it drains towards the Kings River. Develop and implement management actions to address any concerns and/or abnormalities from Station inputs.

**D.** Include a groundwater salinity monitoring program as part of groundwater level surveying to monitor fluctuations and trends in water quality that have significance for irrigation (Corbett et al. 2011).

**E.** Continue to require agricultural lessees to test groundwater quality from the agricultural wells.

**F.** Continue to monitor groundwater quality in areas that were impacted by hazardous materials contamination as part of the IRP (Section 5.7.3 Installation Restoration Program).

**III.** Minimize contributions from both point and nonpoint sources of pollution (including salts) resulting from NAS Lemoore land management actions (some BMPs are identified in the Tulare Lake Basin Plan [Central Valley Water Board 2004]) (Section 5.5 Stormwater and Nonpoint Source Pollution Management).

**A.** Assess and monitor practices to ensure they are achieving their stated goals.

**B.** Ensure that existing facilities are used and land management practices implemented in a way that does not conflict with achieving or maintaining quality or functions of water resources. If this is not possible, mitigate adverse impacts (Section 4.3.2 Wetlands and Jurisdictional Waters of the U.S.).

**C.** Update water quality monitoring and management actions at NAS Lemoore to comply with the Long-Term Irrigated Lands Regulatory Program (California Environmental Protection Agency and Central Valley Water Board 2011, 2012).

**IV.** Identify opportunities to implement management practices recommended by the Tulare Lake Basin Plan (Central Valley Water Board 2004) to reduce agricultural drainage so as to protect water resources (Section 3.3.3.1 Surface Water Resources and Water Quality), as compatible with mission requirements.

**V.** Investigate opportunities to contribute to goals of the Central Valley Salinity Alternatives for Long-term Sustainability program developed by the Central Valley Water Board and State Water Resources Control Board (Central Valley Water Board 2012).

*Central Valley Salinity Alternatives for Long-term Sustainability (CV-SALT) is a comprehensive effort to address salinity problems in California's Central Valley and adopt long-term solutions to enhance water quality and economic sustainability. The goal is to implement a salinity management program through planning and by engaging all water users (CDWR 2009b; Central Valley Water Board 2012).*

## 4.2.3 Floodplains

### Background

The Federal Emergency Management Agency (FEMA) regulates floodplains. Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk. These zones are depicted on a community's Flood Insurance Rate Map or Flood Hazardous Boundary Map. Each zone reflects the

severity or type of flooding in the area (FEMA 2010). The floodplain map available from FEMA for the area around NAS Lemoore is illustrated in Map 3-4.

5090.1C CH-1 states the Navy will avoid direct or indirect development of floodplains, and will restore and preserve the natural and beneficial values served by floodplains. Potential effects of actions in floodplains must be evaluated and early opportunity for public review of proposals in floodplains must be provided. This includes any development that may obstruct, divert, or retard flood flows, or which may affect flood elevations and flood protection. EO 11988 (24 May 1977, 42 Code of Federal Regulations 26951) was also developed to avoid adverse impacts associated with the occupancy and modification of floodplains.

## Specific Concerns

- Flooding potential remains at NAS Lemoore due to the potential overflow of the Kings River to the east, and floodwaters from the Arroyo Pasajero to the west that drain across NAS Lemoore towards the Kings River.
- FEMA Flood Insurance Rate Maps confirm that lands surrounding NAS Lemoore contain High Risk (1% annual chance; 100-year), and Moderate-to-Low Risk (0.2% annual chance; 500-year) flood areas. While the FEMA maps clearly suggest that there is a floodplain at NAS Lemoore, including on a portion of land between the Administration Area and the Operations Area (Map 3-4), no floodplain or flood hazard studies have produced flood maps for the portion of the Station in Kings County.

## Current Management

There is no active management of the risks or benefits provided by floodplains at NAS Lemoore. Risks are moderate, considering that High Risk areas are minimal and located in areas where no major construction is anticipated (currently, it consists of agricultural parcels, Reeves Boulevard, and a portion of NRMA 2). However, flood risk still exists: previous floods at NAS Lemoore occurred in 1969, 1995, and 1997 (J. Crane, pers. com. 2011). If a flood were to occur, it could block transit on Reeves Boulevard and complicate access to or use of agricultural parcels within the floodplain. The culverts under Reeves Boulevard (in areas where historic stream channels existed prior to development of agriculture on the Station) are obstructed or buried by soil.

## Assessment of Current Management

Lack of a floodplain map for the Station hinders the adequate treatment of floodplains during the planning process at NAS Lemoore. Any proposed activities within the floodplain should be considered during environmental project review.

*The CDWR Awareness Floodplain Maps are being developed for those areas without FEMA maps. The NAS Lemoore area map should be available by 2015 and could contribute to understanding location and extent of floodplains on the Station (CDWR website 2013).*

There is opportunity for the Station to incorporate a consideration of floodplain vegetation and function in habitat enhancement and restoration activities proposed in this INRMP, particularly for the floodplain in NRMA 2. This would influence plant selection, disturbance regime, and land contouring. Management of roadside areas at NAS Lemoore could incorporate strategies to manage and direct flood flows in the agricultural area floodplain that crosses Reeves Boulevard.

## Management Strategy

***Objective:*** *Avoid direct or indirect adverse effects on floodplains, as feasible, to maintain Station use and the military mission (DoDI 4715.03). Restore and preserve the natural and beneficial values served by floodplains.*

**I.** Preserve and restore the natural and beneficial values provided by floodplains, such as ecosystem protection, public safety, and flood damage reduction, as well as the hydrologic integrity of aquatic habitat and the vegetation that thrives there.

*EO 11988 states that the NEPA determination of effect on floodplains shall be made according to a Department of Housing and Urban Development floodplain map or a more detailed map of an area, if available.*

**A.** Assist Navy planners in creating a flood hazardous boundary map for the Station so that the severity and type of flooding may be predicted, and so that unnecessary impacts to floodplains may be avoided to prevent any hindrances to Station use and military mission.

**B.** Restore surface water and groundwater sources, stream channels, and natural storage places for sediment and water; this will help to absorb and direct flood flows, and sustain base flows, wet meadows, and other transitional habitats. Manage roadside areas within the agricultural floodplain to absorb and direct flood flows there.

**C.** Incorporate consideration of floodplains into habitat enhancement and restoration activities. Use flora identified as associated with floodplains when enhancing such areas.

*The California Floodplain Management Task Force report (CDWR 2002) provides a comprehensive list of recommendations for improving floodplain management (Bunn et al. 2007).*

**D.** Support California WAP and CDWR goals for regional floodplain management.

**II.** Locate and restore the usefulness of the culverts under Reeves Boulevard to help alleviate the severity and frequency of flooding within the floodplain located there.

**III.** Evaluate through the NEPA and site approval process the potential effects of actions in floodplains, and provide early opportunity for public review of proposals in floodplains. This includes any development in a floodway and floodplain that may obstruct, divert, or retard flood flows, or which may affect flood elevations and flood protection. Provide avoidance and minimization measures, or offsetting mitigation, for direct or indirect development of floodplains.

## 4.2.4 Wildland Fire Management

### Background

Federal wildland fire policy mandates that all federal lands with burnable vegetation have a wildland fire management plan (WFMP) and resources to safely mitigate losses. A WFMP is a strategic document that guides the full range of fire management related decisions, including evaluating the potential for allowing fire to play its natural ecological role. It addresses all aspects of wildland fire management consistent with federal fire policy (USDA and U.S. Department of the Interior 2009). The DoD adopted federal wildland fire management policy through DoDI 6055.6-M (DoD Fire and Emergency Services Program [DoD 2006a]). DoDI 6055.6-M provides policy and criteria for the allocation, assignment, operations, and administration of the DoD Fire and Emergency Services and Emergency Medical Service programs.

### Specific Concerns

- A WFMP for NAS Lemoore does not currently exist.
- Aircraft-related accidents during takeoffs and landings can cause fires.

### Current Management

Controlled burns are occasionally used as part of NAS Lemoore natural resources management to benefit wildlife habitat (NAS Lemoore 2010, Appendix E). Invasive species control burns may be conducted along the Operations Area fence line for tumbleweed, primarily in cases where the Station has not had the

opportunity to spray weeds adequately and immediate control is necessary. Fire may be occasionally used by agricultural lessees to maintain the agricultural irrigation ditches free of weeds as well; to do so, they must first acquire their own burn permits from the San Joaquin Air District. In general in the San Joaquin Valley, burning for agriculture is becoming more limited due to air quality restrictions.

The EMD prepares a prescribed burn management plan in order to obtain the proper permits from the San Joaquin Air Quality Control Board. Most burning activities are conducted by NAS Lemoore staff, Kings County Fire Departments, and the California Department of Forestry and Fire Protection; the U.S. Bureau of Land Management Bakersfield district Hotshot Fire Crew is commonly used to assist burns in larger areas, such as in NRMA 5. The prescribed burns in NRMA 5 are used to promote beneficial habitat for the federally and state endangered San Joaquin kangaroo rat (*Dipodomys n. nitratoides*) (Section 4.5.1.1 San Joaquin Kangaroo Rat (Federally and State Endangered)) and are coordinated as training opportunities for participants.

Outside of prescribed burn activities, there is no WFMP for NAS Lemoore. When analyzing fire hazards, three primary issues are considered: pilot and public safety, potential hazards to adjacent properties and structures, and damage to aircraft. In general, wildfires have not been a major concern at NAS Lemoore given that most of the land is maintained in irrigated agriculture (the dense, green crops contribute to slowing the dispersion of a flare-up) and there are relatively few activities on the Station that generate fire hazards (e.g., one munitions area and plane crashes). Given the uncertain water future at NAS Lemoore, the Station is seeking to secure a baseline water allocation from the Bureau of Reclamation to help ensure viability of agricultural production and its wildfire depressing ability (Section 4.2.1.2 Soil Erosion and Dust Abatement). In addition, the grassland areas inside the Operations Area security fence are mowed regularly to maintain vegetation height at no more than 6 to 8 inches (15–20 centimeters). This practice discourages bird use of such areas to prevent BASH incidents and also reduces the risk of fire spread.

The Operations Area control tower offers an excellent fire lookout. Control tower personnel are charged with being alert to possible security violations; wildfire incidents are reported to the NAS Lemoore Fire Department (Navy 1995), which is responsible for controlling any wildfires that occur on NAS Lemoore.

## Assessment of Current Management

Controlled burns for natural resources management purposes are managed and conducted successfully. Fire can be an effective tool for controlling weeds and promoting habitat beneficial to the San Joaquin kangaroo rat.

A wildfire management plan is important to develop for NAS Lemoore, primarily to map the location of sensitive resources and facilities, as well as access points and routes in the event of a fire. Overall, the main concern is for pilot and public safety; if an aircraft crashes, the resulting fire must be minimal and easily contained so that any necessary rescue efforts are not hampered. In addition, minimizing damage to aircraft, facilities, and adjacent properties helps avoid costly losses.

Protecting important habitats and resources from the threat of wildland fire is also important.

The Agricultural Outlease Program at NAS Lemoore will remain an important part in maintaining green and fire-resistant vegetation in areas close to the Operations Area and flight paths. Naturally occurring vegetation is discouraged in these areas as it tends to become more dry and flammable in the hot summer and fall months.

Ongoing fire management activities and protocols should be standardized in a WFMP, along with the mapping described above.

## Management Strategy

***Objective:*** *Protect the human, infrastructure, natural, and cultural resources of NAS Lemoore from the harmful impacts of wildfire and fire management interventions. Maintain a low risk of wildfire at NAS Lemoore.*

**I.** Develop a WFMP for NAS Lemoore to comply with DoDI 6055.6-M and federal fire policy. This can be done through a formal WFMP or fire planning atlas, depending on whether NAS Lemoore meets certain criteria outlined in DoDI 6055.6-M. Use development of the WFMP to standardize current fire prevention and control practices ongoing at NAS Lemoore.

*If developing a formal WFMP, using an interagency template is preferred (e.g., National Interagency Wildfire Coordinating Group).*

**II.** Develop a fire management approach for NAS Lemoore.

- **A.** Prevent ignitions that cause wildfires. Manage fuels in strategic locations of high fire risk. Suppression is an expensive and last resort.
  1. Continue to irrigate agricultural land. NAS Lemoore personnel or contractors should conduct fire management actions in the agricultural parcel(s) during times when there is no agricultural lessee to do so.
  1. Continue to mow grassland vegetation within the Operations Area security fence.
- **B.** Monitor weather data, including wind patterns to ascertain fire condition. Make data and analysis available to natural resources managers.
- **C.** Maintain a database to track all fires, including area burned, how suppressed, fire cause, fire perimeters, and fire severity.
- **D.** Emphasize staging of fire suppression and post-suppression rehabilitation resources so that wildfires, if they do occur, may be responded to in a non-crisis atmosphere with proper planning. For suppression, this includes equipment pools, water, retardant, suppression prescriptions by management area, and funding.
- **E.** Provide fire suppression support commensurate with resources and adjacent property at risk. Develop specific tactics and initial attack schemes based on personnel and public safety, buildings occupied by humans, highly valuable infrastructure and equipment, presence of federally listed or special status species, unique vegetation communities, etc.
- **F.** Prevent human-caused fires through education, investigation, and outreach, including for residents of the Station's Housing Area.
- **G.** As necessary, develop post-fire rehabilitation guidelines appropriate to NAS Lemoore and its plant communities. Identify and develop partnerships with potential seed sources and seed caches to use for erosion control spot treatment, and for possible restoration of islands of vegetation to stimulate more rapid and effective habitat recovery.
- **H.** Ensure training of qualified on-Station personnel to provide initial response to a wildfire.

***Objective:*** *Use fire as a tool when necessary for native vegetation and habitat management.*

**I.** Use prescribed burns as a means to control noxious invasive weeds, to enhance vegetation, and increase habitat value for the benefit of the San Joaquin kangaroo rat in NRMA 5.

- **A.** Continue to comply with San Joaquin Air Quality Control Board requirements to develop prescribed burn plans and obtain necessary permits for controlled burns conducted at NAS Lemoore.

**B.** The prescribed burning regime should comply with goals set forth in the current San Joaquin Kangaroo Management Plan and the to-be-developed NRMA 3 and NRMA 5 joint management plan, to be consulted on with the USFWS and CDFW (Section 4.5.1.1 San Joaquin Kangaroo Rat (Federally and State Endangered)).

**C.** Continue to solicit USFWS input on burning activities in NRMA 5 on a project-by-project basis until achieving consultation and a Biological Opinion (BO) on the to-be-developed NRMA 3 and NRMA 5 joint management plan.

**D.** Assess timing of prescribed burns to avoid maximum impacts to active wildlife.

**E.** Practice safe prescribed burn techniques.

# 4.3 Management of Vegetation Communities and Habitats

### Background

Section 4.3.1 Vegetation Communities and Habitats presents management strategies for vegetation communities and habitats that can be applied generally to all communities and habitats at NAS Lemoore (e.g., upland areas, wetlands, windbreaks, degraded areas, etc.), particularly the monitoring needs and enhancement methods. Objectives are included in Sections 4.3.1.1 Specific Issues for NRMAs 1, 2, and 6 to 4.3.1.3 Specific Issues for NRMA 4 for vegetation communities and habitats in specific NRMAs. Regulatory considerations for wetlands and jurisdictional waters are addressed in Section 4.3.2 Wetlands and Jurisdictional Waters of the U.S. Habitats managed exclusively for special status species are addressed in Section 4.5 Special Status Species Protection (e.g., NRMA 5 for the San Joaquin kangaroo rat), though there may be some overlap.

Strategies and objectives for vegetation communities and wildlife habitats that are more intensively managed as part of landscaped areas, agriculture or outdoor recreation are addressed in Chapter 5. Chapter 3 contains a discussion of natural resources occurring in all areas. Relevant program management for landscaped areas, agriculture and outdoor recreation is presented in Chapter 2.

As it is Navy policy to incorporate ecosystem management as the basis for managing habitats on NAS Lemoore, this management program uses a long-term view of human activities, including military uses, and biological resources as part of the same environment. To this end, meeting the objectives and strategies outlined here will sustain the biological integrity of NAS Lemoore's habitats while maintaining the primary military mission.

## 4.3.1 Vegetation Communities and Habitats

### Specific Concerns

- Identifying desired future outcomes for habitats and ecosystem services in the NRMAs, and other natural communities on the installation, would help guide management decisions and evaluate progress.
- Native vegetation communities and wetland areas at NAS Lemoore are important for providing native wildlife habitat in a predominantly agricultural landscape in the southern Central Valley.
- Water available for habitat development is lower on the priority list of water uses, especially when water becomes scarce. Without water to support seeding and other habitat enhancement activities, it is very difficult for planted/seeded native growth to survive in the NRMAs.
- In some years, wetlands at NAS Lemoore are threatened by limited water availability.

## Current Management

The goal of vegetation community and habitat management at NAS Lemoore is to maintain land conditions compatible with the military mission, and, where feasible, to conserve habitats for the benefit of native flora and fauna. The strategy to ensure mission compatibility has focused largely on (a) maintaining an agricultural "greenbelt" around the airstrip, which reduces dust, fire spread, and Valley Fever, and (b) discouraging wildlife use of resources close to the Operations Area where they may pose hazards for flight training. Six NRMAs are maintained with natural vegetation and support wildlife communities on the Station.

Vegetation and habitat management has been driven primarily by special status species needs, including the San Joaquin kangaroo rat in NRMA 5. In other NRMAs, some habitat enhancement has occurred when resources are available, including broadcasting seed mix. Water availability has historically been a limiting factor to success of habitat enhancement activities (Section 4.2.2 Water Resources).

Restoration native plantings have included: *Atriplex canescens*, *A. lentiformis*, *A. spinosa*, and *Suaeda moquinii*; riparian vegetation has been encouraged to proliferate in some areas as well. The Station has experienced past success with restoration activities using wild ryegrass. The NAS Lemoore greenhouse has also occasionally supported enhancement efforts by providing plantings. Invasive control in both upland and wetland habitats remains constant as it receives regular annual funding.

Vegetation mapping at NAS Lemoore was recently updated by Tierra Data Inc. (TDI 2012) using the California Native Plant Society (CNPS) methodology as presented in *A Manual of California Vegetation* (Sawyer et al. 2009). The vegetation mapping protocols and methodology laid out in this manual have been adopted by the CDFW as the standard for the Vegetation Classification and Mapping Program.

## Assessment of Current Management

Defining habitat enhancement goals (for both upland and wetland habitats) generally and for each NRMA is important to help direct management and monitoring actions. This includes supporting old field succession to native vegetation by improving the native condition of plant communities. The recommended plant lists provided in this INRMP could be used as a guide (Appendix K).

Habitat enhancement should also support one or more beneficial functions, such as support for wildlife, pollinators, and control of invasives. The NRMA habitat enhancement matrix provided in this INRMP summarizes some appropriate beneficial uses, goals and methods (Appendix K). A phased approach for implementing identified priorities would allow flexibility and contribute to adaptive management.

While baseline inventories and vegetation mapping provide some insight into habitat health or enhancement, a monitoring program to truly assess habitat and vegetation community health, use by native species, and effectiveness of habitat enhancement activities is needed. An ecosystem-based approach can be integrated into design of monitoring activities and a database to record enhancement actions and results. This could improve strategic habitat management activities and increase the general cost effectiveness of habitat management approaches.

## Management Strategy

***Objective:*** *Conserve and enhance the attributes of each vegetation community and habitat that sustain diverse and abundant wildlife, as well as food web support, biodiversity, watershed protection, productivity, and nutrient storage and cycling. Emphasize vegetation communities that support management focus species, and vegetation areas with recognized conservation value, including wetlands.*

**I.** Establish a baseline inventory of natural resources according to priorities tied to threats and vulnerabilities. Conduct monitoring as part of an ecosystem management approach to assess habitat health trends and success of enhancement activities (Section 4.1 Managing with an Ecosystem Approach).

**II.** Promote and enhance native ecosystems and land sustainability when such action is practicable and does not conflict with military mission or capabilities consistent with EO 13514. Restore or establish as much of a natural condition as possible, where feasible.

- **A.** Determine appropriate vegetation communities and native vegetation goals based on soil maps and what the site historically supported.
- **B.** Improve the native condition of vegetation communities, particularly through old field succession and establishment of perennials. Focus on target species, support beneficial functions for wildlife, and draw on guidance from the restoration plant list and NRMA restoration matrix included in this INRMP (Appendix K). Use local seed sources when possible.
- **C.** Pursue a phased approach to restoration. Target priority areas first and adapt subsequent activities based on implementation and monitoring results.
- **D.** Seek opportunities to combine restoration activities as much as possible. For example, invasive species control can be followed by habitat enhancement activities; this can help to more effectively control invasive species than repeated spraying or removal while actively improving native vegetation communities (Section 4.6 Invasive Species Management).
- **E.** Investigate opportunities and suitable areas to allow a prescribed livestock grazing program. Grazing can complement habitat enhancement and restoration (Section 5.2.2 Livestock Grazing).

**III.** Implement strategies specific to plant communities that are at risk and/or have recognized conservation value, such as wetland and aquatic habitats (Section 4.3.2 Wetlands and Jurisdictional Waters of the U.S.).

**IV.** Rehabilitate, reclaim, or revegetate areas subjected to surface-disturbing activities, where feasible and as funding is available.

- **A.** Stabilize disturbed areas from wind and water erosion.
- **B.** Use vegetation and soil maps to plan recovery strategies for disturbed areas, keeping habitat benefits in mind.
- **C.** Roadsides should be considered a special management zone. They tend to be corridors for invasion of non-native plants, given the constant disturbance that can favor invasive species. Their management can also contribute to managing flood flows in floodplains (Section 5.3.1 Roadside Management).

**V.** Enhance the native vegetation in the Habitat Linkage Corridor to benefit pollinators and manage stormwater.[9]

- **A.** Investigate the possibility of establishing Mesquite/Willow/Saltbush hedgerows on the north or south side of the corridor on its eastern end.
- **B.** Place apiary leases strategically near the Habitat Linkage Corridor to encourage pollinator use of native plants there.

[9] Establishing native Indian hemp in the Habitat Linkage Corridor may provide an opportunity to develop a relationship with nearby Indian Tribes. Indian hemp was traditionally used for ceremonial purposes and in basket weaving in the Central Valley.

**VI.** Manage windbreaks to include a variety of trees and shrubs in order to improve wildlife habitat and support other beneficial uses. Use species suggested by the windbreak profile plan in Appendix K to target desired species composition.

- **A.** Replace oleander (*Nerium oleander*) windbreaks with more beneficial species that would promote pollinator use and habitat for wildlife.[10]
- **B.** Enhance the windbreak near the security fence at the north end of the Administration and Housing Areas, and secure water for enhancement.

**VII.** Ensure availability of adequate water to meet natural resources management objectives including habitat enhancement in NRMAs and re-establishment of native habitats and management focus species (Bunn et al. 2007).

- **A.** Maintain or promote the physical and biological conditions necessary for optimizing water resource use in achieving surface characteristics and the desired natural plant community, and other necessary conditions for supporting management focus and special status species and biodiversity.
- **B.** Investigate opportunities to secure water resources for habitat enhancement use (Section 4.2.2 Water Resources).

**VIII.** Where and when feasible, seek opportunities to coordinate and/or partner with the IRP to restore NAS Lemoore IRP sites to benefit wildlife and habitats.

**IX.** Promote collaboration and partnerships with off-Station researchers and organizations to benefit vegetation community and habitat management and restoration at NAS Lemoore. Continue to allow access to researchers and specialists, and maintain a database of their formal and incidental observations.

**X.** Continue to refine and update the NAS Lemoore vegetation map as required. Use the vegetation classification and mapping protocols that meet national Federal Geographic Data Committee and DoD standards along with expert knowledge, to derive habitat value maps for management focus species. Vegetation mapping should comply with the CNPS classification system or the California Vegetation Classification and Mapping Program (described in Sawyer et al. 2009) for current California vegetation classification standards.

**XI.** Conduct long-term vegetation surveys of NRMAs 1, 2, 4, and 6.

#### 4.3.1.1 Specific Issues for NRMAs 1, 2, and 6

##### Assessment of Current Management

NRMAs 1, 2, and 6 are managed as wildlife habitat in the northeast corner of NAS Lemoore. NRMA 6 (located between NRMA 1 and 2) was previously under agricultural production.

There have been sporadic restoration activities in all three NRMAs. For example, though it has taken ten years, creeping ryegrass seeded in NRMA 1 appears to now be colonizing the area well.

More definitive habitat enhancement goals for NRMAs 1, 2, and 6 are needed. They should focus on improving native vegetation and managing the eucalyptus trees. The bed of Sunset Lake in NRMA 2 may require further investigation as its soils may have been contaminated by agricultural drain water from adjacent land. Ensuring there is sufficient water to support revegetation and enhancement activities, particularly for wetlands in these NRMAs, is necessary.

[10] Such action will also help to stem the spread of oleander leaf scorch, an incurable bacterial disease that is infecting oleander plants throughout the southern third of California (Appendix H).

### Management Strategy

***Objective:*** *Enhance the upland and wetland native habitat value of NRMAs 1, 2, and 6 to support wildlife, particularly management focus species.*

**I.** Identify appropriate management focus species for these areas that can provide insight into habitat health, structure and function, as well as success of targeted enhancement activities. Monitor regularly, particularly pre- and post-habitat enhancement.

**II.** Promote native perennials while controlling non-natives and invasive plant species.

- **A.** Encourage high value habitat that used to be associated with the Tulare Lake Basin.
- **B.** Favor creeping ryegrass and increase native saltbush in upland areas of NRMA 1.
- **C.** Control athel tamarisk (*Tamarix aphylla*) over time, gradually replacing it with a native species that provides similar structure and shade.
- **D.** Plant and/or encourage species that provide suitable habitat and food for birds and other wildlife, including forbs, shrubs (i.e., *Atriplex* spp.), and trees.

**III.** Maintain the integrity of the meandering course, which feeds into Sunset Lake from the southeast, in order to maintain quality and reduce sediment input.

**IV.** Improve woodland habitat. Thin the eucalyptus stands in strategic areas to increase and encourage the understory. Interplant with native species, such as mesquite, cottonwood, willows, and any of the other species listed in Appendix K for upland and saline sink areas. Shrub and perennial grass species are highly recommended for habitat enhancement. Continue to issue firewood collection permits for these areas to help control the dead wood.

**V.** Manage the eucalyptus in NRMA 6 to prepare for relocation of burrowing owl (Section 4.5.2.2 Burrowing Owl (USFWS BCC, California SSC)).

**VI.** Investigate opportunities to secure water for habitat enhancement, particularly for existing wetlands. This could include stormwater from the Habitat Linkage Corridor and developing other available sources. The ability to mimic periodic flooding of wetland areas when natural precipitation and run-off are insufficient would help to maintain wetland integrity (given the semi-arid climate and common periods of drought).[11]

**VII.** Based on results from toxicological analysis of Sunset Lake soils, determine the best actions to improve habitat value and if remediation may be appropriate (Section 4.2.1.1 Soil Quality).

**VIII.** Improve habitat for game species (dove, pheasant and quail), simultaneous with general habitat enhancement in these NRMAs.

**IX.** Develop an interpretive site near NRMA 2 that incorporates both native habitat and cultural values existing there.

## 4.3.1.2 Specific Issues for NRMA 3

### Assessment of Current Management

NRMA 3 has been managed as an ephemerally inundated wetland, with a focus on habitat for the western spadefoot toad (*Spea hammondii*); however, the level of inundation has decreased. It was thought that the

[11] If water supplies were increased, seasonal wetlands in these NRMAs could benefit from sufficient water to develop the California Bulrush Marsh Alliance to a much greater degree than is currently present (which provides valuable perching and nesting habitat for birds). Goodding's black willow, sandbar willow and elderberry would also thrive in these habitats with an increase in availability of water throughout the year.

intense invasion of athel tamarisk in NRMA 3 was partially contributing to decreased water levels. Though, control of this invasive species over the past few years has not led to any water level increases (J. Crane, pers. com. 2011). Tamarisk control is ongoing: newly established individuals and previously cut stumps are treated with glyphosphate (Section 4.6 Invasive Species Management). While this contributes to habitat maintenance for the western spadefoot toad, it has not been observed in the NRMA in some time.

Historically, NRMA 3 was hydrologically connected to the southern portion of NRMA 5 (wetland site 29) as a large oxbow wetland or lake (J. Crane, pers. com. 2011). A tailwater sump pond (wetland site 26) now separates them. NRMA 3 and the southern wetland in NRMA 5 could be jointly managed to enhance their ecological relationship. This would likely entail removing the sump pond that separates them, the road that separates NRMA 3 from the tailwater sump, as well as the dike within NRMA 3 that separates it into two wetland areas (wetland sites 24 and 25). The goal should be improved inundation and water retention to support wetland species, including the western spadefoot toad once again. Securing water to achieve this should be a priority.

### Management Strategy

***Objective:*** *Improve the condition of wetland habitat in NRMA 3. Seek to reconnect the entire site hydrologically, including with the wetland in the southern portion of NRMA 5, and manage the area for the benefit the western spadefoot toad.*

**I.** Restore the area by modifying the topography for improved water retention and by planting or encouraging propagation of native species that benefit both bird use and the western spadefoot toad in and around the wetland area (i.e., supporting the toad's food base). Continue to control tamarisk as needed and manage the eucalyptus (Appendix K).

**II.** Investigate opportunities to secure water resources for enhancement of NRMA 3.

**III.** Identify and monitor management focus species for this area that can provide insight into habitat health, structure and function, as well as success of targeted enhancement activities.

**IV.** In consultation with the USFWS and CDFW, develop a combined management plan focused on management of both NRMA 3 and NRMA 5. Incorporate additional analysis on habitat needs and management strategies for wetland species in NRMA 3.

## 4.3.1.3 Specific Issues for NRMA 4

### Assessment of Current Management

NRMA 4, near the Operations Area, was bisected by the installation of the Operations Area fence in 2003. The grassland vegetation within the fence is no longer part of the NRMA; it is mowed to reduce vegetation height to minimize potential BASH hazards. The remaining portion of the NRMA has not been a focus of specific habitat management activities.

### Management Strategy

***Objective:*** *Improve the native habitat value of NRMA 4 focusing on native species propagation for the benefit of native pollinator species.*

**I.** Protect and enhance the existing wetland, focusing on the Cooper's rush (*Juncus cooperi*) Alliance while at the same time avoiding open, standing water, which may attract birds and thus potential BASH incidents (Appendix K).

**II.** Expand the existing spiny saltbush (*Atriplex spinifera*) habitat by controlling for invasive species and enhancing the habitat with species from the upland grassland/saltbush habitat list in Appendix K.

**III.** Plant native species that will improve habitat value for pollinators.

**IV.** Identify and monitor management focus species for this area that can provide insight into habitat health, structure and function, as well as success of targeted enhancement activities.

## 4.3.2 Wetlands and Jurisdictional Waters of the U.S.

### Background

*The discussion of wetlands and jurisdictional waters at NAS Lemoore builds upon that presented in Section 4.2.2 Water Resources. Objectives and strategies described here can also be applied to wetland areas discussed above (i.e., within each of the NRMAs).*

EO 11990 requires that federal agencies minimize any significant action that contributes to the loss or degradation of wetlands and that actions should be initiated to enhance their natural value.

It is Navy policy to avoid adverse impacts to existing aquatic resources and offset those adverse impacts that are unavoidable (NAVFAC P-73). Moreover, Commanders shall ensure that boundaries of legally defined wetlands, on all Navy lands, are identified and mapped with sufficient accuracy to protect them from potential unplanned impacts, and that the maps are distributed to all potential users, including facilities planners, operational units, and tenant commands (5090.1C CH-1). U.S. Army Corps of Engineers (USACE) permits are required under Section 404 of the CWA for the discharge of dredge or fill material into waters of the U.S., including wetlands.

Ensuring sufficient amount and quality of water for wetland habitats is strongly emphasized in the MBTA and the California WAP (Bunn et al. 2007); should be ensured for any relevant federally listed species on the Station (ESA); and is supported by DoDI 4715.03 (Section 4.2.2 Water Resources)

### Specific Concerns

- Some current wetlands may not be reflected in the last wetland inventory for NAS Lemoore (Tetra Tech, Inc. 1996). For example: tailwater sumps that may be used by birds; and the wastewater treatment facility sludge or settling ponds that have been used by tricolored blackbirds in the past.
- No formal jurisdictional delineation for wetlands or waters has occurred at NAS Lemoore. The previous INRMP (Navy 2001b) only suggested the likelihood that a water feature would be jurisdictional (Section 3.4.4 Wetlands and Jurisdictional Waters of the U.S.).
- There is a need to determine if the flood control channel connected to the Kings River near the southeast corner of the Station (crossing under State Highway 198) should be regarded as jurisdictional. This channel requires occasional maintenance that may impact the adjacent Kings River.

### Current Management

*The Protection of Wetlands EO 11990 directs all federal agencies to "take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands."*

NAS Lemoore management of wetlands and jurisdictional waters aims to maintain Station compliance with relevant federal legislation and permit requirements. Outside of this, NAS Lemoore regulates wetland habitats through its general habitat management program (Section 4.3.1 Vegetation Communities and Habitats) targeting the NRMAs, as well as other valuable wetland habitats (including drainage ditches and evaporation ponds). Stewardship wetland habitat management occurs as funding and staff time allow. Wetland areas are also taken into consideration as part of NEPA analysis for specific projects.

Within the above program, wetland habitat management remains very site specific; there is no general wetland habitat management approach at NAS Lemoore. There has been some wetland habitat enhancement and creation, including adjacent to some agricultural parcels; however, their integrity is often threatened by low water availability. NAS Lemoore avoids enhancing wetlands near the Operations Area in order to reduce wildlife attraction and thus the potential for BASH.

## Assessment of Current Management

There is an opportunity for the Station to update its wetland inventory and to conduct a reconnaissance-level jurisdictional determination to ensure compliance with guidance in 5090.1C CH-1 and Section 404 of the CWA (Appendix C). This would allow consideration of recent court cases influencing jurisdictional determinations (e.g., USACE/ U.S. Environmental Protection Agency December 2, 2008a, 2008b, 2008c) and contribute to improved NEPA analysis on a project-by-project basis.

Wetland habitats at NAS Lemoore would benefit from efforts to secure water for habitat enhancement activities (Section 4.2.2 Water Resources), and which is shielded from competing uses on-Station. To protect aquatic and wetland habitats from potential threats, it would be prudent to develop policies that outline wetland protection and water use protocols where necessary. This would allow NAS Lemoore to protect tailwater sump pocket wetlands that are used by or enhanced for wildlife; and ensure that management of wetland drainage ditches and windbreaks by agricultural lessees does not threaten breeding birds.

Wetlands provide essential breeding, spawning, nesting, and wintering grounds for numerous wildlife species. Wetlands also enhance the quality of surfaces by impeding erosive forces, trapping water-borne sediment and associated pollutants, providing a gradual release of stored floods and groundwater, and providing a natural means of flood control and storm damage protection through the absorption and storage of water during high-runoff events.

The Central Valley Joint Venture Implementation Plan (2006) outlines objectives and strategies for improving wetland habitats and their use by wildlife. There is opportunity for NAS Lemoore to partner with this and other organizations to strategically enhance wetland areas on the Station. A relevant potential funding source includes the California Wildlife Conservation Board (www.wcb.ca.gov), which prioritizes wetland habitat restoration activities in the Central Valley.

## Management Strategy

***Objective:*** *Determine the presence or absence of waters of the U.S.; map and distribute according to Navy guidelines.*

**I.** Inventory and map wetland habitats and USACE jurisdictional waters of the U.S. on NAS Lemoore. Include wetlands that may not have been identified in the previous inventory (i.e., wastewater treatment facility sludge ponds, some tailwater sumps, etc.). Use most recent USACE guidance. This includes evaluating the flood control channel potentially connected to the Kings River which crosses under State Highway 198.

***Objective:*** *Consistent with EO 11990, take action to minimize the destruction, loss, or degradation of wetlands, and to protect and enhance the natural and beneficial values of wetlands.*

**I.** Continue to include consideration of impacts on wetlands and surface waters as part of the NEPA process prior to the start of individual projects, including establishment of appropriate buffers. Conduct jurisdictional determinations of wetlands and waters as needed (Section 5.8 NEPA

Compliance). Support the mitigation policy of avoidance, minimization, and compensation for any wetland losses.

**II.** Provide protection to wetlands and jurisdictional waters of the U.S.

- **A.** Minimize the potential for contamination from pesticides.
- **B.** Continue using settling basins to remove undesirable sediment loads from the system.
- **C.** Maintain vegetation along banks of flood control drainage ditches to reduce sediment loads from erosion.
- **D.** Implement BMPs to protect wetland and waters from possible construction and/or facility maintenance impacts (Section 5.3 Construction and Facility Maintenance).
- **E.** Develop a policy to reduce conflicts between water use for agricultural activities and water availability for aquatic and wetland habitats that exist or are developed adjacent to agricultural parcels (Section 4.2.2 Water Resources).

**III.** Conserve and restore water-dependent habitats such as wetlands. This is especially important in the Central Valley since they are among the most significant wildlife areas left.

- **A.** Reestablish and maintain natural flows, flooding patterns, water temperatures, and appropriate chemical conditions in wetlands to support wildlife species and habitats (Bunn et al. 2007). Land use management in uplands from which water flow drains into wetlands should avoid unnaturally accelerating runoff or increasing sediment and contaminant loading.
- **B.** Consistent with the ESA, EO on Migratory Birds, and the California WAP (Bunn et al. 2007), protect and enhance riparian and wetland habitats, and restore degraded riparian and wetland areas. This will contribute to maintaining wildlife diversity in the southern Central Valley.
  1. Maintain and enhance open waters as rest areas for migratory birds.
  2. Avoid wetland habitat enhancement or creation in areas close to the Operations Area, in order to avoid potential BASH concerns.
- **C.** Seek opportunities to work with regional partners and local initiatives in the southern Central Valley to achieve the strategies above (Section 5.6 Beneficial Partnerships and Collaborative Planning). Conservation planning for wetland habitats at NAS Lemoore should also factor in the likely effects from climate change (Section 5.1.3 Sustainability With a Changing Climate and Regional Growth).

**IV.** Identify and monitor wetland management focus species that can provide insight into habitat health, structure and function, as well as success of targeted enhancement activities.

# 4.4 Management of Flora and Fauna Populations

## 4.4.1 General Management of Flora and Fauna Populations

### Background

In this ecosystem-based INRMP (Section 1.10.1 Ecosystem Management and Section 4.1 Managing with an Ecosystem Approach), a habitat-first approach is taken to plant and wildlife populations. Combining this approach with regional partnerships (scaling up) and the use of indicator or management focus species (scaling down), ensures conservation approaches take place at an appropriate scale. All management must be done in a manner to avoid mission compromise. Continuation of habitat conservation efforts, particularly in areas supporting federally listed or SAR, is considered a key element of the Natural Resources

Management Program. Impact avoidance or minimization measures are enacted whenever practicable. Certain species groups, such as pollinators, have become the focus of special international attention due to their key role in the world supply of food, fiber, and ecosystem biodiversity, and the DoD has established partnerships and a commitment to fund projects or actions for those species and animal groups.

In addition to formally listed species, a variety of lists of Species of Special Concern (SSC) have been created for use by other agencies and organizations. SSC lists have been created by the U.S. Bureau of Land Management, U.S. Forest Service, National Audubon Society, and CDFW to serve as watch lists for species that may require a formal listing. Perhaps the most important is the California Natural Diversity Database (CNDDB) list of special animals.[12] The intent of CNDDB, for the special concern category, was to give consideration to those species lacking legal protection, which may help avert costly recovery efforts that would otherwise be required to save such species (Jennings and Hayes 1994).

Future surveys at NAS Lemoore may lead to the discovery of species previously unknown to the Station, including some that may have special status. A method to house and track such data would provide NAS Lemoore planners a tool useful for management decisions and impact assessment (Section 4.8 Data Integration, Access, and Reporting). Ecosystem-wide management of sensitive resources requires mutual cooperation of regional land managers, regulators and scientific groups, which facilitates regional planning efforts toward common goals (Section 4.1 Managing with an Ecosystem Approach).

## Specific Concerns

- Monitoring to assess trends in wildlife populations and impacts from disturbance or habitat enhancement activities could be incorporated into a monitoring program.
- Incorporation of indicator or management focus species monitoring as a way to discern habitat quality and health would be useful.

## Current Management

The primary goals of plant and wildlife management are to protect and conserve species on NAS Lemoore in compliance with federal laws and regulations, within the confines of the military mission. Other than focusing on select species and their habitats, management is generally accomplished to avoid conflict and ensure smooth operation of the military mission.

Management focus species, such as the federally and state endangered San Joaquin kangaroo rat and the resident population of burrowing owls, are regularly monitored. In addition, NAS Lemoore has developed Cooperative Agreements with local institutions to help better characterize plant and wildlife species present on the Station. For example, California State University Fresno conducted a biotic characterization (flora and fauna surveys focusing on small mammals and grassland birds) of the eastern corridor and boundary of NAS Lemoore. The results of such studies help NAS Lemoore to identify and better manage its species and provide opportunities to work with local partners with similar goals.

## Assessment of Current Management

There is an opportunity to strengthen habitat management and enhancement at NAS Lemoore, targeting healthy, sustainable wildlife populations that use an array of structurally and biologically diverse habitat niches. The goal should be to promote a program that complies with current and accepted scientific practices and is integrated with the overall Natural Resources Management Program. Benefits to NAS

[12] It is important to note that the CNDDB is a tool that can be used as a starting point to gain some insight into what species may be present, but should not be used exclusively. Caution is warranted because the CNDDB is a positive detection database; records exist only where species were detected, which means that there is a bias for locations that have had more survey work completed.

Lemoore personnel, their families, and local residents include opportunities to view, hunt, and experience diverse wildlife species. Habitat management for wildlife support is especially important in the agriculture-dominated landscape of the region.

Regular wildlife population monitoring would allow for trend analysis, identification of habitat use, and whether any increases or declines may be attributed to larger regional trends or more localized disturbances. Remedies for this information gap include continuing focused species surveys (e.g., special status species) in addition to monitoring species that indicate quality and health of specific habitats. Monitoring components can also be built into habitat enhancement activities, providing opportunities to identify positive or negative feedbacks on SAR and management focus species, and to build a foundation for adaptive management. Such knowledge allows natural resources managers to gradually improve conditions for wildlife populations and better reflect their current status and needs in light of other land use proposals at the Station.

## Management Strategy

***Objective:*** *Conserve populations of plants, fish, and wildlife through habitat conservation. Enhance flora and fauna populations when not in conflict with health and safety, or the military mission.*

**I.** Ensure biodiversity conservation in compliance with DoDI 4715.03.

- **A.** Maintain or re-establish viable populations of native species on NAS Lemoore when practical.
- **B.** Manage and monitor resources over sufficiently long time periods to allow for adaptive management and assessment of changing ecosystem dynamics.
- **C.** Make use of the CNDDB[13] to provide managers with important information on sensitive species locations and habitat.
- **D.** Implement management efforts to further the conservation of state-listed species when such action is practicable and does not conflict with legal authority, military mission, or operational capabilities.
- **E.** Ensure that biologically or geographically significant or sensitive natural resources, such as ecosystems or species, are monitored and managed for their protection and long-term sustainability.

**II.** Protect and enhance landscape-level habitat values by adopting and implementing policies which protect larger patch sizes, maintain connectivity and dispersal corridors, and establish buffer zones as compatible with mission requirements.

- **A.** Adopt and implement policies which preserve structural and species biodiversity.
- **B.** Minimize habitat fragmentation and seek opportunities to maintain connectivity with habitats on adjacent properties.
- **C.** Delineate and maintain connectivity between habitat patches to link foraging and nesting areas.

**III.** Increase habitat areas for wildlife by incorporating "pocket" habitat areas and by including unused agricultural parcels. Fence off areas where determined compatible with the military mission.

**IV.** Allow harvesting of plant material if it can be consistent with sustaining plant communities in a healthy and vigorous state, as well as viable wildlife populations.

**V.** Avoid adverse impacts to plant and wildlife populations through project review and NEPA analysis.

[13] It is important to note that the CNDDB is a tool that can be used as a starting point to gain some insight into what species may be present, but should not be used exclusively. Caution is warranted because the CNDDB is a positive detection database; records exist only where species were detected, which means that there is a bias for locations that have had more survey work completed.

**A.** Prior to ground disturbance, a qualified biologist should conduct general surveys to identify potential for sensitive species.

**B.** Locate projects to ensure minimal impacts. Encourage multiple use, to the greatest extent feasible, to provide opportunities for wildlife use of such areas after project completion (Section 5.7.4 Sustainability in the Built Environment, Section 5.8 NEPA Compliance).

**VI.** Continue to seek partnerships with other institutions, organizations, and researchers to study distribution and habitat needs of plant and wildlife populations at NAS Lemoore.

***Objective:*** *Identify focus species to manage for and monitor at regular intervals to assess wildlife trends, provide insight into habitat condition, and to establish management needs and responsibilities.*

**I.** Ensure protection and conservation of management focus species and SAR. Acquire, maintain and update baseline data for these and protected species. Ensure these data are available to meet the Station's planning and management needs.

**A.** Track the species being proposed for listing under the federal ESA.

**B.** Maintain an accurate and complete GIS database of all federally listed species, management focus species and related features.

**II.** Reduce potential conflicts among wildlife populations, consistent with the military mission, by emphasizing management focus species and ensuring healthy habitats.

**A.** Identify and map high-value habitats to ensure ability to make avoidance and minimization recommendations on mission activities and development, in both developed and undeveloped areas on the Station. Use the vegetation classification and mapping protocols that meet national Federal Geographic Data Committee and DoD standards, along with expert knowledge, to derive habitat value maps.

*In California, the CNPS system or the California Vegetation Classification and Mapping Program (Sawyer et al. 2009) for vegetation mapping complies with the national Federal Geographic Data Committee standard and the international standard for quantitative floristic vegetation classification that the DoD has agreed to.*

**III.** Consider habitat management and enhancement options for management focus species.

**A.** Define management objectives and target habitat enhancement and restoration activities in appropriate areas to improve habitat value for native species and assemblages of management interest. Monitor success of enhancement activities relative to a baseline habitat value mapping effort.

**B.** Encourage landscaping with natural resources benefits including native plants that: provide a source of food for wildlife, provide necessary nesting and roosting cover for resident and migratory birds (Section 4.4.5 Birds), and support beneficial pollinators (Section 4.4.3 Pollinators).

**C.** Improve habitat for resident and migratory birds at key water sources consistent with the mission of the Station (Section 4.3.2 Wetlands and Jurisdictional Waters of the U.S.).

**D.** Consider planting hedgerows comprised of native species, which offer food and cover benefits to wildlife, as a buffer between agricultural areas and native vegetation communities in grassland and wetland areas.

**E.** Maintain databases for all management focus species regarding taxonomic and legal status, range wide and NAS Lemoore distribution, inventory techniques and time frames for monitoring and assessment (Section 4.8 Data Integration, Access, and Reporting, Appendix G).

**F.** Encourage planting three trees for every landscaped tree removed during construction projects in the Administration and Housing Areas (Section 5.3 Construction and Facility Maintenance) to

avoid loss of habitat, particularly for migratory birds. Locations for replacements should first be reviewed by the EMD to ensure no conflict with the military mission.

**IV.** Monitor the effectiveness of management activities on management focus species and their habitat.

## 4.4.2 Invertebrates

### Specific Concerns

- The only survey for invertebrates was conducted in 1999 (Tetra Tech, Inc. 1999) and focused on aquatic invertebrates in seasonal pools ("rain-filled depressions") in NRMA 1, NRMA 5, and the Habitat Linkage Corridor.
- It is possible that there may be suitable habitat for the federally threatened Valley elderberry longhorn beetle within NRMAs 1 and 2 (Section 4.5.1 Threatened and Endangered Species and Critical Habitat).

### Current Management

Current management of invertebrate species on NAS Lemoore is accomplished primarily through the protection of their habitat in the NRMAs.

### Assessment of Current Management

Invertebrates as a group have remained relatively unstudied at NAS Lemoore. Future surveys for invertebrates could be used as a metric for the health of management focus habitats (e.g., wetlands) and potentially provide valuable information for adaptive management. Better knowledge of invertebrate presence and habitat use can help direct habitat enhancement activities that favor them.

### Management Strategy

***Objective:*** *Identify and protect the abundance, biomass, and diversity of invertebrate functional groups that reflect health in each habitat and the ecosystem as a whole.*

**I.** Continue efforts to gather knowledge on invertebrate species at NAS Lemoore. Conduct surveys and assessments in representative habitats and locales to determine the health and trend of invertebrate populations in the context of ecosystem health and management.

*Assessments can be conducted in conjunction with botanical surveys; during years when plants are in good condition, it is important to keep in mind that non-detection may not indicate absence as some species exhibit extended superdiapause pupal stages.*

**II.** Identify management focus species and monitor regularly as part of relevant habitat enhancement monitoring activities.

**III.** Ensure good water quality in wetland areas; invertebrates are particularly sensitive to water quality. Determine if management is needed based on monitoring results.

**IV.** Conserve habitat with abundant and diverse invertebrate species to the extent practical. Prevent invasion by non-native annual plant species through focusing management on high quality habitat with abundant native species.

**V.** In appropriate areas, use native plants for habitat enhancement, restoration and landscaping, that favor native invertebrate species, pollinators in particular.

## 4.4.3 Pollinators

### Background

Pollinators have become the focus of special international attention due to their key role in the world supply of food, fiber, and ecosystem biodiversity. The DoD has established partnerships and a commitment to fund projects in this subject area. The DoD is a member of the Pollinator Partnership and the North American Pollinator Protection Campaign.[14] Pollinators include a range of species from various animal groups including invertebrates (i.e., bees, butterflies, moths, beetles, flies), birds (i.e., hummingbirds), and mammals (i.e., bats). Some pollinators are in significant decline across the country and around the world. Nearly 80 percent of the world's crops require pollination and thirty percent of food consumed is the result of pollinator activity.

### Specific Concerns

- Surveys for pollinator presence and abundance at NAS Lemoore are needed. Pollinators are important for agriculture and the cultivation of pollination-dependent crops at NAS Lemoore and in the region, as well as for maintenance of healthy native plant assemblages.
- Improper use of pesticides during landscape and facility maintenance can negatively impact plants and habitats that support pollinators.
- Invasive species (flora and fauna) threaten quality of habitats and plants supporting beneficial pollinators.
- Various long term and regional threats to pollinator populations exist, such as habitat loss/change, erosion, and climate change.
- Landscaped areas at NAS Lemoore present an opportunity to support local pollinators through use of native plant species.
- Plants in ecosystems of management interest at NAS Lemoore may be dependent on local pollinators.

### Current Management

There has not been a baseline survey to identify pollinator species and the beneficial roles they play at NAS Lemoore, both for natural resources and habitats, and the agricultural outlease area. Some agricultural lessees occasionally establish apiaries next to their parcels to pollinate crops; this is allowed so long as it does not conflict with the existing Apiary License. Management for pollinator species is accomplished primarily through the protection and management of associated habitats.

### Assessment of Current Management

There are opportunities to support pollinators in vegetation and habitat management throughout NAS Lemoore. Landscapes in developed areas, the NRMAs, and the agricultural outlease area can all be managed to benefit local pollinators. Restoration and coordination with post-construction and facility maintenance activities also represent opportunities to benefit pollinator species. To ensure success of management actions, a baseline inventory of pollinators present at NAS Lemoore, as well as the plants and assemblages that support them, is important. Such an effort could draw on Station-wide surveys already conducted for birds and bats. Invertebrate pollinators should be surveyed.

The role that pollinators play in sustaining sensitive species and rare plants at NAS Lemoore is also worth further investigation, and may provide opportunities to coordinate and streamline research on both. Researching educational materials on pollinators and distributing information on the DoD's new

[14] Online at: www.dodpollinatorworkshop.com/ and www.pollinator.org.

Pollinator Partnership will assist managers in protecting pollinator species and help to educate NAS Lemoore personnel and residents on their importance.

## Management Strategy

***Objective:*** *Maintain and enhance pollinator populations and their habitat when not in conflict with health and safety, or the military mission.*

**I.** Manage for beneficial pollinators in collaboration with DoD and other agency partners.[15]

**II.** Inventory and monitor pollinator populations. Establish the baseline conditions of pollinators, the plants that depend on them, and the benefits they provide to agricultural production at NAS Lemoore. Investigate opportunities to establish research partnerships through cooperative agreements to accomplish this goal.

**III.** Identify and develop pollinator suitable landscapes.

*Pending further review, examples of areas that could be considered for identification as pollinator suitable include but are not limited to: windbreaks or irrigation ditches in the agricultural outlease area; landscaped areas; and NRMAs.*

- **A.** Identify pollinator suitable landscapes at NAS Lemoore as high value habitats on the ground (as necessary) and in management plans in order to protect them from unnecessary disturbances, including any potential misapplication of pesticides, and to maintain a record of their location for successive habitat enhancement activities and monitoring.
- **B.** Seek opportunities to coordinate with post-construction and facility maintenance activities to establish and promote pollinator-friendly plants and landscapes. Refer to Appendix K for a list of plants that attract pollinators that are appropriate for NAS Lemoore.
- **C.** Consider pollinators to boost restoration work. For example, islands of restored vegetation can be created to function as centers of dispersal for key plants that require pollinators, and they could be made more visible to pollinator animals.
- **D.** Establish pollinator pastures and apiary leases in semi-natural areas not currently managed as NRMAs. Refer to Appendix K for a list of plants that attract pollinators that are appropriate for NAS Lemoore.

**IV.** Develop BMPs to ensure that pollinator species are not adversely impacted by NAS Lemoore activities.

*Important pollinator species for the California Dry Steppe Province, in which NAS Lemoore is located, are identified by the Pollinator Partnership (2013).*

- **A.** Identify key plants that require pollinators at NAS Lemoore, and for which management consideration should be provided, especially for landscape level disturbances.
- **B.** Plant native vegetation contained on the recommended plant list that benefit pollinators in a variety of habitats (in both natural and landscaped areas), also considering intended use of such areas to avoid conflicts.
- **C.** Control the spread of invasive species.
- **D.** Develop and implement a management program that supports bee relocation as opposed to bee eradication in the case of any conflicts.

**V.** Develop and distribute educational materials on pollinators, including a pollinator protection guide for managers specific for NAS Lemoore.

*For examples of other BMPs, refer to resources provided by the NRCS's Plant Materials Program (NRCS website 2013).*

[15] Refer to Pollinator Habitat Restoration for Land Managers website (DoD 2013): www.dodpollinatorworkshop.com/

**VI.** Review existing literature on pollinators.

## 4.4.4 Amphibians and Reptiles

### Specific Concerns

- It is unknown to what degree non-native invasive amphibians may be impacting native amphibians at NAS Lemoore.
- Ability to secure water for wetland habitats on the Station is important for supporting native amphibian species (Section 4.2.2 Water Resources; Section 4.3.2 Wetlands and Jurisdictional Waters of the U.S.).

### Current Management

Amphibians and reptiles are conserved at NAS Lemoore primarily through the protection of their habitat, particularly the NRMAs. Protection of aquatic and wetland habitats is especially important for native amphibians on the Station.

### Assessment of Current Management

In addition to regular monitoring for amphibians and reptiles across the Station, indicator reptile and amphibian species can be monitored as a means to assess overall habitat health and quality, particularly for wetland and other mesic habitats at NAS Lemoore. Wetland habitats in agricultural areas are important to consider; water quality in those areas should be monitored and protected to support reptile and amphibian populations. Healthy and diverse populations of both amphibians and reptiles indicates quality habitat, as well as sufficient prey species supported by those habitats, including invertebrates and small mammals.

Although not a significant concern presently, it would be helpful to investigate to what degree non-native invasive amphibians (e.g., bullfrogs) have on native amphibians in their primary habitats on the Station. Non-native bullfrogs have been known to prey on native amphibians. It may be important to develop a control program for them.

### Management Strategy

***Objective:*** *Inventory and determine the health and trend of amphibian and reptile populations, emphasizing those that may indicate ecological trends or may become federally listed, and control exotic species that threaten this health.*

**I.** Identify management focus species and determine where on the Station they are most likely to occur, based on observations and existence of suitable habitat. Conduct monitoring regularly as part of relevant habitat enhancement monitoring activities.

- **A.** As part of general herpetological surveys, conduct a habitat assessment for federally and state endangered blunt-nosed leopard lizard to determine potential presence.

**II.** Control unnatural predation levels on amphibians and reptiles, particularly management focus species and SAR.

- **A.** Evaluate the impact that non-native amphibians may have on sensitive species. Develop management actions if needed, with a goal to reduce populations of the non-native species (e.g., bullfrog) in areas with sensitive wildlife.
- **B.** Per CNO Policy Letter Preventing Feral Cat and Dog Populations on Navy Property (CNO 10 January 2002), ensure that free roaming pets, including cats, are not allowed in natural areas on NAS

Lemoore. Ensure that feral dogs are removed from and coyotes (Canis latrans) managed in natural areas to avoid unchecked predation on native species (Section 4.7.1 Pest and Predator Control).

III. Conserve reptile and amphibian habitat, particularly in the NRMAs. Focus management on high quality habitat with abundant native species (i.e., herbaceous perennials) to help prevent invasion by non-native annuals to the extent practicable.

IV. Participate in DoD Partners for Amphibian and Reptile Conservation.

## 4.4.5 Birds

### Background

DoD policy states that migratory bird programs shall be established in support of and consistent with the military mission. Two ventures, the Partners in Flight (PIF) and the Riparian Habitat Joint Venture were created to protect songbird populations and conserve habitat to stop their decline. The DoDPIF is a coordinated framework for incorporating migratory bird habitat management efforts into INRMPs (DoDPIF 2002, 2013). DoD's strategy focuses on inventory, on-the-ground management practices, education, and long-term monitoring (DoD 4715.DD-R 1996).

The MBTA is the primary legislation protecting migratory birds; it prohibits the taking or pursuing of migratory birds, their eggs, feathers, or nests. Special guidance and exceptions are included for game species and some nuisance pests. The USFWS is the sole authority on coordinating and supervising all federal migratory bird management activities.

The DoD-USFWS Memorandum of Understanding (MOU) (Federal Register 30 August 2006), developed in response to EO 13186 (2001), addresses the conservation of migratory birds on military lands in relation to all activities except readiness. Its guidance covers all activities at NAS Lemoore, including natural resources management, routine maintenance and construction, industrial activities, and hazardous waste cleanups. It emphasizes interdisciplinary collaboration in the framework of the North American Bird Conservation Initiative Bird Conservation Regions, collaborative inventory and long-term monitoring.

The USFWS provided final ruling on "Migratory Bird Permits: Take of Migratory Birds by the Armed Forces" (50 Code of Federal Regulations Part 21, Federal Register 38 February 2007, pgs. 8931-8950), also known as the Migratory Bird Rule. It authorizes the military to "take" migratory birds during military readiness exercises under the MBTA without a permit, but if the military determines that the activity will significantly affect a population of migratory birds, they must work with the USFWS to implement conservation measures to minimize and/or mitigate the effects (Appendix N).

California PIF guidance (2004) and Riparian Habitat Joint Venture (2004) emphasize large-scale research, monitoring and conservation of habitat for migratory birds that utilize a variety of habitats and spatial scales. Achieving this often requires participation in regional initiatives and partnerships for habitat enhancement.

### Specific Concerns

- There is a need to continue documenting and refining knowledge of avian use on the Station, particularly during the breeding season and in relation to habitat type and use.
- It is possible that there may be potential secondary impacts to birds from poisoning of ground squirrels.
- There is a history of impacts from bird-aircraft collisions, particularly from flocks of white-faced ibis using nearby alfalfa fields, red-tailed hawks, and large kettles of Swainson's hawks during migration (Section 4.7.2 BASH Program).

- Continuing efforts to reduce the impacts of avian nesting on aircraft hangars, antennas, and other key structures is important (Section 4.7.1 Pest and Predator Control).
- A viable population of burrowing owls should be maintained on the Station (Section 4.5.2.2 Burrowing Owl (USFWS BCC, California SSC)).
- Maintenance activities are not covered under NAS Lemoore's depredation permit. The Station should encourage avoidance of maintenance activities in areas with known breeding birds during the breeding season. For example, tricolored blackbirds have been known to breed in the main drainage ditch wetland in the agricultural outlease area (Section 5.3 Construction and Facility Maintenance).

## Current Management

Management for avian species at NAS Lemoore focuses on Station-wide surveys and management activities to reduce BASH concerns near the airfield.

Results of the baseline monitoring and assessment program are used to update and refine the installation's species list. In addition, surveys are conducted on a regular basis, funded by EMD or conducted simultaneously with San Joaquin kangaroo rat monitoring and habitat management activities. As part of the compliance with the Waste Discharge Requirements Monitoring and Reporting Program for NAS Lemoore (Central Valley Water Board 2002a), twice-monthly counts are conducted at the evaporation ponds when laboratory analysis of wastewater indicates the selenium concentration exceeds 2.0 ppb. Protection of avian species outside of mission-related issues is achieved through management of their habitat.

NAS Lemoore has a depredation permit for taking nests built in the aircraft hangars for all species, and migratory birds that pose a direct risk to flight operations and pilot safety. Current management protocol often precludes the need for this permit, however, as nests are removed before egg-laying or post-fledging for MBTA-covered species. Nests of other species, such as the rock pigeon, are removed at any time. Removal of nests of MBTA-covered species is reported to the USFWS.

NAS Lemoore discourages bird use of the evaporation ponds to avoid adverse health impacts from potential contamination issues. In compliance with the Waste Discharge Requirements Order (Central Valley Water Board 2002a, 2002b), water levels are maintained at 2 feet (0.6 m) and above (or kept dry) to discourage wading bird use. Several air cannons stationed around the perimeter of the ponds are used to discourage bird use and nesting; they are used daily during the nesting season from April 1 to July 1.

A Wildlife Hazard Assessment (Lang 2012) was conducted by the USDA Wildlife Services in part to determine the threat that birds pose to training and operational activities at NAS Lemoore. Results from the study will be used to inform BASH activities (Section 4.7.2 BASH Program).

## Assessment of Current Management

With no federally-listed avian species present on the installation,[16] management of avian populations at NAS Lemoore is driven by the MBTA and by protection of key habitats (grasslands, wetlands, and riparian habitat). Military land managers must comply with the MOU between the USFWS and DoD required by EO 13186 for integrating the MBTA into management efforts. Guidance set forth by the Secretary of the Defense offers several tools for how to implement management activities for migratory birds. Among the guidance is the development and maintenance of an installation bird checklist, which

[16] While no California least terns were observed in the most recent surveys undertaken by TDI (2012), this species was included in the previous INRMP species list (Navy 2001b) as having been noted from the property. NAS Lemoore contains no suitable breeding habitat for the species, and individuals would only be found in the area as transients during migration. During these times, the most likely area would be the wastewater treatment facility evaporation ponds in the southeastern portion of the Station, where other tern species have been recorded previously.

NAS Lemoore should continue to refine and improve through more regular bird surveys in all habitats during various times of the year. Priority for monitoring should be placed on protected species and SSC, as identified by the USFWS, CDFW, and other comprehensive bird conservation plans. At NAS Lemoore, management focus and indicator species should also be chosen that can be monitored to provide insight into habitat health and condition (Section 4.1 Managing with an Ecosystem Approach).

The MBTA protects all birds and nests from take, so NAS Lemoore should continue to renew the depredation permit for potential BASH species and nest removal from aircraft hangars and antennas, as necessary. The removal of rock pigeon nests has been found to be effective in controlling the population, as only three to four are removed per hangar compared to former levels of 65-100 per hangar. Reporting of nest removal for MBTA-covered species should continue. Focusing routine maintenance of habitat areas (e.g., mowing) outside of the breeding season will also reduce MBTA-related impacts and concerns. This is particularly important for grassland species, many of which nest on the ground in high grass, and because NAS Lemoore does not possess a depredation permit for routine maintenance and construction activities. Active and passive relocation of burrowing owls, and other species as needed, may also help to reduce potential threats.

Improved baseline information (including nesting, habitat use, etc.) and habitat value maps would improve the Station's ability to analyze impacts when the need arises. Habitat value maps could be translated into BMPs and avoidance/minimization measures under NEPA and project review processes, as well as contribute to the Under Secretary of Defense's intent (Memorandum 03 April 2007) for implementing EO 13186 and promoting conservation of migratory birds. Baseline and monitoring efforts should integrate methods and coordinate with the DoD Coordinated Bird Monitoring Plan (EO 13186, DoD-USFWS MOU, and Under Secretary of Defense Memorandum [2007]). Collection of baseline information also facilitates reporting on any significant population effects to migratory birds (50 Code of Federal Regulations Part 21 - Military Readiness Exemption) and helps to support major bird conservation initiatives where DoD is a partner (EO 13186 "Responsibilities of Federal Agencies to Protect Migratory Birds" and DoD-USFWS MOU).

*Bird strikes during flight training at NAS Lemoore are considered under the Military Readiness Exemption of the Migratory Bird Rule. Monitoring of strikes is conducted as required to demonstrate no significant impact to resident and migratory bird populations (Section 4.7.2 BASH Program; Appendix N).*

Additional areas of avian management should include research components. Water quality should continue to be monitored at the evaporation ponds, a key congregation site during migration for a variety of waterfowl and shorebirds. Collaboration with other researchers to examine secondary impacts from ground squirrel poisoning on the Station could be a potential future research project.

In addition to the above, NAS Lemoore should continue to track the listing status of migratory and resident birds found either at the Station or in the vicinity.

## Management Strategy

***Objective:*** *Protect migratory bird populations by avoiding and minimizing impacts to birds using conservation principles, standards, and practices, as compatible with military mission requirements. Comply with the MBTA, the Migratory Bird Rule, EO 13186, the related DoD-USFWS MOU, and Under Secretary of Defense guidance memorandum.*

**I.** Develop and implement conservation measures for the effects of military readiness activities on migratory birds if there may be a significant adverse impact on a migratory bird population. Continue to monitor bird-aircraft strikes, coordinate with the USFWS, and evaluate actions that may be encouraging bird proximity to the airfield (MBTA-Migratory Bird Rule).

**II.** Comply with the MBTA for non-readiness activities including for incidental and intentional take. Conduct an assessment of non-readiness activities that could impact resident or migratory birds. Minimize such take or obtain a depredation permit for those activities if they pose a threat.

**A.** Implement installation-level BMPs for migratory bird protection based on resources and data available for avoidance and minimization of impacts. Activities covered should include mowing, tree trimming, pesticide application, etc. BMPs could include, but are not limited to replacement or compensation for trees removed through planting a comparable native species to serve as habitat.

*Support for BMPs may be obtained from the DoD PIF-L List Serve (2013).*

**B.** As feasible, avoid activities in areas with known nesting birds during the breeding season to avoid take. If this is not possible, develop BMPs, including that any encounters with active bird nests be reported to the EMD.

**C.** Identify and protect key nesting areas, migration routes, important prey base areas, and concentration for birds of prey by mitigating activities during NEPA Compliance and the site approval process. Consider nesting areas and sensitive wildlife concentration areas.

**D.** A qualified wildlife biologist should conduct surveys for active nests no more than ten days prior to start of a project. Surveys should be conducted in a manner to sufficiently identify any nests around the project site and determine their status. Potential impacts to nesting should be identified prior to the start of construction, and buffers established to minimize impacts to nesting birds. For ground-disturbing projects during Swainson's hawk breeding season, buffers should be maintained around hawk nests until a qualified biologist has determined that the birds have fledged and are no longer reliant on the nest or parental care.

**III.** Continue to discourage nesting and roosting in areas that could present hazards to the mission and to avian species:

**A.** Remove nests in and around the aircraft hangars and report removal all MBTA-protected species nests.

**B.** Discourage nesting and roosting by waterbirds around the evaporation ponds, as specified in the Waste Discharge Requirements Order for NAS Lemoore.

**IV.** Monitor water quality in areas and habitats that attract bird use. Focus on areas with surface water that could be used by birds, including regular testing at the evaporation ponds (per the Waste Discharge Requirements Order for NAS Lemoore). If contaminants are detected, determine if a long-term monitoring and control program is needed.

**A.** Conduct a multi-year focused breeding survey on the impacts from selenium on breeding black-necked stilts and American avocets at the Waste Water Treatment Facility evaporation ponds and at Sunset Lake in NRMA 2.

***Objective:*** *Protect and restore key habitats for migratory and resident birds at NAS Lemoore, concentrating on grassland, wetland, and riparian areas, particularly to benefit the military mission.*

**I.** Implement habitat-based strategies for conservation of migratory birds (EO 13186), particularly priority management focus species.

**A.** Identify and map high-value habitats for management focus birds at NAS Lemoore, to facilitate development of avoidance and minimization measures. Wetland habitat mapping should be consistent with vegetation and hydrologic mapping and classification standards.

**B.** Implement long-term priorities for management and conservation of habitat for NAS Lemoore birds based on habitat value mapping.

**C.** Improvements to existing habitat include, but are not limited to, wetland protection and maintenance, enhancement of buffers (particularly around aquatic and wetland habitats), and control of invasive plant and animal species that crowd out other species necessary to migratory bird survival. Encourage habitat management in the NRMAs (e.g., native grasses for game birds, restoring wetland and riparian areas) to attract birds away from air operations and other sensitive Station areas.

**D.** Promote structural diversity (particularly for wetlands) and volume of the understory (including perennials) in strategic areas to provide cover and habitat for ground and understory species.

**E.** Implement habitat management for burrowing owl populations at NAS Lemoore. Relocate burrowing owls from the Operations Area as feasible. Research removing selected leases from agricultural production to develop compensation habitat for the burrowing owl as part of the long-range plan to reduce potential for BASH (Section 4.5.2.2 Burrowing Owl (USFWS BCC, California SSC)).

**F.** Develop and implement a restoration action plan to prioritize enhancement objectives that benefit resident and migratory birds, particularly management focus birds, using some of the above strategies. Integrate consideration of management focus birds into existing or anticipated habitat enhancement plans.

**II.** Maintain existing and install new raptor nesting platforms in areas away from air operations and other sensitive activities to encourage nesting outside of conflict areas.

**III.** Develop and enhance conservation partnerships to further the work of bird conservation (EO 13186, DoD-USFWS MOU, Under Secretary of Defense Memorandum [2007], and Sikes Act [as amended]).

**A.** Integrate the population goals and objectives of regional conservation plans. Comprehensive migratory bird planning efforts include California and national PIF plans (CalPIF 2000; Riparian Habitat Joint Venture 2004), U.S. National Shorebird Plan (Brown et al. 2001), North American Waterfowl Management Plan (2012), Ducks Unlimited Conservation Plan for North American Waterfowl, among others.

**B.** Coordinate and collaborate with conservation partners focusing on key issues, annual work plans, coordinated monitoring, conservation design, and institutional support in state and federal agencies for bird conservation (North American Bird Conservation Initiative, EO 13186, DoD-USFWS MOU, and Under Secretary of Defense Memorandum [2007]). Attend PIF meetings or other significant bird events. Use information collected from partnership programs to better support DoD mission requirements (Section 5.13 Training of Natural Resources Management Personnel).

*Information sharing and coordinated management contributes to protection of bird species on a large scale, which has been stressed in bird conservation initiatives (Cal-PIF).*

***Objective:*** *Continue to inventory and monitor avian use of NAS Lemoore on a regular basis, focusing on special status and management focus species. Improve knowledge of year-round population trends and distributions to contribute to adaptive management of birds.*

**I.** Set up a baseline and long-term monitoring program for reporting on the status of key avian species and populations at NAS Lemoore. Continue to maintain and update the Station's bird checklist, by season, of birds occurring on NAS Lemoore or in the vicinity.

**II.** Consider establishing survey transects on the Station to gather data on trends of bird distribution and habitat use over time.

III. Integrate methods and coordinate with the DoD Coordinated Bird Monitoring Plan. Report to the national military database DoD Bird Conservation Database the results of bird surveys, research and monitoring, and species accounts.

IV. Conduct a focused breeding bird survey to better assess the distribution and abundance of species breeding at NAS Lemoore.

V. Consider partnering with a local Audubon chapter (e.g., Tulare County Audubon Society) to conduct a Christmas Bird Count at NAS Lemoore.

VI. Conduct ongoing avian surveys in the Administration and Housing Areas of NAS Lemoore.

VII. Continue annual surveys of burrowing owl populations on NAS Lemoore (Section 4.5.2.2 Burrowing Owl (USFWS BCC, California SSC)).

VIII. Comply with the Waste Discharge Requirements Order for NAS Lemoore (Appendix D) regarding bird surveys and management measures at the evaporation ponds.

IX. Develop a raptor monitoring and banding program on the Station, focusing on the state threatened Swainson's hawk, to assess long-term trends of raptor species, breeding populations, and to assist in predicting migratory movements for BASH planning.

   A. Conduct a long-term raptor nesting survey of NAS Lemoore.

X. Monitor effectiveness of bird management practices and adjust management strategies as appropriate.

## 4.4.6 Mammals

### Specific Concerns

- Critical Habitat for the federally endangered Buena Vista Lake shrew (*Sorex ornatus relictus*) is designated on 97 acres (39 ha) 1.25 miles east of the Station (USFWS 02 July 2013). It is possible this species occurs on NAS Lemoore (Section 4.5.1.2 Buena Vista Lake Shrew (Federally Endangered)).

### Current Management

Management of mammals consists primarily of maintaining current population levels through protection of potential habitat and conducting surveys to determine species distribution and abundance during baseline surveys.

### Assessment of Current Management

In addition to regular baseline mammal inventories, regular monitoring of management focus and indicator species is useful to identify trends and habitat use. Species of interest include either native species or introduced species that are influencing habitat and other species groups at NAS Lemoore. Indicator species should be chosen that provide the best insight into health of habitats of interest (e.g., their structure and function).

### Management Strategy

***Objective:*** *Provide for healthy populations of mammals by managing for a diversity of native habitat conditions and ensuring that trade-offs between all military and natural resources projects as they affect native mammals are considered in planning, with emphasis on special status mammals.*

I. Identify management focus species and determine where on NAS Lemoore they are most likely to occur, based on observations and existence of suitable habitat. Conduct regular monitoring as part of relevant habitat enhancement monitoring activities.

II. Continue to conduct regular mammal surveys at NAS Lemoore, including identifying habitat use and preference to manage for those species through habitat management activities.

   A. Determine the presence of Tulare grasshopper mouse, listed as a California SSC and identified in the previous INRMP (Navy 2001b) as present at NAS Lemoore.

   B. Conduct surveys for the federally endangered Buena Vista Lake shrew as discussed in Section 4.5.1.2 Buena Vista Lake Shrew (Federally Endangered).

III. Focus management on high quality habitat with abundant native species and minimize habitat fragmentation.

## 4.4.6.1 Bats

### Specific Concerns

- In the past, bats have been observed roosting in developed areas on NAS Lemoore. The Mexican freetail bat (*Tadarida brasiliensis*) roosts in buildings in the Administration, Housing, and Operations Areas. Western pipistrelles (*Pipistrellus hesperus*) roosted in bat boxes near the hospital until those boxes were removed for construction of a new hospital.

### Current Management

Management of bat populations at NAS Lemoore is primarily achieved through management of habitats and plant communities. NAS Lemoore EMD staff have also constructed and installed bat boxes in strategic locations to encourage bat use of those areas and the Station in general.

### Assessment of Current Management

Threats to bats are generally from intrusion of roost sites and degradation of water sources. Bats currently use NAS Lemoore for both roosting and foraging. As a result, protection of key roosting and foraging sites, water sources and food supply are keys to management of healthy bat populations at NAS Lemoore.

In concert with creating or enhancing bat roosting habitat in other areas of the Station, bat roosting in developed areas should be addressed as needed.

In future mammal or bat inventories and pollinator surveys, it would be helpful to assess bat resource use frequency and location on the Station.

### Management Strategy

***Objective:*** *Maintain and enhance bat populations and their habitat when not in conflict with health and safety, or the military mission.*

I. Identify management focus species and determine where on NAS Lemoore they are most likely to occur, based on observations and existence of suitable habitat. Monitor regularly as part of relevant habitat enhancement monitoring activities.

II. Continue to conduct regular bat surveys at NAS Lemoore, including identifying habitat use and preference to provide benefits to those species through habitat management activities.

III. Conserve and enhance bat habitat.

**A.** Maintain open water areas to ensure availability to bats.

**B.** Increase the amount of bat roosting habitats available, consistent with the military mission. Continue the bat roosting program through installation and maintenance of bat boxes in strategic locations throughout the Station, particularly near wetlands.

**C.** During new developments and retrofits, advocate for facility lighting that has less negative impact on bat habitat, such as night-sky compliant lights and lights focused downward as opposed to broadcast lighting.

**IV.** Address bat roosting in Station buildings as needed.

# 4.5 Special Status Species Protection

## 4.5.1 Threatened and Endangered Species and Critical Habitat

### Background

The ESA was revised via the National Defense Authorization Act of 2004 (PL 108-136) to recognize INRMP conservation measures and species benefit that could obviate the need for critical habitat designation on Navy lands. All Navy installations with federally listed threatened or endangered species, proposed federally listed threatened or endangered species, candidate species,[17] or unoccupied habitat for a federally listed species where critical habitat may be designated, must structure the INRMP to avoid the designation of critical habitat.[18] The INRMP may obviate the need for Critical Habitat if it specifically addresses both the benefit provided to the federally listed species and the provisions made for the long-term conservation of the species. The species benefit must be clearly identifiable in the document and should be referenced as a specific topic in the INRMP table of contents.

The USFWS uses a three-point criteria test to determine if an INRMP provides a benefit to the species. An installation is strongly encouraged to use these USFWS criteria, listed below, when structuring its INRMP to avoid the need for Critical Habitat designation.

1. The Plan[19] provides a conservation benefit to the species and demonstrates the provisions made for long-term conservation of the species. The cumulative benefits of the management activities identified in this INRMP, for the length of the INRMP, must maintain or provide for an increase in a species' population, or the enhancement or restoration of its habitat within the area covered by the plan (i.e., those areas deemed essential to the conservation of the species). A conservation benefit may result from reducing fragmentation of habitat, maintaining or increasing populations, ensuring against catastrophic events, enhancing and restoring habitats, buffering protected areas, or testing and implementing new conservation strategies.
2. The Plan provides certainty that the management plan will be implemented. Persons charged with plan implementation are capable of accomplishing the objectives of the management plan and have adequate funding for the management plan. They have the authority to implement the plan and have

[17] Federal Candidate species are plants and animals for which the USFWS has sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities. Candidate species receive no statutory protection under the ESA. The USFWS encourages cooperative conservation efforts for these species because they are, by definition, a species that may warrant future protection under the ESA (USFWS 2011).

[18] Critical Habitat is defined in Section 3(5)(A) of the ESA as "(i) the specific areas within the geographical area occupied by the species at the time it is listed, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection...upon a determination...that such areas are essential for the survival of the species." The designation of Critical Habitat for a federally listed species is one of several protection measures aimed at aiding recovery of the species and its removal from federal listing. The Navy requires CNO-level review of changes to or proposals for critical habitat per Secretary of the Navy Memorandum 25 November 2002.

[19] "Plan" refers to the INRMP.

obtained all the necessary authorizations or approvals. An implementation schedule, including completed dates, for the conservation effort is provided in the plan.

3. The Plan provides certainty that the conservation effort will be effective. The following criteria will be considered when determining the effectiveness of the conservation effort. The plan includes (a) biological goals (broad guiding principles for the program) and objectives (measurable targets for achieving the goals); (b) quantifiable, scientifically valid parameters that will demonstrate achievement of objectives and standards for these parameters by which progress will be measured are identified; (c) provisions for monitoring and, where appropriate, adaptive management; (d) provisions for reporting progress on implementation (based on compliance with the implementation schedule) and effectiveness (based on evaluation of quantifiable parameters) of the conservation effort are provided; and (e) a duration sufficient to implement the plan and achieve the benefits of its goals and objectives.

## Current Management

The goals and objectives of NAS Lemoore's federally endangered, threatened, and SAR management program are to protect, conserve, and enhance those populations in accordance with all applicable federal and Navy regulations. This is critical to the mission as biodiversity conservation contributes to overall ecosystem integrity and sustainability, which in turn supports the military mission by maintaining natural landscapes for realistic military operations.

Programs to protect endangered, threatened and SAR and their associated habitats are budgeted and supported by NAS Lemoore and Commander, Navy Region Southwest. Management of federally listed threatened and endangered species will continue to be accomplished by managing their habitats and land uses in close coordination with the USFWS and with other appropriate land managers. Any action that may potentially affect (positively or negatively) a federally endangered or threatened species must undergo consultation with the USFWS (Section 5.9 Natural Resources Consultation Planning). NAS Lemoore seeks input from the USFWS to coordinate its management programs as appropriate and required. Informal consultation is undertaken on a case-by-case basis by the NAS Lemoore EMD.

At this time, federally listed species documented at NAS Lemoore include the San Joaquin kangaroo rat, which occurs in NRMA 5, and occasional transients of the California least tern, which were observed at the wastewater treatment evaporation ponds.

Since the last NAS Lemoore INRMP (Navy 2001b), baseline surveys conducted on the Station have not documented the presence of any new federally listed species (TDI 2012). Some focused surveys have been conducted. Current management of potentially suitable habitat for any as yet undocumented federally threatened and endangered species populations at NAS Lemoore is addressed in this INRMP via habitat management strategies. Management for the San Joaquin kangaroo rat population at NAS Lemoore is addressed in the INRMP at both the individual and community level via avoidance, minimization, monitoring and habitat enhancement measures to achieve conservation benefits. Though the Buena Vista Lake shrew and San Joaquin kit fox have not been documented on the Station, this INRMP addresses management for those species considering that there is potential for them to occur: Critical Habitat for the shrew is designated less than two miles east of the Station; kit foxes are highly mobile and potentiall sutiable habitat and prey base may exist in the NRMAs.

## Assessment of Current Management

There is an opportunity to conduct surveys for listed species that have the greatest likelihood of occurring at NAS Lemoore (Section 3.6 Special Status Wildlife). Habitat enhancement monitoring proposed in Section 4.3.1 Vegetation Communities and Habitats also contributes opportunities to detect any previously undocumented listed species on the Station. Such surveys and monitoring are necessary to

identify existing (and periodically or indirectly utilized) habitat for those species, and to assist in the determination as Critical Habitat.

Should any other federally listed species be confirmed on the Station, appropriate management strategies and plans should be developed in consultation with the USFWS. Annual INRMP metric updates will provide a formal means to utilize adaptive management and review progress made for protecting and conserving any federally threatened and endangered species that exist at NAS Lemoore.

Otherwise, habitat management goals and actions described above (Section 4.3.1 Vegetation Communities and Habitats; Section 4.3.2 Wetlands and Jurisdictional Waters of the U.S.)—which incorporate an ecosystem approach (Section 4.1 Managing with an Ecosystem Approach)—benefit native and federally listed species at NAS Lemoore. For example, wetland habitat management provides limited resources for occasionally transient federally endangered California least tern (Section 3.6.1.4 California Least Tern (Federally and State Endangered)).

## Management Strategy

***Objective:*** *Maintain viable populations and facilitate conservation of threatened and endangered species on NAS Lemoore and maintain compliance with ESA requirements.*

**I.** Fully implement requirements of the ESA to ensure that activities in or near federally threatened or endangered species habitats are accomplished in accordance with the ESA.

- **A.** Conduct formal and informal consultations with the USFWS early in the project planning process for all actions which may affect federally listed species.
- **B.** Comply with requirements of species or site-specific consultations and with terms and conditions, and reasonable and prudent measures of Section 7 Consultation BOs.
- **C.** Conduct research surveys as needed prior to any military construction project(s), including as part of NEPA or other environmental review process.
- **D.** Develop an accurate and complete GIS database of all federally listed species, SAR, management focus species and related features at NAS Lemoore.

**II.** Track the status of species being proposed for listing under the federal ESA.

**III.** Continue to survey for federally listed threatened and endangered species potentially occurring at NAS Lemoore as part of regular species surveys.

**IV.** If any federally listed species are confirmed present at NAS Lemoore, appropriate management plans and monitoring activities should be developed for them in consultation with the USFWS, and incorporated into the natural resources management program and the INRMP.

**V.** Implement habitat management approaches described in this INRMP (Section 4.3.1 Vegetation Communities and Habitats, Section 4.3.2 Wetlands and Jurisdictional Waters of the U.S.), which benefit native and federally listed species.

- **A.** As they are developed and needed, integrate species-specific management actions/plans into general habitat management plans for NAS Lemoore.
- **B.** Protect areas of potential habitat for federally listed species from disturbance. Avoid pesticide application in these areas.

**VI.** Seek opportunities to develop partnerships with institutions, organizations, and other researchers to develop and improve knowledge and management of federally listed species at NAS Lemoore and to contribute to regional initiatives for those species.

### 4.5.1.1 San Joaquin Kangaroo Rat (Federally and State Endangered)

#### Specific Concerns

- NAS Lemoore is currently conducting habitat management for the San Joaquin kangaroo rat in NRMA 5 without a USFWS BO for such activities.
- The San Joaquin kangaroo rat population in NRMA 5 has fluctuated over the last 20 years, but has trended downward during that time period.

#### Current Management

Studies conducted by the Endangered Species Recovery Program from 1995 to 1998 contributed to development and implementation of several management practices to benefit the San Joaquin kangaroo rat in NRMA 5. It included recommendations for prescribed burning and removing or modifying fence posts around NRMA 5 that served as raptor perches (a recommendation included in the previous INRMP [Navy 2001b]). Smallwood and Morrison began monitoring the San Joaquin kangaroo rat at NAS Lemoore in the fall of 2000 and starting in 2001 began experimenting with vegetation and soil treatments to determine the most favorable habitat for the species in an effort to promote its expansion within NRMA 5.

Over the following ten years efforts have been made to loosen soil, clear vegetation, and plant desired shrub species in coordination with monitoring of vegetation and the San Joaquin kangaroo rat population. Generally, the goals continue to be: (1) to learn which vegetation and soil conditions support the San Joaquin kangaroo rat, and (2) to expand the population across a much larger extent of NRMA 5. Management strategies continue to include vegetation clearing, soil treatments, and seeding. The last prescribed burn for habitat management in NRMA 5 was conducted in 2010 (NAS Lemoore 2010); they have been suspended until consultation with the USFWS can be re-initiated.

In 2003, Smallwood and Morrison developed a NAS Lemoore kangaroo rat management plan based on these goals; it tests and evaluates habitat treatments in an effort to adaptively develop the management program to provide the most benefit to the kangaroo rats in NRMA 5 (Morrison and Smallwood 2003a). Results of treatments in NRMA 5 are used in conjunction with results of other studies conducted on a satellite kangaroo rat population at Highway 41 and Jackson Avenue south of the City of Lemoore to gain the most insight into habitat needs and preferences of this species.

NAS Lemoore has been conducting habitat management in NRMA 5 in the absence of a USFWS BO for the San Joaquin kangaroo rat. Though, such actions contribute in part to the downlisting criteria outlined by the USFWS (2010g; refer to Section 3.6.1.5 San Joaquin Kangaroo Rat (Federally and State Endangered)). Until a formal consultation can be initiated on an updated NAS Lemoore kangaroo rat management plan, NAS Lemoore has been requesting USFWS input for habitat management activities in NRMA 5 on a project-by-project basis (Navy 2010a). In addition, twice yearly kangaroo rat population assessments and any results of habitat management activities in NRMA 5 have been submitted as annual reports to the USFWS (e.g., Smallwood and Morrison 2011). Habitat conditions and characteristics necessary for supporting populations of the San Joaquin kangaroo rat, as identified by the USFWS, are presented in Appendix G and Appendix L.

It had been suggested previously (Navy 2001b) that management of the Habitat Linkage Corridor leading from NRMA 5 to NRMAs 1, 2, and 6 might be used by the kangaroo rat and could promote migration of the species to those habitats in the northeast of NAS Lemoore. However, no kangaroo rats have ever been observed in it. Management of this corridor linkage for such a purpose is no longer an objective.

To prevent conflict with the Agricultural Outlease Program at NAS Lemoore, ground squirrel bait stations installed on agricultural parcels near NRMA 5 are constructed in such a way to prevent San Joaquin kangaroo rat use,[20] as mandated in the Soil and Water Conservation Plan of the agricultural outlease agreement.

## Assessment of Current Management

The San Joaquin kangaroo rat population within NRMA 5 has fluctuated over the last twenty years (Section 3.6.1.5 San Joaquin Kangaroo Rat (Federally and State Endangered)). The overall decline of the species in NRMA 5 has revealed significant vulnerabilities that the species faces, including insufficient soil/vegetation disturbance and lack of redundancy in occupancy of habitat patches.

Because NRMA 5 is the only known location where San Joaquin kangaroo rats remain within NAS Lemoore, and because it is one of only two sites known to support this taxonomic unit, any military operations expanding into NRMA 5 could threaten the remaining population of San Joaquin kangaroo rat. Significant expansion of military operations could prevent habitat expansions that might be needed to ensure the continued existence of this species.

Uncertainties bearing on management include the number of individuals remaining in NRMA 5 (the population is estimated by counting burrows), if the species currently occurs anywhere else within NAS Lemoore, and whether additional populations occur elsewhere other than the known population at Highway 41 and Jackson Avenue. Another uncertainty is the suite of relationships between San Joaquin kangaroo rats and specific plant species and physiographic conditions. The challenge is to identify whether the current environment can be managed to sustain the San Joaquin kangaroo rat (Morrison and Smallwood 2003a; Smallwood and Morrison 2011).

The overall goal for management of the San Joaquin kangaroo rat at NAS Lemoore is to provide suitable habitat in NRMA 5 and to encourage the species' increase and expansion there. Smallwood and Morrison (2011) maintain that habitat management is important to conserve this species, and has become even more important as the population size in NRMA 5 has declined. Experimental treatments are designed toward this end and to allow managers to better understand kangaroo rat relationship with its current habitat and its response to treatments. Smallwood and Morrison (2011) suggest that the soils need to be disturbed in a manner that replicates the conditions of the motocross track when it was still active, in addition to continuing prescribed burns to reduce thick vegetative cover.[21] Management strategies should continue to be adapted as needed, and continued monitoring is essential.

For example, a limited grazing program within NRMA 5 could provide benefits to the kangaroo rat by reducing thatch and providing and maintaining its preferred open space. Other grazing studies being conducted for kangaroo rats and native species include:

- The CDFW is working on a contract to begin grazing in the Kerman Ecological Reserve (USFWS 2010f).
- Research is currently underway in the Lokern area to measure the effects of livestock grazing (cattle) on species of plants and animals at risk of extinction in the San Joaquin Valley (Germano et al. 2006, 2007 as cited in USFWS 2010g).

[20] The use of bait stations are a common practice in the Central Valley; agricultural lessees at NAS Lemoore are permitted to use them to prevent ground squirrel predation on crops. In spring of 2007, ground squirrels numbered in the thousands within NRMA 5. At that time the squirrels had raided adjacent crops up to 400 m from the boundary of NRMA 5. Agricultural lessees were permitted to install ground squirrel bait stations in an effort to protect their crops. By that time, however, the lack of new plant growth in NRMA 5 (due to drought) contributed to the reduction of the ground squirrel population. The bait stations most likely had a smaller contribution to this decline.

[21] Smallwood and Morrison (2011) observe that the off-road vehicle disturbance at NRMA 5 appears to have been critical to the San Joaquin kangaroo rat's persistence by loosening the otherwise increasingly compacted soils, and by clearing vegetation from the motocross tracks.

- Carrizo Plain National Monument is using replicated plots to examine how to optimize conservation of the giant kangaroo rat (*Dipodomys ingens*) by managing cattle grazing and plant composition (Prugh and Brashares 2010).
- The federally endangered Stephens' kangaroo (*Dipodomys stephensi*) rat at Lake Mathews/Estelle Mountain Ecological Reserve is the subject of a grazing experiment using sheep (Shomo 2011; Riverside County Habitat Conservation Agency 2007).
- Cattle grazing and habitat manipulation at Naval Weapons Station Detachment Fallbrook are being conducted to benefit the federally endangered Stephens' kangaroo rat (Smith 2010).

Additional actions that could benefit the San Joaquin kangaroo rat in NRMA 5 include trash removal and perimeter fence repair. While removal of some of the raptor nesting and perching poles near NRMA 5 may have benefited kangaroo rats, predation threat from diurnal raptors that would use such poles is not a significant concern. Raptor feeding usually occurs during the day while San Joaquin kangaroo rat activity is primarily nocturnal. Owl predation on the kangaroo rats is unknown.

In March 2013, the USFWS (2013) published a protocol survey methodology for the San Joaquin kangaroo rat (which includes its subspecies). This methodology will be used in future surveys of the San Joaquin kangaroo rat in NRMA 5 at NAS Lemoore.

## Management Strategy

***Objective:*** *Provide support for and take actions favoring San Joaquin kangaroo rat conservation and/or downlisting by the USFWS. Provide a conservation benefit to the San Joaquin kangaroo rat by providing certainty that the Plan will be implemented and ensuring that it will be effective, including continuation of monitoring activities.*

**I.** The Plan provides a conservation benefit to the species.

**A.** Until an updated management plan for the San Joaquin kangaroo rat is developed in consultation with the USFWS, continue to manage kangaroo rat habitat in NRMA 5 in accordance with the current Kangaroo Rat Management Plan (Morrison and Smallwood 2003a); during this time, continue to request input from the USFWS for adaptive management on a project-by-project basis, in order to contribute to the recovery of the species. Section 3.6.1.5 San Joaquin Kangaroo Rat (Federally and State Endangered) provides more information on the history of San Joaquin kangaroo rat at NAS Lemoore.

1. Enhance San Joaquin kangaroo rat habitat in NRMA 5 by reducing ground-level cover and increasing site productivity, thereby increasing the distribution and abundance of kangaroo rats. This includes, but is not limited to removing exotic plant species, providing suitably disturbed soils, and increasing plant species that provide food and cover. Tools to achieve this include soil treatments, seeding and other vegetation clearing activities. Prescribed burns are also a useful tool, but should be conducted after consultation with the USFWS.

**B.** Develop a combined management plan focused on management of both NRMA 5 and NRMA 3. Development of such a plan would allow for additional analysis of habitat needs and management strategies for the San Joaquin kangaroo rat in NRMA 5 and an opportunity to update the current Kangaroo Rat Management Plan. Appropriate objectives and strategies from the current Kangaroo Rat Management Plan (Morrison and Smallwood 2003a) would be folded into the new plan.

1. Initiate consultation with the USFWS and the CDFW on the combined management plan for both management of western spadefoot toad (NRMA 3) and San Joaquin kangaroo rat (NRMA 5) habitat. Determine additional management actions necessary to be implemented within the timeframe of this INRMP.

a. As part of the consultation, seek to include activities to repair the NRMA 5 fence where needed, remove a dumpster and double-wide trailer frame, and remove trash from NRMA 5.

**C.** Implement avoidance and impact minimization measures to reduce conflicts, if any, with the San Joaquin kangaroo rat and its habitat, as compatible with mission requirements.

1. Continue to ensure that agricultural lessees comply with the Central Valley Water Board restrictions on agricultural runoff, since runoff from adjacent fields could potentially impact NRMA 5.
2. Eliminate disking of road edges adjacent to NRMA 5.
3. Investigate possible impacts that ground squirrel bait stations may be having on San Joaquin kangaroo rats. The USFWS has identified the following vertebrate control agents as detrimental to the existence of kangaroo rats: aluminum phosphide, magnesium phosphide, chlorophacinone, potassium nitrate, sodium nitrate, and zinc phosphide (USFWS 1993 as cited in USFWS 2010f).
4. Establish and maintain a buffer around potential burrows during ground-disturbing activities.

**D.** Participate with recovery planning and other regional planning initiatives to help stabilize San Joaquin kangaroo rat populations.

1. Investigate the possibility of piloting a limited grazing program in NRMA 5 to benefit the San Joaquin kangaroo rat. Collaboration with important partners in the area (e.g., CDFW at Kerman Ecological Reserve) implementing a similar program would be important in order to incorporate their experiences and lessons learned.

**II.** The Plan provides certainty that the management plan will be implemented.

**A.** All project and activity proposals are summarized in an implementation table in Appendix A, including completion dates. They are all assigned the highest priority possible for funding, meaning that there is a compliance responsibility that cannot wait another year (DoDI 4715.03).

**B.** There are sufficient numbers of professionally trained natural resources management staff available to manage NAS Lemoore ecosystems and habitats for the benefit of the San Joaquin kangaroo rat (Section 5.13 Training of Natural Resources Management Personnel). In addition, the Station maintains relationships with local natural resources experts, who regularly provide input for natural resources management actions and programs.

**C.** INRMP updates, review and coordination with other departments and agencies (including USFWS and CDFW) occur on an annual basis. This includes documenting INRMP natural resources management actions and project progress in annual reports sent to the agencies.

**D.** Until an updated management plan for the San Joaquin kangaroo rat is developed in consultation with the USFWS, continue to request USFWS input for habitat management activities for the San Joaquin kangaroo rat in NRMA 5 on a project-by-project basis (e.g., Navy 2010a)

**III.** The Plan provides certainty that the conservation effort will be effective.

**A.** Goals, measurable parameters, monitoring and reporting mechanisms described in the current NAS Lemoore Kangaroo Rat Management Plan (Morrison and Smallwood 2003a) should be applied until other content is developed and incorporated into the future Kangaroo Rat Management Plan for NAS Lemoore (in consultation with the USFWS). These goals and mechanisms are updated as needed based on annual species reports (e.g., Smallwood and Morrison 2011).

**B.** Encourage expansion of the existing population of kangaroo rats from core population clusters to other/outer areas within NRMA 5 via habitat management practices embodied in the current NAS

Lemoore Kangaroo Rat Management Plan (Morrison and Smallwood 2003a), and the future management plan to be developed in consultation with the USFWS.

1. Continue to use this process as a way to understand habitat requirements/preferences and to adjust the kangaroo rat management in NRMA 5 accordingly (adaptive management).
2. Continue to conduct vegetation and soil monitoring/sampling in NRMA 5 to assess treatment impacts and success.

**C.** Continue monitoring and conducting population assessments of San Joaquin kangaroo rats in NRMA 5 at least twice per year. Employ the USFWS protocol survey methodology published in March 2013 (USFWS 2013). Continue to send population assessment and NRMA 5 vegetation monitoring results to the USFWS as part of annual reports (e.g., Smallwood and Morrison 2011).

1. Compare and aggregate monitoring data from NRMA 5 with data from other satellite populations that have been studied to better understand the needs of the species.
2. Adapt the monitoring and management program of the kangaroo rat at NAS Lemoore to comply with the BO that is issued as a result of consultation on the to-be-developed combined management plan for NRMA 3 and NRMA 5.

**D.** Continue to monitor for the possible presence of San Joaquin kangaroo rats outside of NRMA 5 in other habitats at NAS Lemoore, as part of regular species and habitat surveys. If such observations are confirmed, appropriate management actions shall be developed for those individuals and area(s) in consultation with the USFWS.

**IV.** Quantifiable parameters for demonstrating achievement of federally listed species objectives include: the size of the kangaroo rat population at NAS Lemoore; percent area of NRMA 5 used as habitat by the kangaroo rat and the quality of that habitat; and others as appropriate.

**A.** Monitor trend in condition of habitat that supports or could support the San Joaquin kangaroo rat through the current NAS Lemoore Kangaroo Rat Management Plan and a future updated management plan focused on combined management of both NRMA 3 and NRMA 5.

**B.** Progress on implementation will be documented over time by updated assessment of habitat value, disturbance, disturbance recovery, and species population status. This information shall be maintained in a GIS database for evaluation.

1. Apply success criteria included in the current NAS Lemoore Kangaroo Rat Management Plan (until it is updated), which targets expansion and persistence of kangaroo rat occupancy in NRMA 5.
2. Continue to monitor (Morrison and Smallwood 2003a): San Joaquin kangaroo rat relative population levels in NRMA 5; the area of suitable habitat created by habitat management activities; the area of newly occupied or recently discovered habitat that is managed for the kangaroo rat; and the persistence of that occupancy.

### 4.5.1.2 Buena Vista Lake Shrew (Federally Endangered)

#### Specific Concerns

- The USFWS has designated Critical Habitat for the Buena Vista Lake shrew in the Lemoore Wetland Reserve Unit, which encompasses 97 acres (39 ha) and is located approximately 1.25 miles east of NAS Lemoore between Highway 198 and Idaho Avenue (USFWS 02 July 2013). The shrew was documented there in April 2005 and the location is considered the northernmost occurrence of the species (USFWS 10 July 2012) (Section 3.6.1.6 Buena Vista Lake Shrew (Federally Endangered)).

- The most recent surveys at NAS Lemoore did not observe any Buena Vista Lake shrews. Although the effort to install pitfall traps was greater than the effort towards conventional small mammal trapping, this effort was regarded as minimal and the negative findings unconvincing that shrews are not present. The study concluded that either a larger effort or a more cost-effective trapping method would be needed to detect shrews at NAS Lemoore (TDI 2012).

## Current Management

The federal listing and existence of suitable habitat at NAS Lemoore for the Buena Vista Lake shrew requires that the Navy consider it as a management focus species and support surveys and other conservation measures, as applicable, for the protection and maintenance of its populations.

Currently, management for potentially present individuals and populations of the shrew is achieved through management of habitat and resources on the Station (Section 4.3 Management of Vegetation Communities and Habitats). Habitat management and enhancement activities proposed in this INRMP would improve the natural condition of native habitats at NAS Lemoore that could support the species.

Habitat conditions and characteristics necessary for supporting populations of Buena Vista Lake shrew, as identified by the USFWS, are presented in Appendix G and Appendix L.

## Assessment of Current Management

Focused surveys for the Buena Vista Lake shrew should be conducted at NAS Lemoore along with identifying, managing and monitoring habitats on the Station that could support the species. If the shrew is present, the USFWS should be consulted to develop an appropriate management plan for the species at the Station.

## Management Strategy

***Objective:*** *Determine the presence of federally endangered Buena Vista Lake shrew at NAS Lemoore. Protect the habitat and existing populations of this species if discovered at NAS Lemoore, and contribute to the species' conservation and/or downlisting by the USFWS.*

**I.** The Plan provides a conservation benefit to the species.

- **A.** Conduct a focused survey for the federally endangered Buena Vista Lake shrew at NAS Lemoore. If present, develop a management plan for the species and its habitat on the Station in consultation with the USFWS. Integrate the plan into ongoing and proposed habitat management actions and plans and the INRMP.
- **B.** Continue to manage and maintain existing upland and wetland habitats favorable to native species where they currently exist in the NRMAs and other potentially suitable areas of the Station. Management should be conducted as part of vegetation community and habitat management described above (Section 4.3.1 Vegetation Communities and Habitats).
- **C.** If present, implement avoidance and impact minimization measures to reduce conflicts, if any, with important habitat characteristics and conditions for the shrew that may exist at NAS Lemoore, consistent with mission requirements (Appendix G and Appendix L).
- **D.** If present, participate with recovery planning and other regional planning initiatives to help promote stability of habitat and thus populations of the species, as practicable.

**II.** The Plan provides certainty that the management plan will be implemented.

**A.** All project and activity proposals are summarized in an implementation table in Appendix A, including completion dates. They are all assigned the highest priority possible for funding, meaning that there is a compliance responsibility that cannot wait another year (DoDI 4715.03).

**B.** There are sufficient numbers of professionally trained natural resources management staff available to manage NAS Lemoore ecosystems and habitats for the benefit of federally listed species potentially occurring on the Station (Section 5.13 Training of Natural Resources Management Personnel). In addition, the Station maintains relationships with local natural resources experts, who occasionally provide input for natural resources management actions and programs.

**C.** INRMP updates, review and coordination with other departments and agencies (including USFWS and CDFW) occur on an annual basis. This includes documenting INRMP natural resources management actions and project progress in annual reports sent to the agencies.

**D.** Continue to seek USFWS input in developing and implementing projects and/or habitat enhancement activities that may affect habitats or populations of the Buena Vista Lake shrew if confirmed as present on the Station.

**III.** The Plan provides certainty that the conservation effort will be effective.

**A.** Develop and implement appropriate short-term and long-term goals and objectives to benefit and avoid harm to existing populations and important habitat elements of the Buena Vista Lake shrew to the extent that they exist at NAS Lemoore.

**B.** Monitor implementation of activities and adjust as needed based on results, using adaptive management principles.

### 4.5.1.3 San Joaquin Kit Fox (Federally Endangered and State Threatened)

#### Specific Concerns

- Surveys specifically focusing on the presence or absence of the San Joaquin kit fox at NAS Lemoore have not been conducted. Given that individuals are highly mobile and potentially suitable habitat and prey base may exist in the NRMAs, it is possible they may visit the Station to forage or use burrows.
- Critical Habitat for the San Joaquin kit fox has not been designated.

#### Current Management

The federal listing and existence of suitable habitat at NAS Lemoore for the San Joaquin kit fox requires that the Navy consider it as a management focus species and support surveys and other conservation measures, as applicable, for the protection and maintenance of its populations.

Currently, management for potentially present kit fox individuals and populations is achieved through management of habitat and resources on the Station (Section 4.3 Management of Vegetation Communities and Habitats). Habitat management and enhancement activities proposed in this INRMP would improve the natural condition of native habitats at NAS Lemoore that could support the species.

Habitat conditions and characteristics necessary for supporting individuals or populations of San Joaquin kit fox are described in Appendix G.

#### Assessment of Current Management

Focused surveys for the San Joaquin kit fox should be conducted at NAS Lemoore along with identifying, managing and monitoring habitats on the Station that could support the species. If the kit fox is present, the USFWS should be consulted to develop an appropriate management plan for the species at the Station.

## Management Strategy

***Objective:*** *Determine the presence of federally endangered and state threatened San Joaquin kit fox at NAS Lemoore. Protect the habitat and existing populations of this species if discovered at NAS Lemoore, and contribute to the species' conservation and/or downlisting by the USFWS.*

**I.** The Plan provides a conservation benefit to the species.

- **A.** Conduct a focused survey for the federally endangered and state threatened San Joaquin kit fox at NAS Lemoore. If present, develop a management plan for the species and its habitat on the Station in consultation with the USFWS. Integrate the plan into ongoing and proposed habitat management actions and plans and the INRMP.
- **B.** Continue to manage and maintain existing upland and wetland habitats favorable to native species where they currently exist in the NRMAs and other potentially suitable areas of the Station. Management should be conducted as part of vegetation community and habitat management described above (Section 4.3.1 Vegetation Communities and Habitats).
- **C.** If present, implement avoidance and impact minimization measures to reduce conflicts, if any, with important habitat characteristics and conditions for the kit fox that may exist at NAS Lemoore, consistent with mission requirements (Appendix G and Appendix L).
  1. In the event that occupied San Joaquin kit fox burrows are identified on NAS Lemoore, exclusion buffers will be established and maintained around them during ground disturbing activities.
- **D.** If present, participate with recovery planning and other regional planning initiatives to help promote stability of habitat and thus populations of the species, as practicable.

**II.** The Plan provides certainty that the management plan will be implemented.

- **A.** All project and activity proposals are summarized in an implementation table in Appendix A, including completion dates. They are all assigned the highest priority possible for funding, meaning that there is a compliance responsibility that cannot wait another year (DoDI 4715.03).
- **B.** There are sufficient numbers of professionally trained natural resources management staff available to manage NAS Lemoore ecosystems and habitats for the benefit of federally listed species potentially occurring on the Station (Section 5.13 Training of Natural Resources Management Personnel). In addition, the Station maintains relationships with local natural resources experts, who occasionally provide input for natural resources management actions and programs.
- **C.** INRMP updates, review and coordination with other departments and agencies (including USFWS and CDFW) occur on an annual basis. This includes documenting INRMP natural resources management actions and project progress in annual reports sent to the agencies.
- **D.** Continue to seek USFWS input in developing and implementing projects and/or habitat enhancement activities that may affect habitats or populations of the San Joaquin kit fox if confirmed as present on the Station.

**III.** The Plan provides certainty that the conservation effort will be effective.

- **A.** Develop and implement appropriate short-term and long-term goals and objectives to benefit and avoid harm to existing populations and important habitat elements of the San Joaquin kit fox to the extent that they exist at NAS Lemoore.
- **B.** Monitor implementation of activities and adjust as needed based on results, using adaptive management principles.

### 4.5.1.4 Other Federally Listed Species Potentially Present at NAS Lemoore

#### Specific Concerns

- There are elderberry shrubs along the perimeter fence in NRMAs 1, 2, and 6, some which could provide habitat for federally threatened valley elderberry longhorn beetle (generally elderberry shrubs larger than two inches in diameter). In particular, there are large elderberry bushes that would provide suitable habitat for the beetle along the Boggs Slough adjacent to the northeast boundary of NAS Lemoore. It is possible that beetles could migrate on to the Station.
- The federally endangered California least tern has been observed on one occasion (Navy 2001b) to use wetland habitats at NAS Lemoore during its migration through the area. There is no suitable breeding habitat for the species at NAS Lemoore.
- Other federally listed species historically known to occur in the southern Central Valley may use NAS Lemoore habitats and resources, though they have not been observed on the Station to date. These include blunt-nosed leopard lizard, giant garter snake and California tiger salamander among others.

#### Current Management

Their federal listing and existence of potential habitat at NAS Lemoore requires that the Navy consider these species as management focus species and support surveys and other conservation measures, as applicable, for the protection and maintenance of these populations.

Currently, management for potentially present individuals and populations of these species is achieved through management of habitat and resources on the Station (Section 4.3 Management of Vegetation Communities and Habitats). Habitat management and enhancement activities proposed in this INRMP would improve the native and natural condition of native habitats at NAS Lemoore that could support such species.

As identified by the USFWS, habitat conditions and characteristics necessary for supporting populations of federally listed species potentially present on the Station and for which Critical Habitat has been designated, are presented in Appendix G and Appendix L.

#### Assessment of Current Management

Surveys for federally listed species should continue to be included as part of baseline surveys and habitat enhancement monitoring. Identifying suitable habitats for such species is important, even though the species may not be documented there. Surveys should focus on those areas with potential habitat. If any are present, the USFWS should be consulted to develop an appropriate management plan for the species at the Station.

Identifying suitable habitat and/or presence of federally listed species at NAS Lemoore allows natural resources and Station managers to plan natural resources activities accordingly to obviate the need for Critical Habitat designation on the installation and to protect the military mission.

Any projects or actions proposed in areas with potentially suitable habitat for federally listed species should program for species-specific surveys.

## Management Strategy

***Objective:*** *Determine the presence of federally listed species that could be supported at NAS Lemoore. Protect the habitat and existing populations of species discovered at or known to migrate through NAS Lemoore, and contribute to their conservation and/or downlisting by the USFWS.*

**I.** The Plan provides a conservation benefit to the species.

- **A.** Continue to conduct surveys for federally listed species potentially present at the Station as part of baseline surveys and habitat enhancement monitoring. If present, develop a management plan for relevant species and habitat in consultation with the USFWS. Integrate the plan into ongoing and proposed habitat management actions and plans and the INRMP.
  1. As part of general herpetological surveys, conduct a habitat assessment for federally and state endangered blunt-nosed leopard lizard to determine potential presence.
- **B.** Continue to manage and maintain existing upland and wetland habitats favorable to native species in all six NRMAs as part of vegetation community and habitat enhancement described above (Section 4.3.1 Vegetation Communities and Habitats). The INRMP's ecosystem management approach benefits federally listed species potentially present by conserving the resources and ecological processes that support them.
- **C.** Consistent with mission requirements, implement avoidance and impact minimization measures to reduce conflicts, if any, with important habitat characteristics and conditions for these species that may exist at NAS Lemoore (Appendix G and Appendix L).
  1. In the event that a federally listed bird species is discovered nesting at NAS Lemoore, establish buffers around active nests and plan ground disturbing activities around their migration window.[22]
- **D.** If present, participate with recovery planning and other regional planning initiatives to help promote stability of habitat and thus populations of the species.

**II.** The Plan provides certainty that the management plan will be implemented.

- **A.** All project and activity proposals are summarized in an implementation table in Appendix A, including completion dates. They are all assigned the highest priority possible for funding, meaning that there is a compliance responsibility that cannot wait another year (DoDI 4715.03).
- **B.** Ensure there are sufficient numbers of professionally trained natural resources management staff available to manage NAS Lemoore ecosystems and habitats for the benefit of federally listed species potentially occurring on the Station (Section 5.13 Training of Natural Resources Management Personnel). In addition, the Station should maintain relationships with local natural resources experts, who occasionally provide input for natural resources management actions and programs.
- **C.** INRMP updates, review and coordination with other departments and agencies (including the USFWS and CDFW), occur on an annual basis. This includes documenting INRMP natural resources management actions and project progress in annual reports sent to the agencies.
- **D.** Consult with USFWS in developing and implementing projects and/or habitat enhancement activities that may affect habitats or populations of federally listed species if confirmed as present on the Station.

**III.** The Plan provides certainty that the conservation effort will be effective.

[22] The California least tern is migratory with no suitable breeding habitat at NAS Lemoore, and so nesting of this species on the Station is unlikely.

**A.** Develop appropriate short-term and long-term goals and objectives to benefit and avoid harm to existing populations and important habitat elements of potentially present federally listed species to the extent that they exist at NAS Lemoore.

**B.** Monitor implementation of activities and adjust as needed based on results, using adaptive management principles.

## 4.5.2 Other Special Status Species

### Background

A variety of lists of special status species serve as watch lists for species that are worthy of conservation effort and may be potentially deserving of formal listing. These species are used as the basis of conservation and management efforts across the country in an effort to prevent them from needing formal protection under the ESA. Those lists used in this INRMP are described in Section 3.6.2 Other Special Status Species.

All special status species can be found in the CNDDB. The CNDDB, now over 20 years old, is a highly valuable repository of rare plant and animal information maintained by the Habitat Conservation Division of the CDFW. The primary function of CNDDB is to gather and disseminate data on the status and locations of rare and endangered plants, animals, and vegetation types. Its goal is to provide the most current information available on the state's most imperiled elements of natural diversity and to provide tools to analyze these data.[23] For the special concern category, the intent of CNDDB is to give consideration to those species lacking legal protection, which may help avert costly recovery efforts that would otherwise be required to save such species (Jennings and Hayes 1994).

*Special status invertebrate species are not listed in the CNDDB. Very little work has been conducted on most invertebrate species; thus, little is known of their abundance, distribution, or in some cases, their status as a species. Taxonomy changes occur on a regular basis for those species or groups being investigated. Invertebrates are only protected federally under the ESA.*

Of the special status species that have been documented at NAS Lemoore (Section 3.6.2 Other Special Status Species), the burrowing owl and the Swainson's hawk (which both nest on the Station), as well as the western spadefoot toad are discussed in further detail below. Management of all other special status species is addressed here.

### Specific Concerns

- The greater sandhill crane and the willow flycatcher (likely the little willow flycatcher) have been observed at NAS Lemoore. Both are state listed (Threatened and Endangered, respectively), though neither is likely to breed at the Station. The greater sandhill crane's most common habitat association is with flooded fields of corn, wheat and other grain crops in its Central Valley wintering grounds.
- Other than the San Joaquin kangaroo rat and nesting burrowing owl population on the Station, special status species are not monitored individually at NAS Lemoore. Lack of monitoring prevents application of population data to infer habitat health, and use by wildlife.

### Current Management

NAS Lemoore is required to manage for species warranting stewardship, as the DoD recognizes the value of maintaining diverse ecosystems. DoDI 4715.03 states that the DoD shall, to the best of its ability, implement

[23] It is important to note that the CNDDB is a tool that can be used as a starting point to gain some insight into what species may be present, but should not be used exclusively. Caution is warranted because the CNDDB is a positive detection database; records exist only where species were detected, which means that there is a bias for locations that have had more survey work completed.

conservation and management efforts to further the conservation of state-listed species when such action is practicable and does not conflict with legal authority, military mission, or operational capabilities.

All special status species are currently monitored during baseline surveys conducted as part of INRMP updates. NAS Lemoore proposes to actively manage for the burrowing owl population nesting on the Station (Section 4.5.2.2 Burrowing Owl (USFWS BCC, California SSC)).

## Assessment of Current Management

The habitat-based and species specific management measures proposed in this INRMP, in conjunction with site approval and project review processes, provide a sufficient level of natural resources management to protect and conserve species warranting Navy stewardship at NAS Lemoore.

These habitat management and species specific measures should be updated to incorporate new discoveries, as well as changes in management strategies based on mission requirements. Such updates should also be reflected in the INRMP to ensure adequate protection for these species, consistent with the mission of the Station.

Additionally, monitoring of special status species on the Station should occur regularly in conjunction with baseline inventories and other ongoing monitoring associated with habitat enhancement activities. Special status species identified at the federal and state level can serve as good indicator species for habitats at NAS Lemoore. Monitoring them can create a foundation for natural resources management partnerships and data sharing.

## Management Strategy

***Objective:*** *Species warranting Navy stewardship, and the habitats which support those species, will be protected to the extent practicable by giving them consideration during land use planning and management processes.*

**I.** Provide for the recovery, enhancement, and protection of species warranting stewardship, as a proactive strategy to prevent federal listings. Implement the INRMP's ecosystem management approach. Maintain contact with regional specialists and regulatory agencies regarding the listing status of unique species known or thought to occur on NAS Lemoore.

**II.** Continue to participate in the USFWS review and listing process for species known or thought to occur on NAS Lemoore that are being considered for listing under the ESA.

- **A.** Stay updated on agency decisions, published material, and meetings that change the listing status of species.
- **B.** To the extent practical, avoid or minimize impacts from military activities, as well as construction and routine maintenance, to species warranting stewardship.
    1. In the event that the greater sandhill crane and peregrine falcon are discovered nesting at NAS Lemoore, establish buffers around active nests and plan ground disturbing activities around their migration window.

**III.** Continue to resolve baseline biological data gaps.

- **A.** Support ongoing and new research on distribution and ecology of species warranting stewardship. Seek opportunities to partner with academic institutions and other outside researchers to facilitate resource data collection.

**B.** Continue to inventory, monitor and map existing species warranting stewardship on NAS Lemoore, including those that may only use the Station as a stop-over for short periods of time during their migrations (e.g., greater sandhill crane and willow flycatcher).

**C.** Conduct a capture-release telemetry investigation on the movement of American badgers on and around NAS Lemoore.

**IV.** Seek opportunities to develop partnerships with institutions, organizations, and other researchers, including as part of regional initiatives, to develop and improve knowledge and management of special status species at NAS Lemoore.

**V.** Conduct research surveys as needed prior to any military construction project(s), including as part of NEPA or other environmental review process (Section 5.3 Construction and Facility Maintenance; Section 5.8 NEPA Compliance).

### 4.5.2.1 Western Spadefoot Toad (California SSC)

#### Specific Concerns

- The wetland in NRMA 3 currently does not retain much water year round. As a result, its value as habitat for the western spadefoot toad and other wetland species has decreased. In general, wetlands at NAS Lemoore are threatened by limited water availability for habitat in some years.
- Results from the most recent wildlife survey (TDI 2012) indicate that a few western spadefoot toads were observed at night in pools between agricultural areas and also heard in a ditch near Sunset Lake. Observations of toads are not as frequent as in the past, unless there is a substantial amount of standing water on the Station (J. Crane, pers. com. 2011).

#### Current Management

NRMA 3 has been managed in the past to provide habitat for the western spadefoot toad. Currently, no specific management actions in NRMA 3 or elsewhere target habitat enhancement for the species at NAS Lemoore.

#### Assessment of Current Management

The western spadefoot toad could become a management priority in NRMA 3 if water capacity and retention there is enhanced. Subsequent reestablishment of the riparian area would allow NRMA 3 to become a year-round body of water and could support the western spadefoot toad. It is possible that some western spadefoot toads are still aestivating in the ground in that area.

Research and project needs for improving western spadefoot toad habitat in NRMA 3 could be identified as part of developing a combined management for the wetland areas within NRMA 3 and NRMA 5 (Section 4.5.1.1 San Joaquin Kangaroo Rat (Federally and State Endangered)).

#### Management Strategy

***Objective:*** *Provide habitat enhancement and employ other management practices to benefit the western spadefoot toad at NAS Lemoore, particularly in NRMA 3.*

**I.** Improve water retention capability of NRMA 3 to benefit western spadefoot toads and other wetland species (Section 4.3.1.2 Specific Issues for NRMA 3). Seek to secure water for restoration activities in NRMA 3.

**II.** In conjunction with results from the 2009-2010 field survey (TDI 2012), identify areas within NAS Lemoore currently being used by the western spadefoot toad. As applicable, develop management actions to benefit the toad in areas outside of NRMA 3.

**III.** Develop and implement a combined management plan focused on management of NRMA 3 and NRMA 5 that includes restoration of the historical wetland habitat in the southeast portion of NRMA 5. Development of such a plan would allow for additional analysis regarding habitat needs and management strategies for wetland species in NRMA 3, including the western spadefoot toad. Consultation with the USFWS and CDFW should be initiated prior to implementing the plan (Section 4.5.1.1 San Joaquin Kangaroo Rat (Federally and State Endangered)).

**A.** Research feasibility of re-establishing western spadefoot toads at the NRMA 3-NRMA 5 wetland.

**IV.** Participate in the DoD Partners for Amphibian and Reptile Conservation in order to draw on information and expertise of partners that can benefit western spadefoot toad management at NAS Lemoore (Section 4.4.4 Amphibians and Reptiles).

### 4.5.2.2 Burrowing Owl (USFWS BCC, California SSC)

#### Specific Concerns

- The large number of burrowing owls at NAS Lemoore suggests that this population is important regionally due to the few other known large populations of burrowing owls in the San Joaquin Valley and the State of California (K.S. Smallwood, pers. com. 2010; Klute et al. 2003).
- Monitoring artificial nest box use at NAS Lemoore has indicated that the boxes fall into disrepair and become unused if not maintained on a regular basis. Other types of artificial nesting habitat may provide benefits to the burrowing owl and may be more cost effective.
- Coyotes, American badgers (*Taxidea taxus*), and feral dogs are known to prey on burrowing owls by digging up their nest burrows; their presence alone near potential nest sites may diminish the suitability of such sites. In 2008, Smallwood and Morrison (2009) noted that there were large numbers of coyote dens at both the landfill and NRMA 5. Coyotes at these sites are little disturbed by people.
- Burrowing owls are found primarily in the Operations Area, but are not believed to be a significant BASH risk. Their presence, however, may attract other predators that could potentially pose hazards to flight operations. Burrowing owls are completely dependent on ground squirrel burrows (their preferred burrows) when there are no artificial nest structures available for them. The high variability of the abundance of ground squirrels at NAS Lemoore in some years restricts the number of natural burrows available to the burrowing owl.
- Changes in the composition or extent of irrigated agriculture at NAS Lemoore can affect the burrowing owl population. The large population of burrowing owls at NAS Lemoore is due in part to increased prey availability that accompanies irrigated agriculture. At the same time, fallowing agricultural land (as was done when the Operations Area fence was installed), can provide additional burrowing owl habitat.

#### Current Management

The burrowing owl population at NAS Lemoore is managed according to *An Updated Adaptive Management Plan for the Burrowing Owl Population at Naval Air Station, Lemoore* (Rosenberg et al. 2009). The steps taken by the Navy at NAS Lemoore to develop the original management plan for burrowing owls (Rosenberg et al. 1998) were some of the first in California. The updated plan provides guidelines for monitoring, protecting, and enhancing resources at NAS Lemoore to benefit the burrowing owl. It also identifies potential limiting factors, including the availability of burrows, vegetation structure,

food availability, and pesticide exposure. If the recommended trigger population of 32 pairs (half of the average number of owl nests located during all surveys conducted to date throughout the Station) is reached, the plan recommends additional research and monitoring to determine reasons for the decline. Rosenberg et al. (2009) determined the optimal target number of pairs at that time to be around 70. Breeding season population surveys occurred in 2013. The results of these surveys will be used to update the existing burrowing owl adaptive management plan for NAS Lemoore.

Owl conservation activities have included an intensive demographic and space use research program that was part of a state-wide research effort; the protection of burrowing owls during construction activities at the Station's closed landfill; and the attempted restoration of a native grassland designed to increase the number of burrowing owls nesting in the area. In addition, mowing operations, prescribed burning, and the avoidance of disking grasslands has contributed to the large nesting population of burrowing owls at the Station (Rosenberg et al. 2009). Burrowing owl monitoring since then has occurred on a somewhat regular basis.

Artificial nest boxes for the owls were originally installed in the late 1990s. They are used primarily only when ground squirrel burrows are unavailable, though coyotes, American badgers and feral dogs have destroyed a number of them by digging them up. Original placement included: (i) in the airfield to accommodate the population of burrowing owls already existing there - these are now unused (Smallwood and Morrison 2009); (ii) some within NRMA 6 (between NRMA 1 and NRMA 2) to encourage them to relocate out there - these boxes were hardly utilized; (iii) six to eight nest boxes in the landfill - these are now unused due to lack of maintenance.

It is important to continue applying the recommendations provided in the burrowing owl management plan until the current plan is updated. Future management of this species is being reevaluated in light of increased BASH concerns resulting from the increase in raptors attracted to the airfield by the large ground squirrel population.

## Assessment of Current Management

Measures have been proposed to reduce the number of large, broad-winged raptors (primarily red-tailed hawks and Swainson's hawks) near the airfield. The abundance of prey available at the airfield, primarily ground squirrels, attracts large raptors to the area that represent a significant BASH risk. These measures will require that a prey reduction program be implemented, involving a large-scale application of rodenticide to reduce the prey abundance; with a focus on the population of ground squirrels. Measures to reduce the ground squirrel population with the use of rodenticide can reasonably be expected to result in an adverse impact on the burrowing owl population. Prior to implementing the prey reduction program the burrowing owl population in this area will need to be relocated through active and passive relocation methods to mitigate these adverse impacts. Coordination by the Station's Natural Resources Manager with the USFWS and CDFW should occur. A thorough NEPA analysis from the EMD will be required prior to implementing the prey reduction program and burrowing owl relocation.

To facilitate continued adaptive management of the species, follow-up monitoring of the relocated burrowing owls should be implemented to evaluate the program's success. Part of the burrowing owl relocation program should involve the use of an artificial burrow structure that is easy to install, repair, maintain, and designed so that it is not so easily destroyed by predators of burrowing owls.

NAS Lemoore has supported a large number of owls in part due to the agricultural activities and maintenance of areas safe for nesting. Appropriate management of the airfield, NRMAs, and fallowed fields will be required to ensure the use of appropriate areas of the Station for foraging and nesting by burrowing owls, consistent with the military mission.

Land management activities at NAS Lemoore can continue to serve as a model for the conservation of burrowing owls in agricultural landscapes in the San Joaquin Valley, consistent with the mission of the Station.

## Management Strategy

***Objective:*** *Maintain the population of burrowing owls consistent with the mission of NAS Lemoore. Continue to manage the population and improve their habitat on the Station according to the most recent Burrowing Owl Management Plan.*

**I.** Research availability of suitable locations for conducting active relocation of owls on the Station, in the region, or in other parts of the State of California. Coordinate with the USFWS and CDFW to obtain required permits and MOUs prior to conducting burrowing owl relocation.

- **A.** Establish burrowing owl habitat on the Station in areas that are consistent with safe flight operations. Conversion of appropriate agricultural leases to burrowing owl habitat may be necessary to minimize adverse impacts to burrowing owls resulting from BASH mitigation measures near the airfield.
- **B.** Survey potential relocation sites to determine if appropriate habitat conditions are present, such as available burrows and an adequate prey base. Construct and install artificial burrowing owl nesting habitat at relocation sites if necessary.
- **C.** Conduct post-relocation monitoring of relocated owls to determine the long-term success of active and passive owl relocation efforts.

**II.** Update the Burrowing Owl Management Plan as needed.

- **A.** Update the adaptive management plan to reflect changes in management strategies in order to maintain a viable population of burrowing owls on the Station based on the results of relocation efforts.
- **B.** Determine the updated number of owl pairs that would trigger a detailed evaluation of causative factors for the owls' decline and management actions to increase and/or maintain the population.
- **C.** Develop a more efficient monitoring strategy to detect if the trigger population size is reached. This would include more than simply locating all active burrowing owl nests.

**III.** Conduct periodic population assessments of burrowing owls, consistent with the burrowing owl studies conducted at other Navy installations in California.

**IV.** Continue to monitor BASH incidents to determine the level of strike hazard from large raptors and burrowing owls.

**V.** Continue to manage habitat for burrowing owls in appropriate locations on the Station to reduce conflicts with the military mission. Update management based on strategies in the updated burrowing owl management plan.

**VI.** Test the effectiveness of various structures as artificial nesting habitat at NAS Lemoore (or other methods less susceptible to predation) to evaluate nesting preference of burrowing owls and a cost-effective manner of constructing artificial nest habitat that can be easily installed and moved as needed.

**VII.** Continue the artificial nest box program (installation and maintenance) through coordination with local Boy Scouts, Girl Scouts, or volunteer programs and projects.

**VIII.** Provide adequate protection to burrowing owls from predators (i.e., feral dogs, coyotes, and American badgers), which are sometimes known to dig up burrows and nest boxes (Section 4.7.1 Pest and Predator Control).

**IX.** Avoid spraying pesticides in areas known to be inhabited by burrowing owls.

**X.** If ground-disturbing activities are to occur during the normal breeding season (February 1 through August 31), implement avoidance measures as recommended in the Staff Report on Burrowing Owl Mitigation (California Department of Fish and Game 2012).[24]

**XI.** Increase public awareness of burrowing owl conservation by disseminating the positive actions taken by NAS Lemoore (Section 5.11 Environmental Education and Public Outreach).

#### 4.5.2.3 Swainson's Hawk (State Threatened)

##### Background

The Swainson's hawk is listed as threatened under the California Endangered Species Act, and has been selected as an indicator species in the California WAP (Bunn et al. 2007).

In addition to regional conservation plans mentioned above (Section 4.4.5 Birds), several other projects are conserving riparian habitat that will benefit these hawks. These include the California Bay-Delta Authority's Ecosystem Restoration Program, as well as conservation and restoration at the Cosumnes River Preserve. Wintering grounds in Mexico are also receiving conservation work by Partners in Flight (California Department of Fish and Game 2005).

##### Specific Concerns

- Swainson's hawks at NAS Lemoore have become a concern given recent BASH incidents and their proclivity to glide on thermal columns rising from the agricultural outlease area near the airfield. On some occasions, 80 to 100 hawks have been observed there. Three BASH incidents in 2010 involved Swainson's hawks (J. Crane, pers. com. 2011) (Section 4.7.2 BASH Program).
- The Swainson's hawk is threatened by loss of agricultural foraging habitat, such as the alfalfa fields at NAS Lemoore, where it forages for small mammal prey (e.g., gophers and voles). While the Swainson's hawk used to be widespread in California, it is currently restricted to the Central Valley near riparian nesting trees, and somewhat to Great Basin habitat in the northeast corner of the state. Swainson's hawk population levels appear to have experienced an increase in the NAS Lemoore region through increased nesting or potential geographical shifts in its distribution throughout Central California and the southern San Joaquin Valley (T. Schweizer, pers. com. 2013).
- Although mitigation guidelines exist to improve conservation efforts (under the California Endangered Species Act and the California Environmental Quality Act), these guidelines are advisory only, they are not inclusive enough to cover effects on the quality (as compared to extent) of a bird's habitat, and they generally do not extend to agricultural fields. According to the California WAP, a more effective CDFW mitigation policy is needed to address the continued loss of habitat and disturbance of nest sites, particularly in the Central Valley where most of the population still exists.

##### Current Management

There has been no specific management focused on the Swainson's hawk at NAS Lemoore.

##### Assessment of Current Management

Perhaps due to some of the above-described regional efforts, the range of nesting Swainson's hawks has expanded over the past decade into the southern San Joaquin Valley. The important conservation needs for this species include maintaining compatible agricultural practices within ten miles of nest sites, and eliminating major disturbances near nests. The benefit to this species at NAS Lemoore has been a

[24] Available online at: http://www.dfg.ca.gov/wildlife/nongame/docs/BUOWStaffReport.pdf.

consequence of the open condition of the land use and the cycles of prey abundance related to alfalfa field operations, abundance of fallowed farm land, as well as the happenstance distribution of trees occurring within the property. Recognizing these habitat elements would help provide better protection, and ensure proper environmental review with any proposed changes on the Station.

In addition to Swainson's hawks, other raptors foraging at NAS Lemoore include red-tailed hawks (the most common at the Station), northern harriers, Cooper's hawks, sharp-shinned hawks, white-tailed kites, American kestrels, peregrine falcons, prairie falcons, short-eared owls, barn owls, great-horned owls, and western screech owls (Appendix J).

### Management Strategy

***Objective:*** *To the extent practicable with the mission of NAS Lemoore, conserve and enhance habitat elements that provide foraging for Swainson's hawk, as well as other raptors, to contribute to restoration of this species' breeding abundance in the Central Valley region, and to contribute to avoidance of federal listing of this species.*

*The Commanding Officers of shore activities holding Class 1 plant accounts shall conduct surveys to determine the presence and distribution of candidate species and State/territory rare and endangered species (5090.1C CH-1).*

**I.** Conduct periodic surveys for Swainson's hawk, in concert with other raptor surveys, to develop an integrated raptor protection and habitat enhancement plan. Use raptor banding methods as appropriate and feasible. Continue to support population monitoring by outside researchers, including outside installation boundaries as practicable and appropriate.

- **A.** Conduct a multi-year nesting survey of Swainson's hawks at NAS Lemoore.

**II.** Continue habitat management through the agricultural Soil and Water Conservation Plan. Ensure that allowable crops that maintain prey cycles benefiting the Swainson's hawk and other birds of prey are located in appropriate areas away from the airfield.

**III.** Maintain existing trees or establish new tree stands (e.g., as replacement for eucalyptus) where appropriate given BASH concerns, as the amount of nesting trees limits the amount of available nesting habitat.

**IV.** Share survey and monitoring data on Swainson's hawks with regional initiatives, as appropriate, to contribute to a regional understanding of potential shifts in this species' distribution.

**V.** Ensure environmental review, including for any change in agricultural practice, adequately considers effects to Swainson's hawk so that avoidance and minimization measures can be properly implemented.

**VI.** If ground-disturbing project activities are to occur during Swainson's hawk breeding season, a qualified wildlife biologist should conduct surveys for active nests no more than ten days prior to the start of the project. Establish and maintain buffers around Swainson's hawk nests until a qualified biologist has determined that the birds have fledged and are no longer reliant on the nest or parental care.

## 4.5.2.4 Special Status Plants

### Specific Concerns

- It is likely that the lack of surveys for rare and endangered plants may be contributing to a lack of their identification.

## Current Management

Current management of special status plants species on NAS Lemoore is accomplished primarily through the protection of their habitats. There are no federal or state listed species at NAS Lemoore. However, there are several CNPS[25] special status species, including crownscale (*Atriplex coronata* var. *coronata*), California Rare Plant Rank 4.2; San Joaquin spearscale (*Atriplex joaquiniana*), California Rare Plant Rank 1B.2; vernal barley (*Hordeum intercedens*), California Rare Plant Rank 3.2; and Cooper's rush (*Juncus cooperi*), California Rare Plant Rank 4.3 (Appendix G). These species should warrant a special focus in any habitat management or enhancement activities where they are found at NAS Lemoore, to the extent practicable with mission requirements.

## Assessment of Current Management

It would be prudent to conduct rare plant searches at NAS Lemoore to identify the presence of any special status plants. Focused surveys have not been conducted in the past.

If special status plants are present, habitat management activities should incorporate a program for their management as needed. In the case of any federally listed species present, NAS Lemoore would need to consult with the USFWS to develop a management program.

## Management Strategy

***Objective:*** *Evaluate, protect and enhance special status plant populations while ensuring compatible land use and flexibility to fulfill mission requirements.*

**I.** Conduct rare plant searches at high potential areas within NRMAs, prioritizing searches based on habitat suitability, threats and vulnerabilities for potential for endemics.

- **A.** In particular, identify extent of *Atriplex coronata*, a rare species of interest at NAS Lemoore. It tends to occur in NRMA 5.
- **B.** Identify any special or unique flora and fauna associated with floodplains in order to identify the natural and beneficial functions provided by floodplains (Section 4.2.3 Floodplains).
- **C.** If any federally or state listed plants are identified as a result of these searches, management plans and action will be developed for them in consultation with the USFWS and the CDFW, as appropriate.

**II.** Identify threats and vulnerabilities for known locations of special status and management focus plants, or plant assemblages.

- **A.** Develop avoidance and minimization recommendations, as appropriate.
- **B.** Incorporate measures that work well into construction and maintenance practices, and project implementation processes, as appropriate.

**III.** Conduct research surveys, as needed, prior to any military construction project(s), including as part of NEPA or other environmental review process.

**IV.** Avoid, minimize, and mitigate impacts to special status plant species as feasible. Consider including a special focus for them in the EMD's Vegetation Management Instruction (Section 5.3 Construction and Facility Maintenance).

[25] CNPS is a non-profit organization dedicated to the understanding and appreciation of California's native plants and how to conserve them and their natural habitats and is dedicated to the preservation of California native plants. The CNPS has a website dedicated to sensitive and rare plants with a rating system ("California Rare Plant Rank") that has been adopted by the CDFW. The CNDDB, which is produced by the CDFW, has incorporated the rating system of the CNPS.

# 4.6 Invasive Species Management

## Background

EO 13112 defines invasive species as "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health." It requires federal agencies to prevent the introduction of invasive non-native species and provide for their control (5090.1C CH-1, 24-7.j). The Federal Plant Protection Act of 2000 (Title IV of PL 106-224) prohibits introducing any animal, plant or material considered harmful to this country's agriculture. This Act consolidated and modernized all major statutes pertaining to plant protection and quarantine (Federal Noxious Weed Act, National Invasive Species Act, Plant Quarantine Act).

Non-native invasive species are responsible for widespread negative economic and ecological effects ranging from declining wildlife and plant populations, loss of economically important resources, and impacts to human health.

## Specific Concerns

- Invasive species such as tamarisk (*T. aphylla* and *T. ramosissima*), perennial pepperweed (*Lepidium latifolium*), Russian thistle (*Salsola tragus*), and Russian knapweed (*Acroptilon repens*) are common at NAS Lemoore. The majority of them are listed as either "High" or "Moderate" invaders by the California Invasive Plant Council. These and other invasive species found at NAS Lemoore degrade native habitat for special status and other species at the Station. Invasive weeds in general at NAS Lemoore tend to be worse along drainage ditches and under windbreaks.
- Invasive species are potentially migrating onto NAS Lemoore from adjacent properties. Russian knapweed is present on the levees along the Kings River to the north and east of the Station. There is no known regular control of these populations on adjacent lands, primarily due to lack of funds to address them.
- Invasive species control at NAS Lemoore is conducted regularly, but is often based on informal observations of EMD staff with monitoring only occurring prior to control activities. It is important that infestations are addressed strategically and preventatively, while still at manageable levels, to avoid costly eradication efforts and encroachment into uninvaded areas (Cohen and Carlton 1998).
- Occasionally, plant species similar in appearance to invasive weeds are mistakenly targeted in weed control efforts.
- Invasive non-native plants can be a serious threat to natural habitat by changing the structure of the plant community. They are one of the leading causes of degraded ecological condition and ecosystem services. Moreover, climate change has the potential to interact with this stressor through multiple mechanisms and exacerbate impacts on native ecosystems (National Invasive Species Council 2008; U.S. Environmental Protection Agency 2008).

## Current Management

Invasive species control at NAS Lemoore is an integral part of its pest management program guided by the Station's IPMP (NAVFAC Southwest 2010) (Section 5.7.2 Integrated Pest Management).

Invasive species control approaches and involved parties are generally identified according to location on the Station:

1. *Agricultural areas.* Agricultural lessees are required to control invasive species on their parcels and in irrigation ditches per the Soil and Water Conservation Plan of the agricultural outlease agreement.

Control is overseen by the NAS Lemoore EMD (Section 5.2.1 Agricultural Outlease Management, Section 5.7.2 Integrated Pest Management).

2. *Natural Resources Management Areas.* Invasive control is a recurring, annual activity in undeveloped and non-leased areas on the Station. The EMD and Integrated Pest Management Coordinator (IPMC) oversee an invasive control contractor to target areas for weed removal. Recent efforts included treating tamarisk (*T. ramosissima*) in NRMA 3, the landfill, and the Administration Area; and perennial pepperweed in NRMA 1 (Innovative Inclosures 2010). Control with herbicides is preferred; though burning selective species may be used as an emergency control measure.
3. *Karen Mechem Park, Administration Area, and recreation areas.* The Public Works Department (PWD) oversees invasive control conducted by a grounds contractor. The contract contains specifications for control, including targeted species. Both the contractor and the PWD are responsible for ensuring compliance with the IPMP.
4. *Housing Area.* Lincoln Military Housing conducts invasive species control in the Housing Area as part of its management of that area. They and the NAS Lemoore IPMC are responsible for ensuring compliance with the IPMP.
5. *Operations Area.* The PWD oversees a contract for mowing the grassland areas inside the Operations Area fence. This is primarily to maintain vegetation at a height not higher than six to eight inches to prevent BASH concerns.

The IPMC and/or EMD staff occasionally attend invasive area weed meetings with Kings County Agricultural Commissioner representatives. However, limited County funds prevent much action for weed control on adjacent lands

## Assessment of Current Management

NAS Lemoore complies with EO 13112 by controlling invasive species in various areas of the Station. A more systematic approach to evaluating invasive control needs and assigning efforts could improve compliance and effectiveness.

An Invasive Species Control Plan should be developed and include strategic goals that focus on prevention, early detection and rapid response, control and management, restoration, and organizational collaboration. Strategies should include a catalog, map and other documentation of weed control efforts, to better track success of weed management activities and contribute to adaptive management. Sensitive area needs and innovative control measures should be reflected. The plan's priorities should be updated annually based on known aggressiveness of species, regional invasive species lists, current research on the most effective control practices, any changes in conditions, and prior Station experience in controlling invasive species.

*Habitat enhancement and restoration should be an integral part of invasive species control in suitable areas. Restoration can help to more effectively control invasive species than repeated spraying and removal year after year, while actively improving native vegetation communities.*

An invasive species map should be detailed and developed as part of a monitoring standard operating procedure. Accompanied by a more complete list of non-native species showing abundance and distribution can assist natural resources managers to prioritize weed eradication areas and species, assess effectiveness of control efforts, improve weed control efficiency for contractors (e.g., budgeting and scoping), and leverage additional funding. The map, monitoring results, and updated lists of target weeds with pictures should be

*Additional funds for invasive species control and native ecosystem management may also be available through partnerships. The California Wildlife Conservation Board (www.wcb.ca.gov), for example, funds restoration partnership work related to native ecosystems in California.*

shared as appropriate to help identify and control new and expanding invasions early and quickly.

Current management activities should be evaluated in light of their potential contribution to spread of invasive species on the installation, including timing of mowing and agricultural lessee invasive control measures, among others.

Developing and implementing an invasive control program contributes to the conservation of any federally/state listed and sensitive plants at NAS Lemoore by enhancing the ecosystems they depend upon. The control and eradication of non-native invasive plant species is of primary importance to natural resources management at NAS Lemoore and it is an important step toward conservation of native San Joaquin Valley ecosystems.

## Management Strategy

***Objective:*** *Control the spread and introduction of invasive plants with priority on those with the greatest potential for sensitive species or habitat degradation, and restore to native habitat when feasible. Evaluate management capabilities for established non-native invasive species populations and identify strategic gaps. Apply adaptive management principles.*

*Navy installations will prevent the introduction of invasive species and provide for their control per EO 13112. The Navy will identify actions that affect the introduction of invasive species, prevent their introduction, respond rapidly to their control, monitor populations, restore affected native species and their habitat, conduct research and develop technologies to prevent further introductions, and promote public education of the issue (5090.1C CH-1).*

**I.** Comply with EO 13112 on Invasive Species. Use early detection and rapid response as the first order of business. Prevent and control new introductions rapidly.

**II.** Develop an Invasive Species Control Plan for NAS Lemoore that identifies invasive weed control priorities, strategies, methods, and tools. Update annually.

- **A.** Map invasive plant species at NAS Lemoore. Use ongoing incidental observations and regular monitoring to identify current and detect new pest plant introductions. Incidental observations should be verified by the EMD. Record data into a GIS database and update annually.
- **B.** Identify vectors and locations of introduction, such as roads, adjacent properties and equipment used by contractors.
- **C.** Prioritize treatment areas using the invasive species map and known aggressiveness of species, extent of infestation, threat risk to native plants and animals, and potential to transform ecosystem processes or landscapes. Support studies that determine if there are impacts from invasive non-native species already present.
- **D.** Identify areas occupied by special status species, mission critical areas, or areas that are currently lacking invasion to keep clear of pest plants.
- **E.** Monitor and document areas of removal to ensure re-growth does not occur.
- **F.** Incorporate guidelines from the IPMP identifying control and management practices (i.e., herbicides, biocontrol or biopesticides), as well as restoration and rehabilitation approaches or combination of them according to location at NAS Lemoore (Section 5.7.2 Integrated Pest Management).

*Invasive plants are often a symptom of another problem. Finding the true cause, identifying the ecological processes affecting it, and applying an array of integrated tools to address the problem can contribute to greater long-term treatment success.*

**III.** Conduct research and use adaptive management principles to determine the most effective procedures to control weeds in the various habitats at NAS Lemoore.

**A.** Investigate the possibility for and logistics that would be required to develop a limited grazing program as a method to control invasive species and aid in restoration. Consider implementing such a program at NAS Lemoore, if feasible.

**B.** Follow invasive species control with habitat enhancement and restoration activities where appropriate and feasible, as funding permits.

**C.** Monitor treated sites using a control to determine effectiveness of invasive species control efforts and to contribute to adaptive management. The monitoring component should specify an accepted standardized method to ensure accuracy and consistency.

*Often, controlling invasive weed species at times when they are in non-growth phases makes them more susceptible to herbicide applications.*

**IV.** Give appropriate personnel (employees, contractors, lessees) non-native plant recognition training and materials to aid in their control and so newly arriving invasive species can quickly be discovered and eradicated. Prepare invasive weeds educational materials for Station users and contractors using pictures to appropriately identify those that pose threats to NAS Lemoore. Update materials as needed. Include NAS Lemoore EMD in contract scoping and developing a process for field verification to ensure contractor compliance.

**V.** Avoid applying pesticides in areas with known or potential SAR or management focus species. Update "no-spray" areas as needed depending on updates to number and locations of these sensitive species on the Station. Provide information on "no-spray zones," as well as current locations and distributions of these sensitive species to relevant Pest Management Service Providers.

**VI.** Comply with the MBTA. Develop a protocol for conducting invasive plant control in areas where there are breeding birds. Impacts to migratory birds from routine maintenance are not covered as part of NAS Lemoore's depredation permit.

**VII.** Manage the Operations Area, roads, access routes, and new construction sites to minimize the spread of invasive non-native species. Repeated mowing and other disturbances can exacerbate invasive spread. If possible, scheduling mowing to minimize weedy species seed distribution is the most effective. When mowing in areas with invasive plants, it is important to clean equipment of adhering dirt and vegetation between cycles.

**VIII.** Address non-native invasive species in ground disturbing project plans and enforce control measures at construction or maintenance sites. Ensure funding is secured for non-native species removal during all phases (including post-project), if applicable.

**IX.** All plants on the California Invasive Plant Council Invasive Plant Inventory (2006) and all non-native grasses (except those used for turf/lawns or those included in the approved plant list) are unacceptable for landscaped areas.

**X.** Continue to require lessees (including Public-Private Venture) to conduct and report on invasive weed control.

**A.** Support lessees need for reduced reliance on chemical means of invasive species control, per DoDI 4150.07 and Navy Instruction 6250.4C.

**B.** NAS Lemoore personnel or contractors should conduct invasive weed control on agricultural parcels during times when there is no agricultural lessee to do so in order to prevent populations there from spreading.

**C.** Pest management and invasive species control practices should not conflict with natural resources management activities conducted at NAS Lemoore.

**XI.** Promote cooperative interagency efforts and other partnerships to collect data on invasive species populations in the area and methods and responsibilities for their control. Seek partnerships with adjacent properties and investigate additional sources of funding to help prevent invasions onto Station lands.

# 4.7 Prevention and Control of Wildlife Damage

## 4.7.1 Pest and Predator Control

### Specific Concerns

- Feral dogs and cats may pose a hazard to humans when found roaming in the Housing and Administration Areas and other areas occupied by humans.
- Ground squirrels have had significant impacts on crop yields in parcels adjacent to NRMA 5 and in Parcel 4A58. They have become so numerous around the Operations Area that they have become an attractant to larger raptor species such as the red-tailed hawk and Swainson's hawk, which represent significant BASH risk and threat to aircraft safety when near the airfield.
- Pigeons roosting in the aircraft hangars are a potential operational health and safety hazard. They can also damage planes: their defecation on aircraft in the hangars can damage the paint and aircraft canopies.
- Pests identified in the NAS Lemoore IPMP include household pests such as ants, crickets, beetles, and spiders; mosquitoes; gophers and ground squirrels; and weeds.

*The USFWS defines pests as: those organisms (vertebrates, invertebrates, plants, and microorganisms and their vectors, etc.), which are detrimental to fish, wildlife, human health, fish and wildlife habitat or to established management goals.*

### Current Management

Pest control at NAS Lemoore is primarily concerned with the control or elimination of established pests and prevention of new pest species introductions. The IPMP for NAS Lemoore is a long-range, comprehensive planning and operational document that establishes the procedures for conducting a safe, effective, and environmentally sound integrated pest management program. It states that the DoD policy is to ensure DoD pest management programs achieve, maintain, and monitor compliance with all applicable EOs and applicable federal, state, and local statutory and regulatory requirements.

Feral dogs and cats can be a potential health and safety hazard for Station personnel, as well as endangered, threatened, and SAR. Currently, NAS Lemoore implements guidelines of the CNO Policy Letter Preventing Feral Cat and Dog Populations on Navy Property (CNO 10 January 2002) to eliminate adverse effects to native wildlife, as well as prevent injury or disease to Navy personnel. Feeding stray cats in the Administration Area is against this policy.

As needed, the USDA Wildlife Services staff member at NAS Lemoore removes those coyotes that pose potential problems, live-traps and relocates raptors that are a potential threat to operations, and live-traps pigeons in the hangars to reduce their impact on aircraft. In the recent past, typical live-trapping in the hangars would yield three to four pigeons per hangar. While pigeons do not require a depredation permit to control, NAS Lemoore maintains one for operational activities that may impact birds covered under the MBTA. The Wildlife Service's Airport Biologist also implements BASH prevention measures.

Agricultural lessees are allowed to maintain bait stations with rodenticides on their parcels to reduce ground squirrel populations, which threaten their crops. The bait stations are constructed and maintained

according to specifications in the agricultural outlease agreement so that they may pose no threat to the federally endangered San Joaquin kangaroo rat. Occasionally, ground squirrel control is achieved by Wildlife Services using other methods.

Lincoln Military Housing is responsible for conducting pest management in the Housing Area, and coordinating with the NAS Lemoore IPMC as needed.

Finally, the Kings Mosquito Abatement District performs mosquito control on all areas of NAS Lemoore except the Housing Area. Potential areas of mosquito breeding that are often targeted for control include standing water from over-irrigation of landscaped areas and backyard containers filled with water.

## Assessment of Current Management

Pest and predator control and management at NAS Lemoore is generally effective. For example, live-trapping for pigeons in the aircraft hangars has reduced the populations there significantly; previously, there were on the order of 65 to 100 birds nesting in each hangar.

The effectiveness of ground squirrel control in the agricultural outlease area using rodenticide bait stations often depends on the time of the year. When agricultural fields are green with crops, ground squirrels do not show much interest in the bait. During dry periods, the bait stations are more effective, presumably because there is a shortage of food. A recent concern includes possible non-target impacts that the toxins in the rodenticide bait may have at higher trophic levels. It would be prudent to evaluate potential for such impacts and if there are alternative rodenticides or methods of rodent control that may have less impact. It is important to note that farmer use of rodenticide baits to control ground squirrels and other pest rodents is a common practice throughout the Central Valley. Installing additional raptor nesting platforms on the Station in appropriate NRMAs would encourage naturally occurring biological control of ground squirrels in those areas. Raptors, in combination with other types of control, can maintain pressure on the ground squirrel population.

If determined necessary to reduce the BASH potential at the airfield, Wildlife Services should implement a prey reduction program around the airfield to control ground squirrels. The program should at a minimum consist of habitat modification. If habitat modification fails to reduce the ground squirrel population to an acceptable level, then measures for a large-scale control program involving the use of rodenticide should be implemented. Measures to reduce the ground squirrel population with the use of rodenticide can reasonably be expected to result in an adverse impact on the burrowing owl population. Prior to implementing the prey reduction program, the burrowing owl population in this area will need to be relocated to other areas of the Station, region, or state of California using active and passive relocation methods in order to mitigate these adverse impacts (Section 4.5.2.2 Burrowing Owl (USFWS BCC, California SSC)). Coordination by the Station Natural Resources Manager with the USFWS and CDFW should occur. A thorough NEPA analysis from the EMD will be required prior to implementing the prey reduction program and burrowing owl relocation.

Pest wildlife species should only be handled or removed by trained personnel, which may be provided by state and federal certified organizations. This includes feral cats and dogs.

## Management Strategy

***Objective:*** *Identify and monitor pest and predator species on NAS Lemoore. Develop and prioritize control efforts to enhance the natural environment and safeguard human health, safety, and operational capability through effective pest management. Avoid negative impacts to native wildlife and habitats.*

**I.** Provide adequate protection to sensitive resources from the effects of pest control activities.

**A.** Comply with the ESA: one of the threats to federally listed resources is contamination with and adverse impacts of pesticides. Pesticide applicators should take precautions to prevent drift of pesticide to non-target areas, and provide special attention when conducting pest management near special status species and their habitats.

**B.** Ensure that pest control activities do not have an adverse effect on natural resources by ensuring that both commercial and government pest management service providers (including USDA Wildlife Services) comply with the IPMP and adhere to guidelines proposed in this INRMP, particularly in relation to sensitive habitats and special status species.

**II.** Control vertebrate species that are a potential hazard. Comply with the MBTA with regard to controlling avian pests. A USFWS migratory bird depredation permit is required for most bird control. The only birds that do not require a permit are European starlings, English sparrows, and rock dove (pigeons).

**A.** Maintain the NAS Lemoore depredation permit for necessary bird control.

**B.** Conduct live-trapping for pigeons in the aircraft hangars to prevent operational safety and health issues and protect aircraft from damage.

**C.** Develop protocols for emergency avian pest control to avoid impacts to MBTA-protected and other sensitive and non-target species as much as possible.

**III.** Control the size and location of the ground squirrel population at NAS Lemoore by encouraging use of a combination of control measures, as well as emphasizing natural biological control where appropriate and consistent with the BASH Plan. Conduct NEPA analyses as needed for large scale control efforts.

**A.** At a minimum, use habitat modification approaches. If necessary, use rodenticide only after evaluating impacts via NEPA analysis and in conjunction with burrowing owl relocation from relevant areas such as the airfield. Coordinate with the USFWS and CDFW as appropriate.

**B.** Continue to require rodenticide bait stations to be constructed as specified in the agricultural outlease agreement to prevent federally endangered San Joaquin kangaroo rats from using them. Take into consideration the USFWS' identification of control agents that are detrimental to kangaroo rats (USFWS 1993 as cited in USFWS 2010f).

**C.** Investigate impacts to non-target wildlife (secondary poisoning) from the use of rodenticide. If significant, seek alternative baits with less harmful toxins in concert with employing a combination of other control measures.

**IV.** Support lessees need for reduced reliance on chemical means of pest control, per DoDI 4150.07 and Navy Instruction 6250.4C.

**V.** Avoid applying pesticides in areas with known or potential SAR or management focus species. Update "no-spray" areas as needed depending on updates to number and locations of these sensitive species on the Station. Provide information on "no-spray zones," as well as current locations and distributions of these sensitive species to relevant Pest Management Service Providers (Section 5.7.2 Integrated Pest Management).

**VI.** Maintain a cooperative relationship with the Kings Mosquito Abatement District to control mosquito larvae on the Station.

**VII.** Comply with CNO Policy Letter Preventing Feral Cat and Dog Populations on Navy Property (CNO 10 January 2002). This policy ensures the humane capture and removal of free roaming cats and dogs, while prohibiting the use of Trap/Neuter/Release methods.

**VIII.** Educate Station personnel, residents and other visitors on issues such as not feeding wildlife or feral domestic animals.

**IX.** Ensure that key staff members are trained in proper wildlife handling protocols and procedures or have a contract in place with a wildlife pest control organization. Create and maintain a resource that includes all migratory bird depredation and handling permits, key personnel to contact, and procedures on handling various species of pest wildlife. Keep the resource current and available on file at the EMD and the Station Police Department.

## 4.7.2 BASH Program

### Background

BASH is defined as the threat of aircraft collision with birds and other wildlife during flight operations, particularly during take-off and landing and low-altitude training exercises. BASH plans are required by the DoD for military installations where there is a potential for a conflict between military activity and wildlife.

BASH program requirements are not eligible for conservation resources (5090.1C CH-1). Naval air installations Safety and Air Operations Offices shall ensure BASH plans are prepared and implemented. Personnel responsible for BASH programs should ensure that bird strike reporting and information exchange is closely coordinated with the Naval Safety Center. The NAVFAC BASH Biologist is available to assist with the development of BASH Plans, implementation of BIRDRAD (avian radar), and other BASH related requirements. The Naval Safety Center has a website with additional BASH information.

Species involved in BASH are generally the common species that occur near airfields. Large, slow-flying birds (broad-winged raptors); large, wading birds (herons, egrets, and ibis); gulls; and waterfowl (ducks and geese) are more likely to do substantial damage to aircraft when hit due to their mass. Though a single small bird can cause significant damage to aircraft, a flock makes collision more likely and damage more severe. Resident adult birds may learn to avoid aircraft, but young birds and migrants may not be aware of the hazard (NAS Lemoore 2012).

### Specific Concerns

- Bird strike hazards are of major concern to air operations at NAS Lemoore, especially as the speed and number of aircraft operating at the Station has increased. BASH incidents for military aircraft occur predominantly (95%) below 2,000 feet (610 m). Seventy percent of those are below 500 feet (152 m), and 65% of bird strikes occur at the airfield (NAS Lemoore 2012).
- There has been an increase in BASH incidents recently (approximately 25-30 incidents reported per year). This may be partially due to the increase in fallowed agricultural lands due to reduced irrigation water allocations that create habitat conditions attractive to large raptors (Erichsen 1995, Erichsen et al. 1996, Estep 1989, Kuenzi and Morrison 1998, Smallwood et al. 1996, Woodbridge 1998), and from increased awareness of squadron personnel on the importance of reporting suspected BASH incidents.
- With increased fallowing of agricultural land due to decreased water availability, increased road activity, and increase in numbers of raptors feeding and riding thermal columns in the aircraft flight patterns, there is an increased likelihood of BASH incidents and a corresponding risk of damage to aircraft or loss of human life.
- Particular species of BASH concern include the red-tailed hawk, Swainson's hawk, white-faced ibis, mourning dove, horned lark, western meadow lark, whimbrel, and long-billed curlew. Red-tailed hawks and Swainson's hawks tend to glide on thermal columns rising from the fallowed farm land near the airfield; three BASH incidents in 2010 involved Swainson's hawks. Flocks of 2,000 to 3,000 white-faced

ibis have, in recent years, congregated in alfalfa fields near the airfield. The concern is that once frightened into the air by an aircraft coming in to land, a second aircraft could hit the flocks as they settle back down into the fields. No white-faced ibis aircraft strikes of this manner have been reported to date.

- Potential BASH species also include medium-sized and large mammal predators attracted to the Operations Area by the presence of small mammal prey there.

## Current Management

The goal of the BASH program at NAS Lemoore is to identify, reduce, or eliminate known and potential strike hazards from birds or other animals on and around the airfield. The BASH Plan (NAS Lemoore 2012; Appendix D) establishes specific procedures, as well as roles and responsibilities. The BASH Plan also establishes a Bird Hazard Working Group to monitor and implement the BASH program. The NAS Lemoore Natural Resources Manager is the Co-Chair of the Working Group. Program actions include identifying high hazard situations, particularly during critical phases of flight, and aiding supervisors and air crews in altering/discontinuing flying operations when warranted to increase flight safety. Bird avoidance and bird control measures include grounds maintenance, habitat modification, prey base reduction, harassment and depredation. Careful land management practices are designed to discourage bird activity near runways and operational areas. Generally, installations must ensure relevant training opportunities for a staff biologist to address BASH issues. The BASH Plan is updated annually by the NAS Lemoore Safety Officer.

Copies of birdstrike records sent to the Navy Safety Center are retained at NAS Lemoore. Bird/animal-aircraft strike incidents are required to be reported when identified by pilots or maintenance crews. The report records time of day, date, species involved (if known), and location. Remains are also examined and included in reporting when possible and should be sent to the Smithsonian Institution, Feather Identification Lab for positive identification.

Expectations for daily bird use at NAS Lemoore are primarily determined through (a) informal observations from the Natural Resources Manager and others during travel to and from the Operations Area (birds observed are reported to the Flight Operations Tower), or (b) a general understanding of the Flight Operations Tower regarding regular problem areas and bird species. While a significant safety hazard, in relative terms, bird strikes occur less frequently at NAS Lemoore than at other Naval Air Stations (J. Crane, pers. com. 2011; T. Schweizer, pers. com. 2013).

NAS Lemoore lands were evaluated in a Wildlife Hazard Assessment conducted by the USDA Wildlife Services from July 2010 to June 2011 to assess the potential sources of BASH concern including the grassland areas within the Operations Area fence, the agricultural parcels surrounding the airfield, and other natural habitats on the Station that support bird and other wildlife populations (Lang 2012; Appendix E). Results of the study were used to update management actions and the BASH Plan. Bird strike hazards are particularly a concern during migrations (typically February through April and August through November). Examples of management techniques used to prevent animal strikes include:

- Management of the airfield grounds to discourage the presence of birds of any species, especially those most likely to create a BASH problem. To reduce the attractiveness of the area to wildlife, the grassland areas within the Operations Area security fence are regularly mowed to maintain vegetation at a height no greater than 6 to 8 inches.
- The agricultural parcels surrounding the airfield have crop restrictions written into lease documents to discourage significant bird use. Alfalfa is no longer permitted on the approach or departure to the airfield since it attracts more birds than other crops (T. Schweizer, pers. com. 2013). Crops such as cotton have been demonstrated to not attract birds and other wildlife and are compatible with safe

flight operations. Grain crops near the airfield are required to be harvested before they become an attractant to birds while long-term crops such as trees and vineyards are prohibited.

- Wetland areas, which could potentially attract large numbers of wading birds and waterfowl, are purposefully not allowed or enhanced near the airfield. Generally, most wetland areas are located in the northeast portion of the Station, far enough away from the runways and flight zones that they do not represent major BASH concerns.
- A program of prey-base reduction is also currently ongoing within the Operations Area. The goal is to reduce attraction of predators that are a BASH concern. This program is consistent with the Commander, Navy Installation Command BASH Manual, which discusses the reduction of prey base around airfields (T. Schweizer, pers. com. 2014).

NAS Lemoore maintains a USFWS depredation permit to address migratory birds that pose a direct threat to human safety. The EMD manages this permit, submits reports, and renews the permit on an annual basis.

## Assessment of Current Management

The BASH plan for NAS Lemoore complies with DoD and Navy directives, and is implemented through NAS Lemoore Instruction (NAS Lemoore Instruction 11015.1B). Improved and systematic monitoring of BASH species would be beneficial in assessing and tracking daily and seasonal strike hazards. The EMD and Flight Operations will continue to manage BASH potential in accordance with the updated BASH Plan, with assistance from the USDA Wildlife Service's Airport Biologist, taking into account impacts on native species.

## Management Strategy

***Objective:*** *Promote safe aircraft operations at NAS Lemoore by reducing the potential for bird and other animal aircraft strike hazards.*

**I.** Implement the BASH Plan. Daily and seasonal bird movements in the vicinity of the Operations Area can create significant hazards to aircraft operations.

**A.** Update the BASH Plan annually and incorporate recommendations from BASH-related studies as appropriate. The plan review and update is necessary to ensure adaptive management with minimal impacts to bird and other wildlife communities on NAS Lemoore.

1. Revise relevant training and educational materials for NAS Lemoore pilots, ground personnel, and air traffic control as necessary.
2. Revise guidelines provided in other Station plans and contracts that are relevant to BASH reduction practices, as necessary.

**B.** The Natural Resources Manager should, as an important part of the BASH program, maintain a working relationship with the USDA Wildlife Service's Airport Biologist, Flight Operations Tower and Operations Area staff, and the aircrews themselves. The Airport Biologist should provide for issuance of information to all local and transient air crews regarding bird hazards and procedures for bird avoidance.

**II.** Continue to maintain the USFWS migratory bird depredation permit to manage birds that pose a direct threat to human safety at the airfield.

**III.** Promote land management practices and guidelines to decrease airfield attractiveness to birds and minimize raptor prey, primarily ground squirrels. Implement safety procedures to recognize, control, and avoid hazardous bird concentrations.

**A.** Ensure that birds are not unnecessarily attracted to areas which may create hazards with respect to collisions with aircraft.

1. Require adjacent agricultural parcels to employ cropping practices and pest management activities that minimize bird attraction.
2. Maintain vegetation within the Operations Area at a height of six to eight inches to reduce preferred habitat (NAS Lemoore 2012).
3. Minimize presence of broad-leaved weeds on the airfield, which can attract birds.
4. Ensure that habitat enhancement project actions do not encourage bird use near the Operations Area.

**B.** Implement a prey reduction program around the airfield to control ground squirrels and rodents. The program should at a minimum consist of habitat modification. If habitat modification fails to reduce the ground squirrel population to an acceptable level, then measures for a large-scale control program involving the use of rodenticide should be implemented. Measures to reduce the ground squirrel population with the use of rodenticide can reasonably be expected to result in an adverse impact to the burrowing owl population. Prior to implementing the prey reduction program, the burrowing owl population in this area will need to be relocated to other areas of the Station, region, or state of California using active and passive relocation methods in order to mitigate these adverse impacts (Section 4.5.2.2 Burrowing Owl (USFWS BCC, California SSC), Section 4.7.1 Pest and Predator Control).

**IV.** Continue to provide NAS Lemoore BASH-related safety concerns at local public hearings and zoning meetings for projects where changes in land use on adjacent lands have the potential to increase or alter bird populations and habits near the Station that may lead to increased BASH.

***Objective:*** *Strengthen the bird/animal hazard and strike monitoring detection program at NAS Lemoore.*

**I.** Survey and monitor avian species that utilize the NAS Lemoore airfield and adjacent agricultural parcels for foraging and roosting. Document responses to aircraft to evaluate the potential for aircraft impacts.

**II.** Monitor and document bird strikes and carcasses adjacent to the NAS Lemoore airfield (5090.1C CH-1) (Appendix D).

**A.** Establish procedures for collecting and reporting damaging and non-damaging bird strikes.

**B.** Establish a database to track local BASH incidents at NAS Lemoore. Records of BASH incidents should include time of day, date, species involved, and location.

**C.** Ensure squadron safety officers report BASH incidents for inclusion into the local database (Naval Operations Instruction 3750.6 series).

**D.** Ensure that feather and/or blood samples of suspected bird/animal strikes are collected and sent to the Smithsonian for positive identification.

## 4.7.3 Game Species

### Specific Concerns

- The number of upland gamebird species (primarily mourning dove and ring-necked pheasant) have decreased greatly at NAS Lemoore over the past decade. For the most part, this decline has been due to the decreasing presence and availability of water resources for gamebird habitat.

- There are limited opportunities for hunting of other game species, such as rabbit, at NAS Lemoore.

## Current Management

Station personnel or the public who hunt at NAS Lemoore are required to have the appropriate CDFW permit and to acquire a permit from the NAS Lemoore Pass and Decal office. NAS Lemoore does not currently charge a fee for their hunting permit.

Hunters are required to comply with state limits and seasonal restrictions, which is monitored by the State game warden. NAS Lemoore does not require reporting on hunting take/success that occurs on the Station.

The NAS Lemoore Hunting Instruction includes a map detailing those areas of the Station that are off-limits for hunting (Appendix D). These include the Administration and Housing Areas, Karen Mechem Park, the Operations Area, and NRMA 5 (San Joaquin kangaroo rat habitat).

If agricultural lessees do not want hunting on their parcels, they are responsible for posting "No Hunting" signs. For the most part, hunting occurs on the perimeter of the Station, in the NRMAs and along windbreaks.

## Assessment of Current Management

The existing game hunting program at NAS Lemoore is in compliance with 5090.1C CH-1 and DoDI 4715.03, which focus primarily on providing opportunities to Navy personnel and the public for hunting at Navy installations.

In concert with habitat enhancement proposed in other sections of this INRMP, game hunting and game species habitat should be encouraged and developed. If populations of game species increase and there is more hunting demand at NAS Lemoore in the future, it might be feasible to impose a small hunting fee. If so, the management of hunting fees should also comply with 5090.1C CH-1 and DoDI 4715.03 (Section 6.3.4 Funding Sources).

## Management Strategy

***Objective:*** *Develop and enhance habitat for small game species in appropriate areas of the Station.*

**I.** Include components that would attract and enhance game wildlife as part of general habitat management activities in the NRMAs. This could also be achieved as part of creating or enhancing wetland habitats, where not in conflict with the military mission.

**II.** Ensure that habitat developed or enhanced for game wildlife does not conflict with non-game species management or conservation.

**III.** Enhancement techniques, materials or locations should not encourage or promote significant use by species of known BASH concern.

**IV.** Continue to require all hunters using NAS Lemoore lands to have the appropriate CDFW hunting permit and a permit from the NAS Lemoore Pass and Decal office. Provide all hunters with a copy of the Hunting Instruction that includes a map of hunting versus no-hunting areas on the Station.

**V.** Develop hunting opportunities for persons with disabilities.

# 4.8 Data Integration, Access, and Reporting

## Specific Concerns

- Currently, there is no formalized and integrated natural resources data management system for NAS Lemoore. GIS data and other natural resources information is developed and maintained on a project-by-project basis.
- For future natural resources surveys, assessments and targeted programming, there is a need to manage and integrate data, develop data access protocols, and establish data sharing relationships with regional partners.

## Current Management

Various GIS datasets are housed by NAVFAC Southwest through the GeoReadiness Center, government contractors, and the PWD at NAS Lemoore.

The inventory and recording of natural resources field data and maintenance of a database system to house such data are an ongoing effort at NAS Lemoore. As part of this, the Station continues to fund and support biological data collection through outside research Cooperative Agreements.

The PWD has created and staffed a position to support GIS needs of the EMD and other departments at NAS Lemoore, which may support the above effort. However, there is also a need to ensure that natural resources management staff themselves are able to regularly access GIS data to support their decision-making. In the past, there have been issues with suitable computer hardware and software to support this.

Natural resources data for NAS Lemoore is disclosed to outside researchers and institutions on a case-by-case basis. For example, information from a hydrology study on the Station was provided to regional partners to be integrated into a regional study. In general, requests for NAS Lemoore information from off-Station parties is relatively infrequent.

## Assessment of Current Management

The development of a formalized and integrated database for natural resources data and GIS for NAS Lemoore would:

- Simplify the management of Station-wide land use, engineering needs, biodiversity, social factors, and countless other environmental considerations;
- Be useful in working with other federal and state agencies, particularly for listed species or species proposed for listing;
- Provide planners a decision support system for environmental impact evaluation early in the project planning process;
- Maximize training area use, while ensuring proper natural resources management;
- Reduce reliance on perceived subjective judgment;
- Streamline decision-making across departments, preventing delays by reducing unforeseen natural resources management issues and actions required to address them;
- Ensure decision processes are consistent, comprehensive, and defendable; and
- Provide easy-to-use integrated tools to a wide range of users, including NAS Lemoore natural resources managers.

DoDI 4715.03 indicates that INRMPs should contain provisions for sharing appropriate natural resources information with federal and state agencies, nongovernmental organizations, researchers and the general public. Providing this information, in a usable format, to other land managers is important since management of species can be best accomplished when all forms of potential impacts are considered for a species throughout its entire range. Ecosystem-wide resource management requires mutual cooperation of regional land managers, regulators, and scientific groups. It also facilitates regional planning efforts toward common goals. If researchers or scientific organizations would like access to natural resources data for NAS Lemoore, they are encouraged to contact and request data from the NAS Lemoore EMD.

## Management Strategy

***Objective:*** *Ensure technically sound, practical and appropriate use of library and computer technology to integrate, analyze, and communicate natural resources information, monitoring and research in support of management decisions and effective allocation of resources.*

**I.** Set up a central clearinghouse for data, reports, and publications on NAS Lemoore's natural resources that is accessible to relevant personnel (including GIS data).

- **A.** Develop a GIS database to house relevant natural resources information that is integrated and coordinated with other pertinent Station information. Such a tool would help to integrate decision-making across departments, while also streamlining decision-making.
- **B.** As part of the GIS database, update and ensure accuracy of GIS data for all federally listed species, SAR, management focus species and related features at NAS Lemoore (Section 4.5 Special Status Species Protection).
- **C.** Maintain databases for all management focus species regarding taxonomic and legal status, rangewide and NAS Lemoore distribution, and inventory techniques and timeframes for monitoring and assessment (Section 3.6 Special Status Wildlife; Appendix G).

*"Identify opportunities for improved efficiency through increased interagency and DoD Component cooperation, information sharing, technology demonstration and transfer, and public communication" (DoDI 4715.03).*

**II.** Seek standardization of the approach to communicate research and monitoring results so that the format is accessible to a broad audience.

- **A.** Ensure that GIS data are collected and delivered in a standard format as specified by the NAVFAC Southwest GeoReadiness Center.
- **B.** Ensure these data are designed, presented, and available in a way to meet the Station's planning and management needs. Data collection and representation standards should be consistent across relevant projects and scopes of work.
- **C.** Seek to ensure this compatibility with other departments managing Station resources (e.g., IRP, Public Works, and Morale, Welfare, and Recreation Department, etc.).

**III.** Participate in data sharing, technology transfer, and communication as applicable (DoDI 4715.03).

- **A.** "Use heritage and other natural resources database networks whenever appropriate" (DoDI 4715.03) to both inform natural resources management actions at NAS Lemoore and to contribute to the maintenance of those networks.
- **B.** Provide appropriate data to the CNDDB, particularly

*DoDI 4715.03 states that "Installations shall ensure that documents and other data provided to the public do not disclose information on the location or character of natural resources that may: Create substantial risk of harm, theft, or destruction of resources; Invade privacy; Trespass on Government property; Violate Federal Law or regulation; Interfere with or disclose sensitive information regarding the installation's mission; Interfere with the rights guaranteed to Native American groups in accordance with...the National Historic Preservation Act."*

regarding special status species locations and habitat.

**C.** Ensure that unscrutinized data is not shared until it has been reviewed and approved for disclosure to the public (Data Quality Act, DoDI 4715.03). Data review helps the Navy and DoD monitor confidence in data being shared and enhances the value in keeping such data.

**IV.** Continue to develop and maintain data management capabilities for NAS Lemoore.

**A.** Provide a dedicated system to support GIS software and data management capabilities for NAS Lemoore natural resources management staff.

**B.** Set standards for the periodic update of the GIS database. Keep GIS data current.

**This Page Intentionally Blank**

# 5.0 Sustainability and Compatible Use at NAS Lemoore

*Chapter 5 considers how to sustain the use of natural resources through planning, regulatory compliance, public outreach, and linking to other programs and partners both internal and external to Naval Air Station Lemoore. This chapter identifies natural resources management strategies from the point of view of sustainable use of those resources at Naval Air Station Lemoore.*

## 5.1 Sustainability of the Military Mission and the Natural Environment

The Sikes Act (as amended) stipulates that this Integrated Natural Resources Management Plan (INRMP) provides for "no net loss in the capability of the military installation lands to support the military mission." The purpose of this section is to address U.S. Department of Defense (DoD) and U.S. Department of the Navy (Navy) guidance that directs this INRMP to describe the land, air, and water resources that make the mission achievable, and how mission requirements are met while meeting natural resources compliance responsibilities. A successfully implemented INRMP will meet two basic purposes:

*All DoD natural resources conservation program activities shall work to guarantee DoD continued access to its land, air, and water resources for realistic military training and testing and to sustain the long-term ecological integrity of the resource base and the ecosystem services it provides, in accordance with Sections 670a-670o of Title 16 U.S. Code (the Sikes Act [as amended]).*

1. It will ensure the sustainability of all natural resources at an installation.
2. It will ensure no net loss of the capability of installation lands to support the DoD mission.

Healthy, sustainable ecosystems support realistic military mission needs by providing open space and buffers, stable and productive soils, clear air, clean water, and a range of natural cover and environmental conditions available for the indefinite future. Navy guidance requires that INRMPs provide strategy for protecting natural resources assets that support military uses: "Appropriate management objectives to protect mission capabilities of installation lands (from which annual projects are developed) should be clearly articulated and should be high in INRMP funding priorities" (Navy 2006a).

In general, sustainability takes a long-term view of natural resources stewardship and Navy mission accomplishment. For this INRMP, the topic covers the following items.

- The characteristics of the site, location, and natural resources that are key to supporting the Navy mission, and how natural resources constraints and conflicts are managed to protect the mission.
- Resource-specific best practices, consistent with the Navy's Environmental Management System (Naval Operations Instruction [OPNAVINST] 5090.1C CH-1 [hereinafter 5090.1C CH-1]), for the

use of renewable and non-renewable resources and how pollution and wastes are prevented and processed. The practices may address energy, water, water quality, air quality, greenhouse gas management, reducing threats both natural and human, and securing habitat for special status and management focus species[1] into the future.

- Preparing for regional growth and climate change that may encumber future uses.
- Identifying strategic regional partnerships that could help manage encroachment concerns related to natural resources.
- Indicators that help assure progress toward sustainability objectives with no net loss to the military mission.

## 5.1.1 Integrated Military Mission and Sustainable Land Use Decisions

### Background

Important to the military mission at Naval Air Station (NAS) Lemoore are ample air space for training maneuvers, air quality conditions that facilitate high visibility for flight training, airfield safety from Bird/Animal Aircraft Strike Hazard (BASH) incidents, and securing sufficient water to support training and operation needs. The latter includes the Station's agricultural program, which functions as a greenbelt around the airfield, helping to reduce dust (improve visibility), provide a buffer for special status or management focus species, control the spread of soil-borne fungal spores that cause Valley Fever, and abate fire spread should it occur.

### Natural Resources Constraints Map and Land Management Zones

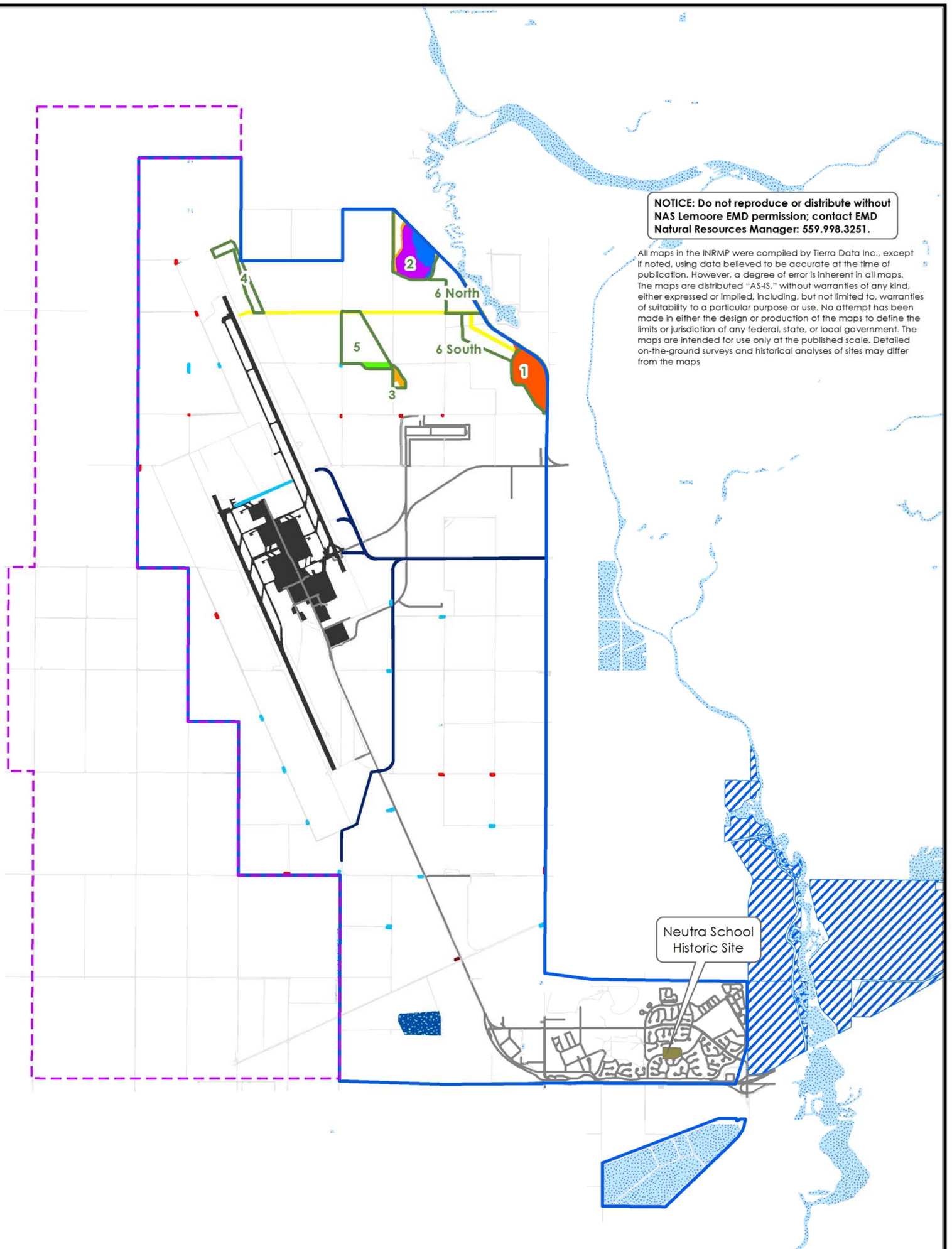
Map 5-1 shows locations of sensitive resources and regulatory limitations on land use as required in the DoD INRMP Template (Deputy Assistant Secretary of the Navy (DASN) Memorandum 14 August 2006) as the "Constraints Map." The map is intended to show all areas where regulatory commitments regarding natural resources could impinge on military mission activities.

Map 5-2 builds on the Constraints Map by grouping sensitive resources into three land management zones based on key regulatory drivers and land use pattern. It carries forward and enhances the NAS Lemoore land management zones that the previous INRMP (Navy 2001b) identified. This map can help NAS Lemoore land and natural resources managers anticipate regulatory requirements, natural resources conflicts and compatibilities, and necessary measures associated with projects or actions in any given location. It allows a manager to avoid or correct conservation problems, and enhance habitats, without impacting the military mission. See below and Table 5-1 for a description and identification of the zones.

**Zone 1:** Lands categorized as Zone 1 are known to have regulatory constraints, such as federally listed species, wetlands with a high likelihood of jurisdictional status under the Clean Water Act (CWA), sensitive historic or cultural resources, or hazardous waste sites. Any development or ground-disturbing land use in these areas would likely require surveys for listed species, consultation with regulatory agencies, or some form of mitigation. NAS Lemoore would follow an impact offsetting priority process of avoidance, minimization, and compensation for biological and cultural resources. These lands tend to have the highest priority for conservation.

[1] Management focus species are those identified in this INRMP and by NAS Lemoore for which there is a special management focus.

Map 5-1. Constraints map for Naval Air Station Lemoore.




NRCS Restoration Areas
Air Safety Easement
NAS Lemoore boundary
Natural Resources Management Area (Labels in Green)
Neutra School Historic Site
Landfill
Roads
Airfield
National Wetlands Inventory

NOTE: This map is for informational purposes only. Specific locations and site approval should be co-ordinated through the Environmental Management Division.

**Wetlands at NAS Lemoore**

LACUSTRINE LIMNETIC Unconsolidated Bottom Permanently Flooded Diked
LACUSTRINE LITTORAL EMERGENT Seasonally Flooded Diked
PALUSTRINE EMERGENT Persistent Artificially Flooded Excavated
PALUSTRINE EMERGENT Persistent Temporarily Flooded Diked
PALUSTRINE EMERGENT Persistent Seasonally Flooded Well Drained
PALUSTRINE EMERGENT Persistent Seasonally Flooded Diked
PALUSTRINE EMERGENT Persistent Temorarily Flooded Seasonally Flooded
PALUSTRINE Unconsolidated Bottom Artificially Flooded Excavated
PALUSTRINE Unconsolidated Bottom Temporarily Flooded Excavated
RIVERINE Intermittent Streambed Artificially Flooded Excavated

G:\Lemoore\MXD\INRMP MXDs\Constraints.mxd

# Constraints Map for NAS Lemoore

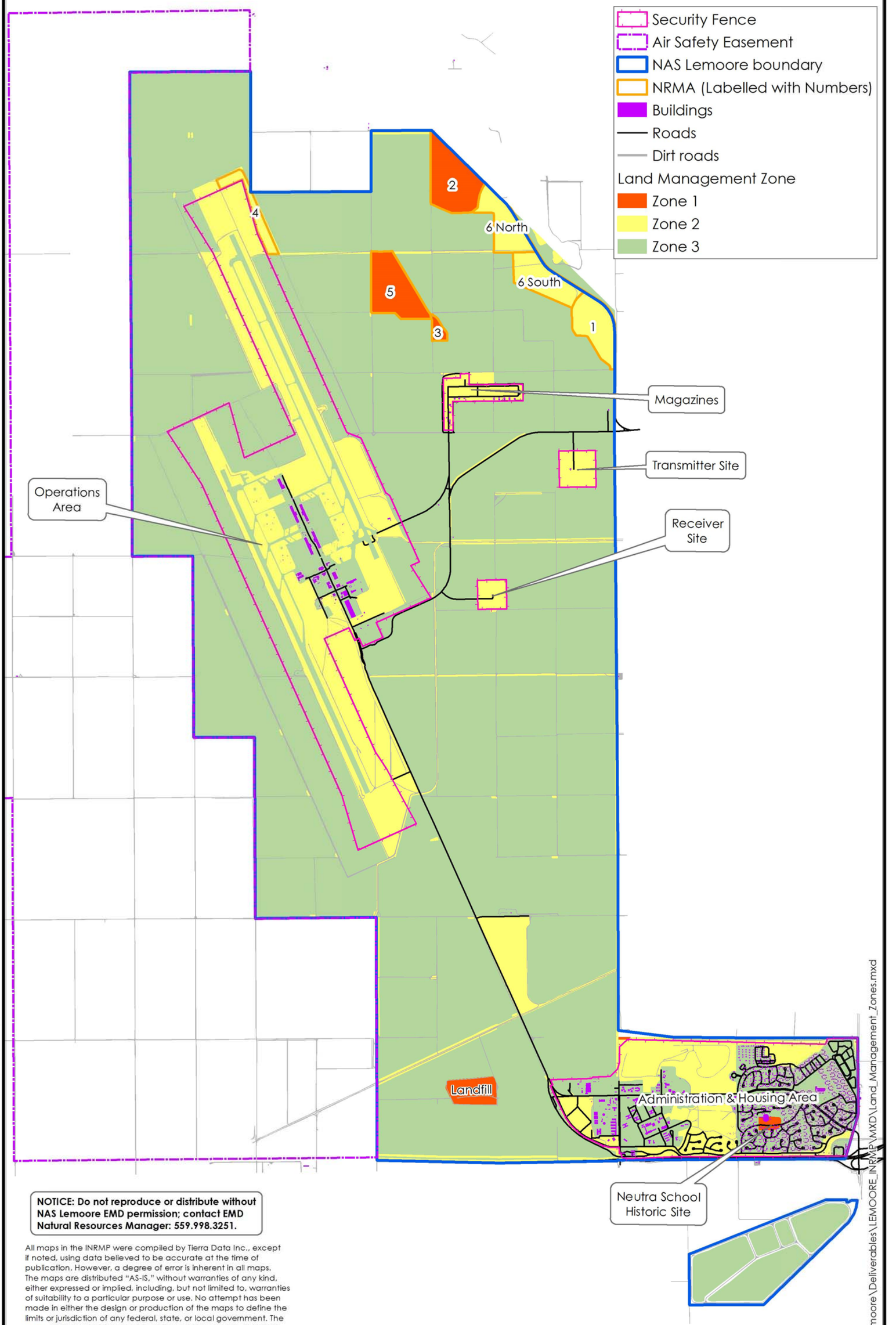
Integrated Natural Resources Management Plan Naval Air Station Lemoore

Miles
0 1
Kilometers
0 1 2

Naval Air Station Lemoore Integrated Natural Resources Management Plan

**This Page Intentionally Blank**

Map 5-2. Land management zones at Naval Air Station Lemoore.




**NOTICE: Do not reproduce or distribute without NAS Lemoore EMD permission; contact EMD Natural Resources Manager: 559.998.3251.**

All maps in the INRMP were compiled by Tierra Data Inc., except if noted, using data believed to be accurate at the time of publication. However, a degree of error is inherent in all maps. The maps are distributed "AS-IS," without warranties of any kind, either expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The maps are intended for use only at the published scale. Detailed on-the-ground surveys and historical analyses of sites may differ from the maps

G:\Lemoore\Deliverables\LEMOORE_INRMP\MXD\Land_Management_Zones.mxd

# Land Management Zones at NAS Lemoore

Integrated Natural Resources Management Plan Naval Air Station Lemoore

Miles
0 1

Kilometers
0 1 2

**This Page Intentionally Blank**

*Table 5-1. Land management zones correlation to habitat values and types at Naval Air Station Lemoore*

| Management Zones | Habitat Areas | Resources of Concern | Habitat Value | Restoration Potential | Potential Regulatory Concerns | Desired Management Condition |
|---|---|---|---|---|---|---|
| Zone 1 | NRMA 5 | ▪ San Joaquin kangaroo rat<br>▪ Western spadefoot toad<br>▪ Burrowing owl<br>▪ Wetland | High | Low | ▪ Endangered Species Act Section 7 consultation<br>▪ Endangered and sensitive species issues<br>▪ Possible jurisdictional wetland | ▪ Continue to manage for the federally endangered San Joaquin kangaroo rat<br>▪ Open non-weedy grassland with ground squirrel colonies<br>▪ Increasing perennial bunch-grasses |
| Zone 1 | NRMA 3 | ▪ Wetland<br>▪ Western spadefoot toad | High | High | ▪ Possible jurisdictional wetland<br>▪ Sensitive species issues | ▪ Some shrubs or trees for perching birds<br>▪ Improved wetland habitat in NRMA 3 and southeast portion of NRMA 5; invasive plants controlled, water retention enhanced |
| Zone 1 | NRMA 2 | ▪ Wetland<br>▪ Western spadefoot toad | High | High | ▪ Possible jurisdictional wetland<br>▪ Sensitive species issues<br>▪ Migratory bird nesting in eucalyptus<br>▪ Vegetation along banks | ▪ Sunset Lake intact vegetation is protected and interpreted<br>▪ Non-native plant species are subdued<br>▪ Eucalyptus stand is thinned of small trees and underplanted with mesquite<br>▪ Riparian wetland forest on the southwest side of Sunset Lake is enhanced |
| Zone 1 | Landfill area in the southwest corner of the Station | Burrowing owl | Medium | Low | ▪ Use as a landfill precludes it from being considered for a number of projects<br>▪ Sensitive species issues | ▪ Continue to manage for burrowing owls if present, a management focus species<br>▪ Current practices are adequate |
| Zone 1 | Neutra School | Historic resource | N/A | N/A | ▪ Listing as a historic resource on the National Register of Historic Places. | ▪ The school building is maintained in compliance with applicable laws and regulations for historic resources |
| Zone 2 | NRMA 1 | ▪ Wetland<br>▪ Western spadefoot toad<br>▪ Crownscale<br>▪ Vernal barley | High | High | ▪ Possible jurisdictional wetland<br>▪ Sensitive species issues (toad and possibly burrowing owl)<br>▪ Sensitive plant species issues | ▪ Non-native plant species are subdued<br>▪ Dead shrubs are removed<br>▪ Upland sites delineated from wetland sites, and both types are revegetated with appropriate species from Table K-1 |
| Zone 2 | NRMA 4 | ▪ Wetland<br>▪ Burrowing owl<br>▪ Cooper's rush | Medium | Medium | ▪ Sensitive species issues<br>▪ Potential for BASH | ▪ There is no large scale standing water to avoid attracting birds associated with BASH<br>▪ Non-native plants are subdued in grassland, shrubland and wetland areas<br>▪ Vegetation is restored with appropriate species from Table K-1. |
| Zone 2 | NRMA 6 | Well-developed saltbush and salt grass habitats, home to many small mammal and bird species, including burrowing owl | High | High | ▪ Possible jurisdictional wetland;<br>▪ sensitive species issues<br>▪ Migratory bird nesting in eucalyptus<br>▪ Vegetation along banks | ▪ Non-native plant species are subdued<br>▪ Dead shrubs are removed<br>▪ Upland sites delineated from wetland sites, and both types are revegetated with appropriate species from Table K-1<br>▪ Eucalyptus stand is thinned of small trees and underplanted with mesquite<br>▪ Riparian wetland forest on the southeast side of the eucalyptus woodland is enhanced |

| Management Zones | Habitat Areas | Resources of Concern | Habitat Value | Restoration Potential | Potential Regulatory Concerns | Desired Management Condition |
|---|---|---|---|---|---|---|
| Zone 2 | Habitat Linkage Corridor (connecting NRMA 5 to NRMAs 6, 1, and 2) | Wetland | Medium | High | ▪ Possible jurisdictional wetland<br>▪ Sensitive species issues | ▪ Habitat linkage corridor with NRMA 5 is enhanced by subduing non-native plant species and enhancing the vegetation with plants listed for saline sinks and wetlands in the restoration plant list (Table K-1)<br>▪ Hedgerow recommendations from Appendix K, Section K.4 Guidelines to Plant Mesquite, Willow, and Cottonwood and Table K-5 are implemented<br>▪ Pollinator habitat is present |
| Zone 2 | Windbreaks located in various areas throughout the Station | Nesting birds | Medium | Low | ▪ Migratory Bird Treaty Act issues<br>▪ Invasive species | ▪ Recommendations in Section K.4 Guidelines to Plant Mesquite, Willow, and Cottonwood are implemented<br>▪ Improved use by migratory birds where appropriate; pollinators are present |
| Zone 2 | Other wetlands located throughout the Station, generally near agricultural pumps and drains | Wetland habitat | Low to Medium | Low | ▪ Habitat value may vary from site to site<br>▪ Conduct wetland delineation prior to activities to determine whether wetland is jurisdictional | ▪ Where appropriate, these areas are enhanced with planting from the wetland restoration list in Table K-1 |
| Zone 2 | Mowed grasslands in the Operations Area and other Station areas | Burrowing owls | Medium | Low | ▪ Migratory Bird Treaty Act issues | ▪ Mowed grasslands are maintained for the military mission and to control invasive species<br>▪ Burrowing owls are relocated to more suitable areas of the Station |
| Zone 2 | Medium archaeo-logical sensitivity zones per Milliken and Young (2000) | Cultural resources | N/A | N/A | ▪ Sensitive and/or significant cultural resources | ▪ Surveys are conducted to identify sensitive cultural resources<br>▪ Significant cultural resources are protected per consultation with the State Historical Preservation Office |
| Zone 3 | Buildings, structures and landscaped areas in the Operations, Administration, and Housing Areas | ▪ Bats<br>▪ Migratory birds | Low | Medium | ▪ May require surveys prior to large-scale repairs or demolition<br>▪ There is one sensitive bat species at the Station, but roosting has not been observed<br>▪ Migratory Bird Treaty Act issues in landscaped areas | ▪ Implementation of Low Impact Development practices. Native species landscaping. Recommendations in Section 5.4 are implemented. Migratory birds are protected.<br>▪ Stormwater treatment elements as applicable<br>▪ Quality of life for personnel |
| Zone 3 | Agricultural lands | None | Low to Medium | Low | ▪ Offers little wildlife habitat. However, birds of prey (e.g., Swainson's Hawk) are tied to prey cycles in agricultural fields | ▪ Integrated pest management and best agricultural practices that promote soil productivity, water quality/conservation and reduced chemical inputs are implemented<br>▪ Pollinator hedgerows/grasses, roadside management with integrated tools, multiple objectives |
| Zone 3 | Wastewater Treatment Facility evaporation ponds | None | Low | Low | ▪ Possible waterfowl exposure to selenium | ▪ Filtration and tertiary treatment ponds are investigated and installed to process pond water for irrigation needs and wetland enhancement |

**Zone 2:** Lands categorized as Zone 2 may have regulatory constraints or may provide significant value to wildlife. Any development or land disturbance likely would require surveys to determine if protected resources are present. If so, NAS Lemoore would consult with the appropriate regulatory agency and may have to implement mitigation measures, depending on the outcome of surveys.

**Zone 3:** Lands located within Zone 3 are likely to have a lesser conservation priority due to their overall lack of cultural and biological integrity, usually due to previous ground disturbance. Most of the lands in Zone 3 are currently used to support the military mission or are outleased for agricultural purposes. Management actions or development activities would likely not require surveys for listed species. Consultation with outside agencies would almost certainly not be necessary.

## Opportunities Map

Map 5-3 shows the area surrounding NAS Lemoore to consider sustainability concerns such as buffers and corridors, as required in the DoD INRMP Template (DASN Memorandum 14 August 2006) as the "Opportunities Map." The map is intended to show all the areas where there are little to no restrictions on the military mission, and also illustrate potential encroachment partnering areas. Lands where activities are affected by military operations, and in contrast those lands or communities that are impacted by military activities, may be considered for collaborative efforts to address both concerns. The Opportunities Map identifies a geographic area where a dialogue or formal agreement among government agencies, private organizations, and NAS Lemoore regarding growth and development may be beneficial. The Opportunities Map incorporates a previously identified Military Operations Area designated by NAS Lemoore.

*The prevention of encroachment should be a major issue detailed in the INRMP. Areas suitable for encroachment partnering agreements should be identified during the development and revision of INRMPs and mapped as a geographic information system theme and reported up the chain to program needed funding. It is important to work with installation planners to identify adjacent natural areas, that if set aside through these agreements, can protect current and future mission requirements. Commander, Navy Installations Command N46 is the resource sponsor for encroachment partnering projects (INRMP Guidance for Navy Installations 18 April 2006).*

## Current Management

The Sikes Act (as amended) requires each installation with significant natural resources to report annually on the status of its INRMP implementation. As part of the annual INRMP review, Commanding Officers (COs) must answer the following questions (DASN [Installations and Environment] August 2006).

- Does the Natural Resources Program effectively consider current mission requirements?
- What is the level of coordination between natural resources personnel and other installation departments and military staff?
- To what extent has the INRMP successfully supported other mission areas? (e.g., encroachment, BASH, range support, port operations, air operations, facilities management, etc.)
- To what extent has there been a net loss of training lands or mission-related operational/training activities?

Encroachment concerns related to natural resources include:

- Dust generation leading to low visibility for pilots and which contributes to potential spread of soil-borne fungal spores that cause Valley Fever;
- Availability of water resources to support military operations, as well as the Station's agricultural program;
- Foreign object damage due to collision with birds or other wildlife;

- Land subsidence (due to groundwater overdraft) both in the region and at NAS Lemoore which could jeopardize sustainability of Station land uses;
- Pest issues and management by the Kings County Mosquito Abatement District on lands adjacent to NAS Lemoore; and
- Cultural resources compliance.

*All DoD natural resources conservation programs shall be integrated with mission activities, installation planning and programming, and other activities as appropriate (DoD Instruction 4715.03).*

NAS Lemoore addresses dust control, spread of soil-borne fungal spores that cause Valley Fever and BASH through land management practices, including maintenance of an agricultural greenbelt on the Station, primarily around the airfield. To maintain this greenbelt, NAS Lemoore is seeking to secure a baseline water allocation from the Bureau of Reclamation in the face of a limited water future. Land subsidence was recently studied through a cooperative agreement with the University of California Davis (Corbett et al. 2011); it provides recommendations for groundwater management on the Station and with regional partners to avoid subsidence which would affect the viability of NAS Lemoore infrastructure and training. Integrated pest management is embodied in the Station's Integrated Pest Management Plan (IPMP; Appendix E). Efforts to work with regional partners to reduce pest issues on adjacent lands are ongoing.

A Joint Land Use Study (JLUS) was also conducted (Tetra Tech Inc. 2011); the results of which identified important partnerships for land use and regulatory planning in the NAS Lemoore region to ensure continued compatibility with training activities and use of the Station's Military Operations Area, including its airspace (Section 5.6 Beneficial Partnerships and Collaborative Planning).

## Assessment of Current Management

Since most of NAS Lemoore's agricultural fields and natural resources function as a safety and security buffer zone for the airfield, sustainable land use and a healthy ecosystem are relatively compatible compared to installations that support more ground troop or off-road training.

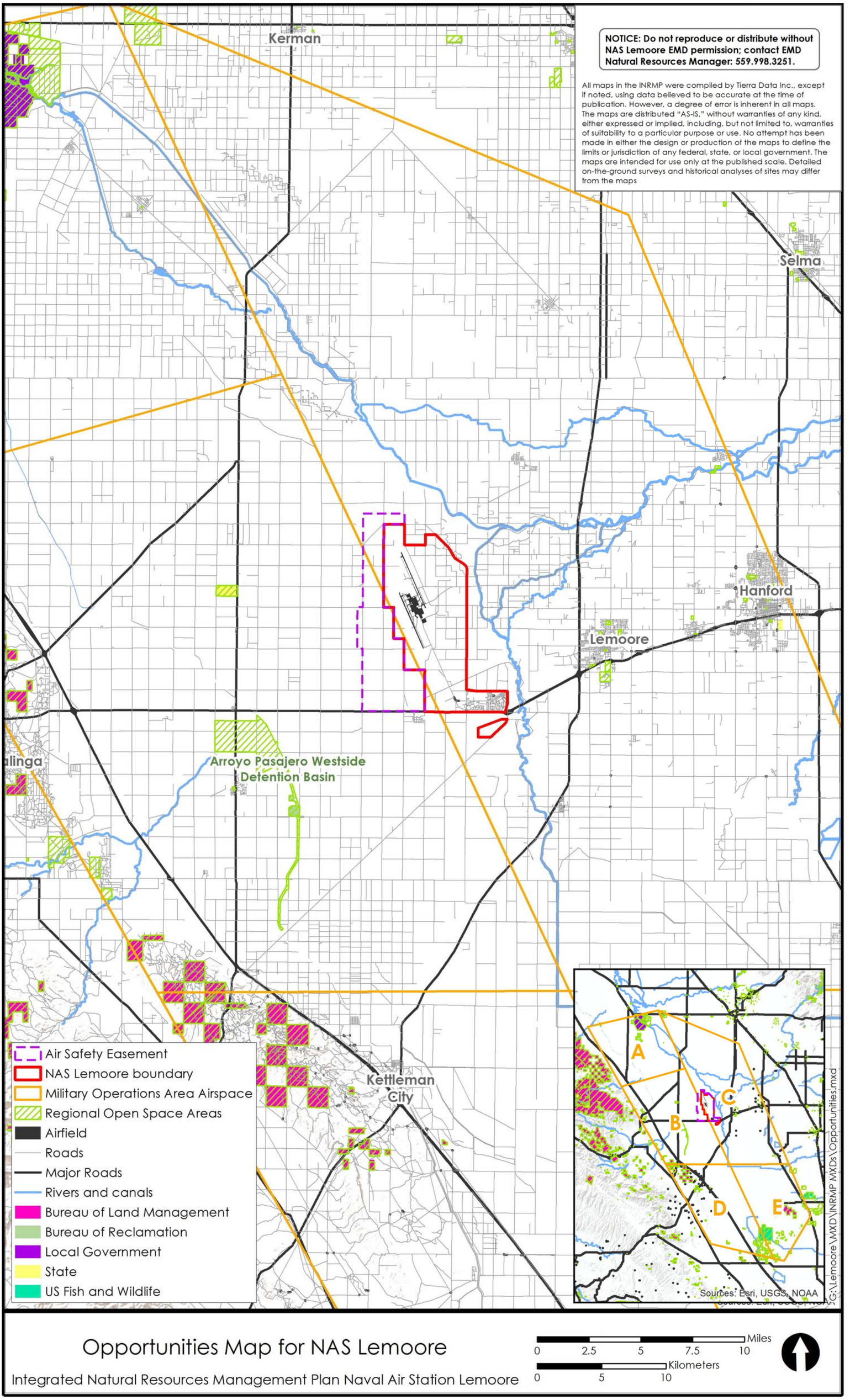
*The Sikes Act requires this INRMP to document "no net loss" to the military mission. A framework of benchmarks is needed to help a manager report on mission sustainability with respect to natural resources concerns.*

To improve and simplify the CO's ability to respond positively to annual metrics questions on the relationship between mission sustainability and natural resources, benchmarks specific to NAS Lemoore could be developed. They would help the CO evaluate whether the military mission has adequate access to and management of natural resources to support the military mission. Such benchmarks should also aid a Natural Resources Manager in evaluating impacts at longer time scales than one project or action at a time, and at both the current and future footprint and tempo of operations.

## Management Strategy

***Objective:*** *Achieve no net loss of military value by aligning current and future land use (location, extent, timing, and intensity) at NAS Lemoore with conservation of environmental values into the future. Minimize the cost of environmental compliance through transparent interpretation of compliance responsibilities and liabilities, availability of high-quality information on status of natural resources, and through decisions based on scientific analysis of ecosystem risk and vulnerability.*

Map 5-3. Opportunities map for Naval Air Station Lemoore.






# Opportunities Map for NAS Lemoore

Integrated Natural Resources Management Plan Naval Air Station Lemoore

0 2.5 5 7.5 10 Miles

0 5 10 Kilometers

Naval Air Station Lemoore Integrated Natural Resources Management Plan

**This Page Intentionally Blank**

**I.** Ensure the CO's preparedness to answer INRMP metrics review questions (as described above) (DASN [Installations and Environment] Memorandum 22 August 2006; DOD Instruction [DoDI] 4715.03).

*The DoD Components shall use Natural Resources Conservation metrics to assess INRMP implementation, measure conservation efforts, ensure no net loss of military testing and training lands across the various installations, understand the conservation program's installation mission support, and indicate the success of partnerships with the USFWS, state fish and wildlife agencies (DoDI 4715.03).*

**II.** Identify the natural resources condition for each management zone, and the Station as a whole, that sustains the military mission. Consider aspects such as: ability of the land to be resilient to or recover from uses, safety and security for the property and Navy operations (including buffers), unencumbered airfield land and air space (including noise buffers, dust control, fire abatement and BASH management). Natural resources compliance, funding, and collaboration with other agencies and organizations are also important. Refer also to Table 5-1.

*The Navy "shall restore or rehabilitate altered or degraded landscapes and associated habitats to promote native ecosystems and land sustainability when such action is practicable and does not conflict with military mission or capabilities consistent with Executive Order 13514" (DoDI 4715.03).*

**III.** Address long-term threats to the resiliency of the natural environment (Section 4.1 Managing with an Ecosystem Approach).

- **A.** Coordinate with Kings County, Fresno County, and the City of Lemoore to implement recommendations provided in the JLUS Final Report published for the NAS Lemoore area (Tetra Tech Inc. 2011).
- **B.** Maintain healthy habitats, using principles of ecosystem management and sustainability to balance short-term projects and actions with long-term goals.

*Military Departments shall assess, as part of seven focus areas on INRMP program requirements, goals, and objectives, INRMP project implementation with regard to: Are SAR identified and are steps being undertaken to preclude listing (DoDI 4715.03).*

**IV.** Conduct vulnerability and risk analyses to prevent environmental compliance issues, such as preventing the listing of Species At Risk (SAR).[5]

**V.** Implement a coordinated monitoring program to facilitate reporting on natural resources condition.

**VI.** Continue to use the National Environmental Policy Act (NEPA) process to guide decisions, document choices, analyze cumulative effects, and conserve natural resources. Include a NEPA coordinator in the earliest phases and process development.

## 5.1.2 Sustainable Water Resources Management

Water supply, use and efficiency is addressed here. Chapter 2 includes a detailed discussion on the current management of groundwater and imported water at NAS Lemoore. Water as a natural resource, including status and condition of groundwater resources, wetlands, jurisdictional waters, water quality and floodplains, is addressed in Chapters 3 and 4. Chapters 3 and 4 also discuss the use of water for habitat enhancement.

[5] SAR are defined in DoDI 4715.03 as: "species on lists maintained by USFWS, National Marine Fisheries Service, and state agencies as threatened or endangered or candidates for such lists. SAR also includes species whose designation as threatened or endangered may require conservation efforts significantly impacting a military mission." DoDI 4715.03 goes on to state: "To the extent practicable, all DoD Components shall establish policy and procedures for the management of SAR to prioritize proactive management of those species that, if listed, could adversely impact military readiness. Program objectives shall focus on efforts that have the greatest potential to prevent the list of SAR (e.g., habitat conservation, planning level surveys, monitoring). Protecting these species is critical; therefore, the installation INRMP should consider funding for SAR protection a high priority."

## Current Management

A number of studies and projects on groundwater resources (including the perched aquifer) have been completed recently. Their results are expected to help define future actions for groundwater use and management at NAS Lemoore, especially for agriculture, which has the greatest influence on the Station's groundwater resources.

- University of California Davis studied groundwater use at NAS Lemoore (primarily for agriculture) and its relationship to land subsidence (Corbett et al. 2011). The study was conducted through a cooperative agreement funded by the Agriculture Outlease Program. It provides recommendations for groundwater and land subsidence management to reduce the threats to the NAS Lemoore airfield, infrastructure and sustainable agriculture.
- NAS Lemoore is evaluating the state of groundwater production and monitoring wells on the Station. The goal is to identify those wells that are in need of repair, or which are unusable, and thus in need of replacement. The majority of agricultural outlease production wells at NAS Lemoore are 20 to 30 years old.
- NAS Lemoore has drilled a potable water well to provide emergency backup water in the event there is not enough potable water from other sources.
- California State University Fresno has conducted a study of the perched aquifer on the Station (Section 4.2.2 Water Resources).

Similar studies for use and management of imported surface water on the Station have not been conducted. Westlands Water District (WWD) provides water to NAS Lemoore for domestic, industrial and agricultural use. Outside of these, the water is also used to satisfy landscaping irrigation needs. NAS Lemoore is moving aggressively toward xeriscaping to use less water in its landscaping (Section 5.4 Landscaping and Grounds Maintenance). However, the Station has limited authority to dictate landscaping practices in the Military Housing Area (managed by Lincoln Military Housing under a Public-Private Venture (PPV) contract with the Navy) except through conditions of a long-term lease.

## Assessment of Current Management and Specific Concerns

- Adequate water supply is an essential component to the long-term sustainability of the military mission. Watersheds and water conveyance systems serve as critical lifelines for water supply, delivery and recharge throughout the region; they are also lifelines for agriculture and remnant natural communities.
- The probability of decreased surface water availability in the future is very significant. NAS Lemoore is vulnerable to declining water deliveries from WWD (Section 1.12 Integrating Other Plans).
- Climate change poses threats to water supplies in Kings and Fresno Counties and could lead to an unsustainable water supply (Tetra Tech Inc. 2010 cited in Corbett et al. 2011).[6]
- Irrigated crops drive groundwater pumping to the degree that irrigation water demands cannot be met by surface water and precipitation. Agricultural practices and water use by crops are intrinsically linked to land subsidence (Corbett et al. 2011).
- Land subsidence can threaten local infrastructure, groundwater storage capacity within the aquifer, natural and constructed waterways (e.g., wetlands, riparian habitats, canals, ditches, etc.), and the ability of the Station to

*In any given year, the WWD water allocation may not be enough to meet the baseline agricultural requirements (24,000 acre-feet/year) for NAS Lemoore.*

[6] "A 2010 report prepared by Tetra Tech (2010) performed a countrywide analysis using annual water use data at the U.S. county level, and using global climate change model outputs for temperature and precipitation, both projected 20 to 40 years into the future. The report found that, under the business-as-usual scenario of demand growth, water supplies in 70% of counties in the U.S. may be at risk to climate change, and approximately one-third of counties may be at high or extreme risk with Kings and Fresno counties being one of the counties at extreme and high risk of demanding an unsustainable water supply" (Corbett et al 2011).

support certain land uses. Given long-term trends, increasingly rapid groundwater level fluctuations, loss of groundwater storage, and uncertainty about refilling the groundwater basin, NAS Lemoore will likely experience historically low groundwater levels, significantly exceeding 250 feet below ground surface, during upcoming droughts.

*The current groundwater rate structure for agricultural leases emphasizes the use of WWD water by charging an increasing rate per volume of water pumped in excess of the first acre-foot per acre for each lease.*

The combination of long-term cuts to surface water supply, extended droughts, and reliance on groundwater pumping endanger the sustainability of the Agricultural Outlease Program (and the benefits it provides the military mission) and could lead to large scale land subsidence. Strategically, these challenges can only be met by managing total consumptive water use within NAS Lemoore and in the region surrounding the Station (Corbett et al. 2011). NAS Lemoore is moving towards active management of both its groundwater and imported surface water resources.

## Management Strategy

***Objective:*** *Sustainably manage groundwater and surface water resources to avoid detrimental impacts of water shortages, and groundwater overdraft, as part of a regional water conservation strategy to manage encroachment to the NAS Lemoore military mission.*

**I.** Improve the sustainable use of water in the Agriculture Outlease Program, landscaping, and the interface between the built and natural environment, and as part of an Environmental Management System, as required under Executive Order (EO) 13514 on Federal Leadership in Environmental, Energy, and Economic Performance (05 October 2009).

**II.** Develop a strategic Sustainable Water Resources Management Plan using quantifiable, rigorous strategies to establish the necessary monitoring programs and evaluate potential mitigation strategies for expected water shortages and related impacts.

- **A.** Retain as much water as possible by reducing consumptive use and waste, while also maintaining water quality.
- **B.** Develop a sustainable water resources management toolbox: work in consideration of all available tools, including water recycling, incentives for agricultural lessee innovation, and use of stormwater where appropriate.
- **C.** Ensure any plan is adaptive over time with continual assessment and course adjustment.

**III.** To ensure safety and security of the military mission, continue close cooperation with WWD to ensure sufficient water supply, as there are no additional available groundwater resources to rely on permanently (Corbett et al 2011). Continue the development of a Memorandum of Understanding (MOU) with the Bureau of Reclamation for a baseline allocation of 24,000 acre-feet/year of water to maintain an agricultural greenbelt around the Operations Area.

**IV.** Manage water used for agricultural production and landscaping sustainably through the Agricultural Outlease Program (Section 5.2.1 Agricultural Outlease Management) and updated landscape management strategies (Section 5.4 Landscaping and Grounds Maintenance).

**V.** Consider participating in the California State Water Resources Control Board (SWRCB) and Regional Water Quality Control Board Watershed Management Initiative (WMI) and Integrated

Regional Watershed Management.[7] An Integrated Regional Watershed Management Plan exists for the Westside area (Section 1.12 Integrating Other Plans).

**VI.** Manage groundwater jointly with surface water (conjunctive use). To manage total consumptive use, coordinate with neighboring water districts and groundwater users, particularly WWD and Kings River Conservation District (Corbett et al. 2011).

- **A.** Continue to address the threat to infrastructure posed by land subsidence. Ensure that groundwater levels do not exceed depths reached during previous droughts, when spring water levels reached 250 feet (76 meters) below ground surface.
- **B.** Continue groundwater monitoring (including the assessment of groundwater production and monitoring wells).
- **C.** Maximize recharge of high quality surface water to the aquifer, particularly as a reserve for drought periods. To do so, consider implementing recommendations from Corbett et al (2011).

*DoD Components shall use a watershed-based approach to manage operations, activities, and lands to avoid or minimize impacts to wetlands, groundwater, and surface waters on or adjacent to installations in accordance with the guidelines and goals established by the Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management (Federal Register 65: 62565-62572) (DoDI 4715.03). NAS Lemoore is near the triple-junction of three groundwater basins: Westside, Kings River, and Tulare Lake.*

**VII.** Expand the use of treated water or other alternative sources.

- **A.** Continue to investigate uses for treated water. Water that undergoes at least secondary treatment would be suitable for agricultural windbreak maintenance and landscaping, as well as for habitat uses or other non-potable uses (including dust abatement).
- **B.** Reinforce xeriscaping mandates on the Station, including in the PPV Housing Area. Best Management Practices (BMPs) require that potable water not be used for landscaping uses that do not require this level of water quality (Section 5.4 Landscaping and Grounds Maintenance).
- **C.** Consider installing a gray water irrigation system at the Administration and Housing Areas. This could help toward achieving the 20% water use reduction that is part of EO 13123.
- **D.** In habitat areas, consider innovative water sources for restoring and connecting native communities. Consider sources of recycled water, rainwater catchment, or fog harvesting. Water available for habitat currently comes lower on the priority list of water uses on the Station, and this will likely continue.

## 5.1.3 Sustainability with a Changing Climate and Regional Growth

### Specific Concerns

- While there is broad consensus on the science of climate change, most models are regional in scale and carry some uncertainty about projected scenarios at the local scale. The Station would benefit from a means to establish the relevance of regional data to the local situation, in order to best plan any response needed.
- A changing climate may affect the military mission at NAS Lemoore through effects on the infrastructure and environment that support the mission. The primary effects may be heightened air quality concerns through dust storms that could result from extended, more frequent drought, and

[7] The WMI is designed to integrate various surface water and groundwater regulatory programs while promoting cooperative, collaborative efforts within a watershed. More information available online at www.swrcb.ca.gov/centralvalley.

increased flood risk for infrastructure. Regional growth is also a concern because it can amplify scarce water supply.

- Certain natural resources will be resilient to the expected changes, and some habitats and species may benefit. However, other species may disappear or habitat issues will be exacerbated (such as flooding, drought, loss of appropriate habitat elements, warmer temperatures, and the synchrony of migratory species and their food sources, including pollinators and their host plants).
- The California Wildlife Action Plan (WAP) (Bunn et al. 2007) recommends consideration of climate science in restoration work. For the Central Valley the WAP identifies climate change as one of five key stressors affecting wildlife, along with growth and development, water management conflicts and reduced water for wildlife, water pollution, and invasive species.
- Water scarcity on a regional and statewide basis could lead to increased costs for local agricultural production. Also, beneficial pollinators that contribute to agricultural productivity may be negatively affected. Adjustments in agricultural crops may be necessitated by changes in available water for agriculture.

## Current Management

The evidence for climate change has generated consensus in the scientific community (U.S. Government Accountability Office 2007; Gitay et al. 2002; Oreskes 2004) and climate change is having observable impacts on natural resources (National Fish, Wildlife and Plants Climate Adaptation Partnership 2012); however, the scale of the problem is global while the ability to act is local and in separate institutions. Addressing climate change poses a new challenge for military and natural resources managers who will need to understand how and where the military mission is vulnerable, and specific changes in ecosystem structure and function that affect natural resources compliance obligations under the Sikes Act (as amended) and other federal laws. Assessing the long-term implications for the military mission and natural resources of growth and a changing climate is in early stages at NAS Lemoore, and generally takes place as part of encroachment planning.

*DoD 4715.03 includes a requirement to address climate change on all DoD installations. It states "All DoD Components shall, in a regionally consistent manner, and to the extent practicable and using the best science available, utilize existing tools to assess the potential impacts of climate change to natural resources on DoD installations, identify significant natural resources that are likely to remain on DoD lands or that may in the future occur on DoD lands and, when not in conflict with mission objectives, take steps to implement adaptive management to ensure the long-term sustainability of those resources."*

## Assessment of Current Management

For effects on the military mission, the natural resources program could contribute expertise to encroachment planners. For natural resources, the key impacts of climate change can be evaluated by identifying the current environmental baseline for natural resources elements that are expected to be vulnerable, or are expected to cause problems to infrastructure or to flying conditions for pilots. Conducting a vulnerability assessment for species or habitats, while at the same time considering other stresses, would help weigh and prioritize a range of possible adaptive strategies. However, the cost-benefit of actions on Navy property may be relatively unfavorable due to the Station's small scale in comparison to the scale of the problem. To address climate change vulnerabilities, actions are best leveraged with inter-jurisdictional partnerships or by expanding the outcome of pilot projects. In general, natural resources managers should identify strategies that promote conservation resiliency to the ecosystem and to military assets, and avoid those that do not, regardless of how the local effects of climate change progress in the coming years.

## Management Strategy

***Objective:*** *Adapt and mitigate the adverse impacts of climate change through goal setting based on science, targets, collaborative and regional conservation planning, risk and vulnerability analyses, metrics specific to NAS Lemoore, and adaptive management.*

**I.** Assess climate change implications for NAS Lemoore operations.

- **A.** Through use of the Readiness and Environmental Protection Initiative (REPI),[8] continue to work with Kings and Fresno Counties and other regional partners to ensure that lands surrounding the Station contain uses compatible to the military mission at NAS Lemoore, including agricultural production and/or preserves and conservation easements for natural resources.
- **B.** Develop a template for a brief for NAS Lemoore senior leadership directly linking the challenge climate change poses to NAS Lemoore's mission. Conduct briefs to the NAS Lemoore command to identify threats to the mission (e.g., dust encroachment, increased flood risk, water availability, sustainability of agriculture and natural resources), report on progress made towards mitigation, and propose opportunities for more coordination.

**II.** Address the anticipated shifts in species ranges and population abundances through adaptive management.

- **A.** Identify species and communities on the Station that are resilient or vulnerable to expected future changes by conducting climate change vulnerability assessments. Monitor those that are vulnerable and at risk in the southern Central Valley through participation in a regional program.
- **B.** Monitor predictions related to air quality, dust storms, and flood for the Tulare Basin in order to plan ahead.
- **C.** Ensure that conservation priorities and expenditures reflect climate change risks.
- **D.** Lessen the impacts of higher air temperatures by fostering a resilient and stable ecosystem.
- **E.** Continue to document the status of threatened, endangered, and other SAR, such that changes in distribution and abundance may be understood in the context of climate change.

*DoD 4715.03 requires that INRMPs address climate change. Navy INRMP Guidance (2006) requires an ecosystem-based, adaptive management approach and encourages partnerships. Climate change adaptation is most effectively undertaken with regional partnerships in mind.*

**III.** Restore habitat features where necessary and practicable to maintain ecosystem function and resiliency for SAR.

**IV.** Support adaptive management through integrated observation and monitoring and use of decision support tools. Identify data and research needs to ensure an effective response to the consequences of climate change.

**V.** Improve coordination and collaboration to ameliorate the consequences and costs of climate change. Emphasize pilot projects, inter-jurisdictional partnership, and adaptive technologies.

- **A.** Collaborate with regional Landscape Conservation

*The 2010 Quadrennial Defense review concluded that DoD must complete climate change assessments at all military installations in an effort to prevent degradation of operational readiness and facilitate adaptation. It states, "DoD will work to foster efforts to assess, adapt to, and mitigate the impacts of climate change."*

[8] "REPI takes advantage of authority (10 U.S. Code §§ 2684a) Congress enacted in 2002 authorizing DoD to partner with state and local governments, and non-governmental organizations to acquire from willing sellers conservation easements on private lands. REPI serves to forestall incompatible land use and protect high-value habitat so that DoD retains the discretion to use military lands free of encroachment-related restrictions and environmental constraints. With REPI agreements and funding DoD can cost-share the acquisition of conservation easements by creating win-win situations for all partners. REPI projects are selected for funding on the basis of a number of criteria, including: military utility, and training and testing value; potential for limiting incompatible development and protecting high-value habitat; and the level of participation and contributions from other project partners" (Tetra Tech Inc. 2011).

Cooperatives[9] or other agencies for regionally coordinated conservation approaches. This strategy is designed to complement existing or emerging federal science, adaptation, and conservation efforts.

**B.** As practicable, improve coordination between natural resources staff and other departments with responsibilities for compliance with energy and environmental management EOs (such as 13423 and 13514). Natural resources staff can assist with application of the Leadership in Energy and Environmental Design (LEED) and Low Impact Development (LID) guidelines that increasingly relate to natural resources.

**VI.** Ensure that Station personnel have access to climate change education. There are a number of DoD-sponsored resources available.[10]

# 5.2 Management of Other Uses & Real Estate Outgrants

## Background

Title 10 U.S. Code (USC) 2667 provides for the use of DoD lands under a lease to an agency, organization, or person as compatible with the military mission and safety. Secretary of the Navy Instruction 11011.47 states that real property may be made available for leasing when it can be clearly shown that…: (a) Its use shall not interfere with the accomplishment of the activity's mission, nor with the Department's present or foreseeable use of the property, nor with other Departmental activities in the vicinity; and (b) Such use shall not cause any substantial expense to the Navy. Title 10 USC 2667 authorizes the Secretary of each military department to lease nonexcess property when determined to be in the public interest or if it will promote national defense.

Additional determining factors for leasing and land use include protection of cultural sites, and sensitive environmental habitats and managed species. All leases and outgrants are subject to comply with all relevant Station plans and this INRMP.

In addition, DoDI 4715.03 indicates that the Heads of the Office of Secretary of Defense and DoD Components with natural resources management responsibilities shall ensure compliance and coordination by tenant activities, lessees, contractors, and operators on lands for which the DoD Component has a direct real estate interest and for which the management has been outsourced by privatization initiatives or Enhanced Use Lease Agreements. This is also supported by 5090.1C CH-1.

## Specific Concerns

- Management activities in the PPV Housing Area need to be in compliance with applicable regulations and Navy guidance (Section 5.3 Construction and Facility Maintenance, Section 5.7.2 Integrated Pest Management, etc.). The relationship between NAS Lemoore Environmental Management Division (EMD) oversight and management of that area is still being defined. While the PPV likely includes provisions establishing responsibility for environmental management, in the past EMD support has been

[9] More information on Landscape Conservation Cooperatives is available at: http://californialcc.org/

[10] Examples include: (1) DoD Natural Resources Conservation Program website contains a presentation from the Climate Change Workshop given at the 2010 National Military Fish and Wildlife Association conference along with links for a number of on-line tools and resources: www.dodworkshop.org/files/ClimateChange/CC-Home.html; (2) The Strategic Environmental Research and Development Program website contains links to DoD-sponsored research on natural resources conservation and climate change: www.serdp.org/Program-Areas/Resource-Conservation-and-Climate-Change; (3) A number of on-line training resources can be used to understand climate science adaptation planning, including DoD Video Responding to Climate Change: www.dodworkshops.org/files/ClimateChange/CC-Animation.html.

requested in handling wild animal problems there. It is unclear what environmental oversight has been provided for management of this area.

## Current Management

Real estate outgrants at NAS Lemoore consist of properties leased for continual use by lessees—such as the agricultural outlease area and the Housing Area—utility corridors (e.g., powerlines to groundwater wells with electric pumps and into the Administration and Housing Areas), and other easements. Easements and utility corridors are established to allow passage onto NAS Lemoore primarily for maintenance purposes. All lessees and outgrant holders are responsible for natural resources management on their respective properties. NAS Lemoore is responsible for natural resources management for all easements and utility corridors. Naval Facilities Engineering Command (NAVFAC) Southwest is responsible for managing all real estate leases and outgrants at NAS Lemoore, including ensuring compliance with applicable regulations and Navy guidance.

## Assessment of Current Management

Real estate outgrants, including utility corridors and other easements, at NAS Lemoore should comply with natural resources management requirements that the Station has agreed to or reasonably proposed, as provided in this INRMP and any other plans developed for NAS Lemoore that regulate actions with potential impact to sensitive resources, habitats, and resource allocations and uses (i.e., Section 1.6.3 Relationship to Other Operational Plans, Section 5.7.1 Integrated Cultural Resources Management Planning, Section 5.7.2 Integrated Pest Management, etc.). Exceptions to this compliance could be made on a case-by-case basis, provided there is a sufficient alternative for environmental oversight to ensure protection of resources and avoidance of violations.

Responsible parties and roles, and a review schedule for outgrants and easements, should be maintained to ensure adequate and appropriate environmental oversight. Keeping any protocols, procedures and other records on hand regarding natural resources treatment and outgrant and easement use would ensure consistency.

## Management Strategy

***Objective:*** *Ensure the long-term viability, land use compatibility, and fair-market value of all leases and outgrants in conjunction with the military mission, natural resources compliance, and best practices. Adopt wildlife-compatible practices where economically feasible, while complying with regulatory requirements and providing for management focus species.*

**I.** Oversee, inspect and monitor outgrants for compliance with environmental protection laws and Navy guidance (e.g., this INRMP).

- **A.** The Natural Resources Manager and NAVFAC Southwest are responsible for ensuring compliance with environmental requirements of outgrants and leases, and that such requirements meet the standards of any NAS Lemoore regulatory responsibilities.
- **B.** Implement policies to include specific environmental compliance actions and adoption of BMPs in all outgrants.
  1. Ensure compliance with breeding season restrictions under the Migratory Bird Treaty Act (MBTA) with respect to vegetation management (Section 5.3 Construction and Facility Maintenance).
  2. Enforce compliance with lease conservation measures and other BMPs, consistency with laws and this INRMP through regular inspections, monitoring of measure effectiveness, and reporting.

3. Implement and enforce a strict water quality protection and water conservation program.

**C.** Work with NAVFAC Southwest Real Estate to ensure periodic inspections of all outgrants and to implement effective actions to address violations.

**D.** Ensure leaseholders comply with all DoD pest management requirements (Section 5.7.2 Integrated Pest Management).

**II.** Evaluate real estate leases through the NEPA process (Section 5.8 NEPA Compliance).

## 5.2.1 Agricultural Outlease Management

### Background

It is DoD policy that each installation shall be assessed for agricultural outlease suitability: "Any such uses shall support the military mission, be addressed in and compatible with the INRMP, and be consistent with long-term ecosystem-based management goals that place ecological sustainability objectives above revenue optimization goals" (DoDI 4715.03) (refer to Section 2.4.1 Agricultural Outleases).[11]

Public Law (PL) 92-378 (10 August 1972), Naval Air Station, Lemoore–Construction Charges, allowed for the construction of the irrigation distribution system provided for under federal reclamation laws, and specifically for the lands at NAS Lemoore to be irrigable through facilities constructed for the WWD.[12]

Revenues from rents on agricultural outleases on Navy lands are a source of funding for Navy natural resources management programs (Section 6.3.4 Funding Sources).

### Current Management

The long, sunny summer days and winters that are mild, moist and often blanketed with tule fog, facilitate the agricultural production and the region's unparalleled ability to grow hundreds of farm crops. Agriculture has been the most highly valued natural resource asset at NAS Lemoore. Revenues from agricultural leases have sustained natural resources programs throughout military lands of the west.

The Agricultural Outlease Program at NAS Lemoore supports the military mission through compatible land use and airfield management and its rental proceeds help to offset management projects and actions required of the lessees on their parcels (refer to Section 1.6.3 Relationship to Other Operational Plans and Section 2.4.1 Agricultural Outleases).[13] The NAS Lemoore EMD and NAVFAC Southwest share responsibility for managing the NAS Lemoore Agricultural Outlease Program as described in Section 2.4.1.1 Agricultural Outlease Program Management.

While informal parcel visits and compliance checks (per NAS Lemoore's IPMP and Soil and Water Conservation Plan) are made frequently by the EMD, formal inspections of leases are conducted twice per year, usually in the spring and fall.

Agricultural leases vary between five and nine years; approval from the Chief of Naval Operations (CNO) is needed for any lease over one year. Thus, to extend a lease, such as part of a potential incentive program for lessees, only one-year extensions are possible without an extended delay. The Navy has been

[11] Agricultural outleasing is defined as the use of non-excess DoD lands under a lease to an agency, organization, or person generally for growing crops or grazing domestic animals. The term "agriculture" includes activities related to producing, harvesting, processing, or marketing an agricultural, aquaculture, maricultural, or horticultural commodity, including the breeding, raising, shearing, feeding, caring for, training, and management of livestock, bees, poultry, fish, shellfish, and fur-bearing animals and wildlife, and the planting, cultivating for harvest, or processing short rotations (less than 15 years) forest products (5090.1C CH-1).

[12] The proceeds from the leases paid to the Navy were then provided to the Department o f the Interior, credited to these construction charges until they were paid in full on 17 June 1988.

[13] Chapter 19 of NAVFAC P-73, Volume II, outlines procedures for the administration of rent receipts received from lessees.

increasing its flexibility with the terms of its agricultural outlease agreements because surface water availability has grown less reliable (Section 2.4.1.2 Agricultural Water Resource Supply and Use). As part of this, the Navy encourages agricultural practices that benefit productive potential of the parcels beyond the lease-term.

## Assessment of Current Management and Specific Concerns

- Agricultural water demands not being met by surface water and precipitation drives the overdependence on the use of groundwater for irrigation.
- As water prices rise and availability becomes uncertain, the agricultural leases need to be as efficient as possible in conserving water.
- Agricultural land retirement should be analyzed for trade-offs under the Sikes Act (as amended) and NAVFAC P-73. These differ by each parcel with potential impacts on the mission, local economy and community, and natural resources program.
- Planning for spring crops has been impaired by the poor timing of the WWD's notice for reduction in NAS Lemoore's Basic Water Allocation.
- The INRMP metrics question regarding ecosystem integrity incorporates questions about the sustainability of agricultural production at NAS Lemoore considering high water table issues, water cutbacks and water conservation infrastructure, and the need for water to support wildlife at U.S. Fish and Wildlife Service (USFWS) refuges.

The San Joaquin Valley continues to face major environmental issues that can affect economic development planning for the future, and the role played by NAS Lemoore. Agricultural sustainability, especially with respect to competing statewide water needs, is one of the foremost issues for the future of natural resources in the region (Bunn et al. 2007). According to the California Water Plan (California Department of Water Resources 2009b), agriculture will continue to dominate the landscape of the western San Joaquin Valley as an important economic driver, and a factor in its socioeconomic structure. It will adapt to changing market, technological, and regulatory forces. Intensification of production in fruits and nuts and vegetables and movement away from field crops is likely to continue in coming years. Increased public concerns about clean water, pesticide use, groundwater contamination, air quality, food safety, and long-term impacts on ecosystems likely will increasingly shape the future role of agriculture here.

Future water supply is projected to become more scarce and volatile considering various and competing demands for Central Valley Project water (Section 1.12 Integrating Other Plans, Section 2.4.1.2 Agricultural Water Resource Supply and Use). Supply augmentation, water use efficiency, demand reduction, flood control improvement, and salt management will all be part of the effort toward meeting this challenge (California Department of Water Resources 2009b). Sufficient water supply for and efficient water use in the NAS Lemoore Agricultural Outlease Program is important for supporting agriculture on the Station and the benefits it provides to sustain the military mission, including vegetative cover around the airfield to control dust, limit the risk of wildfire, and minimize BASH by reducing bird attraction near the Operations Area.

In light of these concerns, NAS Lemoore has evaluated land management practices with regarding to maintaining existing agricultural leases for the production of water intensive crops. Retirement of parcel 4A58 is planned to occur in phases, beginning in 2015. This land has been evaluated by the U.S. Bureau of Reclamation and determined to be non-irrigable land (due to highly saline soil), and thus not eligible for water deliveries from the Central Valley Project (Section 2.4.1.2 Agricultural Water Resource Supply and Use). Retirement of this land is proposed to occur in conjunction with efforts to relocate burrowing owls away from the Operations Area (Section 4.5.2.2 Burrowing Owl (USFWS BCC, California SSC)).

NAS Lemoore's role in the regional economy, including its agricultural role, could be an anchor and leader for sustainability and prosperity during this transition.

## Management Strategy

***Objective:*** *Improve sustainable agricultural practices to the maximum degree compatible with operational requirements of NAS Lemoore, long-term ecosystem management goals and ecological constraints, strategic regional water management plans, and Sikes Act related fair-market value guidelines.*

**I.** Ensure long-term sustainability of agricultural resources, considering NAS Lemoore's most notable issues surround water supply and quality, air quality, population growth, and regional growth.

**A.** Comply with the Farmland Protection Policy Act (FPPA) to "...minimize the extent to which Federal programs contribute to the unnecessary conversion of farmland to non agricultural uses..." (PL 97-98, Sec. 1539-1549; 7 USC 4201, et seq.). The FPPA also stipulates that federal programs are compatible with state, local and private efforts to protect farmland. The Natural Resources Conservation Service (NRCS) is charged with oversight of the FPPA.

*Navy installations shall identify and minimize the adverse effects of their actions on prime and unique farmlands in accordance with 7 USC 4201 et seq. Farm Land Protection Policy (5090.1C CH-1).*

**B.** Consistent with DoD policy, the FPPA, the Sikes Act (as amended), and long-term ecological sustainability, analyze trade-offs of agricultural land retirement that may have impacts on the mission, local economy and community, and the natural resources program.

**C.** In the region, continue to support agricultural easements under the California Land Conservation Act (Williamson Act) as a means to reduce land use conflict with the military mission and conserve agricultural opportunities.[14]

**II.** Pursue water resources management and prepare water infrastructure for a limited water future. Integrate strategies and methods into a Sustainable Water Resources Management Plan (Section 5.1.2 Sustainable Water Resources Management).

**A.** Evaluate groundwater pumping restrictions for agricultural lessees and modify as appropriate.

**B.** Conduct a study to determine agricultural groundwater well upgrading, replacement, and decommissioning needs.

**C.** Consider agricultural land set-asides to reduce vulnerability of the Station and its leases to a potentially water-restricted future for agriculture. Research the feasibility of converting appropriate agricultural leases to grazing leases in light of reduced irrigation water availability (Section 4.2.2 Water Resources).

**D.** Encourage use of smart irrigation systems to address the immediate shortage of surface water supplies due to the reductions in water deliveries through the Sacramento-San Joaquin Delta system (Corbett et al. 2011).

[14] Under the Williamson Act, an owner of agricultural land may enter into a contract with the county if the landowner agrees to restrict use of the land to the production of commercial crops for a term of not less than ten years. Certain compatible uses are also allowed on the property. In return, landowners receive property tax assessments much lower than normal because they are based upon farming and open space uses as opposed to full market value. Local governments receive an annual subvention of forgone property tax revenues from the state via the Open Space Subvention Act of 1971. There are currently more than 16 million acres enrolled in the Williamson Act in 54 counties in the state. Agricultural lands at NAS Lemoore and in the vicinity are classified by the state of California as Farmland of State Importance. Such lands are eligible for the establishment of Farmland Security Zones under 1998 amendments to the Williamson Act. Landowners can receive an additional 35 percent tax reduction in the land's value for property tax purposes if farmers and ranchers keep their property in the conservation program for at least 20 years. Currently, 19 counties in the state have adopted this Farmland Security Zones program. The Farmland Security Zones legislation prohibits the annexation of land enrolled in a 20-year contract to a city, or a special district that provides non-agricultural services, or for use as a public school site.

**E.** Consider potential changes to the Agricultural Outlease Program suggested by Corbett et al. (2011) that would achieve lower consumptive water use in the long-term and improve water resources availability and quality. This could potentially include a combination of: (a) partial land fallowing; (b) conversion to crops with significantly lower consumptive use and applied water demand; (c) use of regulated deficit irrigation on selected crops; (d) improvements in irrigation technology and irrigation timing; (e) conjunctive use of water.

**F.** Investigate opportunities to benefit from grants under the NRCS's Agricultural Water Enhancement Program.

**III.** Conduct integrated on-lease drainage management to prevent impairment of water quality.

**A.** Expand tailwater management to more leases. Include specific details, stipulated in the lease for each parcel, for a proper tailwater management system. This could be a reimbursable project.

**B.** Continue to monitor the perched saline aquifer and evaluate irrigation practices as warranted.

**C.** Develop opportunities through restoration plantings to mitigate the impacts of the shallow saline aquifer while improving wildlife value.

**D.** Develop an integrated drainage management plan with effective source control measures. Failure to control salinity will result in continued decline of regional water quality (California Department of Water Resources 2009b).

**E.** Update water quality monitoring and management actions at NAS Lemoore to comply with the new requirements included in the Long-Term Irrigated Lands Regulatory Program (California Environmental Protection Agency and California Central Valley Regional Water Quality Control Board [Central Valley Water Board] 2011, 2012) (Section 4.2.2.1 Water Quality).

**IV.** Continue to manage crops grown around the airfield for dust mitigation and BASH mitigation. Continue to evaluate any decision by an agricultural lessee to fallow land close to the airfield.

**V.** Continue to ensure compliance with the Soil and Water Conservation Plan of the agricultural outlease agreement. Continue to promote soil conservation through the application of soil amendments. Continue to conduct soil tests and evaluate opportunities to implement strategies presented in Section 4.2.1 Soil Resources.

**VI.** Control, by integrated pest management methods, all noxious and undesirable weeds, rodents, insects, and other pests found on NAS Lemoore's agricultural parcels. Continue to encourage lessees to reduce chemical means of control (per DoDI 4150.07 and Navy Instruction 6250.4C; Section 5.7.2 Integrated Pest Management).

**A.** Monitor pesticide applications on all leased agricultural lands.

**B.** Continue requiring annual submission and subsequent review of pest management plans from individual agricultural lessees.

**C.** Encourage use of bioagricultural techniques in cotton production.

**D.** Promote crop rotation to manage pests and the use of pesticides.

**VII.** Support other INRMP stewardship objectives as practicable. Practice wildlife conservation and habitat enhancement emphasizing beneficial pollinators. Seek to reclaim agricultural water where feasible to use for habitat enhancement purposes (Section 4.3.2 Wetlands and Jurisdictional Waters of the U.S.).

**VIII.** Ensure compatibility of agricultural practices with applicable cultural and historic resources laws and regulations.

**IX.** Pursue research opportunities and partnerships to answer questions regarding agricultural BMPs that not only support the Agricultural Outlease Program, but also improve water use and efficiency and support special status species and SAR.

## 5.2.2 Livestock Grazing

### Background

Policies for agricultural outleasing under DoD and Navy guidance include grazing domestic animals and assessing installations for such outlease suitability. "Any such uses shall support the military mission, be addressed in and compatible with the INRMP, and be consistent with long-term ecosystem-based management goals that place ecological sustainability objectives above revenue optimization goals" (DoDI 4715.03).

Local grazing land markets include beef (often from dairies), sheep, and goat production. The region contains about 37% of the state's total dairies; these dairies account for more than 56% of the total number of cows. The average number of cows per dairy in the region is about 1,700 (County of Kings 2012).

### Specific Concerns

- This INRMP is required to analyze the potential for leasing land for livestock grazing, including its military mission compatibility. While grazing was a historical land use at NAS Lemoore for both sheep and cattle (J. Crane, pers. com. 2011), it has not been considered under recent agricultural market conditions.
- There may be opportunities to achieve INRMP conservation objectives cost-effectively through managed livestock grazing, such as for non-native species control, habitat enhancement, fire management, and as an alternative to mowing.

### Current Management and Assessment

No regular livestock grazing currently occurs on NAS Lemoore. Some sheep grazing is permitted in low water years for weed maintenance on fallowed leases. Forage is available that can be marketed as a lease to local livestock producers on several of the Natural Resources Management Areas (NRMAs), and other parcels with vegetation. No direct incompatibility with the NAS Lemoore military mission has been identified for livestock grazing.

Leasing for livestock grazing would provide some income, although none that approaches the income generated from crop leases. Livestock grazing could be used to defray the cost of routine vegetation management, for example, by replacing maintenance normally accomplished mechanically or with pesticides. Other INRMP objectives could be achieved through targeted grazing such as: mowing for safety, security, or fire control; groundwater management; beneficial pollinators; grounds maintenance; replacing prescribed fire when burning is not feasible; invasive species management; water conservation; land use during water cutbacks; and habitat enhancement for the San Joaquin kangaroo rat (*Dipodomys nitratoides*) and the burrowing owl (*Athene cunicularia*).

Other land managers in the California have been working with livestock as a tool to enhance habitat for various kangaroo rat species, primarily to reduce dense ground vegetation and thatch of non-native grasses. Examples include:

- The Kerman Ecological Reserve (USFWS 2010f);
- Carrizo Plain National Monument using cattle (Prugh and Brashares 2010);

- Lake Mathews/Estelle Mountain Ecological Reserve using sheep (Shomo 2011; Riverside County Habitat Conservation Agency 2007);
- Naval Weapons Station Detachment Fallbrook using cattle to benefit the Stephens' kangaroo rat (*Dipodomys stephensi*) (Smith 2010); and
- The Lokern area to measure the effects of livestock grazing (cattle) on species of plants and animals at risk of extinction in the San Joaquin Valley (Germano et al. 2006, 2007, as cited in USFWS 2010g).

### Management Strategy

***Objective:*** *Investigate opportunities to employ a livestock grazing lease as a tool for natural resources management at NAS Lemoore as compatible with the military mission, this INRMP, and consistent with long-term ecosystem-based management tools that place ecological sustainability objectives above revenue optimization goals. Resolve the potential for livestock use as an ecological restoration tool.*

**I.** Investigate developing variations on a model lease template for different livestock types, grazing objectives, and parcels that have the potential for marketing as leases. Determine logistics required for such a program.

  **A.** Examples of variants include a traditional lease for cattle or sheep using seasonal pastures; or describe conservation or grounds maintenance objectives that might be achieved through the use of animals trained to electric fencing.

  **B.** Conservation objectives could include: reducing non-native thatch to benefit special status species and SAR such as the San Joaquin kangaroo rat; increasing the abundance of native perennial grasses over non-native grasses; and including benefits to plants that harbor beneficial pollinators, such as enhancing the abundance of native milkweed and tarweed that currently occur on the NRMAs, among others.

**II.** Determine fencing requirements for the various livestock types.

**III.** Incorporate a Soil and Water Conservation Plan as required by Navy guidance.

**IV.** Examine potential contribution and conflict with companion INRMP objectives such as San Joaquin kangaroo rat management, invasive species management, grounds maintenance, dust control, fire control, beneficial pollinators, waterfowl enhancement, and groundwater quality.

**V.** Consider conducting a pilot field demonstration, using livestock grazing to meet wildlife habitat conservation objectives in collaboration with other agencies, a university, or non-government partner.

## 5.3 Construction and Facility Maintenance

### Background

Proper siting and design are key to compatibility of construction programs. INRMPs are to discuss the present process used by installation planners for review of any ground disturbing projects, from site selection to completion, and how natural resources professionals currently participate, and should participate in the future, in the review process to ensure that natural resources issues are identified and properly addressed (NAVFAC P-73 Volume II).

By EO, the President has directed that federal agencies shall design, use, or promote construction practices that minimize adverse effects on the natural environment and habitats where cost-effective and to the extent practicable (EO 13112). Several laws pertain; for example, Section 319 of the CWA describes guidelines for the control of nonpoint source pollution. Federal consistency provisions also

authorize states to review federal activities for consistency with state nonpoint source programs and BMPs (Section 5.5 Stormwater and Nonpoint Source Pollution Management).

## Specific Concerns

- There is a need to facilitate the adoption of best science and new technologies by those involved in project development, in part by presenting long term cost-benefits to better evaluate differences in environmental approaches and choices. The long-term costs of alternative construction practices remain obscure to decision makers because natural resources assets are typically not assigned a value.
- Because budget constraints can limit the extent to which impacted resources can be mitigated there is a need to integrate consideration of natural and cultural resources early in the planning process to avoid costly changes in the scope of a project.

## Current Management

The Master Plan for NAS Lemoore is used in the short term to site construction projects, but also serves as a guide for achieving long-term development objectives. The recommendations below help to optimize the use of Navy resources and allow increases in operational capabilities.

All construction projects, and projects having a potential to impact natural resources at NAS Lemoore, require coordination with and review by the EMD and NAVFAC Southwest. This is necessary to determine the type and level of regulatory agency coordination and permitting needed for a given action (Section 5.8 NEPA Compliance, Section 5.9 Natural Resources Consultation Planning).

The following general requirements assist the EMD and NAVFAC Southwest personnel in implementing the land management zones (Section 5.1.1 Integrated Military Mission and Sustainable Land Use Decisions) and reflect the Navy's strategy to take site-specific measures to protect sensitive resources in coordination with the military mission.

- Actions with the potential to affect the environment or natural resources on NAS Lemoore require NEPA compliance (Section 5.8 NEPA Compliance).
- During planning, effects on sensitive resources must be evaluated when locating new facilities and concentrated military operations in or adjacent to biological resources known to contain special status species and SAR. Consultation with the USFWS, in accordance with Section 7 of the Endangered Species Act (ESA), could be necessary. Coordination with all regulatory agencies will be through the EMD and NAVFAC Southwest (Section 5.9 Natural Resources Consultation Planning).
- Site approval from the EMD is required for all facilities and activities. Activities include, but are not limited to, development, reconstruction, repairs, utilities, leases, and easements.
- Consultation with and approval from the EMD and NAVFAC Southwest is required for any substantial activities conducted by lessees, such as in the agricultural outlease area.
- The EMD must approve any actions that could introduce hazardous materials or waste to an uncontaminated area.

## Assessment of Current Management

Current management and early consultation with the EMD and NAVFAC Southwest should minimize unexpected planning and implementation costs and delays, while protecting natural resources. Land management zones (Section 5.1.1 Integrated Military Mission and Sustainable Land Use Decisions) can be used at the earliest stages of the planning process to ensure that natural resources issues are identified and that adequate funding, resources, and commitment are available to comply with federal, state, and Navy regulations. They can also be used to facilitate the planning process and ensure adequate resource protection.

Consultation with the USFWS (informally and formally) should continue regarding any Station management actions that might have an impact on federally listed species, or their habitat, present on the Station. Currently this includes the federally endangered San Joaquin kangaroo rat (Section 4.5.1.1 San Joaquin Kangaroo Rat (Federally and State Endangered)). It is possible that other federally listed species may be documented on the Station in future surveys (Section 4.5.1 Threatened and Endangered Species and Critical Habitat). In that case, relevant facility maintenance and project proposals should be re-evaluated in light of new discoveries.

## Management Strategy

***Objective:*** *Conduct construction and facility maintenance in a way that allows for protection of sensitive environmental resources and the timely, cost-effective completion of environmental documentation requirements, while ensuring full accomplishment of the military mission.*

**I.** Strengthen the participation of natural resources personnel in the site review process (NAVFAC P-73 Volume II).

**II.** Consider environmental impacts in all site feasibility studies and project planning, design and construction. Appropriate conservation work and associated funding shall be included in project proposals and construction contracts and specifications.

*Congress directs all federal agencies, to the maximum extent practicable and consistent with each agency's responsibilities, to conserve and to promote conservation of non-game fish and wildlife and their habitats (5090.1C CH-1), particularly SAR, as defined in DoDI 4715.03.*

**A.** Establish laydown areas where trees and other natural resources will not be affected. Attempt to minimize disturbance by preferring disturbed or developed areas first.

**B.** Vehicular traffic associated with construction and operational support activities, including parking, will remain on established roads to the maximum extent practicable.

**C.** Clean construction and facility maintenance equipment (e.g., mowers) in temporary staging areas or other designated areas, in accordance with BMPs, prior to entering and departing the project corridor to minimize the spread and establishment of non-native invasive plant species (Section 4.6 Invasive Species Management).

*Per 5090.1C CH-1, installation Natural Resources Managers shall ensure that invasive species prevention recommendations are incorporated into new construction programs and operations.*

**D.** Develop and implement a NAS Lemoore Vegetation Management Instruction to guide rehabilitation of construction and maintenance sites, as well as appropriate mitigation methods and ratios for impacts that cannot be restored on-site.

1. Construction and maintenance sites should include revegetation or the distribution of organic and geological materials (i.e., decomposed granite) over the disturbed area to reduce erosion while allowing the area to naturally vegetate.
2. Use native seeds or plants selected from the Station's recommended plant list (Appendix K) to revegetate staging areas and other disturbed areas. Choose plants for landscaped areas that are suitable for NAS Lemoore's unique soil conditions (Appendix H; Section 5.4 Landscaping and Grounds Maintenance). Use site-appropriate, drought-tolerant type of seeding or sod where turf grass has been disturbed.

*Use of native seeds or plants which are compatible with the enhancement of special status species should be used to the extent practicable to revegetate disturbed sites in relevant areas, as required under Section 7(a)(1) of the ESA.*

3. Impacts to areas containing sensitive or management focus species need to be identified in appropriate NEPA documentation. Appropriate restoration and/or mitigation should be provided for these impacts through consultation with the EMD and other agencies as needed.
4. Trees removed during construction or maintenance activities should be replaced at a minimum one-to-one ratio, preferably at a three-to-one ratio by the contractor, unless alternative arrangements are made. Coordinate the locations for new trees with the Natural Resources Manager. The EMD is preparing a list of prioritized planting locations for replacement trees.
5. Develop a list of additional recommended BMPs and/or BMP resources[15] and facilitate consideration of innovative techniques for construction and facility maintenance projects that also address multiple INRMP objectives for dust management, habitat management and enhancement, invasive species control, and the need to encourage perennial grasses and other native plants whose water needs are suited to the region.

**E.** Funding should be provided throughout building phases and post-construction for weed control.

**F.** Design buildings to reduce bird and bat nesting potential.

**G.** The MBTA requires that federal agencies coordinate with USFWS if a construction or site activity would result in the take of a migratory bird in order to obtain applicable permits prior to construction or clearing activities. If construction or clearing activities are scheduled during the nesting season (February 15 through August 31), surveys will be performed to identify active nests (Section 4.4.5 Birds). Contact the Natural Resources Manager for further guidance.

**III.** Promote sustainable land use by avoiding the use of undeveloped land, maintaining open space, establishing water and soil conservation areas, supporting existing natural ecosystems and federally listed species habitats, and maintaining the function of floodplains.

**IV.** Continue to improve practices to protect and improve water quality and to prevent runoff from NAS Lemoore developed and landscaped grounds, roads, and parking lots (Section 5.7.4 Sustainability in the Built Environment and Section 5.5 Stormwater and Nonpoint Source Pollution Management).

**V.** Secure all appropriate permits before work commences.

**VI.** A National Pollutant Discharge Elimination System (NPDES) permit for stormwater discharges from construction activities is required for sites where one or more acres of land will be cleared, graded, excavated, or stockpiled.

*Ensure that state-approved erosion prevention/control measures are included as requirements in the specifications for all ground disturbing construction projects. Include these costs as a specific item in new project investigations and preliminary engineering reports (5090.1C CH-1).*

**A.** For construction projects with a total area greater than one acre (including all phases), a construction permit is required.

**B.** A Storm Water Pollution Prevention Plan (SWPPP) must be prepared prior to filing a Notice of Intent and records of site inspections must be maintained.

**C.** The property owner (installation) must apply for coverage under the U.S. Environmental Protection Agency's (EPA's) General Permit for stormwater discharges associated with construction activities.

**D.** Erosion control measures and appropriate BMPs, as required and promulgated through the SWPPP and engineering designs, will be implemented before, during, and after construction activities. Monitor effectiveness of BMPs.

[15] An example to include on this list would be BMPs imposed by the San Joaquin Valley Air Pollution Control District. Available online at http://www.valleyair.org/Home.htm.

**VII.** Develop and implement protocols (avoidance and minimization measures) for regular maintenance activities, routine repair and emergency repair of infrastructure, so that human life, health and safety are given precedence, but sensitive resources are also protected (per 5090.1C CH-1). Such activities need to be anticipated as much as possible so environmental damage, which is typically worse in an emergency than during a planned repair, can be reduced.

- **A.** Develop a clear understanding with the USFWS about the extent of environmental damage that may be expected from disturbances such as emergency repairs, spills, and fire control. Habitat may be temporarily impacted but not lost.
- **B.** Investigate means to improve successful acquisition of funding for preventive repair of infrastructure to avoid more environmentally damaging emergency repairs.
- **C.** NAS Lemoore personnel or contractors conducting maintenance activities, who come across a nest or other natural resources that they believe is in danger of being impacted, shall contact the EMD immediately for guidance on next steps so as to avoid violating any federal regulations.

**VIII.** Avoid installing broadcast lighting in outdoor areas, particularly on building exteriors. Downward focused lighting decreases light pollution, minimizes impacts to nocturnal wildlife, and can save energy. Areas that may be excepted include lighted ball-fields and other areas where safety is a primary concern (Section 4.4.6.1 Bats).

- **A.** "Night sky compliant" lighting has been certified to meet these requirements to some extent.
- **B.** As lighting fixtures reach the end of their life cycle or where retrofits or renovations allow, consider using focused outdoor lighting.

## 5.3.1 Roadside Management

### Specific Concerns

- There are currently over 100 miles (160 kilometers) of unpaved roadways at NAS Lemoore. These are primarily used as access to agricultural outleased parcels. Many become impassable during the rainy season, but more importantly, generate considerable dust during the dry season. The former concern is a soil conservation and potentially a nonpoint source pollution matter. The latter can be a mission-related concern with airborne dust on the airfield and affecting aircraft; a health concern related to Valley Fever, which is associated with dust transport; and potentially contribute to safety hazards on local highways. Dust is a particulate regulated under the Clean Air Act.
- *Status quo* practices (mowing or other mechanical methods for vegetation clearing) are both time-consuming and energy-intensive. Significant financial and ecological costs are generated.
- Roadsides that are maintained by clearing are vulnerable to invasion by non-native species including noxious weeds, which may be dispersed by wind, truck tires, or treads of agricultural equipment. Invaded roadsides act as linear vectors of non-native plant invasion into surrounding fields and open space, including NRMAs. This is a matter of concern under the federal Plant Protection Act and EO 13112.
- Bare roadsides become vulnerable to wind erosion, resulting in loss of soil and increased dust hazard.

### Assessment of Current Management

Roadside management is most often performed using a combination of periodic removal (particularly through herbicide application) or mowing of vegetation, as specified in maintenance contracts or work orders. The responsibility for the maintenance and condition of roadsides is shared and so must be coordinated among departments at NAS Lemoore.

Roadsides are seldom recognized as a potential ecological unit in the larger landscape, complete with ecosystem services that benefit the military mission and natural resources. At NAS Lemoore, there is an extensive system of earth surfaced roads primarily used as access to agricultural leased lands. An ecological approach to maintaining these roadsides would reduce costs associated with time-consuming and energy-intensive mowing, provide improved dust control, restore ecological functioning (including water absorption from runoff to reduce nonpoint source pollution), improve exotic weed control, reduce use of herbicides, and provide habitat enrichment for wildlife.

## Management Strategy

***Objective:*** *Develop an Integrated Roadside Vegetation Management Plan to guide a long-term strategy to convert strategic and appropriate roadside areas into self-sustaining plant communities that require minimum maintenance and provide an array of services that benefit the military mission and natural resources management. The plan would:*

**I.** Treat roadsides (including graded roads in undeveloped areas of the installation) as a separate focus of land management.

**II.** Inventory and categorize relatively uniform road segments, based on soils, drainage, and microtopgraphy of road edge. Identify areas with desirable vegetation and sites that need improvement.[16]

**III.** Recognize that roads traverse different habitat and land-use types. Roadside vegetation species should be selected according to habitat.[17]

**IV.** Regulate mechanical mowing according to security requirements. Encourage plants that can withstand the mowing required.

**V.** Improve the ecological condition of roadsides to enhance biodiversity, reduce non-natives, absorb and direct flood flows, control pollutants, and provide cultural and natural resources education (Forman et al. 2003). Replacing non-native annual grasses and forbs with deeply rooted perennial species would regulate and reduce ponding of water along roadsides and reduce nonpoint source pollution from agricultural runoff by absorption of nutrients.

*Saltgrass provides superior ground covering capacity that would significantly limit invasion of non-native grasses and other species and would minimize wind erosion resulting from poor ground covering capacity of non-native grasses and forbs, especially late in the dry season, when soils are most vulnerable to disturbance by wind. This species would do well in areas that require mowing to a minimum of six inches.*

**VI.** Facilitate adaptive management through testing and improving planting methods, management practices, seed sources, seeding rates, seed mixes, planting, or contouring equipment, etc.

**VII.** Encourage a pilot field demonstration and emphasize incremental implementation to additional areas. Determine the best timing and best set of cultural practices, planting mix, biological methods, and mechanical methods.

**VIII.** Provide public awareness materials and outreach to other departments, agencies, and the public. Make an interpretive sign for the demonstration.

**IX.** Provide guidelines and directives for contractors who seed, plant, and maintain roadsides.

[16] Roadsides can be mapped in cross-section by traveled road way; unimproved shoulder; recovery area; side slope; open-cut ditch; backslope, backberm; and field edge (adjacent to agriculture or other).

[17] For example, roads in agricultural areas could function as corridors for plants that attract pollinator insects (Appendix K). Finer textured foliage shrub species such as four-wing saltbush (*Atriplex canescens*) or honey locust (*Prosopis glandulosa*) are superior for capturing lateral dust generated by passing vehicles. Perennial creeping grasses, such as creeping wild rye (*Elymus triticoides*) or saltgrass (*Distichlis spicata*) are ideal understory species that capture dust particles.

## 5.3.2 Fence Maintenance and Buffer Zones

### Current Management

Security fencing is provided in necessary areas to restrict access for safety and security reasons, including around the Operations Area, Administration and Housing Areas, Transmitter and Receiver Sites, and the Magazine Area. Additional internal fencing provides an extra measure of security for sensitive equipment and infrastructure on the Station (including protection for personnel safety). Maintaining buffer zones around these fenced areas helps to avoid conflicts with natural resources during regular use and maintenance activities. Security fencing is either currently provided or installation planned around all NRMAs except for NRMA 4 to keep out off-road vehicles.

### Management Strategy

***Objective:*** *Using integrated fencing and buffer zones, provide security and safety for operations, personnel, and the public, while avoiding and minimizing environmental impacts.*

**I.** Integrate security fencing, required clear zones, safety requirements, and encroachment control into designated, multi-purpose buffer zones in appropriate areas. Maintain perimeter and internal security fencing to protect public and personnel safety.

- **A.** Maintain and repair security fences as needed to prevent access for species that may be incompatible with land uses or training activities (e.g., coyotes within the airfield security fence).
- **B.** Maintain grounds within buffer zones through mowing and other measures to reduce wildlife attractants.
- **C.** Continue to maintain the agricultural parcels around the airfield as another buffer area. Manage crops adjacent to the airfield for dust and BASH mitigation (Section 2.4.1 Agricultural Outleases and Section 4.7.2 BASH Program).

**II.** Construct and repair fences around the NRMAs as needed to prevent trespass into these areas.

**III.** Ensure maintenance methods do not promote invasive species spread, or do not hinder reasonable establishment of native habitats and species.

# 5.4 Landscaping and Grounds Maintenance

### Background

Landscaping and grounds maintenance at NAS Lemoore must be reconciled with legal drivers, including the Sikes Act (as amended), 5090.1C CH-1, NAVFAC P-73, Volume II, the CWA Section 404, EO 13112, EO 13148, EO 13514, EO 13423, EO 13514, and the presidential Memorandum of April 1994, Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds. These requirements cover both maintenance of the existing landscape and development of new landscapes.

### Specific Concerns

- Water is the dominant natural resource impacted by landscaping. As water availability becomes an even more pressing concern over the next 20-30 years, care needs to be taken to tailor the selection of planting with an appropriate water regime. High water use landscaped plants at NAS Lemoore show signs of prior insufficient watering (TDI 2012).
- There are approximately 70 acres (28 hectares [ha]) of irrigated turfgrass at NAS Lemoore, primarily in the Housing Area and Karen Mechem Park. BMPs for water and chemical inputs are not

systematically monitored. A plan to upgrade all irrigation delivery systems to the highest level of conservation is not yet in place.

- Performance standards listed for landscape maintenance are in need of a system to regularly evaluate performance and adjust for deficiencies by establishing clear goals and expectations.
- Topping[18] and heading[19] of canopy branches can be counterproductive in the long term, as this type of pruning can stimulate heavy sprouting that lacks proper vascular connection with older wood, and is subject to breakage. This unnecessarily deforms the canopy and reduces ecological function.
- Native species are generally not incorporated into landscape planning and installation.
- In particular, there is not a comprehensive plan to address the enhancement and maintenance of Karen Mechem Park.

*INRMP Guidance for Navy Installations (Navy 2006) directs INRMP content to cover: (a) installation landscape plans, (b) BMPs for erosion control, nonpoint source pollution, low maintenance landscaping, reduced mowing procedures, and water conservation, (c) integration of low-maintenance indigenous species in landscape planning and projects, and (d) BMPs for the selection of plant materials for land rehabilitation. This is supported by 5090.1C CH-1.*

- The Station is anticipating a future reduction of landscape management efforts and budget.
- The MBTA restricts certain landscaping and tree maintenance activities during the breeding season for migratory birds. Likewise, BASH and special status species concerns restricts certain landscaping in some areas of the Station.

## Current Management

Grounds maintenance for approximately 350 acres (140 ha) of NAS Lemoore is currently under contract through the Public Works Department. Approximately 170 (68 ha) acres are managed as xeriscaped units, requiring minimum irrigation. Approximately 60 acres (24 ha) of xeriscaped units are natural grasslands that are mowed to a height of six to eight inches (particularly around the airfield), as needed, for the purpose of dust control and to discourage bird activity. Mowing also helps to control invasive plant species.

Landscaped areas provide ceremonial and recreational spaces for NAS Lemoore personnel and dependents. Many of the plantings in these areas reflect more than a century of landscape gardening tradition and practice in the southern San Joaquin Valley. Approximately 160 acres (65 ha) of the Station are planted with trees and shrubs that are generally tolerant of the extreme dry heat of summer and the foggy, damp winter chill. However, most of these species, along with the extensive turfgrass, require significant irrigation during the eight-month dry season (March–October). Cool season turf grass types, such as hybrid fescue, which is currently planted in the Housing Area and in some recently planted areas of Karen Mechem Park requires 4.24 feet of water per year, equivalent to 678.4 acre-feet per year for 160 acres (65 ha) of irrigated landscape.[20] Warm season turf such as bermuda grass, which is considerably more salt tolerant, would require 3.16 feet per year, equivalent to 505.6 acre-feet per year for 160 acres (65 ha) (Appendix H). Xeriscaped areas are generally wayside or right-of-way areas with annual grasses and forbs that are not native.

Standard principles of landscape maintenance are detailed in the grounds maintenance contract.

## Assessment of Current Management

Improved front-end planning of landscape management, in conjunction with INRMP objectives and strategies described below can save NAS Lemoore both money and resources in the long-term. While

[18] Topping: "reduction of a tree's size using heading cuts that shorten limbs or branches back to a predetermined crown limit," (Costello 2006).

[19] Heading: "cutting currently growing or one-year old shoots back to a bud, or cutting an older branch or stem back to a lateral stub in order to meet a defined structural objective" (Costello 2006).

[20] This is assuming that irrigation volumes follow University of California guidelines (Hartin et al. 2001) for the San Joaquin Valley.

some recommended innovations and practices may require up-front capital investment (which could be committed in phases), long-term cost savings will make them both worthwhile and contribute to quality of life at and sustainability of the Station.

Such planning spans a range of actions including establishing mechanisms to evaluate landscape contractor performance, improving irrigation systems and management to promote increased efficiency, shifting to more regionally appropriate species for the Station considering its unique soil conditions and availability of water resources, developing pruning standards, investigating methods to capture and use alternate sources of water, and developing a specific plan to guide landscaping in Karen Mechem Park.

All guidelines below are designed to contribute to more efficient and cost-effective landscape management that can be sustained on a long term and is specific to NAS Lemoore's military and support uses, quality of life goals, and unique environmental conditions.

## Management Strategy

***Objective:*** *Develop and implement a landscape management plan that establishes a best practices approach tailored to the site-specific environmental conditions of NAS Lemoore. Emphasize sustainable, water efficient, regionally appropriate and educational landscape areas that support the military mission, quality of life, and natural resources management.*

**I.** Incorporate INRMP goals and strategies into any new landscape maintenance contracts.

**II.** Adopt a revised planting list for horticultural species at NAS Lemoore that includes regionally appropriate species (Appendix H can be used as a guide).

**III.** Recognize that while native species are preferable, some non-native species may be more appropriate given the peculiar combination of environmental factors at NAS Lemoore (high heat, saline conditions, perched water table; Appendix H). All plants on the California Invasive Plant Council Invasive Plant Inventory (2006) and all non-native grasses (except those used for turf/lawns or those included in the approved plant list) are unacceptable.

**IV.** Where appropriate, encourage landscaping with natural resources benefits including native plants that provide a source of food for wildlife, provide necessary nesting and roosting cover for resident and migratory birds, and support and benefit pollinators.

**V.** Reduce the use of grass as a generic groundcover. Identify areas where turfgrass would be highly functional (ball fields, ceremonial settings) and should be retained. Identify and replant areas of unnecessary turfgrass with more drought-tolerant species (such as bermuda grass).

*Well maintained turfgrass is required in the current landscape management contract. The area of turfgrass currently in cultivation at NAS Lemoore is estimated to use between 450 and 700 acre-feet of water per year.*

**VI.** Use irrigation zones to manage the landscape in concert with the reduction of turfgrass. Areas that are suitable for more drought-tolerant species, such as Karen Mechem Park, should be zoned for less frequent irrigation. Recreational, ceremonial and other areas that would retain turfgrass and other high water species should be zoned for more frequent water.

**VII.** Prioritize areas for landscape enhancement and projects. Provide guidelines to use species that fulfill various landscape requirements and goals, but use significantly less water in light of the region's limited water future.

- **A.** Entries, highway frontage, significant buildings and areas for quiet walking and exercise should be thought of as areas for targeted landscape enhancement.
- **B.** Incorporate xeriscaping where possible.

**C.** Consider emphasizing strategic shading of buildings and outdoor pedestrian passages.

**VIII.** Provide specific guidance on the development of new or renovated landscaped units at the Station, as needed.

**IX.** Incorporate principles and objectives from the Station's IPMP (NAVFAC Southwest 2010).

**X.** Evaluate grounds maintenance contracts and contractors using best knowledge-based practices that are specific to NAS Lemoore's needs and environmental conditions. Contractors should be experienced with California native plants and other Mediterranean climate plant species, which require a very different understanding of water, mulching, timing of pruning and planting techniques.

*The California Native Plant Society and Las Pilitas Nursery in nearby Santa Margarita maintain websites that are extraordinarily rich in information on native plant landscaping.*

**XI.** Contractor and landscape design team coordination with the Navy should occur early in the planning process to determine site-specific needs and constraints, particularly in relation to BASH species and federally listed species.

**XII.** All plants should be verified for availability in size and quantities needed for each project prior to specifying on plans or scopes of work.

**XIII.** Develop pruning standards that are suited to individual species and their growth forms and require that maintenance contractors comply with them.[21]

***Objective:*** *Conserve and use water efficiently in landscape management, which supports sustainability of the Station and benefits the military mission through long-term cost savings: Maximize use of rainwater runoff from buildings and surface flow for landscape irrigation and other non-potable uses; Recycle wastewater for use in the landscape and habitat restoration; Reduce water use in the landscape with smart irrigation practices.*

**I.** Develop a Station-wide water plan that includes measurable objectives, defined methods and implementation timelines for improving efficient water use and conservation in the landscape and encouraging innovative techniques and technologies. Emphasize methods to maximize rainwater capture and reuse (see also Section 5.1.2 Sustainable Water Resources Management).

*Per 5090.1C CH-1, installations should employ landscaping practices and technologies that conserve water and prevent pollution.*

**II.** As part of long range water planning, investigate design and implementation of a facility and distribution system to recycle wastewater on site for irrigation and other uses. Primary and secondary treatment is already practiced on site. Tertiary treatment could be employed to remove nutrient loads and can be incorporated into an attractive treatment wetland design featuring native water plants. Explore additional sources of funding to implement.

*Treated water can be used for irrigation and wetland enhancement, or released to recharge groundwater. There are a number of examples of such systems operating at different scales: City of Arcata, California; Oberlin College, Ohio; Evergreen State College, Washington.*

**III.** Modernize irrigation technology to current standards for water usage. Adjust irrigation scheduling according to published University of California standards for the San Joaquin Valley (Appendix H).

[21] The American National Standards Institute materials are the basis for a number of local pruning plans. Pruning methods should highlight the natural, genetic-based growth habits of the specific plant species, since they are not the same for all trees and shrubs. Very few species are adapted to repeated shearing over a long period of time. Shearing should only be used when the objective is to maintain a formal hedge. Most landscaped species at NAS Lemoore are not suited to hedging. Those that are include boxwoods, privet and some hollies.

**IV.** Develop an inventory of current irrigation practices and hardware. Phase in highly efficient MP rotator-sprinklers (Hunter Irrigation). MP Rotator heads use 50% of the water of traditional heads to deliver the same amount of water.

**V.** Consider using drip irrigation for new plantings of low water use. Drip requires a highly filtered water source, so that the incorporation of sediment separators will be required when using groundwater or recycled water. These are self-flushing devices that eliminate clogged drip emitters, the primary problem encountered in drip systems.

*A number of other current practices aimed at substantially reducing water usage are known from the region, and local knowledge and advice is available for developing a comprehensive plan for irrigation systems used for landscape maintenance.*

**VI.** Implement the use of bioswales as landscape and interpretive features, as well as functional ones. Bioswales (earthen swales planted with appropriate species) can be installed in landscaped areas to filter sediments from runoff and aid in infiltration of the water. Excess water can be directed toward constructed seasonal wetlands or other holding facilities such as cisterns.

**VII.** Promote the use of permeable hardscape, which can be used in large parking facilities and other areas using existing technology. Bioswales can be combined with permeable surfacing to filter and direct any excess water during a heavy rain event.

*When used in parking areas, systems designed to break down hydrocarbon waste can be used within the percolation column beneath the surface to minimize or eliminate hydrocarbon pollution from the water column.*

**VIII.** Prioritize and implement strategies to comply with recent DoD and Navy policy mandating use of LID strategies for stormwater management for federal facility construction (Section 5.5 Stormwater and Nonpoint Source Pollution Management).

***Objective:*** *Develop and implement an enhancement and maintenance plan for Karen Mechem Park that emphasizes regionally appropriate species and water conservation, and sustains the park as an inviting recreational space for Station personnel, families and guests.*

**I.** Incorporate principles of irrigation zoning. Locate trees that require abundant water in or near lawn areas (Table H-2), which require daily irrigation during Central Valley summers. For long-range planning, consider removing and replacing trees from drier areas (Table H-3).

**II.** Inspect park trees on a regular basis to identify individuals with disease, structural issues, or poor health. As feasible, address them through management or remove those that are deemed a threat.

- **A.** Address Oleander Leaf Scorch, a lethal and incurable form of Pierce's disease that affects oleanders (Appendix H).
- **B.** Avoid planting London plane or Modesto ash trees in the park. The former suffer from disease problems that are difficult to control; the latter have structural issues that can lead to large branches splitting and breaking off (Appendix H).
- **C.** Address trees that have suffered drought-induced decline or death. In some cases, tree health can be restored through deep irrigation and annual applications of gypsum. Remove individuals beyond saving or which have died (Appendix H; Appendix E).
- **D.** Protect trees from sunscald, which can cause long-term disfiguration and lack of vigor. On an annual basis, apply outdoor white latex paint to the trunk until the crown is developed enough to shade it from noon to late afternoon.

**III.** Use more drought-tolerant species, especially those that compose the tree canopy, and which meet the landscape objectives of the park (Appendix H, Table H-3).

**IV.** Use new tree planting as an opportunity to invite participation of Station personnel, dependents, and as appropriate, the public.

# 5.5 Stormwater and Nonpoint Source Pollution Management

## Background

Stormwater management is guided by the Section 319 of the CWA. These guidelines assign the states responsibility to implement nonpoint source pollution BMPs. Federal consistency provisions also authorize states to review federal activities with state nonpoint source programs (5090.1C CH-1). Stormwater discharges into waters of the U.S. require a NPDES permit. Applications for coverage are under the EPA's General Permit for stormwater discharges, administered by the SWRCB.

*According to Navy guidance, INRMPs should be used as a primary tool for identifying nonpoint source problem areas, specifying corrective measures, and coordinating nonpoint source compliance planning with State nonpoint source programs when addressing land management issues (5090.1C CH-1).*

Beginning in 2011, Navy and DoD policies (16 November 2007 and 19 January 2010, respectively) mandated implementation of LID strategies for stormwater management for federal facility construction as regulated and guided by the Energy Independence and Security Action Section 438 (Title 42 USC 17094) and the updated United Facilities Criteria 3-210-10, LID (15 November 2010). (The California NPDES General Permit for Construction Stormwater [Order No. 2009-0009-DWQ] also includes requirements for post-construction BMPs [aka LID], which are mandatory beginning September 2012.)

LID is a site design strategy with a goal of maintaining or replicating the pre-development hydrologic regime through the use of designs to create a functionally equivalent hydrologic landscape. Hydrologic functions of storage, infiltration, and groundwater recharge, as well as the volume and frequency of discharges are maintained through the use of integrated and distributed micro-scale stormwater retention and detention areas, reduction of impervious surfaces, and the lengthening of flow paths and runoff time (Coffman 2000; EPA 2000). This contrasts with conventional approaches that typically convey and manage runoff in large facilities located at the base of drainage areas.

DoD policy specifically instructs practitioners to implement EPA Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act (December 2009) using LID technologies. Additional LID resources include Appendix B of United Facilities Criteria 3-210-10, Low Impact Development, which provides LID Best Practices and the California Stormwater Quality Association website,[22] which maintains an LID toolbox resource.

NAS Lemoore should support and accelerate the development and implementation of nonpoint source pollution management programs that ensure water quality protection. The Navy should place special emphasis on preventing nonpoint source pollution from ground disturbing actions (e.g., construction) in areas adjacent to streams, wetlands, and other water bodies. 5090.1C CH-1 (Chapter 24) includes agricultural run-off in the definition of nonpoint source pollution.

## Specific Concerns

- Potential discharge of NAS Lemoore agricultural tailwater into surface waters (non-jurisdictional) and groundwater may now contribute to noncompliance. Such discharges are regulated by the Central

[22] Access online at: www.casqa.org/LID/tabid/240/Default.aspx.

Valley Water Board as part of the Long-term Irrigated Lands Regulatory Program (California Environmental Protection Agency and Central Valley Water Board 2011, 2012) (Section 4.2.2.1 Water Quality).

- Runoff during large rain events may contribute nutrients or other contaminants to the nearby Kings River.

## Current Management

The NAS Lemoore SWPPP (2006) guides stormwater management for the non-traditional Municipal Separate Storm Sewer System (MS4) at NAS Lemoore. It identifies (a) potential pollutant sources and industrial activities that could have an impact on stormwater quality; (b) monitoring and reporting guidelines (including a sampling plan); (c) BMPs for both stormwater discharges and authorized non-stormwater discharges; and (d) the stormwater pollution prevention team. The plan is periodically reviewed and updated as needed.

NAS Lemoore is listed as a new non-traditional MS4 permittee as part of the SWRCB's renewal of the Phase II Small MS4 General Permit (2003-0005-DWQ), adopted in February 2013.[23] Updates to it include new requirements for system mapping, commercial/industrial inspection and monitoring; a universal application of post-construction stormwater quality requirements; incorporation of emerging technologies, including LID; and electronic submittal of information (California Environmental Protection Agency and SWRCB 2012).[24]

Stormwater drainage ditches in undeveloped areas of the Station are not necessarily managed as such. They do provide some habitat for wildlife; for example the Habitat Linkage Corridor and a central drainage ditch (also identified as wetland site #2), which both drain the Operations Area. Those located in the agricultural outlease area are managed for weeds by the agricultural lessees.

Nonpoint source pollution is generally not managed at NAS Lemoore as part of a separate program. For agricultural parcels on the Station, nonpoint source pollution prevention practices are built in, to a certain degree, to the Soil and Water Conservation Plan of the agricultural outlease agreement.

Construction activities greater than one acre are required to submit a Notice of Intent to the SWRCB for any anticipated stormwater discharges. Requirements included in the NAS Lemoore SWPPP and on the SWRCB's website are based on a general construction stormwater permit. A template SWPPP is provided to assist contractors.

## Assessment of Current Management

While NAS Lemoore remains in compliance with the NPDES Small MS4 General Permit, the Station should take actions to incorporate updates to the permit.

The most significant opportunity for NAS Lemoore to improve its management of stormwater is in implementing LID practices. NAS Lemoore-appropriate BMPs for LID implementation should be identified and developed to guide not only compliance with Energy Independence and Security Action Section 438, but to be considered for all construction and redevelopment projects at NAS Lemoore. LID technologies can also be implemented to help address current stormwater and nonpoint source pollution problem areas.

[23] A copy of the final order for the permit can be found here: http://www.swrcb.ca.gov/water_issues/programs/stormwater/

[24] http://www.swrcb.ca.gov/water_issues/programs/stormwater/phase_ii_municipal.shtml, Accessed 06 April 2013.

### Management Strategy

***Objective:*** *Enhance stormwater and nonpoint source pollution management practices to improve water quality and wildlife habitat and to continue to comply with the CWA and Navy and DoD requirements for LID implementation.*

**I.** Update the NAS Lemoore SWPPP as needed.

**II.** Continue to monitor stormwater discharges (and authorized non-stormwater discharges) and improve management actions, including ensuring compliance with NPDES Small MS4 General Permit requirements and other relevant permitting.

**III.** Minimize contributions from both point and nonpoint sources of pollution (including soil erosion, salts, and pesticides) resulting from NAS Lemoore land management actions. Water quality BMPs are methods, measures, or practices selected by an agency to meet its nonpoint source control needs. BMPs are identified in the NAS Lemoore SWPPP, as well as by the Central Valley Water Board and the Tulare Lake Basin Plan.

**A.** Update water quality monitoring and management actions at NAS Lemoore to comply with the new requirements included in the Long-Term Irrigated Lands Regulatory Program (California Environmental Protection Agency and Central Valley Water Board 2011, 2012) (Section 4.2.2.1 Water Quality; Section 5.2.1 Agricultural Outlease Management).

**IV.** Promote the use of LID practices at NAS Lemoore as BMPs that not only contribute to compliance with the Energy Independence and Security Action for construction projects, but also address current stormwater and nonpoint source pollution problem areas as well.

**V.** Develop a plan with the NRCS to direct stormwater to the Wetland Reserve Program land adjacent to the southeast corner for the Station instead of the nearby Kings River.

## 5.6 Beneficial Partnerships and Collaborative Planning

### Background

The DoD has signed numerous memoranda of understanding among agencies and non-governmental organizations for collaborative conservation and management initiatives under INRMPs. These are listed in Appendix D.

*Supporting military installations' conservation efforts is a concerted effort by the DoD, the four Military Services, the DoD Legacy Management Program, the DoD REPI Program, the DoD Partners in Flight Program, the National Military Fish and Wildlife Association, and the International Association of Fish and Wildlife Agencies.*

Cooperative management of NAS Lemoore wildlife is required under the Sikes Act (as amended) and the Fish and Wildlife Coordination Act.[25] The USFWS and the California Department of Fish and Wildlife (CDFW) have a statutory obligation to review and coordinate on INRMPs (Section 1.9.3 External Stakeholders). Recognizing this core, three-way partnership in preparing, reviewing, and implementing INRMPs among the DoD, U.S. Department of the Interior (DoI), USFWS, and state fish and wildlife agencies, a Tripartite Agreement was signed in July 2013. The CDFW and other state fish and wildlife agencies were represented by the International Association of Fish and Wildlife Agencies. The desire is for "synchronization of INRMPs with existing

[25] Like NEPA, the Fish and Wildlife Coordination Act is essentially procedural as no specific outcome is mandated.

fish and wildlife service and state natural resources management plans" and "mutually agreed-upon fish and wildlife service conservation objectives to satisfy the goals of the Sikes Act."

The Sikes Act (as amended) provides a mechanism whereby the DoD, DoI, and host states cooperate to plan, maintain, and manage fish and wildlife on military installations. Sikes Act provisions and cooperative agreements for outdoor recreation, such as for hunting and fishing, are implemented nationally by a MOU between the DoD and DoI. The Sikes Act (as amended) no longer requires a Cooperative Agreement with the USFWS or CDFW as a separate document; however, the DoD 17 May 2005 guidance states that joint review should be reflected in a memo or letters.

The DoD and Navy policy calls for installations to expand involvement in regional ecosystem planning, management, and restoration initiatives. Establishing cooperative planning efforts with surrounding land agencies and individuals will benefit NAS Lemoore natural resources and those of the entire region. Cooperative planning can also reduce the costs of actions that require management across boundaries such as biological monitoring.

The Navy also sees partnerships as a means to manage encroachment pressure on the Navy mission. The definition of encroachment is defined in OPNAVINST 11010.40: "Any Navy or non-Navy action planned or executed in the vicinity of a Naval activity or operational area which inhibits, curtails, or possesses the potential to impede the performance of the mission of the Naval activity." The instruction also defines encroachment to be any lack of action by the Navy to coordinate with local jurisdictions, monitor the development plans of adjacent communities, or adequately manage facilities and real property.

## Specific Concerns

- There is a need to identify and focus efforts in regional conservation planning.
- Encroachment issues for the Station requiring regional partnerships and management include the potential for land subsidence (due to groundwater overdraft), dust, availability and reliability of water resources, and regional growth.

## Current Management

NAS Lemoore consults with USFWS and the CDFW on management of special status species and habitat on the Station, primarily regarding the resident population of the federally endangered San Joaquin kangaroo rat (Section 4.5.1.1 San Joaquin Kangaroo Rat (Federally and State Endangered)) and the burrowing owl (Section 4.5.2.2 Burrowing Owl (USFWS BCC, California SSC)). NAS Lemoore works with the Bureau of Reclamation and WWD regarding availability of water resources to meet Station needs (including agriculture). The Station also collaborates with a U.S. Department of Agriculture (USDA) Wildlife Services staff member assigned full time to helping address BASH issues in the Operations Area.

In identifying and managing encroachment issues with neighbors, NAS Lemoore is guided by its Encroachment Action Plan. This document establishes a Military Influence Area for NAS Lemoore, which is used to identify potential encroachment issues and recommendations to reduce them (refer to Section 2.2.2.1 Military Influence Area and Air Safety Easement).

Additional beneficial partnerships have included:

- Cooperative partnerships between NAS Lemoore and academic institutions and researchers such as the San Joaquin Valley Endangered Species Recovery Program, individual burrowing owl researchers, permitted San Joaquin kangaroo rat researchers, California State University Fresno

(biotic characterization of the eastern corridor and boundary of the Station, and a soil salinity survey), and the University of California Davis (hydrology and groundwater studies).

- Local governments (i.e., Kings County Association of Governments, Kings County, Fresno County, and the City of Lemoore) in development of the JLUS Final Report (Tetra Tech Inc. 2011) with objectives and guidelines to achieve compatible land and airspace use goals in the area of NAS Lemoore. Those members of the JLUS Technical Working Group relating to natural resources include: California Water Alliance, Sequoia Riverlands Trust, Tulare Basin Wildlife Partners, and WWD.[26]

NAS Lemoore's regulatory partners include:

- USFWS Ecological Services;
- USFWS Migratory Bird Permit Office;
- USDA Wildlife Services;
- USDA Farm Services Agency;
- USDA Natural Resources Conservation Service;
- U.S. Geological Service;
- U.S. Army Corps of Engineers (USACE);
- Bureau of Reclamation;
- CDFW;
- Kings County Agricultural Commissioner; and
- Fresno County Agricultural Commissioner.

## Assessment of Current Management

There is opportunity for NAS Lemoore to continue expanding partnerships to inform natural resources management both on the Station and in the region. Local and regional partnerships can support this INRMP's management strategies for habitat enhancement, and the Station's need to reduce any potential encroachment on its military mission.

Opportunities for local and regional partnerships include:

- Regional Ecosystem and Habitat Conservation Planning Efforts. As applicable, NAS Lemoore should seek to participate in species-specific recovery plans, and regional natural resources management and land use efforts. This could include:
  - Tulare Basin Wildlife Partners, which works to: protect and restore natural communities in the Tulare Basin, create integrated land and water management solutions, and collaborate with the CDFW, Bureau of Reclamation, and NRCS (Tulare Basin Wildlife Partners 2012).[27]
  - The Central Valley Joint Venture.
- Agricultural neighbors and partners to address water resources use in agriculture, including groundwater overdraft, contamination, land subsidence, and irrigation efficiency.
- Water Commissions of Kings, Tulare and Fresno. They have recently been re-established to align themselves with larger regional water efforts, such as the California Partnership for the San Joaquin Valley, California Water Institute, and Upper Kings Basin Water Forum (Kings County 2010).

[26] A full list of the participating groups can be found in the JLUS Final Report (Tetra Tech Inc. 2011). The Military Influence Area from NAS Lemoore's Encroachment Action Plan was used as the "study area" for the JLUS.

[27] Website: http://www.tularebasinwildlifepartners.org/

- Local weed management groups.
- The Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALT) program, which is an effort to develop and implement comprehensive salinity management (Section 4.2.2.1 Water Quality).
- California SWRCB and Central Valley Water Board WMI and Integrated Regional Watershed Management. WMI is designed to integrate various surface water and groundwater regulatory programs while promoting cooperative, collaborative efforts within a watershed.[28] An Integrated Regional Watershed Management plan exists for the Westside area (Section 1.12 Integrating Other Plans).
- Grants under the NRCS Agricultural Water Enhancement Program. Agricultural Water Enhancement Program five-year contracts for cost share assistance were awarded to WWD for $10 million.
- The California WAP for the Central Valley – a comprehensive state wildlife conservation strategy, which identifies the Tulare Lake Basin as a focus for wetland restoration (Bunn et al. 2007).
- Other nearby federal landholders.

## Management Strategy

***Objective:*** *Be proactive in cooperative resources planning partnerships to create regional conservation, ecosystem-based solutions of mutual benefit while also protecting the NAS Lemoore military mission.*

**I.** Participate in regional conservation and ecosystem planning efforts, in collaboration with other governmental agencies and non-governmental organizations.

*An opportunity for funding of regional conservation initiatives includes the California Wildlife Conservation Board (www.wcb.ca.gov).*

**A.** Ensure NAS Lemoore involvement, based on the following criteria (DoDI 4715.03):

1. Proper internal coordination of other DoD stakeholders.
2. Evaluation of agreements that may encumber land or resources now or in the future. Emphasize the critical importance of ensuring continuation of the military mission and its unique attributes, which cannot be replaced.
3. Evaluation of the potential benefits to NAS Lemoore natural resources.

**B.** Pursue pertinent DoD ecosystem management objectives (per DoD 4715.03, refer to Section 1.10.1 Ecosystem Management). Strive to maintain and improve the sustainability and biological diversity of the ecosystem at the local landscape and other relevant ecological scales.

**C.** Become a non-binding partner in regional conservation planning efforts, such as Landscape Conservation Cooperatives.

**D.** In concert with local partners (Kings County, Fresno County, and the City of Lemoore) implement recommendations provided in the NAS Lemoore JLUS Final Report (Tetra Tech Inc. 2011), including for BASH management, NAS Lemoore Environmental Stewardship Programs, and REPI opportunities.[29]

1. Develop policies to protect critical areas supporting military readiness, agricultural uses in compatible areas, and/or environmental conservation including partnering opportunities with

[28] More information available online at: www.swrcb.ca.gov/centralvalley.

[29] "REPI takes advantage of authority (10 USC §§ 2684a) Congress enacted in 2002 authorizing DoD to partner with state and local governments, and non-governmental organizations to acquire from willing sellers conservation easements on private lands. REPI serves to forestall incompatible land use and protect high-value habitat so that DoD retains the discretion to use military lands free of encroachment-related restrictions and environmental constraints. With REPI agreements and funding DoD can cost-share the acquisition of conservation easements by creating win-win situations for all partners. REPI projects are selected for funding on the basis of a number of criteria, including: military utility, and training and testing value; potential for limiting incompatible development and protecting high-value habitat; and the level of participation and contributions from other project partners" (Tetra Tech Inc. 2011).

The Nature Conservancy, Regional Lands Trust, NRCS, U.S. Geological Survey, State of California (Williamson Act Legislation), and others.

2. Formalize a policy to implement cross-jurisdictional collaboration and coordination in development review and planning process including implementing JLUS Recommendations.

**E.** Seek planning partnerships to address land subsidence (due to groundwater overdraft), availability and quality of water resources, dust abatement, and invasive species.

**F.** Seek partnerships locally and regionally to promote efficient agricultural techniques, such as precision agriculture.

**G.** Continue to work with the Bureau of Reclamation on ensuring sufficient water resources for Station needs, which in turn benefit the natural resources program.

**II.** Meet with USFWS and CDFW at least annually to fulfill Sikes Act provisions and related inter-agency cooperative agreements.

**A.** Ensure compatibility with INRMP goals, objectives, and policies, as well as internal consistency in future inter-agency agreements and plans.

**B.** Involve state and federal resources agencies in the implementation of INRMP objectives and policies when practicable.

**C.** Promote information sharing and scientifically-based, coordinated data collection and management planning.

**D.** Support California WAP goals and objectives for the region, which touch on water resources management, invasive species, climate change, water pollution, wetlands, burrowing owl and Swainson's hawk.

**E.** Support USFWS regional goals such as habitat conservation planning.

**F.** Discuss and finalize annual INRMP metrics for the Station.

**III.** Continue the use of Cooperative Agreements to achieve natural resources management objectives, especially research. Cooperative Agreements may be used to accomplish work identified in the INRMP, and may be entered into with states, local governments, non-governmental organizations, and individuals to provide for the maintenance and improvement of natural resources, or to benefit natural resources research, on DoD installations. A long-term advisory relationship and cooperative research relationship could be established with local universities, conservation groups, and local preserves (e.g., Kern National Wildlife Refuge, Tulare Basin Wildlife Partners), based on their work with species and ecosystems similar to those at NAS Lemoore.

# 5.7 Integrating Other Internal Plans and Programs

## Background

INRMPs are to be prepared in coordination with installation range plans, training plans, Integrated Cultural Resources Management Plans, IPMP, Installation Restoration plans that address contaminants covered by Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), and related provisions, and other appropriate plans and offices (5090.1C CH-1). However, this INRMP is not intended to function as a comprehensive

*This INRMP should be "fully coordinated with appropriate installation offices responsible for preparing, maintaining, and implementing other programs and plans that may affect land used or be affected by land use decisions" (DoDI 4715.03).*

compilation of details on all related topics, but to briefly summarize the key interrelationships with these plans, and reference where detailed information can be found.

## 5.7.1 Integrated Cultural Resources Management Planning

### Background

Cultural resources are protected primarily through the National Historic Preservation Act of 1966, PL 89-665, as amended (16 USC §§470-470x-6) and its implementing regulations (36 Code of Federal Regulations 800), the Archaeological and Historic Preservation Act of 1974 (Moss-Bennett Act), PL 86-532 (16 USC §§469-469c), and the Archaeological Resources Protection Act of 1979, PL 96-95 (16 USC §§470aa-470mm). Section 106 of the National Historic Preservation Act requires federal agencies to consider the effects of their actions on properties listed in or eligible for listing in the National Register of Historic Places. Criteria for inclusion in the National Register of Historic Places are provided in 36 Code of Federal Regulations 60.4 (refer to Appendix C).

### Current Management

The primary objective of NAS Lemoore's cultural resources management program is to conserve significant cultural resources at NAS Lemoore, as outlined in the Station's Integrated Cultural Resources Management Plan (Navy 2012c), and to implement this INRMP in a consistent manner.

A significant amount of work and documentation concerning the management of known historical and cultural resources on NAS Lemoore is available from the EMD, including the most recent Integrated Cultural Resources Management Plan (Navy 2012c; Section 1.6.3 Relationship to Other Operational Plans). NAS Lemoore complies with the National Historic Preservation Act, the Archaeological Resources Protect Act, and the Native American Graves Protection and Repatriation Act, when managing NAS Lemoore's cultural resources.

### Coordination Approach

Prior to initiating any new land disturbance activities at NAS Lemoore, project proponents, facility managers, or other contractors should consult with the EMD. This includes activities ranging from construction and facility maintenance to habitat enhancement and restoration. Briefings for any personnel working in or near sensitive habitat areas, cultural resources areas, and historic buildings or structures that may be eligible for the National Register of Historic Places, should help keep them apprised of any prohibited activities or restrictions for specific areas of the installation.

## 5.7.2 Integrated Pest Management

### Background

OPNAVINST 6250.4C and 5090.1C CH-1, Chapter 17 require all Navy activities that conduct pest management operations to have an IPMP.

### Specific Concerns

- The EMD occasionally finds that agricultural lessees are not performing weed control and removal on their parcels. Enforcement of this is part of lease compliance, first handled by the EMD and then by NAVFAC Southwest, if no result is achieved.

## Current Management

NAS Lemoore's Integrated Pest Management Coordinator (IPMC) is responsible for overseeing the pest management program at the Station. The purpose of the pest management program is to aggressively control, by mechanical means or pesticide application, all noxious and undesirable weeds, rodents, insects and other pests on NAS Lemoore's improved grounds and agricultural lease parcels.

NAS Lemoore's IPMP contains current pest management requirements and guidelines (NAVFAC Southwest 2010). It is a long-range, comprehensive planning and operational document that establishes the procedures for conducting a safe, effective, and environmentally sound integrated pest management program. It covers all pest management and pesticide-related activities conducted by civilian and military DoD personnel, commercial pest management services providers, and lessees on NAS Lemoore, including tenant commands. The IPMP is reviewed and updated annually (per OPNAVINST 6250.4C, Encl (2), pg. 5). The plan adds value by developing compliance systems and streamlining operations involving the use of pesticides including applications, storage, and the archiving of records, all of which are tightly regulated by the Federal Insecticide, Fungicide and Rodenticide Act, state and local laws, DoD, and Navy regulations.[30] As a planning document, NAS Lemoore's IPMP is a vital component of effective integrated pest management. A list of approved pesticides for use at NAS Lemoore is included in Appendix E of the Station's IPMP or is available from the installation IPM Coordinator.

Other than ensuring that a pesticide is registered with the EPA and determining if it has a State Department regulation, and so long as its application is in compliance with state and federal laws, approval of a pesticide for use on NAS Lemoore makes no specific considerations for where it will be applied (other than aerial application in the agricultural outleases). The EMD provides input regarding the introduction of new pesticides at NAS Lemoore, petitions for which generally come from agricultural lessees, the Station itself or contractors (including the PPV).

## Coordination Approach

Integrated pest management at NAS Lemoore should contribute to the DoD's annual goals or measures of merit per DoDI 4150.07 (DoD 2008a) and OPNAVINST 6250.4C (Navy 2012a).

*Per DoD 4150.07, the DoD's measures of merit include: (a) 100 percent of DoD installations will have current pest management plans; (b) Maintain the 55 percent pesticide use reduction achieved from 1993 to 2003 (in pounds of active ingredient); (c) 100 percent of all DoD installation pesticide applicators will be appropriately certified.*

Reinforcing integrated pest management environmental objectives as a means to support INRMP goals should include: reducing reliance on chemical means of pest control and supporting lessees toward such a goal (DoDI 4150.07); reducing pesticide pollution to prevent adverse impacts on air, water, and land resources; ensuring all pesticide applicators are appropriately certified and trained; promoting the use of effective technologies and methods to control pests; complying with appropriate record keeping and reporting requirements to ensure compliance with relevant laws and regulations; requiring agricultural lessees to conduct and report on pest management activities on their parcels per the Agricultural Outlease Agreement; enabling the IPMC to maintain effective oversight of the program and coordination with local agencies; reviewing lessee and contractor pest management plans and applications for the use of new pesticides; and updating the IPMP at intervals defined in DoDI 4150.07 and OPNAVINST 6250.4C.

Due to the environmentally sensitive areas located on NAS Lemoore, in addition to a list of pesticides, pest management procedures to be used for the following programs should be submitted to the IPMC for

[30] The state of California can also enforce pesticide use as regulated by other state enforced federal laws such as the CWA, RCRA, and Clean Air Act.

review and approval: noxious weed control; predator management; aerial application of pesticides; control of migratory bird pest species. Chemical and non-chemical control of pests and invasive plants during the breeding season in areas with known migratory birds should also be reviewed by the IPMC to facilitate compliance with the MBTA.

During times when there is no agricultural lessee, NAS Lemoore should evaluate the need to conduct pest management actions in the agricultural outlease areas.

## 5.7.3 Installation Restoration Program

### Background

The DoD established the Installation Restoration Program (IRP) in 1975 to provide guidance and funding for investigating and remediating hazardous waste sites caused by historical disposal activities at military installations. The fundamental goal of the IRP is to protect human health, safety, and the environment. The IRP investigates and, if necessary, remediates former disposal and test areas, some of which were used before the disposal of chemicals was regulated or even fully understood.

### Specific Concerns

- Navy INRMP Guidance for Navy Installations (April 2006) specifically directs natural resources managers to participate in IRP decision-making and restoration activities.
- As appropriate, part of the remedial action could include restoring an area to include wildlife habitat in that the habitat features are compatible with remediation.

### Current Management

NAS Lemoore has an active IRP aimed at identifying and reducing to prescribed safe levels any potential risks caused by the Navy's past operations on the Station. Funding from the IRP is designated for any studies needed prior to removal or remediation, removal actions, interim remedial actions, and remedial actions of known hazardous waste sites. Currently, the IRP has been able to close a number of sites with regulatory agency concurrence, is actively seeking no further action from regulatory agencies on a number of others, and is conducting ongoing studies on remaining sites to respond to regulatory agency requirements to determine appropriate courses of clean-up and closure (Section 2.4.3 Installation Restoration Sites). The IRP continues to monitor groundwater quality in areas that were impacted by hazardous materials contamination and which have been addressed or are currently being addressed. A number of closed Installation Restoration sites maintain land use controls.

### Coordination Approach

The Station recognizes that adverse impacts to natural resources addressed in this INRMP may result from the release of hazardous substances, pollutants, and contaminants into the environment. The Navy IRP is responsible for identifying CERCLA releases, RCRA releases, and releases under related provisions; considering risks and assessing impacts to human health and the environment, including impacts to endangered species, migratory birds, and biotic communities; and developing and selecting response actions when a release may result in an unacceptable risk to human health and the environment.

When appropriate, the EMD will help the IRP Remedial Project Manager identify potential impacts to natural resources caused by the release of these contaminants.

EMD staff will also participate, as appropriate, in the IRP decision-making process by communicating natural resources issues on the Station to the Remedial Project Manager, attending Restoration Advisory

Board meetings, reviewing and commenting on IRP documents (e.g., Remedial Investigation, Ecological Risk Assessment), and ensuring that response actions, to the maximum extent practicable, are undertaken in a manner that minimizes impacts to natural resources on the Station.

When appropriate, the EMD will make recommendations to the IRP Remedial Project Manager regarding cleanup strategies and site restoration. During initial monitoring protocols, the Natural Resources Manager may suggest sampling and testing be accomplished so as to not impact sensitive or critical areas. Also during site restoration, the Natural Resources Manager has the opportunity to recommend site restoration practices that are outlined within the INRMP. Examples include landfill caps restored to grasslands, excavation areas restored to wetland/pond areas, and treated water located to enhance a pond area.

## 5.7.4 Sustainability in the Built Environment

### Background

Sustainable development produces highly efficient and cost effective buildings that reduce the use of natural resources such as energy and water, decrease pollution, and provide a healthier indoor and outdoor environment in developed settings. EO 13514 requires each federal agency to implement high performance building design, construction, operation and management, maintenance, and deconstruction based on the Guiding Principles for Federal Leadership in High Performance and Sustainable Building (Guiding Principles). The EO was issued to "strengthen the environmental, energy, and transportation management of federal agencies in the United States" and requires the setting of goals for energy and water conservation, building design and construction, waste and recycling, and procurement procedures.

The Navy was the first federal agency to participate in the LEED program and has the highest number of LEED certified structures of any federal agency. The Navy uses the LEED criteria as a tool in applying sustainable development principles and as a metric to measure their achievement.

### Current Management

NAS Lemoore currently has several project and actions in the planning stages that would contribute to Navy-mandated programs such as LEED, LID, and National Governors Association (NGA) Checklist.[31] One is to place solar panels on roofs of buildings and conduct some remodeling of buildings; another is to transition to more xeriscaping (Section 5.4 Landscaping and Grounds Maintenance).

### Assessment of Current Management

Many opportunities exist for the construction of infrastructure in a way that promotes the achievement of the Navy's mission in an environmentally integrated way. For example, the use of landscape designs that benefit wildlife close to human use areas, and bioengineering techniques can promote favored wildlife, while excluding undesirable species, such as rats. Across nearly all sectors of environmental concern there is unfulfilled potential to conduct operations that affect natural resources in a more sustainable manner. Extending site review to the long-term sustainability of habitats, species, and ecological functions adjacent to facilities could benefit multiple program objectives based on the National Governors Association Checklist, LEED, and LID criteria. There is a need to develop local indicators that tier off of these. The following strategies are designed to improve sustainability of both projects and habitat. Many are adapted from EO 13423 (January 2007).

[31] Available online at http://www.nga.org/cda/files/072011NCDFULL.pdf

## Management Strategy

***Objective:*** *Sustain the Navy's mission facilities and infrastructure into the future without decline to natural resources assets by supporting innovation in planning, design, project management, and implementation for development projects affecting the built environment.*

**I.** Strengthen the participation of natural resources personnel in the site and project review process at NAS Lemoore.

**II.** Ensure Navy leadership has visibility with respect to the total life-cycle cost of mission sustainment, day-to-day operations, infrastructure development, and redevelopment.

**III.** Use the Regional Shore Infrastructure Plan, Master Plan, site approval, and NEPA processes to bring interdisciplinary support to decisions early in the project planning phase.

- **A.** Ensure early project review for stormwater management, landscaping, solid waste, permitting, and construction activities.
- **B.** Expand the incorporation of sustainability principles into project scope and cost estimates, such as that reflected in DoD Form 1391.

*Much of Navy sustainability planning occurs within the Regional Shore Infrastructure Plan process. It is the tool where facility needs are evaluated, and siting options are examined. One of the stated goals pertaining to natural resources sustainability is: "Recognizing the environmental association of all planning recommendations and providing ecologically sustainable solutions that support and enhance the regional shore establishment" (NAVFAC Instruction 11010.45).*

**IV.** Promote sustainable land use. Planners should avoid using undeveloped land, open space, water and soil conservation areas, and existing natural ecosystems.

- **A.** Clean up and redevelop polluted sites when available and feasible.
- **B.** Protect ecologically sensitive areas such as listed species habitats, woodlands, mesic grasslands, wetlands, and water sources. Preserve culturally sensitive areas such as historic and archaeological sites.
- **C.** Plan for efficient use of water through drainage recapture, drought tolerant landscaping, recycling, and other means (see also Section 5.4 Landscaping and Grounds Maintenance and Section 5.5 Stormwater and Nonpoint Source Pollution Management).
- **D.** Use regionally appropriate vegetation. Encourage landscape design and maintenance practice that reduce or eliminate pesticides and synthetic fertilizers.
- **E.** Align proposed structures on the site to take advantage of positive, or minimize negative, climatic and weather factors, such as sun angle and wind direction, thereby using passive measures to reduce energy consumption.
- **F.** Improve energy efficiency in buildings and structures.
- **G.** Prevent waste and encourage recycling.

**V.** Promote conjunctive land uses that increase efficient use of resources (e.g., water, energy, land, etc.), and facilitate introduction and use of renewable energy.

**A.** Investigate opportunities to support renewable energy technologies, including appropriate siting, on the Station (Section 2.5 Future Land Use and Airspace Patterns and Plans).[32]

**B.** For any conjunctive uses that may impact or remove land from agricultural production, evaluate compliance and consistency with FPPA (Section 5.2.1 Agricultural Outlease Management).

**C.** Conduct an integrated analysis of approaches for evaporation pond management at NAS Lemoore. Such an analysis should assess trade-offs in potential conjunctive uses.

*The DoD plans to create an "innovation fund... to enable components to compete for funding on projects that advance integrated energy solutions" and "the Department is increasing its use of renewable energy supplies and reducing energy demand to improve operational effectiveness, reduce greenhouse gas emissions in support of U.S. climate change initiatives, and protect the Department from energy price fluctuations" (2010 Quadrennial Defense Review). The DoD Energy Conservation Investment Program supports this goal.*

**VI.** Define and adopt metrics of success that are meaningful to NAS Lemoore, which integrate environmental stewardship and mission accomplishment. Encourage the introduction of concepts and methods embodied in LEED, LID and National Governors Association Checklist that could be achieved at NAS Lemoore.

# 5.8 NEPA Compliance

## Background

NEPA requires federal agencies to assess, in detail, the potential environmental impacts of their actions that could significantly affect the quality of the environment.[33] It is intended to help decision makers make informed decisions that are based on an understanding of environmental consequences and opportunities that would protect, restore and enhance the environment.

NEPA requires an analysis of whether a major federal action will result in a significant environmental impact. The process requires an analysis of all reasonable alternatives to proposed action, but does not require the selection of the least damaging alternative. Individual and cumulative impacts must also be considered. The NEPA process must be documented using one of the following:

*NEPA requires a discussion of the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity.*

1. Record of Categorical Exclusion (CATEX). CATEXs are actions that the Navy and EPA agree do not individually or cumulatively have a significant effect on the human environment; and therefore, do not require preparation of an Environmental Assessment (EA) or Environmental Impact Statement (EIS).

*CATEXs are in accordance with Secretary of the Navy Instruction 5090.6A dated 26 April 2004. Their use meets the requirements of NEPA as specified by the federally appointed Council on Environmental Quality.*

2. An EA is the analysis to be completed when the government is uncertain as to whether an action would significantly affect the environment or whether the action would be controversial; the result of an EA is either a Finding of No Significant Impact or a requirement to complete an EIS.

[32] The DoD will "speed innovative energy and conservation technologies from laboratories to military end users. The Environmental Security and Technology Certification Program uses military installations as a test bed to demonstrate and create a market for innovative energy efficiency and renewable energy technologies coming out of the private sector and DoD and Department of Energy laboratories....the Department is also improving small-scale energy efficiency and renewable energy projects at military installations through our Energy Conservation Investment Program" (2010 Quadrennial Defense Review).

[33] Analysis of significant environmental impacts that cannot be avoided includes not only potential impacts to natural resources, but also to cultural resources, air quality, hydrological resources, hazardous waste management, lead paint, asbestos, and Installation Restoration (CERCLA) sites.

3. An EIS is a document that presents a full and complete discussion of significant impacts. An EIS informs the public and decision makers of reasonable alternatives to the proposed action.

An important component of NEPA is the requirement for public participation in the decision-making process. Federal agencies are to encourage and facilitate public involvement through a scoping and environmental review process. The requirements for public involvement differ between an EA and an EIS in that for EIS-level assessments the process must meet formal requirements specified in the regulations that implement NEPA.

The EA for the 2001 INRMP (Navy 2001b) remains in place for this INRMP update. This INRMP uses the same ecosystem approach with updated and more clearly defined individual management strategies.

## Specific Concerns

- Future surveys on the Station may identify sensitive resources previously unknown to occur there. In this case, some ongoing CATEX projects would be operating on the basis of Station natural resources information that may be outdated.
- Projects that require digging or excavation may require NEPA analysis and consultation with the State Historic Preservation Office to evaluate any significant impacts to cultural resources on the Station (Section 5.7.1 Integrated Cultural Resources Management Planning).

## Current Management

INRMPs function as a significant source of baseline conservation information and conservation initiatives used to develop NEPA documents for military readiness activities (INRMP Guidance for Naval Installations April 2006). Results of surveys and delineations planned in this INRMP are also sources of valuable information for NEPA analysis.

*INRMPs are to discuss the present process used by installation planners for review of projects, particularly any ground disturbing projects, from site selection to completion, and how the natural resources professionals currently participate, and should participate in the future, in the review process to ensure that natural resources issues are identified and properly addressed (NAVFAC P-73 Volume II).*

The level of NEPA analysis applied to each action or project at NAS Lemoore is determined on a project-by-project basis. Project proponents and NEPA planners responsible for NAS Lemoore ensure compliance with NEPA requirements and 5090.1C CH-1 guidance. The 5090.1C CH-1 outlines the NEPA process for the Navy.

NAS Lemoore EMD reviews the majority of land use and management projects, including those at the CATEX level. To ensure proper consideration of sensitive natural resources at NAS Lemoore, coordination with the EMD should be as early as possible to ensure adequate environmental pre-planning, as described in 5090.1C CH-1, Section 5-1.11.

## Management Strategy

***Objective:*** *Apply NEPA requirements and policies to enhance mission-related use and conservation of natural resources. Seek opportunities for streamlining and coordinating multiple site approval and environmental assessment procedures.*

**I.** Continue to assess the environmental consequences of each proposed action that could affect the natural environment, and address the significant impact of each action through analysis, planning and avoidance, using the existing NEPA process.

**A.** Ensure that any proposed action that has the potential for physical impact on the human environment undergoes the NEPA process, unless it is included in a previous NEPA document.

**B.** Keep apprised of upcoming projects for early consideration and notification of outside agencies, if appropriate.

**C.** Through evaluation, including prior public comments, ensure that the appropriate level of NEPA documentation is prepared.

**D.** If federally listed species or designated Critical Habitat is known to occur in the project area then the site approval should address direct and indirect impacts to these resources, and consult with the USFWS.

**E.** Encourage consideration of indirect effects during project analysis. Effects beyond the immediate project footprint, such as lighting, noise, turbidity, increased truck traffic, etc., can negatively affect sensitive species.

**F.** Consider evaluating current NEPA CATEX projects in light of updated natural resources information, as needed.

**II.** Standardize the format by which cumulative effects are discussed in NEPA documentation (Council on Environmental Quality 1997, 2010).

**A.** Properly bound the spatial and temporal extent of projects, such that all other projects that overlap in time and space are considered.

**B.** Consider evaluating cumulative effects for a suite of CATEX projects which may impact the same areas repeatedly across projects.

**C.** Support research to improve the adequacy of cumulative effects analysis at predicting when habitat or species effects become significant.

**D.** Develop means to mitigate for cumulative effects.

**III.** The NEPA planning process should integrate project-specific plans with overall land use and natural resources management plans. It should also facilitate routine maintenance work and consider potential measures to mitigate impacts.

**A.** Integrate NEPA planning early with regular planning functions of each office.

1. Per 5090.1C CH-1, Section 5-1.11 (18 July 2011), action proponents are required to establish a written pre-planning process to identify environmental planning requirements and estimated timelines as early as possible, when developing a proposed action. The written pre-planning process must have elements that:
    a. Ensure environmental planning begins as early as possible in developing a proposed action;
    b. Establish a process for communication and development of consensus among internal Navy stakeholders;
    c. Provide adequate information for cost-effective contracting and document preparation and review; and
    d. Ensure collection and development of current information, data, statistics, and best available science that are the foundation of sound analysis and high quality environmental planning documents.
2. Technical assistance should be provided by staff to support other offices, when needed, before and after a proposed action is submitted for NEPA review, giving guidance on: project design, site selection, and scope of work; development of reasonable alternatives, including alternative sites; and selection of appropriate mitigations so the proposal integrates mitigation from the beginning.

**B.** Strengthen participation of natural resources management personnel in the site and project review process (NAVFAC P-73 Volume II) (Section 5.3 Construction and Facility Maintenance).

**IV.** Update NEPA forms for project proponents, including site approval checklists.

**A.** Provide a list of pre-approved conservation measures or mitigation for project proponents to select from.

**B.** Reference appropriate environmental protection and mitigation policies from this INRMP.

**C.** Make available to project planners updated geographic information system (GIS) maps of sensitive resources on the property to assist in evaluating potential impacts of proposed projects and in recommending appropriate mitigation opportunities.

**V.** Implement NEPA programmatically, such as for routine maintenance (e.g., weed control, mowing, etc.), if federally listed species may be affected, so that maintenance and other periodic work can continue without delay.

**VI.** Communicate directly with all affected parties during NEPA process to avoid misunderstandings and delays.

**A.** Keep a stakeholder contact list. Contact off-site interested and affected agencies and parties as soon as possible on projects with potentially significant environmental impacts, particularly if controversial.

**B.** If possible, coordinate with regulatory agencies in the early stages of the planning process, so project designs and construction schedules can be developed to have the least impact on special status species.

# 5.9 Natural Resources Consultation Planning

## Background

Because an INRMP is a long-term planning document that directs the management and conservation of natural resources on a day-to-day basis, it may provide the foundation information necessary for ESA consultations, migratory bird permits/resources information, and any federal consistency determinations. INRMPs also provide pertinent information for various planning level documentation, some information applicable to master plans, CWA permits, and Clean Air Act permits. CERCLA and RCRA related information might also be derived and shared with installation planners and environmental engineers (Navy INRMP Guidance for Naval Installations April 2006).

Section 7(a)(2) of the ESA requires federal agencies to ensure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of a federally listed species or destroy or adversely modify their designated Critical Habitat. This is done through consultation with, and assistance from, the Secretary of Interior (through the USFWS) to emphasize identification and resolution of potential species conflicts in the early stages of project planning. A Biological Opinion (BO) is the product of this interagency consultation pursuant to Section 7(a)(2) of the ESA and is covered in the implementing regulations published in 50 Code of Federal Regulations Part 402.

*DoDI 4715.03 requires INRMPs to include procedures "to comply with federally-listed threatened and endangered species management and recovery efforts on DoD lands and waters…and shall emphasize military mission requirements and interagency cooperation during consultation, species recovery planning, and management activities."*

Informal consultation is an optional process between the USFWS and the action agency to determine whether a formal consultation is

needed. It provides an opportunity to discuss ways to modify the action to reduce or remove adverse effects to the species or Critical Habitat. Based on the best scientific and commercial data available, the agency determines the effects on federally listed species and Critical Habitat. It concludes when a determination of *no effect* is made, when the USFWS concurs with a *not likely to adversely affect* determination, or when the agency initiates formal consultation.

Formal consultation is needed when the action agency determines, through informal consultation or a biological assessment, that the action will affect the federally listed species or Critical Habitat. It begins with the federal agency's written request for consultation under Section 7 (a)(2) of the ESA, and concludes with the USFWS issuing a BO under Section 7 (b)(3) of the ESA. No consultation is needed when the proposed action falls under an existing BO or if there is no federally listed species or designated Critical Habitat within the proposed action area.

In addition, waters of the U.S., including wetlands, are protected under the CWA and EO 11990. The USACE regulates impacts to wetlands and other waters under Section 404 of the CWA and Section 10 of the Rivers and Harbors Act. Projects that may involve any impacts, including excavating dredged or fill material, to waters of the U.S. and wetlands must be reviewed and authorized by the USACE and reviewed by the EPA.

Consultation strategy should be designed to avoid military mission delay or impairment. For this reason it should be designed as programmatically and comprehensively as possible.

## Specific Concerns and Current Management

- Habitat for the federally endangered San Joaquin kangaroo rat is actively managed at NAS Lemoore (Section 4.5.1.1 San Joaquin Kangaroo Rat (Federally and State Endangered)). Current management is conducted in the absence of a BO; however NAS Lemoore has solicited USFWS input on a project-by-project basis until consultation can re-commence and a BO is produced. NAS Lemoore needs to reinitiate consultation with the USFWS regarding management of this species in NRMA 5. Critical Habitat for the kangaroo rat is currently not designated on the Station.
- No other listed species are currently known to occur regularly on the Station.[34] However, it is possible that future surveys may document federally listed species that were previously unknown to occur on the Station. Informal consultation could begin regarding potential presence of federally listed species and surveys scheduled to determine if they are present.
- There are currently no species present at NAS Lemoore that are proposed for listing.
- The current wetland identification and classification report (which includes jurisdictional suggestions) for NAS Lemoore dates to 1996 (Tetra Tech Inc. 1996). There is a need to update it; it does not reflect recent court cases affecting application of jurisdictional status to isolated bodies of water (such as wetlands) (Section 4.3.2 Wetlands and Jurisdictional Waters of the U.S.).

A resource that can be used for consultation on federally listed species is the ESA Section 7 Consultation Handbook (USFWS and National Marine Fisheries Service 1998) (Appendix C).

Considering that future surveys and delineations may identify new and different locations of sensitive resources at NAS Lemoore, it may also be prudent to re-evaluate ongoing facility maintenance and management actions to ensure proper measures are taken for consultation and compliance with the

[34] While no federally endangered California least terns were observed in the most recent surveys undertaken by Tierra Data Inc. (2009-2010), this species was included in the previous INRMP species list as having been noted from the property. NAS Lemoore contains no suitable breeding habitat for the species, and individuals would only be found in the area as transients during migration. During these times, the most likely area would be the wastewater treatment facility evaporation ponds in the southeastern portion of the Station, where other tern species have been recorded previously.

MBTA, ESA, CWA, and other applicable laws and regulations (Section 5.8 NEPA Compliance, Appendix C).

## Management Strategy

***Objective:*** *Streamline natural resources consultation through clear communication of regulatory requirements. Collaborate with project proponents to plan mitigation and conservation measures to avoid or minimize effects on natural resources first, then "rectify, reduce, eliminate, or compensate for the impact" of unavoidable effects (Council On Environmental Quality 1978).*

**I.** Use this INRMP as an initial screen for review of projects proposed on the Station from both Navy and outside interests.

- **A.** All proposals that are not categorically excludable should provide the acres and habitat type currently present on the site, and the known locations of special status species on or adjacent to the site.
- **B.** Determine the need to re-evaluate categorically excludable activities in light of updated information regarding location and status of sensitive resources at NAS Lemoore.

**II.** In order to avoid military mission delay or impairment, consultation should be approached as programmatically and comprehensively as possible.

**III.** Improve the success of mitigation and enhancement projects based on regulatory, functional, and ecosystem criteria by using: performance work statements; project lists (one-time projects); and standardized scopes of work for recurring work.

**IV.** Determine if CWA Section 404 compliance is necessary for any projects on NAS Lemoore property.

**V.** *Standard Mitigation Measures.* The following mitigation measures should be planned for proposed actions as appropriate.

- **A.** *Avoidance and Minimization First.* Proposed actions must include impact avoidance and minimization measures as a first step as part of the environmental protection plan for all standard operating procedures during planning. Possible measures include worker environmental protection briefings, signs, markers, protective fencing, biological monitoring, erosion and sedimentation prevention, noise baffling, and temporary impact restoration.
- **B.** *Survey Buffers.* When making presence/absence determinations relative to a project, buffer areas where indirect effects may affect species must be considered as well. If a habitat is used by a species for some important part of their life cycle, it is considered occupied regardless of the presence of the species at any one time.
- **C.** *Use of a Qualified Biological Monitor.* A biological monitor or qualified biologist should be retained, in coordination with the natural resources biologists, to educate workers, oversee and implement impact avoidance and minimization, and document impacts.
- **D.** *Breeding Season Avoidance.* Planners must review proposed actions with regard to conduct of actions during the active breeding season (can be January–September) and project-caused loss of traditionally used nesting/roosting sites. Habitat clearing activities should be timed to avoid the breeding season to maximum extent practicable to avoid damage to active bird nests. All contracts and work orders prepared for NAS Lemoore must include provisions in the Environmental Protection section, which prohibit harming, damage, or destruction of active bird nests while requiring "work arounds." Navy Contracts Specialists can provide such language.

**E.** *Restoration Plans to Be Completed in Advance.* All actions that require active habitat restoration, enhancement, and/or compensation must have an appropriate plan developed prior to implementation.

**F.** *Seasonal Avoidance Measures for Facilities Projects.* During the active growing and breeding season, species and habitats are more sensitive to harm, harassment, or damage. Any seasonal restrictions must be in accordance with mission requirements and compatibility.

**G.** *Phasing of Work.* Often, careful planning can show that impacts to the differing resources can be phased or avoided. To assist project planners, a schedule of sensitivity periods will help.

**H.** *Tracking Mitigation.* Develop a master list that includes all environmental agreements, including NEPA projects, USACE permits, and BOs. This master list should: 1) identify all requirements and restrictions associated with these agreements, and 2) document all progress made to comply with these agreements until project completion.

# 5.10 Outdoor Recreation

## Specific Concerns

*In response to the Sikes Act (as amended), a MOU between DoI and DoD was signed which requires all military installations to develop outdoor recreation plans where there are suitable resources for such a program consistent with national security.*

- Drawing on current information and strategies presented in this INRMP, as well as contributions from the Department of Morale, Welfare, and Recreation (MWR), an updated outdoor recreation plan for NAS Lemoore should be developed.
- Natural resources management and monitoring of impacts in recreation areas could be strengthened.
- Landscaping along the jogging path could be improved to provide shade for joggers and to better support wildlife (Section 5.4 Landscaping and Grounds Maintenance). This work could be done in conjunction with nearby windbreak restoration efforts. Interpretive displays could also be installed to support environmental education and outreach goals (Section 5.11 Environmental Education and Public Outreach).

## Current Management

*The Sikes Act (as amended) and 5090.1C CH-1 require Navy installations to provide outdoor recreation and interpretive opportunities to the public where and when it is compatible with military safety and security needs. Outdoor recreation activities are intended to support the stewardship of DoD's natural resources (see alsoSection 5.11 Environmental Education and Public Outreach).*

Outdoor recreation, as defined for the purposes of this section, is the active use of the Station's natural resources and outdoor areas for recreation and physical exercise.

NAS Lemoore's outdoor recreation management program is designed to provide military personnel, their families, and local residents with ample opportunities to participate in outdoor recreational activities on NAS Lemoore. The recreational program consists of a variety of outdoor activities, including wildlife viewing, hunting, skeet shooting, horseback riding, jogging and bicycling. Outdoor recreational activities in designated training areas is strictly prohibited.

It is the desire of NAS Lemoore to maintain and enhance the outdoor recreation program by promoting the activities already available, and developing additional opportunities as feasible.

## Management Strategy

***Objective:*** *Promote compatible, sustainable outdoor recreation opportunities to enhance quality of life for military personnel, their families, and local residents with access permission while conserving natural resources and without compromising the military mission.*

**I.** Develop an updated outdoor recreation plan and goals for appropriate use of outdoor recreation areas on the Station. The plan will help NAS Lemoore comply with the Sikes Act (as amended) and the MOU between the DoD and DoI. In the event of potential conflicts of use, sound biological management practices shall prevail.

- **A.** Identify and maintain suitable outdoor recreation opportunities for Station personnel, particularly those that improve quality of life for Navy personnel and improve knowledge of the natural world and the Navy's stewardship of natural resources (Section 5.11 Environmental Education and Public Outreach).
- **B.** Conduct a survey of personnel for recreational opportunities. Use results to tailor outdoor recreation opportunities to perceived needs, as feasible.
- **C.** The plan should include wording for a NAS Lemoore Instruction on outdoor recreation that includes written guidelines and appropriate maps of where outdoor recreation is allowed and not allowed, and whether it is permitted for the general public or military personnel and dependents only. It should also include NAS Lemoore's off-road vehicle use policy. The instruction should be made available to all potential users.

*The Sikes Act (as amended) provides for cooperative agreements with the National Park Service, which in conjunction with the INRMP, may be used as a mechanism for a program of planning, development maintenance and coordination of outdoor recreation on Navy lands (5090.1C CH-1 and NAVFAC P-73 Volume II).*

- **D.** Keep in mind the need to determine carrying capacity as recreational activities grow and change.
- **E.** Update the plan as needed to keep strategies current and to reflect changing uses of Station lands for outdoor recreation purposes.

**II.** Investigate opportunities to improve landscaping along the jogging path to provide shade for joggers and to better support wildlife (Section 5.4 Landscaping and Grounds Maintenance). Interpretive signs could also be installed (Section 5.11 Environmental Education and Public Outreach). As part of this effort the windbreak along the northern boundary of the Administration Area could also be improved and water supplied to Karen Mechem Park landscaping.

**III.** Provide, where possible and compatible with the mission, access for disabled American veterans, military dependents with disabilities, and other persons with disabilities.

**IV.** Promote use of NAS Lemoore's small-game hunting opportunities by implementing habitat enhancements discussed in Section 4.3 Management of Vegetation Communities and Habitats and Section 4.7.3 Game Species.

**V.** Maintain the grounds of the trap- and skeet-shooting facility on the Station for personnel and local residents.

**VI.** Develop simple monitoring guidelines to assess quality of natural resources in recreation areas. Use results to identify management actions to improve and protect those resources for both habitat and user benefit.

**VII.** Enforce public access regulations as required (Section 5.12 Public Access).

# 5.11 Environmental Education and Public Outreach

## Background

*The Sikes Act (as amended) requires each military service to support environmental education for personnel and for the public where and when it is compatible with military safety and security needs.*

DoD policy encourages outreach and environmental education for the public and for DoD personnel when it comes to natural resources management on Navy installations. The DoDI 4715.03 states that the "DoD shall engage in public awareness and outreach programs to educate DoD personnel and the public regarding the resources on military lands and DoD efforts to conserve those resources" and further emphasizes that a "conservation ethic [be] integrated throughout DoD through education, training, and awareness programs."

Similarly, the CO's Environmental Policy Statement (Navy 2009) (Section 1.6 Achieving INRMP Success) states that NAS Lemoore is committed to environmental stewardship through:

- Participating in efforts to improve environmental protection and understanding in our communities.
- Ensuring this policy is communicated to all military, civilian personnel, contractors and to the public to encourage continual improvement within the region.

## Specific Concerns

- Currently, there is no single guiding vision or plan that identifies or pursues opportunities to increase NAS Lemoore's leadership in environmental education or public outreach.

## Current Management

NAS Lemoore has hosted a number of public outreach, educational and environmental programs and events in the past. Previous programs, events, materials and partnerships included:

- Brochures for NAS Lemoore personnel regarding natural resources management topics such as crop-dusting activities and burrowing owls on the Station.
- The NAS Lemoore Environmental Support website that is accessible to the public. It currently hosts the CO's Environmental Policy Statement (Navy 2009) and other limited information regarding environmental management and natural resources at NAS Lemoore.
- Earth Day activities targeting NAS Lemoore personnel, their families (including students in the on-Station school) and retired military.
- The NAS Lemoore Air Show for which the Station provides free access to the public.
- A Fourth of July ceremony in the City of Lemoore.
- A partnership with local Boy Scout and Girl Scout troops, who have camped in the NRMAs in the past.

## Management Strategy

***Objective:*** *Promote an environmental awareness and conservation ethic through natural resources education and partnership programming, and distribution of NAS Lemoore environmental and sustainability information for the public and Station personnel.*

**I.** Identify and prioritize environmental education and outreach opportunities.

**II.** Improve existing programs for public outreach and education on natural resources values.

**III.** Seek opportunities to partner with local educational institutions and groups for natural resources programs and projects at NAS Lemoore. Maintain a list of Station-based research projects that NAS Lemoore would welcome assistance with from local researchers and students (Appendix M). Provide for recreational and educational opportunities in suitable NRMAs to local Boy Scout and Girl Scout troops.

**IV.** Develop and provide interpretive signage and materials for areas that may be of interest for wildlife viewing, nature trails and other outdoor spaces valuable for outdoor recreation activities and enjoyment (Section 5.10 Outdoor Recreation).

**V.** Maintain a database of completed projects and research results for NAS Lemoore.

- **A.** Disseminate information to the public and Station personnel on positive natural resources management and sustainability actions taken by the Station.
- **B.** Make results from programming and public outreach available to the public (including educational institutions).
- **C.** Promote and advertise natural resources management and sustainability programs and initiatives at NAS Lemoore on its public website in coordination with the Cultural Resources program, MWR, and the Public Relations Office.

*NAVFAC P-73 Volume II, Chapter 1: "Successful implementation of the INRMP can hinge on instilling a conservation ethic in installation civilian and military personnel and in providing a bridge to the public via awareness and education programs. On base, personnel can respond to posters, videotapes, maps, handbooks and personal presentations. Other techniques such as public forums, newspapers, prepared talks, special events, conservation education centers, and nature trails can be used to inform the public of the values of natural resources conservation and show how they can help to support the program."*

**VI.** Ensure that NAS Lemoore personnel, contractors and decision makers have adequate natural resources management information and training relevant to their job or role on the Station to ensure compliance with natural resources conservation policies (Section 5.13 Training of Natural Resources Management Personnel).

**VII.** Invite the Navy environmental magazine "Currents" to write a short piece on natural resources and environmental management at NAS Lemoore, particularly given the Station's contribution to Navy agricultural outlease funds which support Navy-wide natural resources management activities. The published article could be linked to the NAS Lemoore public website for further exposure.

# 5.12 Public Access

## Background

DoDI 4715.03, Natural Resources Conservation Program, 18 March 2011 states,

> "The principal purpose of DoD lands and waters is to support mission-related activities. Those lands and waters shall be made available to the public for educational or recreational use of natural and cultural resources when such access is compatible with military mission activities, ecosystem sustainability, and other considerations such as security, safety, and fiscal soundness. Opportunities for such access shall be equitably and impartially allocated."

Navy guidance 5090.1C CH-1 states, "Military lands will be available to the public and DoD employees for enjoyment and use of natural resources, except when a specific determination has been made that a military mission prevents such access for safety or security reasons, or that the natural resources will not support such usage."

DoDI 4715.03 (18 March 2011) further specifies that INRMPs shall describe areas and conditions appropriate for public access, and that:

1. Federal or state conservation officials shall be given access to DoD-controlled natural resources to conduct official business pursuant to applicable requirements of laws and regulations (e.g., section 1531 of the Sikes Act [as amended]) and an installation's operational, security, and safety policies and procedures.
2. Military installations shall ensure, where practicable and when not in conflict with mission objectives or the INRMP, that active and retired military service members and disabled veterans have access to its lands and waters for hunting, fishing, and non-consumptive use of wildlife.
3. Members of Native American, Native Hawaiian, Alaska Native tribes, bands, nations, pueblos, villages, or communities may have access to DoD sites and resources that are of religious importance, or that are important to the continuance of their cultures consistent with the military mission, EO 13007 (Reference [ao]), appropriate laws and regulations, and subject to safety and security. Members of federally recognized Indian tribes, Alaska Natives, and Native Hawaiian organizations shall also have access to installations for the purposes of non-commercial gathering of botanical and mineral resources for traditional cultural use.
4. Opportunities for public access shall be equitably and impartially allocated consistent with the parameters outlined within DoDI 4715.03.

## Specific Concerns

- Transient trucks, not related to NAS Lemoore, use Pole Line Road as a short-cut between the paved roads that surround the Station. Their use of this dirt road contributes to dust generation.

## Current Management

*Per 5090.1C CH-1, the installation policy on public access should be re-assessed periodically to determine if additional public access can be allowed. A good time to make this assessment is during the INRMP reviews and updates.*

Currently, public access is restricted at NAS Lemoore outside of special events targeting the public or other collaborative uses of Station lands such as partnerships with local organizations or natural resources research and studies. Any individual wishing to gain access who is not DoD personnel must obtain a pass from the NAS Lemoore Security Office or have a NAS Lemoore escort onto the Station. These restrictions are based on security and safety requirements, given the mission of the Station and to minimize impacts to Station resources. Agricultural lessees and hunters are provided access as long as they comply with any restrictions or requirements for use of Station lands. Hunting access is governed by the most recent NAS Lemoore Hunting Instruction (Section 2.4.6 Outdoor Recreation and Appendix D).

Station police deal with trespassers, and as necessary, elevate any particular issues to county sheriffs or the CDFW game warden. Station security often patrols NAS Lemoore lands, including agricultural outleases.

## Management Strategy

***Objective:*** *Allow for public access to NAS Lemoore as consistent with the Sikes Act (as amended), the military mission, natural resources responsibility, safety and security.*

**I.** Maintain clear and coherent policies regarding public access to and use of NAS Lemoore, including for the hunting program, natural resources studies and research, special events, and any other anticipated public uses.

**II.** Continue to limit public access to the Station, or portions of it, for reasons that include safety and security concerns, general security and liability issues, presence of federally endangered and threatened species or other special status species and habitats, fire safety, and cultural resources concerns.

**III.** To comply with DoDI 4715.03 continue to grant access to NAS Lemoore, or portions of it, to qualified individuals as warranted, including:

- **A.** Federal or state conservation officials related to DoD-controlled natural resources and applicable requirements of laws and regulations (see also Section 5.9 Natural Resources Consultation Planning);
- **B.** Military Service members, retired or active, and their families and guests, for outdoor recreation and non-consumptive uses of wildlife; and
- **C.** Members of Native American communities for access to sites or resources that are of religious or cultural importance, and for non-commercial gathering of botanical and mineral resources for traditional cultural use.

**IV.** As appropriate with the mission and to the extent practicable, support access for disabled American veterans, military dependents with disabilities, and other persons with disabilities.

**V.** Take active measures to discourage and minimize unauthorized access and trespass. Ensure that maps and any other informational materials provided to the public clearly show the boundaries of restricted areas of NAS Lemoore. Place appropriate signage in key access areas. Liaise with NAS Lemoore police as necessary to address any trespass affecting natural resources on the Station.

# 5.13 Training of Natural Resources Management Personnel

## Background

The Sikes Act (as amended) requires "sufficient numbers of professionally trained natural resources management and natural resources enforcement personnel to be available and assigned responsibility" to implement an INRMP. Staff should also be provided opportunities and support to receive both comprehensive training specific to their job and supplemental training in a timely manner, as needed, to ensure proper and efficient management of natural resources (DoDI 4715.03, 5090.1C CH-1). Continued professional training is considered an integral part of responsible natural resources management and BASH mitigation. In particular, DoDI 4715.03 instructs that opportunities for "efficiencies in providing natural resources conservation training through increased interagency and DoD Component cooperation" should be identified.

A balanced, multiple-use natural resources program through professional management is the ultimate goal of an INRMP (NAVFAC P-73 Volume II). The INRMP is expected to describe sources of manpower, both internal and external, required by the Station and any training that is necessary.

## Specific Concerns

- There is a need to determine necessary training and certifications for management of sensitive resources and anticipated trends (e.g., from climate change, limited water resources, etc.) at NAS Lemoore.

## Current Management

The NAS Lemoore EMD and NAVFAC Southwest are responsible for natural resources management at NAS Lemoore. Both teams maintain professionally trained natural resources management personnel with various specialized skills for managing Station resources. Both NAS Lemoore and NAVFAC Southwest also coordinate with other NAS Lemoore departments and Station lessees for natural resources management, when needed.

Currently, the natural resources personnel responsible for NAS Lemoore are members of various professional natural resource-related organizations and societies. Attending meetings provides excellent opportunities to develop professional relationships, as well as maintain professional standards.

In addition, NAS Lemoore staff have been able to obtain support for training required in order to obtain or maintain needed certifications (e.g., Annual Pesticide Training and Recertification). Such training allows staff to respond to and handle natural resources issues that arise as a result of daily Station activities.

## Assessment of Current Management

Properly trained personnel are required to achieve objectives and guidelines of this INRMP. Natural resources managers entrusted with this work must have a thorough knowledge and understanding of biology and natural resources, as well as administrative duties such as project management, reporting, and contracting.

Current training and professional development opportunities for natural resources staff have been sufficient to adequately implement the NAS Lemoore INRMP and manage natural resources on the Station. This includes maintaining needed certifications. However, with expanding natural resources management needs (including addressing a limited water resources future, climate change, anticipated surveys, delineations, and updating GIS records), there is a need for additional training.

Training may be obtained from a variety of sources, including universities, regulatory agencies, professional societies, and other Navy or military organizations. These training opportunities may be offered in the forms of structured courses or conferences, workshops, and symposia. Conferences/workshops will be evaluated for their practical, local applicability to ongoing projects and funding availability.

## Management Strategy

***Objective:*** *Continue to improve the success of natural resources management activities through professional development and training.*

**I.** Continue to provide professionally trained personnel for enforcement of conservation laws and regulations, consistent with the Sikes Act (as amended).

- **A.** Provide sufficient technical support to staff, as well as training and networking opportunities to achieve INRMP goals and objectives.
- **B.** Every person preparing, implementing, supervising and managing natural resources programs shall receive environmental and natural resources training specific to their job assignment (5090.1C CH-1 Chapter 28).
- **C.** Ensure environmental staff receive ongoing training and professional development through attendance at workshops, classes, training, and conferences. Support for training should be provided to staff responsible for INRMP implementation and maintaining necessary certifications and permits, including, but not limited to:
  1. Pesticide and integrated pest management certification (continuing education requirements);
  2. Certifications required for federally listed species surveys and management;

3. Wildlife-related permits;
4. Wetland management training and continuing education;
5. GIS and global positioning system training to enable collaborative work between natural resources staff, GIS staff, and contractors for purposes such as data management and reporting;
6. Climate change-related training;
7. USFWS National Conservation Training Center courses on Interagency Consultation for Endangered Species, and additional webinars and online training; and
8. Naval Civil Engineering Corps Officers School courses and workshops in natural resources compliance, environmental law and negotiation, and GIS/Geostatistics (http://www.cecosweb.com/).

**II.** NAS Lemoore natural resources managers should participate in each of the following annual workshops or professional conferences as appropriate and funding allows: National Military Fish and Wildlife Association annual workshop; North American Wildlife and Natural Resources Conference; and Partners in Flight national, regional, and state meetings.

# 5.14 Natural Resources Law Enforcement

## Background

Enforcement of laws, primarily aimed at protecting natural resources (and recreation activities that depend on natural resources) shall be an integral part of a natural resources program and shall be coordinated with or under the direction of the Natural Resources Manager for the affected area. Natural resources law enforcement training shall be budgeted for, and each installation with hunting, fishing, or protected species shall ensure trained personnel are available (5090.1C CH-1).

According to DoDI 4715.03 (March 2011), DoD Components shall also coordinate with appropriate agencies to support conservation law enforcement to enforce federal and applicable state laws and regulations pertaining to the management of the natural resources under their jurisdiction.

## Current Management & Assessment of Current Management

At NAS Lemoore, recurring issues with migratory birds, the continuation of the hunting program, and the confirmed and potential existence of federally listed species at the Station may warrant personnel trained in both the ESA, MBTA, and natural resources law enforcement.

Currently, NAS Lemoore EMD staff respond to issues regarding the MBTA. Both NAS Lemoore and NAVFAC Southwest jointly ensure compliance with the ESA and oversee compliance of lessees and contractors with applicable laws and regulations. The USDA Wildlife Services staff member at NAS Lemoore handles coyote presence in the Operations Area, pigeon nests in aircraft hangars, removal of nuisance stray cats or dogs, as well as any live-trapping, relocation and/or authorized take of raptors (under a USFWS Migratory Bird depredation permit) that are posing a problem. The hunting program is managed by the EMD. Any hunting related issues at the Station are first handled by this office and Station police, and subsequently by the CDFW Game Warden, if necessary. County Agricultural Commission officers may also routinely access agricultural parcels on the Station to monitor agricultural pest activity; they often put out pest traps and could be contacted regarding misuse of pesticides that affect the Station or local natural resources.

In general, the objectives and strategies proposed in the INRMP promote Station compliance with all applicable laws and regulations, including an increasing focus of the state of California to ensure adequate water resources and water quality protection (Bunn et al. 2007).

## Management Strategy

***Objective:*** *Provide for enforcement of natural resources laws and regulations by professionally trained personnel, taking proper safety and security measures.*

**I.** Commanders shall permit federal and state Conservation Officers access to enforce natural resources laws, after taking proper safety and security measures. Assistance from federal and state Conservation Officers should be solicited with any existing or proposed Wildlife Law Enforcement Program on the Station.

**II.** Take steps to discourage and minimize the impacts of unauthorized access, using appropriate signage in key access areas.

**III.** Provide for enforcement of natural resources laws and regulations by professionally trained personnel (DoDI 4715.03). Provide and budget for natural resources law enforcement by sufficient personnel trained in natural resources law enforcement for Stations with hunting, fishing, or protected species (5090.1C CH-1).

**This Page Intentionally Blank**

# 6.0 Implementation Strategy

*To successfully attain the Objectives and Strategies of this Integrated Natural Resources Management Plan, the measures in Chapters 4 and 5 need to be prioritized, assigned, and prepared for funding. This chapter lays out an implementation strategy that is a key component of the Navy's adaptive management approach, and is consistent with the budgeting hierarchy of Department of Defense and Navy directives.*

## 6.1 General Considerations

A successfully implemented Integrated Natural Resources Management Plan (INRMP) will:

- Ensure the sustainability of all ecosystems encompassed by Naval Air Station (NAS) Lemoore; and
- Ensure no net loss of the capability of NAS Lemoore lands to support the Department of Defense (DoD) mission.

*The Sikes Act (as amended) and DoD guidance require that INRMPs ensure that no net loss of available land and operational carrying capacity for military support occurs while pursuing environmental protection needs (DoD 4715.DD-R 1996).*

Formal adoption of an INRMP by a Regional Commander or Installation Commanding Officer constitutes a commitment to seek funding and execute, subject to the availability of funding, all Navy Environmental Readiness Level (ERL) 4 projects and activities in accordance with specific timeframes identified in the INRMP. For a description of ERL 4 projects and activities and budget programming hierarchy for this INRMP (both DoD and U.S. Department of the Navy [Navy]), see Section 6.3.1 Funding Classifications.

Successful implementation of this INRMP will depend upon not only the guidelines set up and projects described, but how well these are translated into performance work statements (who will do what and with what money), projects lists and scopes of work, and a workload plan. It must fit into the formal Environmental Management System established at NAS Lemoore for integrating environmental considerations into day-to-day activities across all levels and functions of Navy enterprise (Section 1.10 Management Approaches). NAS Lemoore's regionally significant natural resources, and its staff and environmental ethic set the stage to help lead resources management in partnership with other agencies. To accomplish this, NAS Lemoore will need to take advantage of funding opportunities outside normal program boundaries, consistent with authority to receive and use any such funds.

The responsibility for development, revision, and implementation of INRMPs is shared at every level among many different command elements. Roles of various parties identified in implementing this INRMP are described in Section 1.9 Roles, Responsibilities, and Stakeholders. These entities ensure the programming of resources necessary to establish and support an integrated natural resources program consistent with legislative requirements, DoD policy, and stewardship.

### 6.1.1 Staffing

The Sikes Act (as amended) specifically requires that there be "sufficient numbers of professionally trained natural resources management and natural resources enforcement personnel to be available and assigned responsibility" to implement an INRMP.

The 5090.1C CH-1 states:

> "Natural resources programs shall support military readiness and sustainability and commands shall assign specific responsibility, provide centralized supervision and assign professionally trained personnel to the program. Natural resources personnel shall be provided an opportunity to participate in natural resource management job-training activities and professional meetings."

NAS Lemoore Environmental Management Division (EMD) is the primary department responsible for natural resources management at the Station. The EMD identifies personnel requirements to accomplish INRMP goals and objectives, allocates existing budgetary and personnel resources, and identifies staffing needs based on any additional current and future projects. Through oversight and monitoring, these personnel ensure that a consistent conservation program is carried out using strategies outlined in this plan to support the Navy mission and achieve INRMP goals and objectives. Refer to Section 5.13 Training of Natural Resources Management Personnel.

Cooperative projects among different Navy organizations are monitored by the originating or controlling office as specified prior to project implementation.

## 6.2 INRMP Review and Metrics

The INRMP review and revision process is described in Section 1.11: INRMP Review and Revision Process.

NAS Lemoore complies with all recent DoD INRMP guidance and the Sikes Act (as amended) for both five-year and annual reviews of the NAS Lemoore INRMP (Section 1.11: INRMP Review and Revision Process). Annual reviews conducted in cooperation with the USFWS and California Department of Fish and Wildlife (CDFW) (per DoD policy) facilitate adaptive management by providing an opportunity for the parties to review the goals and objectives of the plan, as well as establish a realistic schedule for undertaking proposed actions. NAS Lemoore also improves and refines natural resources management by adjusting success criteria and priorities based on past accomplishments, new risks and threats, new biological information, and changes in policy.

Upon request from Chief of Naval Operations (CNO)/Commander, Navy Installations Command, Naval Facilities Engineering Command (NAVFAC) Southwest coordinates natural resources requirements with other federal, state, or local agencies, including the acquisition of INRMP mutual agreement between the Navy, U.S. Fish and Wildlife Service (USFWS), and CDFW. NAS Lemoore provides a notice of intent to prepare or revise the INRMP to the USFWS Field Office and the CDFW and ensures that the USFWS Regional Sikes Act Coordinator is notified. Annual reviews are conducted in compliance with the Sikes Act (as amended) in coordination with the USFWS and the CDFW and any other INRMP stakeholders at the discretion of the Natural Resources Manager. The annual reviews are intended to verify the following:

- Current information on all conservation metrics is available.
- All *must fund* projects and activities have been budgeted for and implementation is on schedule.

- All required trained natural resources positions are filled or are in the process of being filled.
- Projects and activities for the upcoming year have been identified and included in the INRMP. An updated project list does not necessitate revising the INRMP.
- All required coordination has occurred.
- All significant changes in the installation's mission requirements or its natural resources have been identified.
- The INRMP objectives remain valid.

*Must fund projects are defined and assessed based on four Navy environmental readiness levels to enable capability-based programming and budgeting of environmental funding. Such projects support all actions specifically required by law, regulation or Executive Order just in time (refer to Section 6.3.1 Funding Classifications).*

NAS Lemoore EMD also tracks INRMP implementation and disseminates related information to others as appropriate. They maintain natural resources program information needed to satisfy reporting requirements, legislative information requests, and to support project requests. This information is collected in the NAVFAC Natural Resources Data Call Station and applicable geographic information system (GIS) programs.

### 6.2.1 INRMP Metrics

As a guide for addressing annual INRMP review, the Navy Natural Resources Metrics are used to assess INRMP implementation, measure conservation efforts, ensure no net loss of military testing and training lands, understand the conservation program's installation mission support and indicate the success of partnerships. They are used to gather and report essential information required by Congress, Executive Orders (EOs), existing U.S. laws, and the DoD on an annual basis. There are seven Focus Areas that comprise the Natural Resources Metrics to be evaluated during the annual review of the Natural Resources Program/INRMP.

1. Ecosystem Integrity
2. Listed Species and Critical Habitat
3. Fish and Wildlife Management and Public Use
4. Partnership Effectiveness
5. Team Adequacy
6. INRMP Project Implementation
7. INRMP Impact on the Installation Mission

A full copy of the most recent Natural Resources Metrics questions are presented in Appendix O and are available on the Navy Conservation Website (Figure 6-1).

## 6.3 Funding and INRMP Implementation

The Navy and NAS Lemoore intend to implement recommendations in this INRMP within the framework of regulatory compliance, national Navy mission obligations, anti-terrorism and force protection limitations, and funding constraints. Any requirement for the obligation of funds for projects in this INRMP shall be subject to the availability of funds appropriated by Congress, and none of the proposed projects shall be interpreted to require obligation or payment of funds in violation of any applicable federal law, including the Anti-Deficiency Act, 31 USC § 1341, et seq.

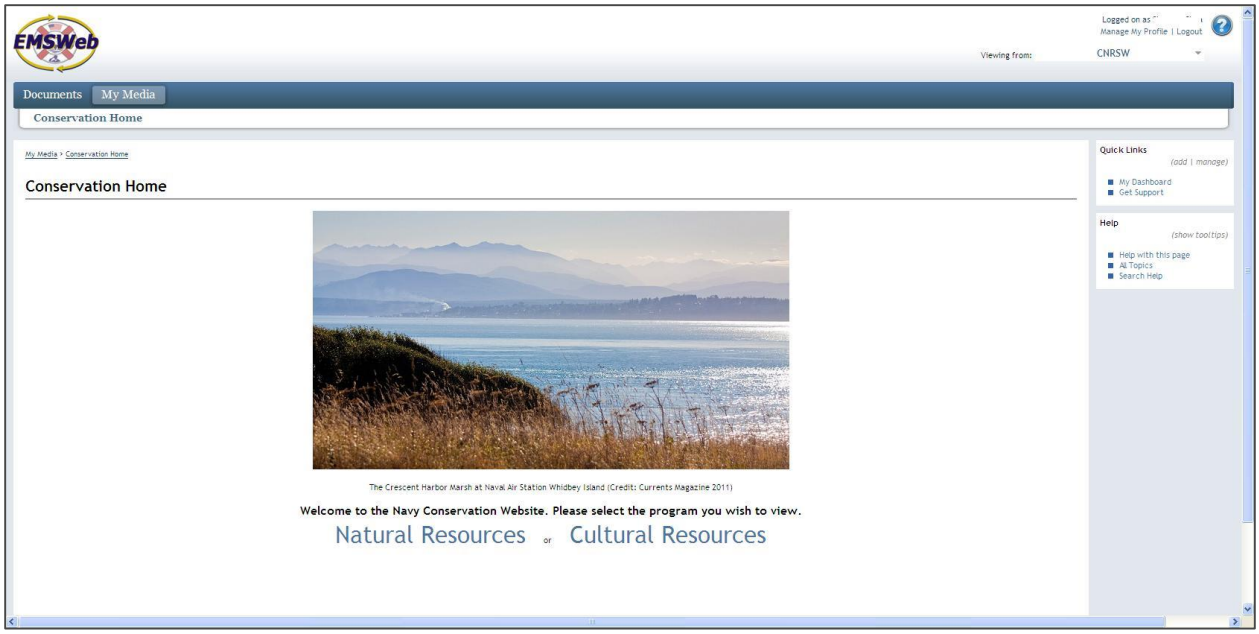



*Figure 6-1. Navy Conservation Website, where the metrics builder can be found.*

The INRMP is considered implemented if the installation:

1. Actively requests, receives, and uses funds for all ERL 4 projects and activities;
2. Ensures that sufficient numbers of professionally trained natural resources management staff are available to perform the tasks required by the INRMP;
3. Coordinates annually with all cooperating offices; and
4. Documents specific INRMP action accomplishments undertaken each year.

## 6.3.1 Funding Classifications

For the purposes of this INRMP, the terms stewardship and compliance have specific meaning as criteria for implementing project action lists. Project rankings are assigned based on whether an activity is mandatory to comply with a legal requirement such as under the Endangered Species Act (ESA), Clean Water Act (CWA), or Migratory Bird Treaty Act (MBTA). Alternatively, a project or action may be considered good land stewardship but is not considered an obligation for NAS Lemoore to be found in compliance with environmental laws. Projects or actions considered necessary to comply with the law are generally funded within budget constraints, whereas stewardship projects or actions are ranked lower for funding consideration when projects are competed among multiple installations. Current policy is, however, that they will eventually be funded.

The funding strategies described here are implemented when projects or actions are defined and prioritized. The budgeting plan for the INRMP is based on programming and budgeting priorities for conservation programs described in 5090.1C CH-1. Funds will be requested for tasks within this INRMP based on this plan.

### Environmental Readiness Program Assessment Database

Environmental Portal and the Environmental Program Requirements Web (EPRWeb) is an optimized online database used to define all programming for the Navy's environmental requirements. EPRWeb

records data on project expenditures, and provides immediate, web-based access to requirements entered by the multiple Navy environmental programs, including Environmental Compliance, Pollution Prevention, Conservation, Radiological Controls and Range Sustainment as related to environmental costs on military ranges. It is the Navy's policy to fully fund compliance with all applicable federal, state and local laws; EOs; and associated implementing rules, regulations, DoDIs and Directives, and applicable international and overseas requirements (5090.1C CH-1).

All natural resources requirements are entered into the EPRWeb and they are available for review/approval by the chain of command by the dates specified in the Guidance letter that is provided annually by Chief of Naval Operations (N45). This database is the source document for determining all programming and budgeting requirements of the Environmental Quality Program. EPRWeb is also the tool for providing the four ERL capabilities used in producing programming and budgeting requirements for the various processes within the budget planning system.

The budget programming hierarchy for this INRMP is based on both DoD and Navy funding level classifications. The four programming and budgeting priority levels detailed in Department of Defense Instruction (DoDI) 4715.03 (18 March 2011) Natural Resources Conservation Program, implement policy, assign responsibilities, and prescribe procedures for the integrated management of natural and cultural resources on property under DoD control. Budget priorities are also described in 5090.1C CH-1, Environmental and Natural Resources Program Manual.

## Department of Defense Funding Classifications

The previous classification used Class 0, I, II, and III projects. The guidance has been updated and Enclosure 4 of DoDI 4715.03 defines the four classes of conservation programs. The projects and actions recommended in this INRMP have been prioritized based on compliance and stewardship criteria provided in the hierarchy below. Navy policy requires funding of DoD Recurring Natural Resources Conservation Management Requirements and Non-Recurring Current Compliance projects.

### *Recurring Natural Resources Conservation Management Requirements*

*Formerly DoD Class 0.* These activities are needed to cover the administrative, personnel, and other costs associated with managing the DoD Natural Resources Conservation Program that are necessary to meet applicable compliance requirements in federal and state laws, regulations, EOs, and DoD policies, or in direct support of the military mission. DoD components shall give priority to recurring natural resources conservation management requirements associated with the operation of facilities, installations, and deployed weapons systems. These activities include day-to-day costs of sustaining an effective natural resources management program, as well as annual requirements, including manpower, training, supplies, permits, fees, testing and monitoring, sampling and analysis, reporting and record keeping, maintenance of natural resources conservation equipment, and compliance self-assessments.

### *Non-Recurring Current Compliance*

*Formerly DoD Class I.* These projects and activities are needed to support: an installation currently out of compliance; signed compliance agreements or consent order; meeting requirements with applicable federal or state laws, regulations, standards, EOs, or policies; immediate and essential maintenance of operational integrity or military mission sustainment; and projects or activities that will be out of compliance if not implemented in the current program year.

### *Non-Recurring Maintenance Requirements*

*Formerly DoD Class II.* These projects and activities are needed to meet an established deadline beyond the current program year and maintain compliance. Examples include: compliance with future deadlines;

conservation, GIS mapping, and data management to comply with federal, state, and local regulations, EOs, and DoD policy; efforts undertaken in accordance with non-deadline specific compliance requirements of leadership initiatives; wetlands enhancement to minimize wetlands loss and enhance existing degraded wetlands; and conservation recommendations in Biological Opinions.

### *Non-Recurring Enhancement Actions Beyond Compliance*

*Formerly DoD Class III.* These projects and activities enhance conservation resources or the integrity of the installation mission or are needed to address overall environmental goals and objectives, but are not specifically required by law, regulation, or EO, and are not of an immediate nature. Examples include: community outreach activities; educational and public awareness projects; restoration or enhancement of natural resources when no specific compliance requirement dictates a course or liming of action; and management and execution of volunteer and partnership programs.

## Navy Environmental Readiness Levels for Assigning Budget Priorities

Four Navy ERLs have been established to enable capability-based programming and budgeting of environmental funding (recurring and non-recurring projects), and to facilitate capability versus cost trade-off decisions. ERL 4 is considered the absolute minimum level of environmental readiness capability required to maintain compliance with applicable legal requirements. Navy policy requires funding of all so-called DoD Recurring Natural Resources Conservation Management Requirements and Non-recurring Current Compliance projects. The definitions of ERL 4 through ERL 1 follow, as provided in 5090.1C CH-1:

1. Environmental Readiness Level 4
   - Supports all actions specifically required by law, regulation, or EO (DoD Non-recurring Current Compliance and Non-recurring Maintenance Requirements projects) just in time.
   - Supports all DoD Recurring Natural Resources Conservation Management Requirements as they relate to a specific statute such as hazardous waste disposal, permits, fees, monitoring, sampling and analysis, reporting and record keeping.
   - Supports recurring administrative, personnel and other costs associated with managing environmental programs that are necessary to meet applicable compliance requirements (DoD Recurring Natural Resources Conservation Management Requirements).
   - Supports minimum feasible Navy executive agent responsibilities, participation in Office of the Secretary of Defense sponsored inter-department and inter-agency efforts, and Office of the Secretary of Defense mandated regional coordination efforts.
2. Environmental Readiness Level 3
   - Supports all capabilities provided by ERL 4.
   - Supports existing level of Navy executive agent responsibilities, participation in Office of the Secretary of Defense sponsored inter-department and inter-agency efforts, and Office of the Secretary of Defense mandated regional coordination efforts.
   - Supports proactive involvement in the legislative and regulatory process to identify and mitigate requirements that will impose excessive costs or restrictions on operations and training.
   - Supports proactive initiatives critical to the protection of Navy operational readiness.
3. Environmental Readiness Level 2
   - Supports all capabilities provided under ERL 3.
   - Supports enhanced proactive initiatives critical to the protection of Navy operational readiness.
   - Supports all Navy and DoD policy requirements.

- Supports investments in pollution reduction, compliance enhancement, energy conservation and cost reduction.

4. Environmental Readiness Level 1
   - Supports all capabilities provided under ERL 2.
   - Supports proactive actions required to ensure compliance with pending/ strongly anticipated laws and regulations in a timely manner and/or to prevent adverse impact to Navy mission.
   - Supports investments that demonstrate Navy environmental leadership and proactive environmental stewardship.

## 6.3.2 Implementation Schedule

This INRMP will become effective upon the acceptance and signatory release described in Section 1.9 Roles, Responsibilities, and Stakeholders. Current projects, activities, and plans have been incorporated into the INRMP (Section 6.4 INRMP Implementation Summary and Schedule; Appendix A), as the plan serves as a formal structuring and integration of the existing natural resources management program.

Future work identified herein (Appendix A) will be implemented as funding becomes available. Priorities identified in this INRMP will generally determine the order of implementation. The EMD will determine what projects and activities are appropriate to initiate, given funding, at any particular time. The INRMP is meant to be flexible, dynamic, and adaptable to the immediate concerns and needs of natural resources management and the Navy mission. Programming for INRMP implementation generally occurs in one- to three-year budget cycles through the Program Objectives Memorandum system; this is how the DoD allocates resources and links INRMP objectives to budgets and execution.

## 6.3.3 Federal Anti-Deficiency Act

The Navy and NAS Lemoore intend to implement actions in this INRMP within the framework of regulatory compliance, national Navy mission obligations, anti-terrorism and force protection limitations, and funding constraints. The execution of any of the INRMP projects or activities will be dependent on the availability of appropriate funding sources. Any requirement for the obligation of funds for projects or actions in the INRMP shall be subject to the availability of funds appropriated by Congress. None of the proposed projects or actions shall be interpreted to require obligations or payment of funds in violation of any applicable federal law, including the Anti-Deficiency Act, 31 U.S. Code [USC] § 1341.

## 6.3.4 Funding Sources

In order to implement the various research, surveys, and programs necessary to fulfill the mission of the EMD, funding must be identified and acquired. There are several avenues of funding available to the EMD, beyond the typical Navy operational budget, that allow the inclusion of additional projects or activities to assist the EMD in their mission-related and stewardship endeavors. The EMD must continually assess the priority and level of budgetary needs to fulfill Navy and regulatory requirements and to sustain overall program goals. These funding sources are discussed below in general terms, as this process is dynamic and is dependent on the INRMP's continuously developing program.

These programs will be implemented using Navy personnel and program resources as much as possible; however, it is likely that contractors will accomplish many projects and activities. The EMD will identify projects or actions that would be accomplished using contract vehicles, with existing contracts being used where possible and appropriate.

For large projects or actions that involve different Navy organizations, representatives of these organizations would coordinate budgeting and scheduling to ensure that the project or activity can be accomplished in the planned timeframe. Large-budget projects may not be completely funded in a fiscal year, requiring incremental funding over the term of the project.

In some cases, smaller, lower-priority projects may be conducted using unspent funds from other tasks or year-end fallout funding. Some projects may be accomplished with little or no funding required, such as those requiring only a change of policy or coordination and effort from volunteer labor. These tasks can be implemented virtually as soon as planning is performed.

In concert with the above, the EMD can ensure adequate funding for NAS Lemoore natural resources management initiatives by providing documentation to secure appropriate levels of in-house funding; maintaining prioritized lists of management efforts to facilitate programs required for compliance and legal mandates and to support the military mission; developing long-range plans and documentation to secure off-site funding; continuing to request funding from other agencies for programs of mutual benefit; and continuing to support scientific and academic efforts to initiate or supplement natural resources management programs.

#### 6.3.4.1 Department of Defense Funding Sources

##### Operations and Maintenance Funds

Funding sources for the natural resources program are derived from General and Administrative, Operations and Maintenance Navy (O&MN), and input into the Navy Environmental Program Requirements (EPR) system for funding. This primary budgetary source is the basis for maintaining the personnel and core programs inherent to the natural resources program. These appropriated funds are the primary source of resources to support must-fund, just-in-time environmental compliance, i.e., Navy ERL 4 projects. Operations and Maintenance Navy funds are generally not available for Navy ERL 3-1 projects. It is the responsibility of the EMD to manage the natural resources program budget and funding. Once O&MN funds are appropriated for core personnel and the program, funding can be justified for other project requirements.

##### Fish and Wildlife Fees

Fish and Wildlife Fees are collected via sales of licenses to hunt or fish. They are authorized by the Sikes Act (as amended) and may be used only for fish and wildlife management on the installation where they are collected. NAS Lemoore generates no Fish and Wildlife Fees, and none are anticipated unless demand for a hunting program develops to a size that would be feasible to charge a hunting fee, which is not anticipated.

##### Revenues from Agricultural/Grazing Outleasing

Revenues from rents on agricultural outleases on Navy lands are a source of funding for natural resources management programs. Funds accumulated through the outleasing of agricultural lands on many installations are directed back into the natural resource program and reallocated throughout the Navy by NAVFAC Headquarters. NAS Lemoore maintains approximately 54 agricultural outleases covering 12,776 acres (5,170 hectares), which are renewed every five to ten years. The Agricultural Outlease Program at NAS Lemoore is managed by NAVFAC Southwest in San Diego, California with the assistance of the Public Works Department at NAS Lemoore (refer to Section 2.4.1 Agricultural Outleases and Section 5.2.1 Agricultural Outlease Management). Some of NAS Lemoore's natural resources personnel and most agricultural outlease improvement projects are funded by the centrally managed fund. While the sale of forest products and rents of grazing leases on Navy lands can also generate revenues for natural resource programs on Navy installations, NAS Lemoore does not presently conduct sales of forest products or manage leases for grazing on the Station.

Revenues from the Agricultural Outlease Program are available for (NAVFAC P-73 Vol. II):[1]

- Priority A: Expenses for outleasing land for agricultural and grazing uses.
- Priority B: Projects that enhance, improve, or perpetuate the potential to increase agricultural and grazing outlease proceeds. Projects may be for any cost-effective work necessary to bring land into agricultural and grazing use.
- Priority C: Land management improvement projects to accomplish or support soil surveys, soil maps, erosion control, watershed management and other similar requirements.
- Priority D: Contracted surveys and inventories essential for development and implementation of multiple-use natural resources management plans and cooperative agreements.
- Priority E: Expenses of preparing multiple-use natural resources management plans.
- Priority F: Other natural resources projects that support conservation and natural environment enhancement objectives of approved multiple-use natural resources management plans.

## DoD Legacy Funds

The Legacy Resource Management Program (LRMP) was enacted in 1990 to provide financial assistance to military natural and cultural resources management. The program assists with protection and enhancement of natural resources while supporting military readiness. Legacy projects may involve regional ecosystem management initiatives, habitat preservation efforts, archaeological investigations, invasive species control, and/or monitoring, and predicting migratory patterns of bird and other animals.[2]

The LRMP has three main components: stewardship, leadership, and partnership. Stewardship projects assist the military in sustaining its natural resources. Leadership initiatives provide programs that serve to guide and often become flagship programs for other military, scientific, and public organizations. Partnerships provide for cooperative efforts in planning, management, and research.

The LRMP emphasizes five areas:

- Ecosystem approaches to natural resources management to maintain biological diversity and the sustainable use of land and water resources for the military mission and other uses.
- Interdisciplinary approaches that incorporate the often-overlapping goals of natural and cultural resources management. Legacy strives to take advantage of this by sharing management methodologies and techniques across natural and cultural resource initiatives.
- Promoting natural and cultural resources by public and military education and involvement.
- Application of resource management initiatives regionally. The LRMP supports regional efforts between the military and other governmental and non-governmental organizations.
- Development of innovative new technologies to provide more efficient and effective natural resources management.

## Recycling Funds

Installations with a Qualified Recycling Program may use proceeds for some types of natural resource projects. While NAS Lemoore does have a recycling program, the installation does not receive any proceeds from that program for natural resources management.

[1] Per amendment of Title 10 USC 2667(d) in 1982 by Public Law 97-321.

[2] Information on this program can be found at www.dodlegacy.org.

### Special Initiatives

The DoD or Navy may establish special initiatives to fund natural resource projects. Funding is generally available only for a limited number of projects. The two currently existing DoD initiatives focus on managing forested areas on Navy lands: Streamside Forests and Sustaining Our Forests, Preserving Our Future.

## 6.3.4.2 External Assistance

Personnel limits have resulted in the need for outside assistance with some natural resources programs on NAS Lemoore. The growth of environmental compliance requirements has increased the need for external assistance.

Many external assistance projects will be determined by funding availability. As feasible, NAS Lemoore should provide funding and support for research, other studies, and specific management programs to further installation natural resources management through Contractor Support, Cooperative Agreements (CAs), Memoranda of Understanding, and other partnership vehicles appropriate for the installation.

### Contractor Support

Contractors give NAS Lemoore access to a wide variety of specialties and fields. At NAS Lemoore, contractors are involved in conducting National Environmental Policy Act (NEPA) review and documentation for large projects, vegetation surveys, species surveys, invasive species management, grounds maintenance, management plans, and similar activities.

### Memoranda of Understanding

Memoranda of Understanding (MOU) provide valuable services to NAS Lemoore that benefit both sustainability of the military mission and natural resources management. For example, an MOU with the U.S. Department of Agriculture Wildlife Services has provided management of migratory birds and other animals posing threats to NAS Lemoore aircraft, Bird/Animal Aircraft Strike Hazard (BASH) concerns and feral cats and dogs. Other examples are provided in Appendix D.

### Cooperative Agreements

Navy guidance on INRMPs states: "Installations are encouraged to work with other organizations, agencies, and individuals both on and off the installation throughout the planning process. Building partnerships with the right organization(s) is essential for ecosystem management." CAs[3] are one means to accomplish this kind of partnership. Indeed, the Sikes Act (as amended) states that the Secretary of Navy can enter into CAs with states, local governments, nongovernmental organizations, individuals, and with other agencies (inter-agency agreements) to provide for: (1) the maintenance and improvement of natural resources on, or to benefit natural and historic research on, DoD installations; (2) the maintenance and improvement of natural resources located off of a DoD installation if the purpose of the cooperative agreement or interagency agreement is to relieve or eliminate current or anticipated challenges that could restrict, impede, or otherwise interfere with, whether directly or indirectly, current or anticipated military activities.

In order to use a CA, substantial involvement is expected between the Navy and state, local government, or other recipient when carrying out the activity contemplated in the agreement. CAs provide a mutually beneficial means of acquiring, analyzing, and interpreting natural resources data, which can then be used to inform natural resources management decisions. CAs are funded by the Navy and produce information that can be used to help resource managers achieve project-specific compliance with environmental laws.

[3] Cooperative Agreements are legal relationships between the navy and States, local governments, institutions of higher education, hospitals, non-profit organizations or individuals. The principal purpose of the relationship is to transfer a thing of value to the State, local government, or other recipient to carry out a public purpose of support or stimulation authorized by a law of the United States instead of acquiring (by purchase, lease, or barter) property or services for the direct benefit or use of the United States Government. Authorization for CAs is arranged through the NAVFAC.

### Cooperative Ecosystem Studies Units

The Cooperative Ecosystem Studies Units program is a working collaboration among federal agencies, universities, state agencies, non-governmental organizations, and other nonfederal institutional partners. The Cooperative Ecosystem Studies Units National Network provides multidisciplinary research, technical assistance, and education to resource and environmental managers. Although the overall program is overseen by the U.S. Department of the Interior, one of the participating agencies is DoD.

### University Assistance

Universities are an excellent source of research assistance. NAS Lemoore has used several universities in recent years to help with specialized needs (particularly natural resources research), such as California State University Fresno and the University of California Davis. Work with these two universities was accomplished through Cooperative Ecosystem Studies Units. At NAS Lemoore, collaboration with universities is regularly accomplished through Cooperative Ecosystem Studies Units or Cooperative Agreements.

## 6.3.5 Research Funding Requirements

Environmental program funding within the Navy is primarily based upon federally mandated requirements. Consequently, program managers are encouraged to seek outside funding for projects and activities consistent with the INRMP, such as research, that will benefit natural resources on installations, but that are not directly related to federal mandates.

New funding sources should be sought from federal, state, local, and nonprofit organizations with an interest in achieving the goals and objectives of this INRMP in partnership with NAS Lemoore. Any such funding would need to be consistent with authorization to receive and use such funds. These will often require cost-sharing. This funding opportunity should be sought for projects and activities that are not DoD ERL 4 *must-fund* items, tied directly to immediate regulatory compliance. Examples are watershed management, habitat enhancement, or wetland restoration. Refer to Appendix M.

# 6.4 INRMP Implementation Summary and Schedule

The approach and actions that support INRMP implementation are identified in this section. Following these, Table 6-1, Table 6-2, Table 6-3, and Table A-1 summarize various aspects of the implementation of this INRMP.

The purpose of Table A-1 in Appendix A: Implementation Summary Table is to summarize all projects or activities that NAS Lemoore intends to implement over the duration of the INRMP time frame. It is organized according to INRMP management topic. Management strategies presented in Chapter 4: Natural Resources Management Strategies and Prescriptions, Chapter 5: Sustainability and Compatible Use at NAS Lemoore, and Chapter 6: Implementation Strategy identify the means by which NAS Lemoore intends to achieve desired future conditions. Management actions, such as EPR projects, are specific projects or activities that provide NAS Lemoore a mechanism to strive towards achieving those desired future conditions. Individual EPR projects may address multiple management strategies encompassing various INRMP management topics. In order to reduce redundancy, management strategies are incorporated by reference in the INRMP Management Strategy column of the table along with the corresponding objective. Management strategies that pertain to special status species have their own sections rather than including special status species management strategies in the broader sections that pertain to wildlife populations.

Table 6-1 identifies the various EPR project codes and descriptions that are referenced in the EPR Project Code column of Table A-1; these include the EPR number or placeholder for future EPR projects if appropriate. Table 6-2 identifies the applicable funding sources for each project or activity; for more information on funding sources refer to Section 6.3.4 Funding Sources. Table 6-3 identifies the applicable INRMP legal drivers, or compliance requirements, for all of the various INRMP management projects or activities. All projects and actions listed in Table A-1 support compliance with 5090.1C CH-1 and DoDI 4715.03.

Effective implementation of the NAS Lemoore INRMP relies on organizational capacity, communication, planning functions, staffing, budgeting, and innovative technology support to ensure compliance with environmental laws, stewardship of natural resources, and continued use of installation lands by the Navy, as required by the Sikes Act (as amended). Investigating and utilizing all appropriate avenues and partnerships to achieve the goals and objectives of this INRMP will contribute to the best possible management and most efficient use of funds. Implementing a balanced, multiple-use natural resources program can be accomplished through:

- Professional management (NAVFAC P-73 Volume II) with ongoing training and professional development opportunities.
- Prioritizing and allocating funding to support compliance requirements with emphasis on INRMP actions and projects in the order of ERL 4 (*must fund*[4]), ERL 3, ERL 2 and ERL 1 (5090.1C CH-1, DoDI 4715.03, Section 6.3.1 Funding Classifications). Budget priorities for threatened and endangered species management, especially compliance with Biological Opinions, should receive the highest possible budgeting priority, and support the need to avoid Critical Habitat designations under Section 4(b)(2) of the ESA, or Section 4(a)3 of the ESA (exemption from Critical Habitat designations for national security reasons).
- Identifying new funding sources from federal, state, local, and nonprofit organizations with an interest in achieving the goals and objectives of this INRMP and through partnerships to further NAS Lemoore natural resources management goals and compliance (for non ERL 4 *must fund* items). Partnerships can strengthen natural resources management actions locally and regionally, particularly when supporting mutual goals of this INRMP and the California Wildlife Action Plan or other regional plans.
- Seeking recognition for natural resource work conducted at NAS Lemoore to showcase management accomplishments.
- Continuing to ensure effective communication, adaptive oversight and policy leadership through the Navy Natural Resources Strategic Plan.

[4] Specifically, must fund projects and actions are those required to: (a) Meet with legislative directives, EOs, and any legal requirement supported by laws and regulations found, but not limited to, federally listed species surveys, baseline wetland delineations, mapping of federally listed species, and mapping of Critical Habitat; (b) Meet the USFWS special management criteria for federally listed species management and avoidance of Critical Habitat designation on military bases; (c) Integrally support mission readiness, training requirements, and land sustainability, such as prevention of resource loss or degradation and baseline data collection and long-term trend monitoring efforts; (d) Provide for qualified natural resources personnel.

*Table 6-1. Integrated Natural Resources Management Plan environmental program requirements, project codes and descriptions.*

| EPR Project Code | Description |
|---|---|
| 6304200094 | SW NAS Lemoore Fish and Wildlife Conservation Maintenance |
| 6304210117 | Shallow Saline Aquifer Monitoring Program |
| 6304280308 | SW-NASL San Joaquin Kangaroo Rats Monitoring, Biological Assessment, and Management |
| 63042NR113 | SW-NASL Burrowing Owl Active Relocation and HMP Implementation |
| 63042NR149 | Windbreak Conversion to Native Tree Species |
| 63042NR197 | NAS Lemoore INRMP - For INRMP Development |
| 63042NR201 | Baseline Surveys for the Buena Vista Lake Shrew |
| 63042NR001 | Invasive Weed Control |

*Table 6-2. Integrated Natural Resources Management Plan project funding sources.*

| Funding Sources | Description |
|---|---|
| NAS Lemoore EMD In-House | NAS Lemoore Environmental Management Division funding |
| NAS Lemoore Other Navy In-House | NAS Lemoore Department of Public Works or other NAS Lemoore Department or Division funding |
| O&MN | Operations and Maintenance Navy funding |
| Ag. Funds | Agricultural/Grazing Outleasing funding |
| DoD Legacy | DoD Legacy funding |
| Navy Tenant | NAS Lemoore Naval tenant funding |
| Partnership | Research institution, non-governmental organization, volunteer funding, or other partnership funding |
| Project Proponent | Project proponent funding |

*Table 6-3. Integrated Natural Resources Management Plan implementation table management project or activity legal drivers.*

| Acronyms | Description |
|---|---|
| AHPA | Archaeological and Historical Preservation Act |
| ARPA | Archaeological Resources Protection Act |
| BEPA | Bald and Golden Eagle Protection Act |
| CAA | Clean Air Act |
| CA ILRP Framework | California Central Valley Water Board Recommended Irrigated Lands Regulatory Program Framework |
| CESA | California Endangered Species Act |
| WAP | California Wildlife Action Plan |
| CWA | Clean Water Act |
| DQA | Data Quality Act |
| DoD Partnership | Partnership for Amphibian and Reptile Conservation (PARC), Partners in Flight (PIF), Pollinator Partnership, etc. |
| EO 11988 | Floodplain Management |
| EO 11514 | Protection and Enhancement of Environmental Quality |
| EO 11990 | Protection of Wetlands |
| EO 11991 | Protection and Enhancement of Environmental Quality |
| EO 12342 | Environmental Safeguard for Animal Damage Control on Federal Lands |
| EO 13112 | Invasive Species |
| EO 13186 | Migratory Birds |
| EO 13423 | Strengthening Federal Environmental, Energy, and Transportation Management |
| EO 13514 | Federal Leadership in Environmental, Energy, and Economic Performance |
| ESA | Endangered Species Act |
| FNWA | Federal Noxious Weed Act |
| LRPPA | Legacy Resource Protection Program Act |
| MBTA | Migratory Bird Treaty Act |
| Migratory Bird Rule | 50 CFR Part 21 Migratory Bird Permits: Take of Migratory Birds by the Armed Forces, 28 February 2007 |
| NAVFAC P-73, Vol. II | NAVFAC, P-73. (May 1987) Real Estate Procedural Manual and Natural Resources Management Procedural Manual |
| Navy Guidance for INRMPs | Chief of Naval Operations (N45) Integrated Natural Resources Management Program (INRMP) Guidance. 10 April 2006 |
| NEPA | National Environmental Policy Act |
| 5090.1C CH-1 | Environmental Protection and Natural Resources Manual (as amended) |
| OPPA | Oil Pollution Prevention Act |
| PPA | Plant Protection Act |
| Presidential Memorandum of April 1994 | Presidential Memorandum, Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds, 26 April 1994 |
| QDR | 2010 Quadrennial Defense Review |
| RCRA-HSWA | Resource Conservation and Recovery Act - Hazardous and Solid Waste Amendments |
| SCA | Soil Conservation Act, 16 USC §§ 590a et seq. |
| Sikes Act (as amended) | Sikes Act (Fish and Wildlife Conservation and Military Reservations Act) of 1960, as amended |
| DoDI 4715.03 | DoD Natural Resources Conservation Program |
| DoDI 6055.06 | DoD Fire and Emergency Services Program |
| WPFPA | Watershed Protection and Flood Prevention Act |

# 7.0 References

ACME Mapper. 2011. USGS Topo Maps for United States (Map), Cartography by United States Geological Survey. http://mapper.acme.com/, Retrieved 02 December 2011.

Ahlborn, G. n.d. Western Mastiff Bat, Eumops perotis. California Wildlife Habitat Relationships System, California Department of Fish and Game, California Interagency Wildlife Task Group. Online at: http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentVersionID=18101

Altman, B. and R. Sallabanks. 2012. Olive-sided Flycatcher (*Contopus cooperi*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/502

Arnold, G.W., and J.R. Weeldenburg. 1990. Factors determining the number and species of birds in road verges in the wheatbelt of Western Australia. Biological Conservation. 53:295-315.

Arroues, K.D. 2012. Personal communication. Soil Scientist, USDA Natural Resources Conservation Service.

Baldwin, B.G, D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosatti (eds.). 2012. The Jepson Manual: Vascular Plants of California, Second Edition, Thoroughly Revised and Expanded. University of California Press, Berkeley and Los Angeles, California. 1600 pp.

Barr, C. 1991. The Distribution, Habitat, and Status of the Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*). U.S. Fish and Wildlife Service, Sacramento, California. November.

Bartow, J.A. 1991. The Cenozoic Evolution of the San Joaquin Valley, California. US Geological Survey Professional Paper 1501.

Bass, R.E. and A.I. Herson. 1993. Mastering NEPA: A Step-by-Step Approach. Point Arena, California: Solano Press Books.

Bat Conservation International. 2013. BCI Species Profiles: *Lasiurus blossevillii*. Online at: http://www.batcon.org/index.php/all-about-bats/species-profiles.html. Last Accessed 02 April 2013.

Beedy, E. C. and W. J. Hamilton III. 1999. Tricolored blackbird (*Agelaius tricolor*), In: The Birds of North America No. 423 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

Bloom, P. H. 1980. The status of Swainson's hawks in California. Cal. Dept. Fish and Game Fed. Aid in Wildlife Restoration Proj. W-54-R12.42pp.

Brandle, J.R., L. Hodges and X. H. Zhou. 2004. Windbreaks in North American agricultural systems. Agroforestry Systems 61: 65-78.

Brown, S., C. Hickey, B. Harrington, and R. Gill (eds). 2001. United States Shorebird Conservation Plan, 2nd Ed. Manomet Center for Conservation Sciences. Manomet, Massachusetts. May. Available online at: http://www.fws.gov/shorebirdplan/USShorebird/PlanDocuments.htm

Bunn, D., A. Mummert, M. Hoshovsky, K. Gilardi, and S. Shanks. 2007. California Wildlife: Conservation Challenges, California's Wildlife Action Plan. Wildlife Health Center, School of Veterinary Medicine, University of California, Davis, Davis, CA. Prepared for the California Department of Fish and Game. Online at www.dfg.ca.gov/habitats/wdp/.

Bureau of Reclamation (BoR) and the San Luis and Delta-Mendota Water Authority. 2006. Westside Integrated Water Resources Plan. Adopted on 04 May 2006. 350pp. Available online at http://www.sldmwa.org/intergrated_resources_plan.htm

California Bay-Delta Authority (CALFED). 2000. Ecosystem restoration program plan: Volume 1: Ecological attributes of the San Francisco Bay-Delta watershed. Final Programmatic EIS/EIR Technical Appendix. Sacramento. http://calwater.ca.gov/Programs/EcosystemRestoration/EcosystemVol1RestorationPlan.shtml.

California Department of Conservation. 2008. Kings County and Fresno County Farmland Importance maps. http://redirect.conservation.ca.gov/DLRP/fmmp/product_page.asp. Accessed on August 11, 2010.

California Department of Fish and Game (CDFG). 1993. 5-Year Status Review: Swainson's Hawk (*Buteo swainsoni*). Prepared by the Wildlife Management Division and Nongame Bid and Mammal Program. Sacramento, California.

_____. 1994. Five-Year Status Review: Greater Sandhill Crane (*Grus canadensis tabida*). Sacramento, California.

_____. 2005. The status of rare, threatened, and endangered plants and animals of California 2000-2004. Sacramento.

_____. 2011. Special Animals (898 taxa). January.

_____. 2012. Staff Report on Burrowing Owl Mitigation. 07 March. Available online at: http://www.dfg.ca.gov/wildlife/nongame/docs/BUOWStaffReport.pdf

California Department of Fish and Wildlife (CDFW). 2013a. State and Federally Listed Endangered & Threatened Animals of California. January

_____. 2013b. State and Federally Listed Endangered, Threatened, and Rare Plants of California. January.

California Department of Food and Agriculture (CDFA). 2010a. California Agricultural Resources Directory 2008-2009. Available online at: http://www.cdfa.ca.gov/statistics/. Last accessed 13 September 2010.

_____. 2010b. Noxious Weed Pest Rating. Available online at: http://www.cdfa.ca.gov/plant/ipc/weedinfo/winfo_list-pestrating.htm. Last Accessed 22 February 2013.

_____. 2014. California Agricultural Resource Directory 2010-2011. Available online at: http://www.cdfa.ca.gov/statistics/. Last accessed 02 February 2014.

California Department of Water Resources (CDWR). 2002. California Floodplain Management Task Force “California Floodplain Management Report.” December 12. Available online at: http://www.water.ca.gov/floodmgmt/lrafmo/fmb/fas/specialprojects/taskforce.cfm

_____. 2003. California's Groundwater, Bulletin 118, Update 2003. Available online at: http://www.water.ca.gov/groundwater/bulletin118/update2003.cfm. Last accessed February 2013.

_____. 2009a. California Water Plan Update 2009: Integrated Water Management. Vols. I-IV. Available online at: http://www.waterplan.water.ca.gov/cwpu2009/index.cfm

_____. 2009b. California Water Plan Update 2009: Tulare Lake Integrated Water Management. Department of Water Resources Regional Reports, Bulletin 160-09, Vol. 3. Available online at http://www.waterplan.water.ca.gov/cwpu2009/index.cfm#volume3.

_____. 2010. California Statewide Groundwater Elevation Monitoring (CASGEM). Available online at: http://www.water.ca.gov/groundwater/casgem/online_system.cfm. Last accessed June 2010.

_____. 2013. Awareness Floodplain Maps website: http://www.water.ca.gov/floodmgmt/lrafmo/fmb/fes/awareness_floodplain_maps/. Last accessed 11 April 2013.

California Environmental Protection Agency (Cal/EPA), Regional Water Quality Control Board Central Valley Region (Central Valley Water Board). 2011. Recommended Irrigated Lands Regulatory Program Framework Staff Report. Available at http://www.sjdeltawatershed.org/

_____. 2012. Irrigated Lands Regulatory Program (ILRP). Website: http://www.swrcb.ca.gov/centralvalley/water_issues/irrigated_lands/index.shtml Last Accessed December 10, 2012.

California Environmental Protection Agency (Cal/EPA), State Water Resources Control Board (SWRCB). 2012. MS4 Water Permit Fact Sheet: Proposed Changes to the General NPDES Permit for Small Municipal Separate Storm Sewer Systems. Available online at: www.swrcb.ca.gov/water_issues/programs/stormwater Last Accessed December 10, 2012.

California Herps. 2013. *Ambystoma californiense* - California Tiger Salamander. Species Account online. Available at: www.calherps.com.Last Accessed 26 March 2013.

California Invasive Plant Council (Cal-IPC). 2006. California Invasive Plant Inventory. Cal-IPC Publication 2006-02. California Invasive Plant Council: Berkeley, California.

California Native Plant Society (CNPS). 2013. Inventory of Rare and Endangered Plants (online edition, v9-01a). California Native Plant Society. Sacramento, CA. Accessed on Wednesday, March 20, 2013.

California Natural Diversity Database (CNDDB). Online quickviewer. http://imaps.dfg.ca.gov/viewers/cnddb_quickviewer/app.asp. Accessed on August 19, 2010.

California Natural Diversity Database (CNDDB). 2013. Online at: http://www.dfg.ca.gov/biogeodata/cnddb/ Last Accessed February 2013

California Partners in Flight (CalPIF). 2000. Version 1.0. The draft grassland bird conservation plan: a strategy for protecting and managing grassland habitats and associated birds in California (B. Allen, lead author). Point Reyes Bird Observatory, Stinson Beach, CA. http://www.prbo.org/calpif/plans.html

California Wildlife Conservation Board website: http://www.wcb.ca.gov/ Last Accessed 22 January 2013.

Cannings, S. and G. Hammerson. 1994. NatureServe species account *Taxidea taxus*, American Badger. Available online at: www.natureserve.org. Last Accessed 02 April 2013.

Center for Biological Diversity, lead petitioner. 2003. Petition to the State of California Fish and Game Commission and supporting information for listing the California population of the western burrowing owl (*Athene cunicularia hypugea*) as an endangered or threatened species under the California Endangered Species Act. Oakland, California.

Central Valley Joint Venture. 2006. Central Valley Joint Venture Implementation Plan - Conserving Bird Habitat. U.S. Fish and Wildlife Service, Sacramento, CA.

Central Valley Regional Water Quality Control Board (Central Valley Water Board). 2002a. Monitoring and Reporting Program No. R5-2002-0062 for U.S. Department of Navy Lemoore Naval Air Station Wastewater Treatment Facility Kings County.

_____. 2002b. Waste Discharge Requirements for U.S. Department of Navy Lemoore Naval Air Station Wastewater Treatment Facility Kings County. Order No. R5-2002-0062.

_____. 2004. Water Quality Control Plan for the Tulare Lake Basin, Second Edition. Revised January 2004.

_____. 2012. Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS). California Environmental Protection Agency, Central Valley Regional Water Quality Control Board. Updated July 3, 2012. http://www.swrcb.ca.gov/rwqcb5/water_issues/salinity/.

_____. 2013. Revised Monitoring Reporting Program Under Order R5 2002-0062, Lemoore NAS WWTF, Kings County (WDID 5D160700001, RM 131463). March 25.

Chesemore, D.L., and W. M. Rhodehamel. 1992. Ecology of a vanishing subspecies: The Fresno kangaroo rat (*Dipodomys nitratoides exilis*). Pages 99-103 in D. F. Williams, S. Byrne, and T. A. Rado, Editors, Endangered and sensitive species of the San Joaquin Valley, California: Their biology, management and conservation. California Energy Commission, Sacramento. 388 pp.

Coffman, L. 2000. Low-Impact Development Design Strategies, An Integrated Design Approach. EPA 841-B-00-003. Prince George's County, Maryland. Department of Environmental Resources, Programs and Planning Division.

Cohen, A. N., and J. T. Carlton. 1998. Accelerating invasion rate in a highly invaded estuary. Science 279: 555-558.

Cole, Luke W. 2012. Birding in Kings County. Site Guide Reprinted from the Central Valley Bird Club Bulletin. Available online at: http://www.cvbirds.org/SiteGuides/KC.pdf and http://www.cvbirds.org/CVBirdsSites.htm. Last Accessed 13 November 2012.

Collinge, S.K, M. Holyoak, C.B. Barr, and J.T. Marty. 2001. Riparian habitat fragmentation and population persistence of the threatened valley elderberry longhorn beetle in central California. Biological Conservation vol. 100: 103-113.

Collins, P.W. 1998. Tulare grasshopper mouse, *Onychomys torridus tularensis* In Bolster, B.C. (Ed.) 1998. Terrestrial Mammal Species of Special Concern in California. Draft Final Report prepared by P.V. Brylski, P.W. Collins, E.D. Pierson, W.E. Rainy and T.E. Kucera. Report submitted to California Department of Fish and Game Wildlife Management Division, Nongame Bird and Mammal Conservation Program. Available online at: http://www.dfg.ca.gov/wildlife/nongame/ssc/1998mssc.html.

Comrack, L.A. and R.J. Logsdon. 2008. Status review of the American peregrine falcon (*Falco peregrines anatum*) in California. California Department of Fish and Game, Wildlife Branch, Nongame Wildlife Program Report 2008-06. 36 pp + appendices.

Congressional Research Service. 2005. Report for Congress. California's San Joaquin Valley: A Region in Transition December 12, 2005. Tadlock Cowan, Coordinator, Analyst in Rural and Regional Development Policy Resources, Science, and Industry Division.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). 2012. Appendices I, II, and III. Valid from 25 September 2012. Online at: http://www.cites.org/eng/app/appendices.php

Corbett, F., T. Schetrit, and T. Harter. 2011. Crop Water Use, Groundwater Flow, and Subsidence at Naval Air Station Lemoore, Fresno and Kings County, California. Groundwater Cooperative Extension Program, Department of Land, Air, and Water Resources, University of California, Davis. Prepared as part of California Cooperative Ecosystem Studies Unit, Department of Defense.

Cornell Lab of Ornithology. 2013. Long-billed Curlew. Online at: http://www.allaboutbirds.org/guide. Last accessed 22 March 2013.

Costello, Larry. 2006. Pruning standards for trees in the City and County of San Francisco. San Francisco Department of the Environment. Available online at: http://www.sfenvironment.org/sites/default/files/fliers/files/sfe_uf_tree_pruning_standards.pdf Last Accessed February 2013.

Council on Environmental Quality (CEQ). 1978. 43 FR 56003, Part 1508. 29 November 1978. Regulations Implementing the National Environmental Policy Act (NEPA).

_____. 1997. Executive Office of the President. Considering Cumulative Effects under NEPA. January.

_____. 2010. Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions.

County of Kings Agricultural Commissioner. 2012. Kings County Agricultural Crop Report 2011.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service Report No. FWS/OBS/-79/31. Washington, D.C. December.

Craig, D. and P. L. Williams. 1998. Willow Flycatcher (*Empidonax traillii*). In The Riparian Bird Conservation Plan: a strategy for reversing the decline of riparian-associated birds in California. California Partners in Flight. http://www.prbo.org/calpif/htmldocs/riparian_v-2.html.

Craighead, J.J. and F.C. Craighead, Jr. 1959. Hawks, owls, and wildlife. Dover Publications, Inc., New York. 443pp.

Crane, J. 2010-2011. Personal communication. NAS Lemoore Natural Resources Manager, 1995-2011.

Croft, M.G. 1972. Subsurface geology of the later Tertiary and Quarternary water-bearing deposits of the southern part of the San Joaquin Valley, California. US Geological Survey Water-Supply Paper 1999-H.

Croft, M.G, and G.V. Gordon. 1968. Geology, hydrology, and quality of water in the Hanford-Visalia area San Joaquin Valley, California. U.S. Geological Survey open file report.

Cypher, B.L., S.E. Phillips, and P.A. Kelly. 2007. Habitat Suitability and Potential Corridors for San Joaquin kit fox in the San Luis Unit, Fresno, Kings and Merced Counties, California. Prepared for the US Bureau of Land Reclamation South-Central California Area Office and US Fish and Wildlife Service Endangered Species Program. California State University, Stanislaus, Endangered Species Recovery Program.

Dahlstrom, C. 2010-2013. Personal communication. Natural Resources Specialist, Desert IPT, Naval Facilities Engineering Command Southwest.

DeSante, D. F., E. Ruhlen, and R. Scalf. 2007. The distribution and relative abundance of burrowing owls in California during 1991-1993: evidence for a declining population and thoughts on its conservation. Pages 1-41 in Barclay, J. H., K. W. Hunting, J. L. Lincer, J. Linthecum, and T. A. Roberts (eds.), Proceedings of the California Burrowing Owl Symposium. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, California.

Dugger, B.D. and K.M. Dugger. 2002. Long-billed Curlew (*Numenius americanus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/628. Last Accessed 22 March 2013.

ECORP. 2007. Tulare Lake Basin Hydrology and Hydrography: A Summary of the Movement of Water and Aquatic Species. Prepared for US Environmental Protection Agency. Document No. 909R07002.

El Rio Reyes Conservation Trust. 2010. The Kings River – River of Holy Kings. http://www.elrioreyestrust.org/kings_river_holy.shtml. Accessed 25 April 2010.

Endangered Species Recovery Program (ESRP). 2013. Tulare Grasshopper Mouse (Onychomys torridus tularensis). Online at: http://esrp.csustan.edu/publications/pubhtml.php?doc=sjvrp&file=chapter02M05.html. Accessed 02 April 2013.

Eng, L.L. 1984. Rare, threatened and endangered invertebrates in California riparian systems. In: California riparian systems Ecology, conservation, and productive management, ed. R.E. Warner and K.M. Hendrix. University of California Press, Berkeley, California.

Environmental Laboratory. 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Station. Vicksburg, Mississippi.

Erichsen, A.L. 1995. The White-tailed Kite (*Elanus leucurus*): nesting success and seasonal habitat selection in an agricultural landscape. Master's thesis, University of California, Davis.

Erichsen, A.L., K.S. Smallwood, A.M. Commandatore, B.W. Wilson, and D.M. Fry. 1996. White-tailed Kite movement and nesting patterns in an agricultural landscape. Pp. 166-176 In D.M. Bird, D.E. Varland, and J.J. Negro, eds., Raptors in human landscapes. Academic Press, San Diego, CA.

Estep, J.A. 1989. Biology, Movements, and Habitat Relationships of the Swainson's Hawk in the Central Valley of California, 1986–1987. California Department of Fish and Game, Nongame Bird and Mammal Section, Sacramento, CA.

Faunt, C.C., ed. 2009. Groundwater Availability of the Central Valley Aquifer, California. U.S. Geological Survey Professional Paper 1766, 225p.

Federal Emergency Management Agency (FEMA 2010). 2010. DFIRM Flood Maps. Available for purchase online at: https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1. Downloaded August 2010.

Field, C.B., G.C. Daily, F.W. Davis, S. Gaines, P.A. Matson, J. Melack, and N.L. Miller. 1999. Confronting climate change in California: Ecological impacts on the Golden State. Cambridge, Mass: The Union of Concerned Scientists and the Ecological Society of America. http://www.ucsusa.org/documents/calclimate.pdf.

Forman, R.T.T., D. Sperling, J.A. Bissonette, A.P. Clevenger, C.D. Cutshall, V.H. Dale, L. Fahrig, R. France, C.R. Goldman, K. Heanue, J.A. Jonmes, F.J. Swanson, T. Turrentine, and T.S. Winter. 2003. Road Ecology: Science and Solutions. Island Press, Washington D.C., Covelo and London.

Gallegos and Associates. 1997. Cultural Resource Inventory Report for the E-2 Aircraft Squadrons Realignment, NAS Lemoore, California. Prepared for Tetra Tech, Inc., La Jolla, California. Gallegos and Associates, Carlsbad, California.

Gervais, J.A., C.M. Hunter, and R.G. Anthony. 2006. Interactive effects of prey and p,p'DDE on burrowing owl population dynamics. Ecological Applications, vol. 16: 666-677.

Gervais, J.A., D.K. Rosenberg, and R.G. Anthony. 2003. Space use and pesticide exposure risk of male burrowing owls in an agricultural landscape. Journal of Wildlife Management 67:156-165.

Gervais, J.A., D.K. Rosenberg, and L.A. Comrack. 2008. Burrowing Owl (*Athene cunicularia*). Pp. 218-226 in Shuford, W.D., and T. Gardali, editors. California Bird Species of Special Concern. Studies of Western Birds No. 1. Western Field Ornithologists, Camarillo, California and California Department of Fish and Game, Sacramento, California.

Gitay, H., A. Suarez, R.T. Watson, and D.J. Dokken (eds). 2002. Climate Change and Biodiversity. Intergovernmental Panel on Climate Change Technical Paper V. April.

Goals Project, 1999. Baylands Ecosystem Habitat Goals. A report of recommendations prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. U.S. Environmental protection Agency, San Francisco, CA / SF Bay Regional Water Quality Control Board, Oakland, CA. 209 pp with five appendices. Also available at www.sfei.org

Goldfarb, W. 1984. Water Law. Butterworth Publishers, Boston. 233 p.

Griggs, F.T., J.M. Zaninovich, and G.D. Werschkull. 1992. Historical native vegetation map of the Tulare Basin, California. Pages 111-118 in Endangered and sensitive species of the San Joaquin Valley, California: their biology, management, and conservation (D.F. Williams, S. Byrne, and T.A. Rado, editors). California Energy Commission, Sacramento, 388 pp.

Grinnell, J. 1932. A relic shrew from central California. Univ. California Publ. Zool. 38: 389-390.

_____. 1933. A Review of the recent mammal fauna of California. Univ. California Publ. Zool., 40: 71-234

Halstead, J.A. and J.A. Oldham. 2000. New distribution records for the elderberry longhorn beetle *Desmocerus californicus* Horn (Coleoptera: Cerambycidae). Pan-Pacific Entomologist 76 (1): 74-76.

Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff, E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K.N. Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville. 2004. Emissions pathways, climate change, and impacts on California. Proceedings of the National Academy of Sciences 101(34):12422–12427. http://www.pnas.org_cgi_doi_10.1073_pnas.0404500101.

Hartin, J., P.M. Geisel, and C.L. Unruh. 2001. Lawn Watering Guide for California. University of California Agriculture and Natural Resources Publication 8044. Davis, California. 11p. Online at: http://ucanr.edu/files/47995.pdf.

Heizer, R.F. and A.B. Elsasser. 1980. The Natural World of the California Indians. University of California Press, 271pp.

Hickey, C., W.D. Shuford, G.W. Page, and S. Warnock. 2003. Version 1.1. The Southern Pacific Shorebird Conservation Plan: A strategy for supporting California's Central Valley and coastal

shorebird populations. PRBO Conservation Science, Stinson Beach, CA. See: http://www.prbo.org/cms/docs/wetlands/SPSCPlan_010904.pdf

Hickman, J. 1993. The Jepson Manual: Higher plants of California. University of California Press, Berkeley, California. 1,400pp.

Hunting, K. and L. Edson. 2008. Mountain Plover (*Charardrius montanus*). California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California (W.D. Shuford and T. Gardali, Eds.). Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Hurlbert, S. H. 1984. Pseudoreplication and the design of ecological field experiments. Ecological Monographs 54:187-211.

Innovative Inclosures. 2010. Final Project Report for Exotic Pest Plant Species Control Naval Air Station Lemoore, California. November. Prepared under contract with Naval Facilities Engineering Command Southwest: N68711-04-D-3603 Delivery Order 88.

Jennings, M.R. and M.P. Hayes. 1994. Amphibian and Reptile Species of Special Concern in California. Report to California Department of Fish and Game, Rancho Cordova, California, 255pp.

Johnson, B. S. 1997. Demography and population dynamics of the burrowing owl. Journal of Raptor Research 9:28-33.

Jones, S. J. 1971. Some Regional Aspects of Native California. 2nd ed. In The California Indians: A Source Book, R. F. Heizer and M. A. Whipple, 90-91. Berkeley: University of California Press.

Jurek, R.M. 1994. A bibliography of feral, stray, and free-ranging domestic cats in relation to wildlife conservation. California Department of Fish and Game, Nongame Bird and Mammal Program Rep. 94-5, 24pp. See: http://www.dfg.ca.gov/wildlife/nongame/nuis_exo/dom_cat/dfgcatbiblio.html

Kelly, P. A., E. Cypher, D. F. Williams, and C. E. Uptain. 2000. Habitat management plan: San Joaquin kangaroo rats (*Dipodomys nitratoides*) on Naval Air Station, Lemoore. Report to Commanding Officer, Naval Air Station, Lemoore. January 2000.

Kings County. 2002. Revised Dairy Element: Biological Resources. Online at: http://www.countyofkings.com/planning/Plan/Dairy/Volume%201B%20-%20B/4-04%20Bio.pdf. Last accessed 10 April 2013.

_____. 2010. 2035 Kings County General Plan. Prepared by the Kings County Community Development Agency. http://www.countyofkings.com/planning/2035%20General%20Plan.html. Accessed 25 April 2010.

Kings River Conservation District (KRCD) and Kings River Water Association (KRWA). 2009. The Kings River Handbook. 5th Ed. Prepared by the Public Information Staff of the Kings River Conservation District and the Kings River Water Association. Fresno, CA. http://www.krcd.org/_pdf/Kings_River_Handbook_2009.pdf (25 April 2010).

Klute, D. S., L. W. Ayers, M. T. Green, W. H. Howe, S. L. Jones, J. A. Shaffer, S. R. Sheffield, and T. S. Zimmerman. 2003. Status assessment and conservation plan for the western burrowing owl in the United States. U. S. Department of Interior, Fish and Wildlife Service, Biological Technical Publication FWS/BTP-R6001-2003, Washington, D.C.

Knopf, Fritz L. and M. B. Wunder. 2006. Mountain Plover (*Charadrius montanus*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/211doi:10.2173/bna.211.

Kroeber, A. L. 1925. Handbook of the Indians of California. Smithsonian Institution, Bureau of American Ethnology, Bulletin 78.

Kucera, T.E. 1998. Badger, Taxidea taxus In Bolster, B.C. (Ed.) 1998. Terrestrial Mammal Species of Special Concern in California. Draft Final Report prepared by P.V. Brylski, P.W. Collins, E.D. Pierson, W.E. Rainey and T.E. Kucera. Report submitted to California Department of Fish and Game Wildlife Management Division, Nongame Bird and Mammal Conservation Program. Available online at: http://www.dfg.ca.gov/wildlife/nongame/ssc/1998mssc.html.

Kuenzi, A.J. and M.L. Morrison. 1998. Avian habitat use and flight behavior in relation to bird-aircraft strikes in western U.S. agricultural lands. 1998 Transaction of the Western Section of The Wildlife Society 34: 1-8.

Lang, N. 2012. Wildlife Hazard Assessment for Naval Air Station Lemoore, California (July 2010 - June 2011). US Department of Agriculture, Animal and Plant Inspection Service, Wildlife Services. Three Rivers, CA. Cooperative Service Agreement: 10-73-06-6223-IA.

Lewis, J.C., K.L. Sallee, and R.T. Golightly Jr. 1993. Introduced red fox in California. California Department of Fish and Game Nongame Bird and Mammal Section Report 93-10. Sacramento. http://www.dfg.ca.gov/hcpb/info/bm_research/bm_pdfrpts/93_10.pdf

Milliken, R., and D.C. Young. 2000. Surface Reconnaissance, Geomorphological Analysis, and Reassessment of Archaeological Sensitivity Zones at Naval Air Station, Lemoore. Prepared for Tetra Tech, Inc, San Francisco, California, and Engineering Field Activity, West, Naval Facilities Engineering Command, San Bruno, California. Prepared by Far Western Anthropological Research Group, Inc., Davis, California. January 2000.

Miyamoto, S., I. Martinez, M. Padilla, A. Portillo, and D. Ornelas. 2004. Landscape Plants List for Salt Tolerance Assessment. Texas A&M Univ. Research Center and El Paso Water Utilities.

Moorman, C.E., K.R. Russell, M.A. Menzel, S.M. Lohr, J.E. Ellenberger and D.H. Van Lear. 1999. Bats roosting in deciduous leaf litter. Bat Research News Vol. 40: 74-75.

Morrison, M. L., L. S. Mills, and A. J. Kuenzi. 1996. Study and management of an isolated, rare population: the Fresno kangaroo rat. Wildl. Soc. Bull. 24:602-606.

Morrison, M.L. and K. S. Smallwood. 2003a. Ecology and Management of the Fresno Kangaroo Rat (*Dipodomys nitratoides exilis*) at Naval Air Station Lemoore. Eastern Sierra Institute for Collaborative Education. Prepared for Engineering Field Activity, West, Letter Agreement: N68711-01LT-01022. May 2003.

_____. 2003b. Kangaroo rat survey at RMA4, NAS Lemoore. Report to U.S. Navy. 6 pp. + 7 photos + 1 map.

_____. 2004. Kangaroo rat survey at RMA4, NAS Lemoore. Report to U.S. Navy. 4 pp.

Moulton, C. E., R. S. Brady, and J. R. Belthoff. 2006. Association between wildlife and agriculture: Underlying mechanisms and implications for burrowing owls. Journal of Wildlife Management 70:708-716.

National Fish, Wildlife and Plants Climate Adaptation Partnership. 2012. National Fish, Wildlife and Plants Climate Adaptation Strategy. Association of Fish and Wildlife Agencies, Council on

Environmental Quality, Great Lakes Indian Fish and Wildlife Commission, National Oceanic and Atmospheric Administration, and U.S. Fish and Wildlife Service. Washington, D.C. Online at: http://www.wildlifeadaptationstrategy.gov/pdf/NFWPCAS-Final.pdf. Last accessed 04 February 2014.

National Invasive Species Council (NISC). 2008. National Invasive Species Management Plan 2008-2012.

National Oceanic Atmospheric Administration (NOAA). 2010. Website: http://www.wrh.noaa.gov/hnx/newslet/fall01/fog.htm. Last accessed 13 September 2010.

Natural Resources Conservation Service (NRCS). 1986. Soil Survey of Kings County, California. Available online at: http://www.nrcs.usda.gov/wps/portal/nrcs/surveylist/soils/survey/state/?stateId=CA. Last Accessed: January 2014.

_____. 2006. Soil Survey of Fresno County, California, Western Part. Available online at: http://www.nrcs.usda.gov/wps/portal/nrcs/surveylist/soils/survey/state/?stateId=CA. Last Accessed: January 2014.

_____. 2010. Watershed Protection and Flood Prevention Act Website: http://www.nrcs.usda.gov/programs/watershed. Accessed on March 22, 2010.

_____. 2013. Plant Materials Program website: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/plantsanimals/pollinate/ Last Accessed 22 January 2013.

NatureServe. 2013. http://natureserve.org/. Last Accessed 26 March 2013.

Naval Air Station (NAS) Lemoore. 2006. Storm Water Pollution Prevention Plan (SWPPP) Naval Air Station Lemoore, California. Environmental Site Office (ESO). 17 July 2006.

_____. 2010. Naval Air Station Lemoore FY 2010 Tumbleweed Park Habitat Maintenance Prescription Burn Plan. 10pp.

_____. 2012. Bird/Aircraft Strike Hazard (BASH) Management Plan. NASLEMINST 11015.1B.

Naval Facilities Engineering Command Southwest (NAVFAC Southwest). 2008. Installation Appearance Plan, Naval Air Station Lemoore. Prepared by URS, Project. No. 27697012. 07 August 2008.

_____. 2010. Integrated Pest Management Plan, Naval Air Station Lemoore, California. January 2010. San Diego, CA.

North American Waterfowl Management Plan 2012 - People Conserving Waterfowl and Wetlands. Available online at: http://www.nawmprevision.org/ and http://www.fws.gov/birdhabitat/NAWMP/Planstrategy.shtm

Nottrott, A. and J. Kleissl. 2010. Validation of the NSRDB-SUNY global horizontal irradiance in California, Solar Energy 84(10), pp. 1816-1827.

O'Connor, R.J. and M. Shrubb. 1986. Farming and birds. Cambridge University Press, New York. 304pp.

O'Farrell, T. P., and M. L. Sauls. 1982. Assessment of proposed agricultural outleasing Naval Air Station, Lemoore, California, on the endangered San Joaquin kit fox, Vulpes macrotis mutica, and blunt-nosed leopard lizard, *Crotaphytus* (=*Gambelia*) *silus*. Unpublished Report to the U.S. Department of the Navy, Lemoore, California.

Ogle, D. and L. St. John. 2005 Plant Guide: Fourwing saltbush Atriplex canescens (Pursh) Nutt. USDA - NRCS Plants Database online. Available at http://plants.usda.gov./java/profile?symbol=ATCA2.

Oreskes, N. 2004. The Scientific Consensus on Climate Change. Science, Vo. 306, No. 5702, p.1686. 03 December 2004.

Page, R.W. 1986. Geology of the Fresh Ground-Water Basin of the Central Valley, California, with Texture Maps and Sections. Regional Aquifer-System Analysis. US Geological Survey Professional Paper 1401-C.

Page, G.W., L.E. Stenzel, G.W. Page, J.S. Warriner, J.C. Warriner and P.W. Paton. 2009. Snowy Plover (*Charadrius nivosus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/154

Pierson, E.D. and W.E. Rainey. 1998. Western mastiff bat, Eumops perotis In Bolster, B.C. (Ed.) 1998. Terrestrial Mammal Species of Special Concern in California. Draft Final Report prepared by P.V. Brylski, P.W. Collins, E.D. Pierson, W.E. Rainy and T.E. Kucera. Report submitted to California Department of Fish and Game Wildlife Management Division, Nongame Bird and Mammal Conservation Program. Available online at: http://www.dfg.ca.gov/wildlife/nongame/ssc/1998mssc.html.

Pollinator Partnership. 2013. website: www.pollinator.org/guides.htm Last Accessed 22 January 2013.

Pollinator Partnership and North American Pollinator Protection Campaign. 2013. website: www.pollinator.org Last Accessed 22 January 2013.

Presser, T.S. 1994. The Kesterson effect. Environmental Management, Vol. 18, No. 3, p.437-454.

Preston, W.L. 1981. Vanishing landscapes: land and life in the Tulare Lake Basin. University of California Press, Berkeley, CA. 278pp.

Prugh, L. and J. Brashares. 2010. Carrizo Plain Ecosystem Project 2010 Report. Prepared for agency partners. 23pp.

Quesada, R.M. 2012-2013. Personal communication. Geologist, Desert IPT, Naval Facilities Engineering Command Southwest.

Riparian Habitat Joint Venture (RHJV). 2004. Version 2.0. The riparian bird conservation plan: a strategy for reversing the decline of riparian associated birds in California. California Partners in flight. Http://www.prbo.org/calpif/pdfs/riparian.v-2.pdf.

Riverside County Habitat Conservation Agency. 2007. Stephens' Kangaroo Rat Habitat Management and Monitoring Plan & Fire Management Plan for RCHCA Lands in the Lake Mathews and Steele Peak Reserves. Prepared by Dudek, 605 Third Street, Encinitas, California.

Roberts, T. A. and C. O. Gaber. 2007. Habitat loss and population status estimate for burrowing owls in the San Joaquin Valley. Pages 70-75 in Barclay, J. H., K. W. Hunting, J. L. Lincer, J. Linthecum, and T. A. Roberts (eds.), Proceedings of the California Burrowing Owl Symposium. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, California.

Robichaud, P.R., L.E. Ashmun, and B.D. Sims. 2010. Post-fire treatment effectiveness for hillslope stabilization. Gen. Tech. Rep. RMRS-GTR-240. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 62 p.

Rosenberg, D.K. and J.A. Gervais. May 2009. Burrowing Owl Population Assessment at Naval Air Station Lemoore.

Rosenberg, D.K., J.A. Gervais, D.F. DeSante, and H. Ober. 1998. An Adaptive Management Plan for the Burrowing Owl Population at Naval Air Station, Lemoore. The Oregon Cooperative Fish and Wildlife Research Unit, Corvallis, OR and The Institute for Bird Populations, Point Reyes Station, CA. Prepared for US Navy, Engineering Field Activity West. August 1998.

_____. 2009. An Updated Adaptive Management Plan for the Burrowing Owl Population at Naval Air Station, Lemoore. The Oregon Wildlife Institute, Corvallis, OR and The Institute for Bird Populations, Point Reyes Station, CA. OWI Contribution No. 201 and IBP Contribution No. 375. Prepared for Naval Facilities Engineering Command Southwest, San Diego, California. Cooperative Agreement N62473-07-2-0033. May 2009.

Rosenberg, D.K., and K.L. Haley. 2004. The ecology of burrowing owls in the agroecosystems of the Imperial Valley, California. Studies in Avian Biology 27: 120-135.

Ruckelshaus M.H., C.G. Hays. 1998. Conservation and management of species in the sea. In: Fieldler PG, Kareiva PM, editors. Conservation biology for the coming decade. Chapman & Hall, New York, p112–156.

Saenz, J.M., and A. Goss. 2009. Surface and Subsurface Investigation for Deep Well Installation at Naval Air Station, Lemoore. Hydrologic and Geologic Assessment: A Fact Finding Effort for Installation of Water Resource Infrastructure. NAVFAC Engineering Service Center.

San Joaquin Valley Air Pollution Control District. 2011. Website: http://www.valleyair.org/Home.htm, last accessed 2011.

San Joaquin Valley Drainage Program. 1990. A Management Plan for Agricultural Subsurface Drainage and Related Problems on the Westside San Joaquin Valley. Final Report of the San Joaquin Valley Drainage Program. US Department of the Interior and California Resource Agency. September 1990.

Sawyer, J.O., and T. Keeler-Wolf. 1995. A Manual of California Vegetation. California Native Plant Society. Sacramento, California.

Sawyer, J.O., T. Keeler-Wolf, and Evens. 2009. A Manual of California Vegetation. Second Edition. California Native Plant Society. Sacramento, California.

Saugey, D.A., B.G. Crump, R.L. Vaugh, and G.A. Heidt. 1998. Notes on the natural history of Lasiurus borealis in Arkansas. Journal of the Arkansas Academy of Science Vol. 52: 92-98.

Schweizer, T. 2011-2014. Personal communication. NAS Lemoore Natural Resources Manager, 2012-Present.

Sharp, C.S. 1902. Nesting of Swainson's Hawk. Condor 4:116-118.

Shomo, Brian. 2011. Restoration through modern interpretations of yesterday's actions. Grasslands. California Native Grassland Association. Natural Resources Manager, Riverside County Habitat Conservation Agency.

Shuford, W. D., and T. Gardali (Editors). 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento. Available online at: http://www.dfg.ca.gov/wildlife/nongame/ssc/birds.html.

Skeel, M.A. and E.P. Mallory. 1996. Whimbrel (*Numenius phaeopus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/219. Last Accessed 22 March 2013.

Smallwood, K.S. 1995. Scaling Swainson's hawk population density for assessing habitat-use across an agricultural landscape. J. Raptor Research 29:172-178.

_____. 2010. Unpublished Final Report to Tierra Data Inc: Quarterly Mammal Surveys and Spring Bird Surveys at Naval Air Station, Lemoore 2009-2010. 11 September 2010.

_____. 2008-2011. Personal communication. Consultant biologist.

Smallwood, K.S. and S. Geng. 1993. Alfalfa as wildlife habitat. California Alfalfa Symposium 23:105-8.

Smallwood, K. S. and B. Karas. 2009. Avian and Bat Fatality Rates at Old-Generation and Repowered Wind Turbines in California. Journal of Wildlife Management 73:1062-1071.

_____. 2008. Burrowing owls at Dixon Naval Radio Transmitter Facility. Report to U.S. Navy. Naval Facilities Engineering Command, Southwest, Desert Integrated Products Team, San Diego, California. 28 pp.

_____. 2009. San Joaquin kangaroo rat (*Dipodomys n. nitratoides*) Conservation Research in Resource Management Area 5, Lemoore Naval Air Station: 2009 Progress Report (Inclusive of work during 2000-2009). Naval Facilities Engineering Command, Southwest, Desert Integrated Products Team, San Diego, California.

_____. 2011. San Joaquin Kangaroo Rat (*Dipodomys n. nitratoides*) Conservation Research in Resource Management Area 5, Naval Air Station, Lemoore: 2011 Progress Report (Inclusive of work during 2000-2011). Naval Facilities Engineering Command Southwest, Desert Integrated Products Team, San Diego, California.

_____. 2012. San Joaquin Kangaroo Rat (*Dipodomys n. nitratoides*) Conservation Research in Resource Management Area 5, Naval Air Station, Lemoore: 2012 Final Report (Inclusive of work during 2000-2012). Naval Facilities Engineering Command Southwest, Desert Integrated Products Team, San Diego, California.

Smallwood, K.S., B.J. Nakamoto, and S. Geng. 1996. Association analysis of raptors on an agricultural landscape. Pages 177-190 In D.M. Bird, D.E. Varland, and J.J. Negro, eds., Raptors in human landscapes. Academic Press, San Diego, CA.

Smallwood, K. S., L. Neher, and D. A. Bell. 2009. Map-based repowering and reorganization of a wind resource area to minimize burrowing owl and other bird fatalities. Energies 2009(2):915-943. http://www.mdpi.com/1996-1073/2/4/915.

Smallwood, K. S., C. G. Thelander, M. L. Morrison, and L. M. Rugge. 2007. Burrowing owl mortality in the Altamont Pass Wind Resource Area. Journal of Wildlife Management 71:1513-1524.

Smith, D.A., K. Ralls, B.L. Cypher, and J.E. Maldonado. 2005. Assessment of scat-detection dog surveys to determine kit fox distribution. Wildlife Society Bulletin 33:897-904.

Smith, G. 2010. Fallbrook Enlists Cattle to Improve Fire Safety, Help Endangered Species. Naval Weapons Station Seal Beach Public Affairs. April 10. Published online: http://www.navy.mil/submit/display.asp?story_id=52494. Last accessed 11 April 2013.

Soil Conservation Service (SCS). 1966. U.S. Naval Air Station Lemoore, California Surface Drainage Reconnaissance Report Class "C".

State Water Resources Control Board (SWRCB). 2010. GAMA - Groundwater Ambient Monitoring & Assessment Program. Available online at: http://www.waterboards.ca.gov/water_issues/programs/gama/geotracker_gama.shtml. Last accessed 13 September 2010.

_____. 2013. Geotracker. Website: http://geotracker.waterboards.ca.gov/. Last Accessed Feb 2013.

Talley, T.S., E. Fleishman, M. Holyoak, D.D. Murphy, and A. Ballard. 2007. Rethinking a rare-species conservation strategy in an urban landscape: The case of the valley elderberry longhorn beetle. Biological Conservation Vol. 135: 21-32.

TEC, Inc. 2007. Final Archaeological Survey Report, Naval Air Station Lemoore. Report on file at NAS Lemoore.

Tetra Tech, Inc. 1996. Wetland Identification and Classification Report for NAS Lemoore. Unpublished report to the U.S. Department of the Navy, Lemoore, California. December 1996.

_____. 1999. Ecological inventory of NAS Lemoore survey report, Naval Air Station, Lemoore, California. Unpublished Report to the U.S. Department of the Navy, Lemoore, California.

Tetra Tech, Inc. and J.H. Douglas & Associates. 2011. Naval Air Station Lemoore Joint Land Use Study. Prepared for Naval Air Station Lemoore Joint Land Use Study Policy Committee. 30 August 2011. Available online at http://www.kingscog.org/jlushome.html

Tierra Data, Inc (TDI). 2012. Naval Air Station Lemoore Biological Resources Surveys. Prepared for Naval Facilities Engineering Command Southwest under Contract No: N62473-06-D-2402 Delivery Order 0027. September 2012.

Tulare Basin Wildlife Partners. 2012. Tulare Basin Wildlife Partners. http://www.tularebasinwildlifepartners.org/. Last Accessed December 10, 2012.

Twisselmann, E. C. 1967. A flora of Kern County, California. Wasmann Journal of Biology 25:1–395. As cited in: Michael G. Barbour, Todd Keeler-Wolf, Allan A. Schoenherr. 2007. Terrestrial Vegetation of California. John Wiley. New York, New York.

University of California Santa Barbara (UCSB) Bren School of the Environment. 1998. The California Gap Analysis Project-Final Report. University of California, Santa Barbara, CA. [http://www.biogeog.ucsb.edu/projects/gap/gap_rep.html.

Uptain, C., E. Cypher, and G. Gray. 1998. Selected results of vegetation sampling at Tumbleweed Park, Naval Air Station Lemoore: Preliminary summary. Appendix M in Tetra Tech, Inc. (1999), Ecological inventory of NAS Lemoore survey report, Naval Air Station, Lemoore, California.

Uptain, C. E., P. A. Kelly, E. Cypher, and D. F. Williams. 2000. Results of San Joaquin kangaroo rat population monitoring during 1999 on Naval Air Station, Lemoore. Report to Commanding Officer, Naval Air Station, Lemoore. March 2000.

U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (EPA). December 2, 2008(a). Revised Guidance Memorandum: Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States.

_____. December 2, 2008(b). Response to Comments "Clean Water Act Jurisdiction Following the Supreme Court's Decision in Rapanos v. United States & Carabell v. United States Guidance" issued June 5, 2007.

_____. December 2, 2008(c). Questions and Answers Regarding the Revised Rapanos & Carabell Guidance.

U.S. Bureau of Reclamation. 2007. San Luis Drainage Feature Re-evaluation: Record of Decision. URL: http://www.usbr.gov/mp/sccao/sld/docs/sld_feature_reeval_rod.pdf

U.S. Department of Agriculture (USDA) and U.S. Department of the Interior (USDI). 2009. Guidance for Implementation of Federal Wildland Fire Management Policy. February 13. Available online at the National Interagency Fire Center website: http://www.nifc.gov/policies/policies_documents/GIFWFMP.pdf

U.S. Department of Agriculture (USDA), Forest Service. 2012. Giant Sequoia National Monument Management Plan. Sequoia National Forest. August.

U.S. Department of Defense (DoD). 1994. Office of the Under Secretary of Defense [OUSD] Memorandum. Implementation of Ecosystem Management in the Department of Defense. 08 August 1994.

_____. 1996. Department of Defense Directive (DoDDIR) 4715.DD-R: Draft Integrated Natural Resources Management in the Department of Defense. April 1996.

_____. 2002. Deputy Under Secretary of Defense (DUSD) (Installations and Environment [I&E]) Memorandum. Implementation of Sikes Act Improvement Act: Updated Guidance with Attachment. 10 October 2002.

_____. 2004. Assistant Deputy Undersecretary of Defense for Environment, Safety and Occupational Health Policy Memorandum. Implementation of Sikes Act Improvement Amendments: Supplemental Guidance concerning INRMP Reviews. 01 November 2004.

_____. 2005. Office of the Under Secretary of Defense Memorandum for Deputy Assistant Secretary of the Army (Environment, Safety and Occupational Health), Deputy Assistant Secretary of the Navy (Environment), Deputy Assistant Secretary of the Air Force (Environment, Safety, and Occupational Health), Director Defense Logistics Agency. Implementation of Sikes Act Improvement Amendments: Supplemental Guidance concerning Leased Lands. 17 May 2005.

_____. 2006a. Department of Defense Instruction (DoDI) 6055.06-M: DoD Fire and Emergency Services Certification Program. 23 February 2006.

_____. 2006b. Department of Defense Office of the Under Secretary of Defense Memorandum for Deputy Assistant Secretary of the Army (Environment, Safety, and Occupational Health), Deputy Assistant Secretary of the Navy (Environment), Deputy Assistant Secretary of the Air Force (Environment, Safety, and Occupational Health) and Director Defense Logistics Agency Regarding Integrated Natural Resources Management Plan (INRMP) Template, 14 August 2006.

_____. 2006c. Department of Defense Instruction 2000.16: DoD Antiterrorism Standards. 02 October 2006.

_____. 2007. Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics. Memorandum of Understanding to Promote the Conservation of Migratory Birds between the USFWS and the DoD in Accordance with EO 13186. April 2007.

_____. 2008a. Department of Defense Instruction (DoDI) 4150.07: DoD Pest Management Program. 29 May 2008.

_____. 2008b. Department of Defense Instruction 4715.16: Cultural Resources Management. 18 September 2008.

_____. 2010a. Office of the Under Secretary of Defense (Acquisition, Technology and Logistics), Memorandum for Acting Assistant Secretary of the Army (Installations and Environment), Acting Assistant Secretary of the Navy (Installations and Environment), Acting Assistant Secretary of the Air Force (Installations, Logistics, and Environment). DoD Implementation of Storm Water

Requirements under Section 438 of the Energy Independence and Security Act (EISA). 19 January 2010.

_____. 2010b. Quadrennial Defense Review Report. Washington, D.C. Available online at: http://www.defense.gov/qdr/

_____. 2010c. United Facilities Criteria (UFC), Low Impact Development (UFC 3-210-10). 15 November 2010.

_____. 2011. Department of Defense Instruction (DoDI) 4715.03: Natural Resources Conservation Program Manual. 18 March 2011.

_____. 2013. Pollinator Habitat Restoration for DoD Land Managers website: http://www.dodpollinatorworkshop.com/ Last Accessed 22 January 2013.

U.S. Department of Defense (DoD) and U.S. Department of Agriculture (USDA). 1988. Master Agreement between Department of Defense and Department of Agriculture concerning the use of National Forest System lands for military activity.

U.S. Department of Defense (DoD) Partners in Flight (PIF). 2002. Department of Defense Partners in Flight Strategic Plan: The Conservation and Management of Migratory and Resident Landbirds and Their Habitats on Department of Defense Lands. Available at: http://www.dodpif.org/plans/stratplan.php

_____. 2013. Strategic Plan Website: http://www.dodpif.org/plans/stratplan.php. Last accessed 13 April 2013.

U.S. Department of the Interior (DoI). 1970. Part 17 – Conservation of endangered species and other fish or wildlife: Appendix D United States list of endangered native fish and wildlife. Federal Register 35: 16047 – 16048.

_____. 2011. Basin Report: Sacramento and San Joaquin Rivers. Available online at: http://www.usbr.gov/climate/SECURE/factsheets/sacramento-sanjoaquin.html. Last accessed February 2013.

U.S. Department of the Navy (Navy). 1958. Congressional Testimony. Subject: Naval Air Station Lemoore. Answers to Items Contained in Statement by Gordon W. Garland, Public Relations Council in Behalf of Westhaven Farmers Association, as Appearing in the Transcript of the Hearings Before the Armed Service Committee of the House on the 1958 Military Construction Program.

_____. 1987. Natural Resources Management: Procedural Manual. Naval Facilities Engineering Command. Volume II.

_____. 1992. Master Plan: Naval Air Station, Lemoore. Prepared by Wolf Planning, Inc.

_____. 1994. FEIS: Base Realignment of Naval Air Station Lemoore, California, Volumes I, II & III. Western Division, Naval Facilities Engineering Command.

_____. 1995. Naval Air Station, Lemoore; Natural Resources Management Plan. Prepared by: California State University, Fresno, California.

_____. 1997. Naval Air Station, Lemoore Historic and Archaeological Resources Protection (HARP) Plan for the Years 1997-2002. Prepared for Engineering Field Activity, West, Naval Facilities Engineering Command, San Bruno, California. Prepared by Far Western Anthropological Research Group, Inc., Davis, California, and JRP Historical Consulting Services, Davis, California. February 1997.

_____. 1998. Preliminary Final Environmental Impact Statement for the Realignment of E-2 Squadrons from Naval Air Station, Miramar. Volumes I & II.

_____. 2001a. Chief of Naval Operations (N45), Navy Environmental Management System (EMS) Policy 06 December 2001 (5090 Ser N451G/1U595831).

_____. 2001b. Final Integrated Natural Resources Management Plan and Environmental Assessment Naval Air Station Lemoore 2001 Through 2005. Prepared by Tetra Tech Inc. for U.S. Navy Engineering Field Activity West, Daly City, California.

_____. 10 January 2002. Chief of Naval Operations (N45) Policy Letter Preventing Feral Cat and Dog Populations on Navy Property (5090 Ser N456M/1U595820)

_____. 2005. Final Activity Overview Plan, Naval Air Station Lemoore. Prepared by TEC Inc. for NAS Lemoore.

_____. 22 August 2006. Office of the Assistant Secretary (Installations and Environment) Memorandum for Commander Navy Installations Command (N45), Director Environmental Readiness Division (N45), Director Facilities and Services Division (CMC-LFL). Department of the Navy Natural Resources Program Metrics.

_____. 2006a. Chief of Naval Operations (N45), Integrated Natural Resources Management Plan Guidance for Navy Installations: How to Prepare, Implement and Revise Integrated Natural Resource Management Plans (INRMP). 18 April 2006. (5090N456K/6U838101)

_____. 2006b. Environmental Assessment for the NAS Lemoore Proposed Airspace. Desert Integrated Product Team, Naval Facilities Engineering Command Southwest, San Diego, California.

_____. 2007. Assistant Secretary of the Navy (Installations and Environment), Memorandum for Deputy Chief of Naval Operations (Fleet Readiness and Logistics), Deputy Commandant of the Marine Corps (Installations and Logistics). Department of the Navy (DoN) Low Impact Development (LID) Policy for Storm Water Management. 16 November 2007.

_____. 2009. Commanding Officer Naval Air Station Lemoore, Naval Air Station Lemoore Environmental Policy. 04 May 2009.

_____. 2010a. Commanding Officer Naval Air Station Lemoore: Letter to the U.S. Fish and Wildlife Service, 5090 N45L/0072. June 15.

_____. 2010b. Air Installations Compatible Use Zone Report, Naval Air Station Lemoore, California. November.

_____. 2011. Chief of Naval Operations Instruction 5090.1C CH-1: Environmental Readiness Program Manual. 18 July 2011.

_____. 2012a. Chief of Naval Operations Instruction 6250.4C: Navy Pest Management Programs. 11 April 2012.

_____. 2012b. Final Site Management Plan Naval Air Station Lemoore, Lemoore, California. July. Prepared by Tetra Tech EM Inc. under contract with Naval Facilities Engineering Command Southwest.

_____. 2012c. Integrated Cultural Resources management Plan for Naval Air Station Lemoore, Kings and Fresno Counties, California. Prepared by SWCA Environmental Consultants, Pasadena, California. Contract No. N68711-04-D-3621/0009.

_____. 2012d. Chief of Naval Operations (N45), Director Energy & Environmental Readiness Division. Interim Policy for Reporting Annual Integrated Natural Resources Management Plan Reviews. 19 Dec 2012. (5090, Ser N454J/12U158339).

U.S. Environmental Protection Agency (EPA). 2000. Office of Water (4203): Low Impact Development (LID), A Literature Review. Washington, DC 20460. EPA-84-B-00-005. October 2000.

_____. 2008. Climate Change on Aquatic Invasive Species and Implications (Final Report Feb. 2008).

_____. 2009. Office of Water (4503T): Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act (EISA). Washington, DC 20460. EPA 841-B-09-001. December 2009. Available online at: http://www.epa.gov/owow/NPS/lid/section438/

_____. 2010a. Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). http://www.epa.gov/agriculture/Ifra.html. Accessed 22 March 2010.

_____. 2010b. History of the Clean Air Act. http://www.epa.gov/air/caa/caa_history.html. Accessed 22 March 2010.

_____. 2010c. Summary of the Resource Conservation and Recovery Act. http://www.epa.gov/lawsregs/laws/rcra.html. Accessed 23 March 2010.

_____. 2010d. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). http://www.epa.gov/superfund/policy/ cercla.html. Accessed 23 March 2010.

U.S. Fish and Wildlife Service (USFWS). 02 May 1980. Endangered and Threatened Wildlife and Plants; Reproposal of Critical Habitat for California Elderberry Longhorn Beetle; Proposed Rule. Federal Register Vol. 45, No. 87: 29373.

_____. 30 January 1985. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status and Critical Habitat for the Fresno Kangaroo Rat; Final Rule. Federal Register Vol. 50, No. 20: 4222.

_____. 05 March 1993. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Pacific Coast Population of the Western Snowy Plover; Final Rule. Federal Register Vol. 58, No. 42: 12864.

_____. 1998. Recovery Plan for Upland Species of the San Joaquin Valley, California. Prepared by Williams, D.F., E.A. Cypher, P.A. Kelly, K.J. Miller, N. Norvell, S.E. Phillips, C.D. Johnson, and G.W. Colliver. U.S. Fish and Wildlife Service, Portland, Oregon. URL: http://www.fws.gov/nwi/

_____. 1999. Endangered and threatened wildlife and plants: Final rule to remove the American peregrine falcon from the federal list of endangered and threatened wildlife, and to remove the similarity of appearance provision for free-flying peregrines in the conterminous United States. Federal Register 64: 46543-46558.

_____. 06 March 2002. Endangered and Threatened Wildlife and Plants; Endangered Status for the Buena Vista Lake Shrew (*Sorex Ornatus Relictus*); Final Rule. Federal Register Vol. 67, No. 44: 10101.

_____. 24 January 2005. Endangered and Threatened Wildlife and Plants; Final Rule to Designate Critical Habitat for the Buena Vista Lake Shrew (*Sorex ornatus relictus*); Final Rule. Federal Register Vol. 70, No. 14: 3428.

_____. 23 August 2005. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the California Tiger Salamander, Central Population. Federal Register Vol. 70, No. 162: 49380.

_____. 29 September 2005. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Pacific Coast Population of the Western Snowy Plover; Final Rule. Federal Register Vol. 70, No. 188: 56970.

_____. 21 April 2006. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to Delist the Pacific Coast Population of the Western Snowy Plover. Federal Register Vol. 71, No. 77: 20607.

_____. 2006a. California Least Tern (*Sternula antillarum browni*): 5-Year Review Summary and Evaluation. Carlsbad, California.

_____. 2006b. Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*) 5-Year Review: Summary and Evaluation. Sacramento Fish and Wildlife Office, Sacramento, California. September.

_____. 2008. Birds of Conservation Concern 2008. United States Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85pp. Online at: www.fws.gov/migratorybirds/.

_____. 2009a. California Tiger Salamander (*Ambystoma californiense*) Santa Barbara County Distinct Population Segment 5-Year Review: Summary and Evaluation. Ventura Fish and Wildlife Office, Ventura, California. November.

_____. 2009b. Species Account: California tiger salamander (*Ambystoma californiense*). www.fws.gov/sacramento/es/animal_spp_acct/california_tiger_salamander.pdf. Last accessed August 19, 2010).

_____. 2009c. Species Account: Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*). www.fws.gov/sacramento/es/animal_spp_acct/velb.pdf. Last accessed August 19, 2010).

_____. 2010a. Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service: Oil Pollution Act of 1990 Website: http://www.fws.gov/laws/lawsdigest/OILPOLL.html. Accessed 30 March 2010.

_____. 2010b. Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service: Emergency Wetlands Resources Act of 1986 Website: http://www.fws.gov/laws/lawsdigest/emwet.html. Accessed on March 23, 2010.

_____. 2010c. Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service: North American Wetlands Conservation Act Website: http://www.fws.gov/laws/lawsdigest/nawcact.html. Accessed on March 23, 2010.

_____. 2010d. Endangered and Threatened Wildlife and Plants: Listing the Mountain Plover as Threatened. Federal Register 75:37353-37358.

_____. 2010e. Blunt-nosed leopard lizard (*Gambelia sila*) 5-Year Review: Summary and Evaluation. Sacramento, California. February.

_____. 2010f. Fresno Kangaroo Rat (*Dipodomys nitratoides exilis*), 5-Year Review: Summary and Evaluation. Sacramento Fish and Wildlife Office, Sacramento, California. February.

_____. 2010g. Tipton Kangaroo Rat (*Dipodomys nitratoides nitratoides*), 5-Year Review: Summary and Evaluation. Sacramento Fish and Wildlife Office, Sacramento, California. February.

_____. 2010h. San Joaquin kit fox (*Vulpes macrotis mutica*) 5-Year Review: Summary and Evaluation. Sacramento Fish and Wildlife Office, Sacramento, California.

_____. 19 August 2011. Endangered and Threatened Wildlife and Plants; 90-Day Finding on a Petition to Delist the Valley Elderberry Longhorn Beetle; Proposed Rule. Federal Register Vol. 76, No. 161: 51929.

_____. 2011. Fact Sheet: Candidate Species, Section 4 of the Endangered Species Act. USFWS Endangered Species Program, Arlington, VA. Available online at: http://www.fws.gov/endangered/esa-library/pdf/candidate_species.pdf

_____. 10 July 2012. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Buena Vista Lake Shrew; Proposed Rule. Federal Register Vol. 77, No. 132: 40706.

_____. 19 June 2012. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Pacific Coast Population of the Western Snowy Plover; Final Rule. Federal Register Vol. 77, No. 118: 36728.

_____. 02 October 2012. Endangered and Threatened Wildlife and Plants; Removal of the Valley Elderberry Longhorn Beetle From the Federal List of Endangered and Threatened Wildlife; Proposed Rule. Federal Register Vol. 77, No. 191: 60238.

_____. 23 January 2013. Endangered and Threatened Wildlife and Plants; Removal of the Valley Elderberry Longhorn Beetle From the Federal List of Endangered and Threatened Wildlife; Proposed Rule. Federal Register Vol. 78, No. 15: 4812.

_____. 2013. Survey protocol for determining presence of San Joaquin kangaroo rats. Sacramento Field Office. Available online at: http://www.fws.gov/sacramento/es/Survey-Protocols-Guidelines/Documents/SFWO%20Final%20San%20Joaquin%20K-Rat%20Trapping%20Protocol-2013.pdf

U.S. Fish and Wildlife Service (USFWS)/ National Marine Fisheries Service (NMFS). 1998. Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act. March. Available online at: http://www.fws.gov/endangered/esa-library/pdf/esa_section7_handbook.pdf

U.S. Forest Service (USFS). 1995. United States Forest Service Description of the Ecoregions of the United States. Compiled by Robert Bailey. Available online at: http://www.fs.fed.us/land/ecosysmgmt/. Last accessed 13 September 2010.

U.S. Geological Survey (USGS). 2008. Geologic Hazard Center website: http://geohazards.usgs.gov/. Last accessed 13 September 2010.

_____. 2009. Additional information on the San Joaquin Valley subsidence study. http://ca.water.usgs.gov/news/2009/MoreInfoSept4_2009.html. 4 September. Accessed on December 1, 2011.

U.S. Government Accountability Office. 2007. Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources. Report to Congressional Requesters, GAO-07-863.

Wallace, W. J. 1978. Southern Valley Yokuts. In Handbook of North American Indians, Vol. 8, California, 448-461. Robert F. Heizer, Volume Editor. William C. Sturtevant, General Editor. Smithsonian Institution, Washington, DC.

Warrence, N.J., J. W. Bauder, and K. E. Pearson. 2003. Salinity, Sodicity and Flooding Tolerance of Selected Plant Species of the Northern Cheyenne Reservation. http://waterquality.montana.edu/docs/methane/cheyenne_highlight.pdf

Warrick, G.D., and B.L. Cypher. 1998. Factors affecting the spatial distribution of a kit fox population. Journal of Wildlife Management 62:707-717.

Western Regional Climate Center (WRCC). 2014. Website: http://www.wrcc.dri.edu/. Last Accessed July 2014.

White, C., N. Clum, T. Cade and W. Hunt. 2002. "Peregrine Falcon (*Falco peregrinus*)." In: The Birds of North America, No. 660. (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Williams, D.F. and A.C. Harpster. 2001. Status of the Buena Vista Lake Ornate Shrew (*Sorex ornatus relictus*). Final Report in Partial Fulfillment of The Central Valley Project Improvement Act Section 3406(B)(1). Endangered Species Recovery Program, California State University, Stanislaus, Turlock, CA

Woodbridge, B. 1998. Swainson's Hawk (*Buteo swainsoni*). In The Riparian Bird Conservation Plan: a strategy for reversing the decline of riparian-associated birds in California. California Partners in Flight. Available online at: http://www.prbo.org/calpif/htmldocs/riparian_v-2.html, and http://www.prbo.org/calpif/htmldocs/species/riparian/swainsons_hawk.htm. Last accessed 05 February 2014.

**This Page Intentionally Blank**