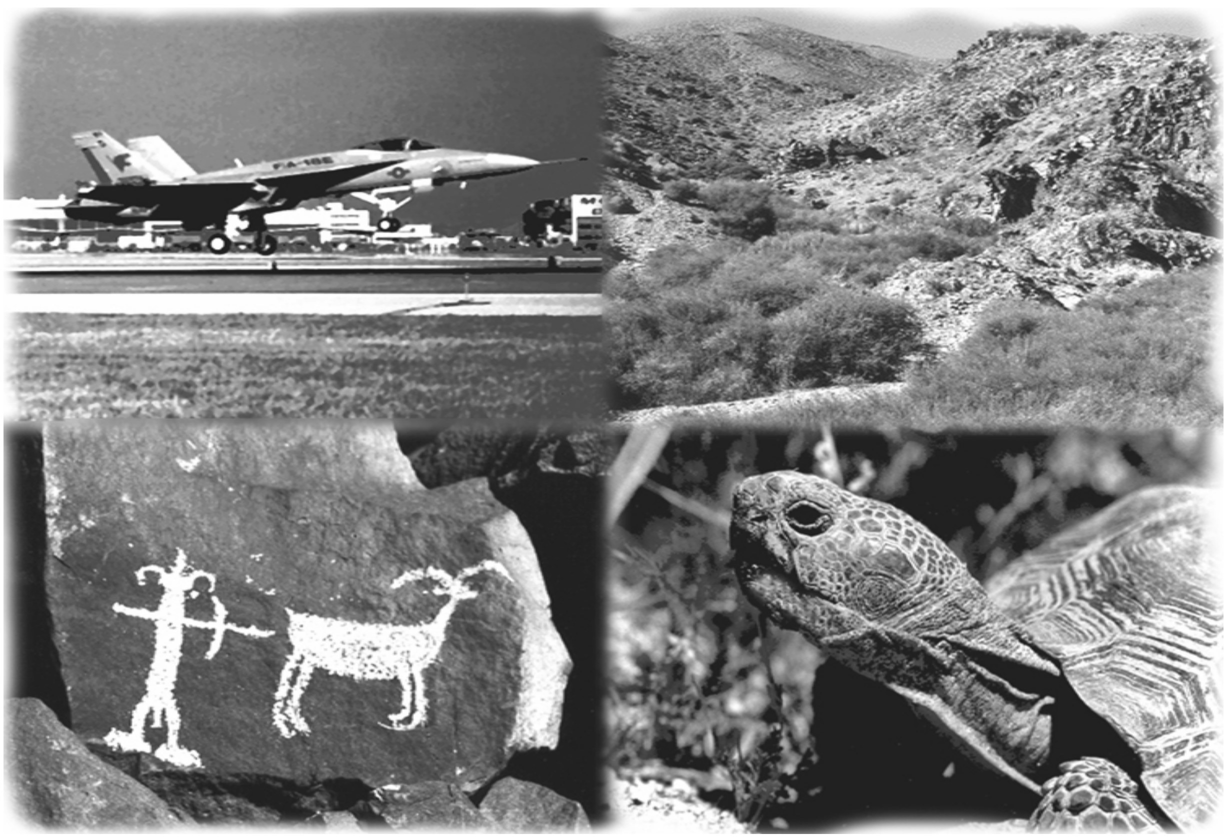
Volume III
Appendices

Final

ENVIRONMENTAL IMPACT STATEMENT
For Proposed Military Operational Increases and Implementation of Associated Comprehensive Land Use and Integrated Natural Resources Management Plans



February 2004

Prepared by:

Naval Air Weapons Station **and** **The Bureau of Land Management** (as a cooperating agency)
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Comprehensive Land Use Management Plan (CLUMP)

NAWS AdPub 012

DRAFT

Comprehensive Land Use Management Plan (CLUMP) for Naval Air Weapons Station China Lake, California

September 2001

Prepared by:
Naval Air Weapons Station China Lake, California and The Bureau of Land Management (as a cooperating agency) Ridgecrest, California

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DRAFT

Comprehensive Land Use Management Plan (CLUMP)
for the
Naval Air Weapons Station
China Lake, CA

Endorsing Officials

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State Director, Bureau of Land Management	Commanding Officer NAWS, China Lake

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ACRONYM LIST

AFB	Air Force Base
AFFTC	Air Force Flight Test Center
AICUZ	Air Installation Compatible Use Zone
AMP	Activity Master Plan
BASH	bird-aircraft strike hazard
BLM	Bureau of Land Management
BRAC	Base Realignment and Closure
CDCA	California Desert Conservation Area
CDPA	California Desert Protection Act
CE	categorical exclusion
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLPL	China Lake Propulsion Laboratories
CLUMP	Comprehensive Land Use Management Plan
CO	Commanding Officer
DoD	U.S. Department of Defense
DOI	U.S. Department of Interior
EA	Environmental Assessment
EC	Environmental Coordinator
EIS	Environmental Impact Statement
EM	electromagnetic
EOD	explosive ordnance disposal
EPMD	Environmental Planning & Management Department
FAA	Federal Aviation Administration
FLPMA	Federal Land Policy Management Act
GIS	Geographical Information System
GPS	Global Positioning System
HE	high explosive
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
IWV	Indian Wells Valley
KGRA	Known Geothermal Resource Area
LUASC	Land Use and Airspace Steering Committee
MOA	Military Operations Area
MOU	Memorandum of Understanding
NAVAIR	Naval Air Systems Command
NAWCWD	Naval Air Warfare Center Weapons Division
NAWS	Naval Air Weapons Station
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NHL	National Historic Landmarks
NRHP	National Register of Historic Places
NTC	National Training Center
OGC	Office of General Counsel
ORV	off-road vehicle
PA	Programmatic Agreement
PAO	Public Affairs Office
PD	project description
PPV	Private/Public Venture
R&D	research and development
RDT&E	research, development, test, and evaluation
REC	record of environmental consideration
RMP	Range Management Plan
ROD	Record of Decision
RSM	Range Safety Manual
SARA	Superfund Amendment and Reauthorization Act
SHPO	State Historic Preservation Office
SNORT	Supersonic Naval Ordnance Research Track
SWPL	Salt Wells Propulsion Laboratory
T&E	test and evaluation
UAV	Uninhabited Aerial Vehicle

EXECUTIVE SUMMARY

The California Desert Protection Act (CDPA) of 1994 (Public Law 103-433) reauthorized the Navy's continued use of public withdrawn lands at the Naval Air Weapons Station (NAWS) at China Lake until 2014 or until the next reauthorization legislation. This Act also requires the development of a land use management plan for these withdrawn lands in accordance with the Federal Land Policy and Management Act (FLPMA) of 1976 (Public Law 94-579). Under the provisions of the CDPA and through a memorandum of agreement, the Department of the Interior assigned management responsibility of these withdrawn lands to the Navy. The Navy has chosen to develop and implement a comprehensive land use management plan (CLUMP) to support the current and long-term military mission and continue environmental stewardship programs at NAWS China Lake.

The CLUMP contains land use guidelines and procedures for the management of military operations and environmental resources at NAWS China Lake. It provides a working tool to accommodate changes and updates to meet the current and future land use management needs. The CLUMP establishes baseline conditions for environmental resources and land use in accordance with other keystone management plans at NAWS. These keystone plans include the draft Integrated Natural Resources Management Plan (INRMP), the draft Integrated Cultural Resources Management Plan (ICRMP), the draft Range Management Plan (RMP), the Air Installation Compatible Use Zones (AICUZ) update, and other technical directives. The CLUMP integrates environmental resource management, operations planning, and an environmental review process to support land use decision-making. The CLUMP is intended to make the management of land use and environmental resources more proactive, simpler, and less time-consuming.

This draft CLUMP represents the Navy's proposed action to guide land management until 2014 or until the next legislative reauthorization, in partnership with the Bureau of Land Management (BLM) and the public. The CLUMP will be finalized after the Navy's environmental impact statement (EIS) record of decision (ROD).

The draft CLUMP contains four chapters. Chapter 1 provides a general overview of the effort including a description of the purpose and need for the plan, and the Navy mission at China Lake. Land management goals and policies, key management initiatives, and expected outcomes are described in Chapter 1. This chapter also includes a description of the CLUMP development process and planning assumptions, and defines its relationship with other NAWS management plans.

Chapter 2 describes the regional setting; provides an overview of China Lake lands and a summary of the military research, development, test, and evaluation (RDT&E), training, and support activities; nonmilitary land uses; and the natural and cultural resource features of NAWS.

Chapter 3 contains a description of the land management strategies employed to control and direct land uses in a manner that will achieve the goals of the plan. Chapter 3 provides a description of the land use zoning process, a key element of the CLUMP management framework. This zoning method defines land use patterns in terms of land use types, general intensity, and location. It also identifies environmental management areas defined by resource type, location, and management priority that are based on a resource's protection status (i.e., endangered species, historic structure) as described in the respective resources management plan. Land use and environmental resource objectives and guidelines are provided in this chapter. These guidelines provide day-to-day direction for land use and environmental resource management and were developed from the referenced keystone management plans. These guidelines also incorporate other requirements identified through interviews with NAWS managers, technical personnel, customers, and the general public during scoping meetings.

Chapter 4 describes the Station's approach for implementing the CLUMP. Elements of the Station's land use management process presented include descriptions of the land use planning and environmental resource management procedures, and the CLUMP land use decision process. Chapter 4 also describes the CLUMP decision support tools (Geographic Information System (GIS), project review criteria) and administrative requirements for plan implementation and maintenance.

This draft CLUMP establishes a formalized corporate land use planning and management process at NAWS to meet evolving military mission requirements in compliance with the CDPA and Navy environmental resource management regulations as outlined in the Navy's Environmental and Natural Resources Program Manual (OPNAVINST 5090.1B). The CLUMP provides a strategic management framework that accommodates the military mission and provides the flexibility to incorporate evolving mission requirements over the life of the plan, while continuing the protection and conservation of environmental resources found on these Navy-administered lands.

For additional information or to provide comments on the draft CLUMP, contact Mr. John O'Gara, Code 8G0000D, Environmental Project Office, Naval Air Weapons Station, China Lake, CA 93555-6100, (760) 939-3213 or Fax: (760) 939-2980.

Note: Acreage calculations located in various tables throughout this document are based on draft GIS mapping data. In some instances these data slightly underestimate the total acreage for a particular feature and, when combined with other features, may not accurately represent the total acreage for the entire Station. These errors are estimated to be less than 0.02% of the total for NAWS administered lands.

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

The California Desert Protection Act (CDPA) of 1994 (Public Law 103-433) (shown in Appendix A) reauthorized the Navy's continued use of public withdrawn lands at the Naval Air Weapons Station (NAWS) at China Lake, California, (the Station) until 2014 or until the next reauthorization legislation. This act requires the development of a land use management plan for these withdrawn lands, in accordance with the requirements of the Federal Land Policy and Management Act (FLPMA) of 1976 (Public Law 94-579). Under provisions of the CDPA and through a memorandum of agreement (MOA), the Department of the Interior (DOI) assigned management responsibility of these withdrawn lands to the Navy. (See Appendix B for the MOA—Regarding Land Management Authority.)

The Navy proposes to implement this draft Comprehensive Land Use Management Plan (CLUMP) at NAWS to accommodate a moderate increase in the military test and training mission and enhance environmental management programs and practices. The CLUMP is designed in accordance with China Lake business re-engineering and development initiatives; Navy environmental management and compliance directives, specifically the Navy's Environmental and Natural Resources Program Manual (OPNAVINST 5090.1B); and considers the influences of evolving technologies on weapons systems research, development, test and evaluation (RDT&E), and training requirements. This draft CLUMP represents the Navy's proposed action to guide land management for the term of this withdrawal period or until the next legislative reauthorization. The CLUMP has been developed in partnership with the Bureau of Land Management (BLM) and the public. The CLUMP will be finalized after publication of the Navy's Record of Decision (ROD) on its final environmental impact statement (EIS).

The Navy has used China Lake lands to support its RDT&E and training missions for more than 50 years. During wartime and in peace, NAWS has served the Navy and the nation by developing effective air-weapon systems and by providing safe and secure space for training, tactics development, and the testing of military and nonmilitary systems for government, industry, and allies. Because the Navy recognized the extent and diversity of environmental values inherent in these lands, NAWS military and civilian leaders have managed the Station's holdings for the protection and conservation of these environmental resources.

1.2 PURPOSE AND NEED

The CLUMP establishes a formal corporate process for land use management at NAWS that meets current and evolving military mission requirements and ensures compliance with the CDPA and Navy regulations contained in OPNAVINST

5090.1B. Land use includes ongoing and future military operations, public health and safety practices, and environmental resources management programs. The CLUMP provides a strategic framework for management of military operations, public health and safety practices, and environmental resource management programs until 2014 or until the next reauthorization legislation. The CLUMP management framework provides a business compliance plan that consolidates existing procedures and streamlines land management processes. The plan provides the tools to achieve the goals and objectives of existing and developing land use and resource management plans described in Section 1.10. The CLUMP formally establishes the strategic planning and management vehicle to support the Navy's military mission for land use and environmental resource management.

1.3 GOALS

NAWS has established the following goals for managing of public lands under their jurisdiction:

1. Maintain and enhance core RDT&E, training, and mission-support capabilities.
2. Improve the efficiency of land use management practices to accommodate the ongoing and evolving military RDT&E, training, and support mission.
3. Ensure compliance with statutes and regulations to protect sensitive natural and cultural resources, to maintain environmental quality and to exercise responsible stewardship of public lands.
4. Ensure public health and safety and maintain a secure military operating environment on NAWS administered lands.
5. Maintain and enhance coordination and cooperation with neighboring communities, agencies, and organizations.
6. Provide reasonable accommodation of compatible nonmilitary land use to the extent practicable.

1.4 MISSION

NAWS is part of the Navy Region South West, San Diego, which is part of Commander Navy Installations (CNI). NAWS operates and maintains base facilities and provides support services, including airfield operations for NAWCWD organizations, assigned tenants, and transient units. NAWS is responsible for managing all lands within the Station boundaries to support the mission of NAWCWD, to maintain environmental compliance, to provide safety and security services, and to exercise responsible stewardship of public lands.

> *The mission of NAWS is to operate and maintain base facilities and provide base support services, including airfields, for the NAWCWD organization at NAWS, assigned tenants and activities, and transient units.*

The Naval Air Warfare Center Weapons Division (NAWCWD), China Lake, California, is a tenant of NAWS, and is part of the Naval Air Systems Command (NAVAIR). Headquartered in Patuxent River, Maryland, NAVAIR oversees 18 major technological and engineering centers, test and evaluation (T&E) centers, depots, and logistic support activities nationwide.

> *The mission of NAVAIR is to develop, acquire, and support Navy aeronautical and related technology systems for use by the U.S. operating forces.*

NAWCWD is responsible for conducting the military mission at NAWS. NAWCWD conducts RDT&E and in-service engineering for Navy, Air Force, Army, and Joint Service weapon systems. NAWCWD is involved in all aspects of developing and testing weapon systems, including propulsion, guidance, fuzing, and warhead. NAWCWD also develops and tests airborne electronic warfare systems and performs aircraft weapons integration.

> *The mission of NAWCWD is to provide our forces with effective and affordable integrated warfare systems and life-cycle support to ensure battlespace dominance.*

1.5 POLICIES

Guidance and direction for the management of NAWS-administered lands are provided in the following general policies.

Military Land Use Policy

Whether held in fee simple or withdrawn from the public domain, all NAWS lands are dedicated to meeting the current and evolving Navy and Department of Defense (DoD) readiness mission. NAWS will control and direct land uses on-Site to accomplish its military mission and conserve environmental resources. NAWS will locate military and nonmilitary land use in previously disturbed areas, when practicable, to minimize overall land use effects and to conserve sensitive environmental resources.

Compliance Policy

NAWS will continue to comply with all applicable statutory and regulatory requirements concerning its natural and cultural resources.

Coordination Policy

As appropriate, NAWS will coordinate with other planning and management agencies involved in ecosystem management initiatives in the region.

Nonmilitary Land Use Policy

NAWS intends to accommodate nonmilitary land uses to the extent that (1) these activities are compatible with the military mission and (2) they do not create adverse safety, security, fiscal, regulatory, or environmental effects. Nonmilitary land use is grouped into four categories: Native American interests, educational and research activities, recreational activities, and commercial activities.

1.6 KEY MANAGEMENT INITIATIVES

The Navy's proposal to implement the CLUMP will enable NAWS to better manage the Station's environmental resources and accommodate planned or expected increases to ongoing and evolving military operations. The draft CLUMP has two principal components, one implementing improved administrative processes and procedures and another accommodating proposed increases to current military T&E and training activities.

1. The proposed administrative changes incorporates an integrated planning and management process to facilitate on-going military operations, conserve and protect environmental resources, enhance specific ongoing health and safety programs, and accommodate a limited number of mission compatible nonmilitary land uses. The land use planning and management processes contained in the draft CLUMP include the following:

- Develop and implement land management goals and policies to improve process efficiency, facilitate mission support, and ensure compliance with applicable laws and regulations.

- Establish baseline patterns of current military land use and environmental resources management areas as described in their respective plans; i.e., Integrated Natural Resources Management Plan (INRMP) and draft Integrated Cultural Resources Management Plan (ICRMP).
- Develop and implement specific management objective and guidelines for land use, environmental resources management, and public health and safety procedures.
- Continue to address public interest regarding community noise and other environmental quality concerns associated with ongoing and evolving RDT&E, training, and support operations.
- Continue reasonable accommodation of compatible nonmilitary land uses.
- Continue and enhance community and interagency coordination.
- Develop and implement a monitoring, review, and amendment process for updates to the CLUMP.

2. The proposed changes to military operations include increases in the type, tempo, and location of ongoing and evolving military test, training, and support operations to meet expected customer requirements over 5 years. The draft CLUMP also accommodates limited nonmilitary use and access to NAWS-administered lands. The proposed military land use and operational increases include the following defined areas.

Range-Related Flight Operations

- Increase the tempo of range-related test and aircrew training flight operations, including increases in nighttime flight operations.
- Increase the tempo of daytime supersonic flight operations.

Airfield Flight Operations

- Increase the tempo of airfield flight operations in response to test and training activities.

Range Land Use

- Increase the tempo of target and test site use throughout the China Lake ranges.
- Reintroduce high explosive (HE) ordnance use at two traditional use areas (existing targets) and increase the tempo of HE use at authorized impact areas.
- Resume the use of previously disturbed but currently underused test and target areas throughout the China Lake ranges.
- Formalize operating areas and increase the tempo of ground troop training activities, establish a new training area for limited light infantry activities at the Coso Military Targets area, and introduce limited tracked vehicle training operations at the Airport Lake target area.

Nonmilitary Land Use

- Accommodate limited mission-compatible nonmilitary uses on a case-by-case basis. Expected activities include Native American traditional and religious uses, research and educational activities, recreational uses, and limited commercial uses.

1.7 Expected Outcomes

Implementation of the CLUMP establishes the planning and management framework that is expected to accommodate the Navy's comprehensive, long-term land use needs in an efficient and cost-effective manner. Specifically, the CLUMP will address the following:

1. Ensure that all ongoing and proposed land use complies with CDPA, FLPMA, and OPNAVINST 5090.1B requirements.

2. Establish a simplified planning and management process that will result in informed decisions regarding land use, environmental resource management, environmental compliance, public health and safety, and public land stewardship practices.
3. Establish clearly defined performance criteria to determine whether ongoing or new actions conform to the CLUMP goals and objectives and to the ROD for the CLUMP and the EIS.
4. Implement the goals and objectives of other keystone management plans and initiatives.
5. Minimize risks to sensitive environmental resources.
6. Minimize constraints on military operations and reduce the cost of doing business for NAWS and NAWCWD customers.
7. Maintain and enhance NAWS's role in regional land use and eco system management initiatives.

1.8 PLANNING ASSUMPTIONS

The NAWS CLUMP is designed in accordance with the following assumptions.

1. NAWCWD's RDT&E and training mission will continue to provide the products and services required by the Fleet, DoD, and other customers in a timely and cost-effective manner. This mission also is fully compatible with responsible stewardship of public lands.
2. Military land use requirements are generally expected to continue in a manner similar to historic trends over the term of the CLUMP. Most land uses are expected to occur within the traditional land use patterns described in the plan.
3. Specific new land use requirements are difficult to forecast; therefore, a flexible process is needed to accommodate evolving mission requirements through a timely, disciplined, and well-informed decision support process.
4. The protection and conservation of NAWS natural and cultural resources will continue to be an important component of regional ecosystem management initiatives.
5. No significant increases in staffing levels are expected at NAWS or NAWCWD in the near term. Operational increases will be accommodated through improved management procedures.
6. Should significant operational increases be proposed at NAWS by means of a future Base Realignment and Closure (BRAC) process or other decision, those activities would be expected to tier off the CLUMP and final EIS then be evaluated under a separate environmental review.

1.9 DEVELOPMENT APPROACH

The CLUMP was developed in accordance with the land use planning guidelines described in FLPMA and the California Desert Conservation Area (CDCA) Management Plan (Bureau of Land Management (BLM) 1980) and the OPNAVINST 5090.1B. The CLUMP also incorporates the requirement of the Sikes Act as amended in 1997. The interdisciplinary technical team that developed the draft CLUMP was comprised of staff representatives from NAWS (range, environmental, public works, legal, public affairs, laboratories) and the BLM Ridgecrest area office. The team gathered input for the CLUMP from a wide variety of sources, including military and civilian managers and technical staff, China Lake customers, the general public, and interested agencies through extensive public involvement. The Navy, in partnership with the BLM, is preparing an EIS to evaluate the potential environmental effects of implementing the proposed draft CLUMP. The overall approach for the development of the CLUMP is summarized in Figure 1-2.

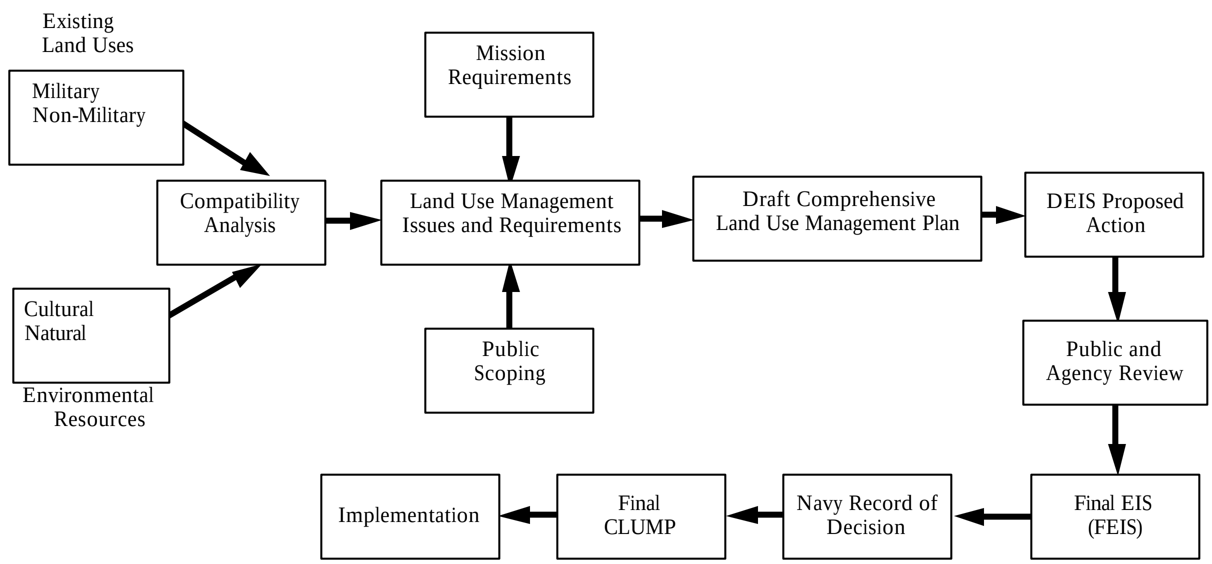

Figure 1-1. CLUMP Development Process.

The CLUMP development process included extensive efforts to collect available information describing the Station's land uses and environmental resources. The information was analyzed to identify significant data gaps. Field surveys were then conducted at many locations to more fully characterize land use and environmental resource conditions throughout the Station. A number of related studies were also conducted to support the development of the plan. These studies are summarized in the following list.

1. The Land Use Patterns Report described current operational land use at NAWS, including the primary types of use as well as the intensity and locations of the operations.
2. The Natural and Cultural Resources Report described the environmental resources patterns, including the type, location, and protection status of natural and cultural resources located on NAWS lands.
3. The Land Use Compatibility Analysis Report performed a comparative analysis of the data contained in the land use and environmental resources reports to analyze the general compatibility between existing operational use and sensitive environmental resources. This report was instrumental in helping the team to identify where additional environmental field surveys were needed and where special management emphasis may be required.
4. The Target and Test Area Disturbance Characterization Report identified existing land disturbances adjacent to targets and test areas throughout the NAWS ranges. Extensive surveys were performed at more than 50% of the targets and test areas Range-wide. The surveys determined that existing land disturbances were generally limited to a narrow band immediately adjacent to the impact areas, and that related impacts from military use covered less than 10% of the designated safety buffer areas.

Additional inputs to the CLUMP development were obtained from NAWS managers, customers, and staff who were consulted to identify operational needs and potential improvements to existing land management processes. Land use and environmental resource management requirements were identified through internal discussions with senior managers, range operations managers, test planners, environmental planning and resource managers, land use planners, facilities planners, airfield operations personnel, legal counsel, and public affairs representatives. The general public; federal, state, and local agencies; Native American tribes; and interested organizations were also given an opportunity to participate with the Navy in the development of the CLUMP through briefings and public scoping meetings conducted throughout the region.

This draft CLUMP integrates the results of public scoping efforts, extensive field surveys, analysis of ongoing management processes, and projected land use and environmental management requirements with the Navy land use management goals and policies described in Sections 1.3 through 1.5. This process constitutes the framework of the proposed CLUMP and will be used to guide and support land use management decisions over the term of the plan (until 2014 or the next legislative reauthorization).

The final CLUMP will be designed in accordance with the Navy's ROD on the final EIS and implemented at NAWS through a Station-wide NAWCWD Instruction.

1.10 RELATIONSHIP TO OTHER NAWS MANAGEMENT PLANS

The CLUMP integrates the principal objectives and management guidelines from several existing and recently developed technical management plans, and establishes a unified corporate land use management process at China Lake. These keystone documents include the following:

1. The NAWCWD China Lake Range Management Plan (RMP) (1996) describes the military T&E mission and land ranges at NAWS and the various types of military operations, land use, and available support assets employed throughout the ranges. The RMP also discusses test and environmental planning processes and the strategic objectives for continuing military T&E operations at NAWS.

2. The draft ICRMP (1999) describes cultural resources at NAWS and the regulatory framework guiding the program, and prioritizes management objectives, projects and processes used to accomplish these objectives.

3. The INRMP (1999) describes on-Station natural resources, the regulatory framework affecting these resources, and the projects and objectives to inventory and manage natural resources at NAWS. The program emphasizes threatened or endangered species, species of special management concern, surface and groundwater resources, and habitat conservation.

4. The Air Installation Compatible Use Zones (AICUZ) Plan (2001) provides an update to the Station's 1977 plan. The updated AICUZ identifies current noise-related footprints associated with military airfield operations at NAWS. The AICUZ identifies operational and noise abatement objectives and recommends land use planning guidelines for NAWS and NAWCWD operations and local and regional planning agencies.

5. The NAWS Activity Master Plan (AMP) (1989), referred to in the EIS as the Naval Weapons Center (NWC) Master Plan, is a descriptive account of the Station's real estate, land use, facilities, utility and circulation systems, and environmental resources. The AMP addresses planning and management of the Station's facilities and infrastructure and serves as its general land use plan. The final CLUMP will replace that portion of the AMP defining the NAWS land use planning and management processes.

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CHAPTER 2
LAND USE AND ENVIRONMENTAL RESOURCES

This chapter provides a general description of the land use and environmental resources occurring on NAWS administered lands. Complete descriptions of these features are contained in the respective keystone plans referenced in Chapter 1. Land use at NAWS includes military activities throughout the range areas for high-hazard air warfare weapons systems RDT&E and training operations. Other military land uses include airfield operations, ordnance storage areas, laboratories, administrative, residential area, and associated facilities and infrastructure. NAWS lands have also been used for a variety of nonmilitary uses including Native American religious and traditional uses; scientific research and educational projects; a limited number of recreational opportunities; and commercial activities, such as geothermal exploration and development and utility easements.

2.1 REGIONAL SETTING

NAWS is in the Upper Mojave Desert of California, approximately 150 miles northeast of Los Angeles (Figure 2-1). The Station, composed of the North Range and the South Range, covers approximately 1,700 square miles (4,402 square kilometers) and is located in three counties. The North Range is in all three of these counties, the southwest portion of which is in Kern County. The northern two-thirds are in Inyo County, and the southeast portion is in San Bernardino County. The South Range lies entirely in San Bernardino County.

NAWS is predominantly surrounded by federally owned lands interspersed with pockets of private and state lands. Small areas of privately owned land are found immediately to the south and along the western boundary of the North Range and south of the South Range. The incorporated city of Ridgecrest and the unincorporated city of Inyokern are located adjacent to NAWS.

2.1.1 Other Federal Lands

Death Valley National Park is directly north and east of NAWS. The park's boundary was realigned to be contiguous with portions of the South Range boundary as part of the CDPA. Sequoia and Kings Canyon National Parks are located approximately 50 miles (80 kilometers) northwest of the Station. The Sequoia National Forest areas are directly west of the Station's boundary. The Inyo National Forest is composed of two parcels located to the west and north of NAWS. BLM manages approximately 12 million acres of public land throughout the CDCA, including 10 wilderness areas adjacent to the NAWS boundary.

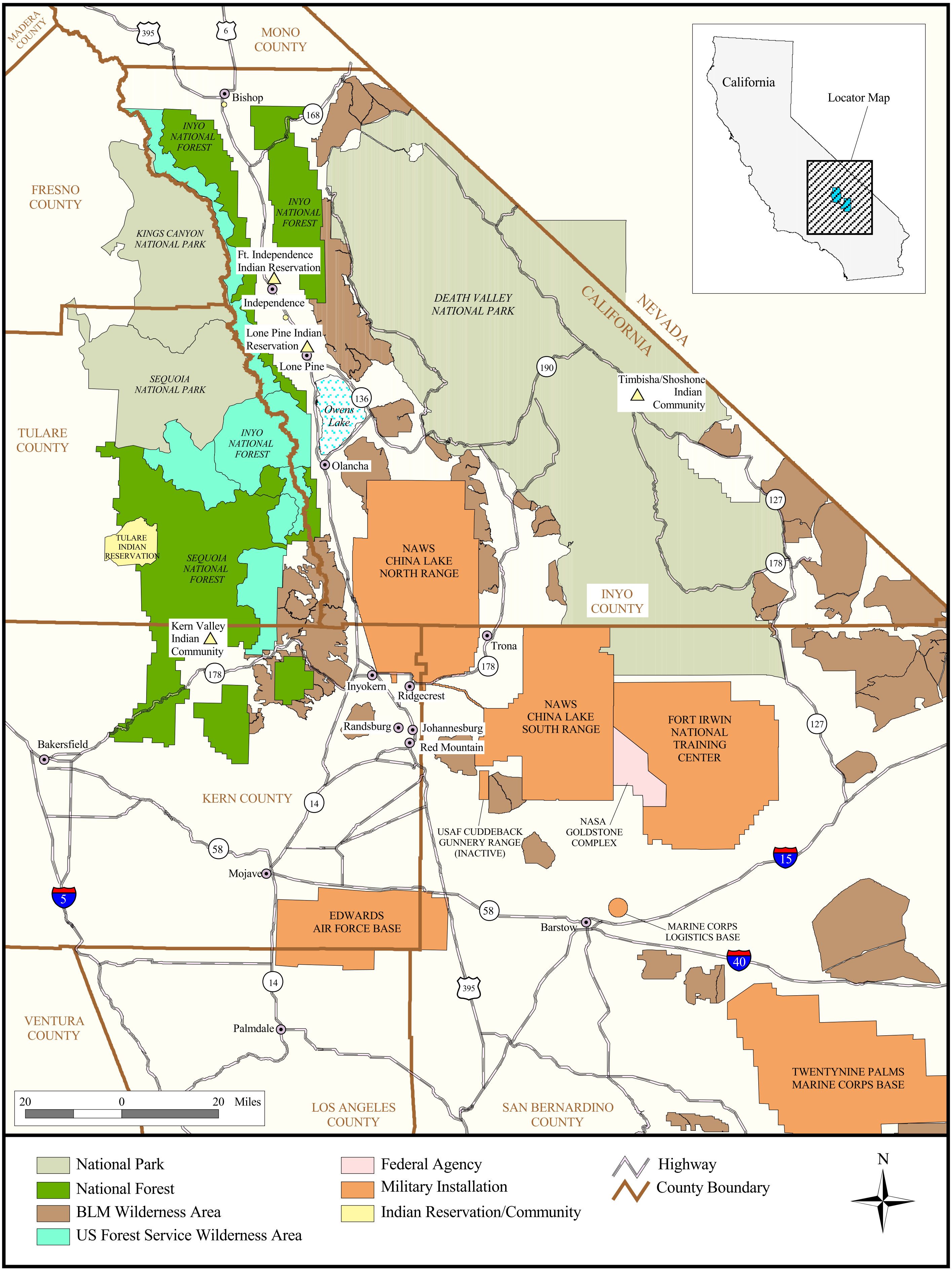


Figure 2-1 Regional Vicinity Map of NAWS China Lake

2.1.2 Other Military Installations

The Army's National Training Center (NTC) at Fort Irwin is located adjacent to the eastern boundary of the NAWS South Range. Other military installations in the region include the Air Force Flight Test Center (AFFTC) at Edwards Air Force Base (AFB), the Marine Corps Air Ground Combat Center at Twenty-Nine Palms, and the Marine Corps Logistics Base in Barstow.

2.2 CHINA LAKE LANDS

2.2.1 Physical Features

NAWS ranges extend over 1.1 million acres and are in an ecological transition zone between the Basin and Range and the Mojave Desert provinces. Station lands are composed of complex terrain and contain a variety of landforms (Figures 2-2 and 2-3), including forested mountain peaks, deeply cut canyons within volcanic tablelands, and an extensive system of upland slopes and low-lying playa dry lakes. As such, these lands contain a diversity of environmental resources, including extensive natural and cultural (prehistoric and historic) resources. Natural resources include three federally listed threatened and endangered species, a variety of water resource features, and extensive tracts of generally undisturbed wildlife habitat. Cultural resources include National Register Sites and Districts, prehistoric and historic properties potentially eligible for National Register listing, and numerous other prehistoric and historic sites and features.

2.2.2 Land Ownership

NAWS land assets within the China Lake boundaries (Figures 2-4 and 2-5) are a combination of lands owned by the Department of the Navy; DOI lands withdrawn from public domain; and other lands acquired through lease, easement, or permit for Navy use as described in Table 2.-1.

Table 2-1. Lands Acquired by Lease, Easement, or Permit for Navy Use.

	Acres
Fee simple (owned by U.S. Navy)	86,479
Withdrawn from public domain (expiration 30 Sep 2014)	1,023,777
License / permit / agreement	54
Easement (purchase and / or condemnation)	16
In-leased (from various sources)	117
Total Land Assets	1,110,443

Acreage calculations in this table are based on legal descriptions contained in the CDPA (1994) and Recorded Title Reports (Navy).

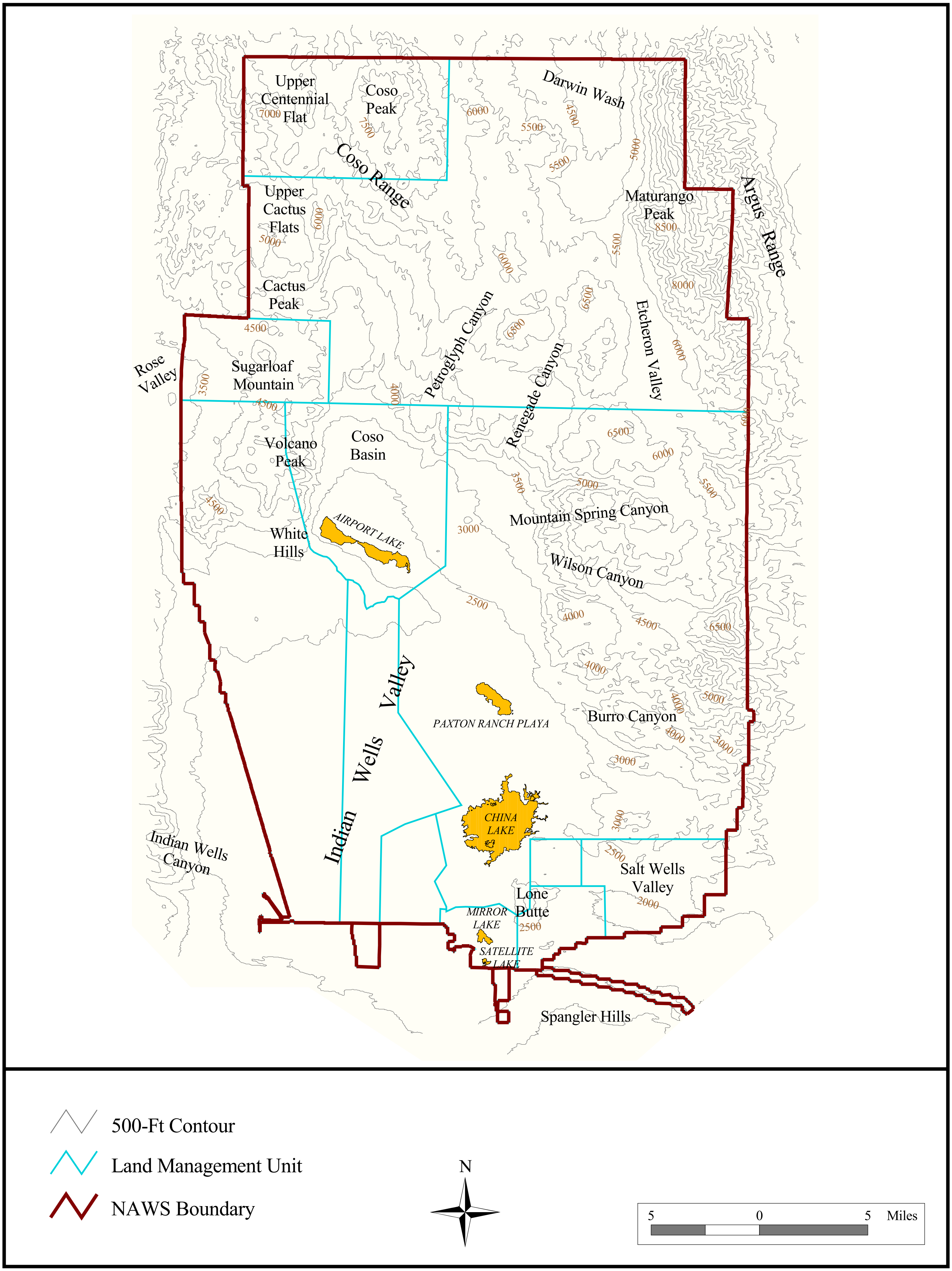


Figure 2-2 Topography and Landforms, North Range

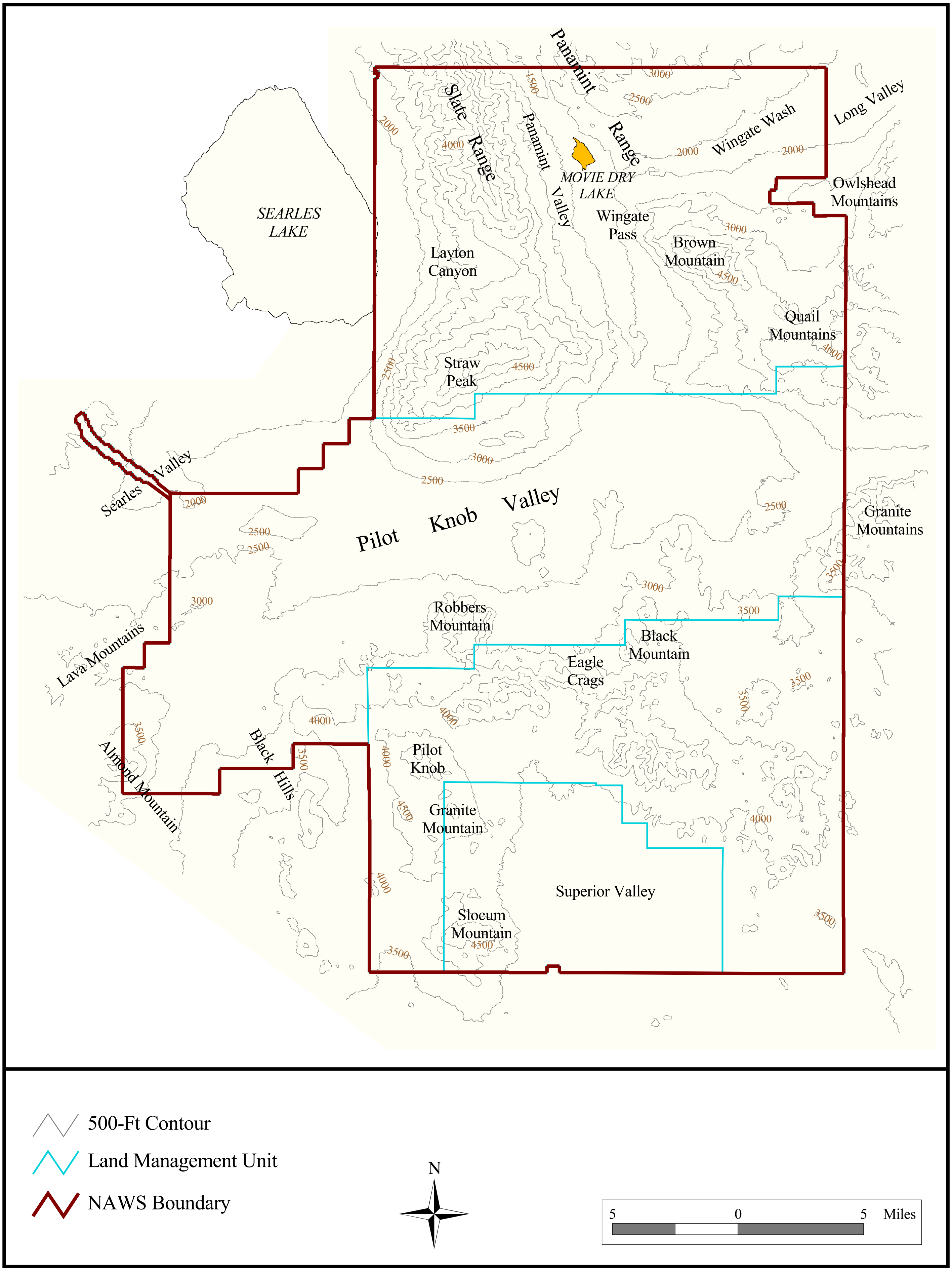


Figure 2-3 Topography and Landforms, South Range

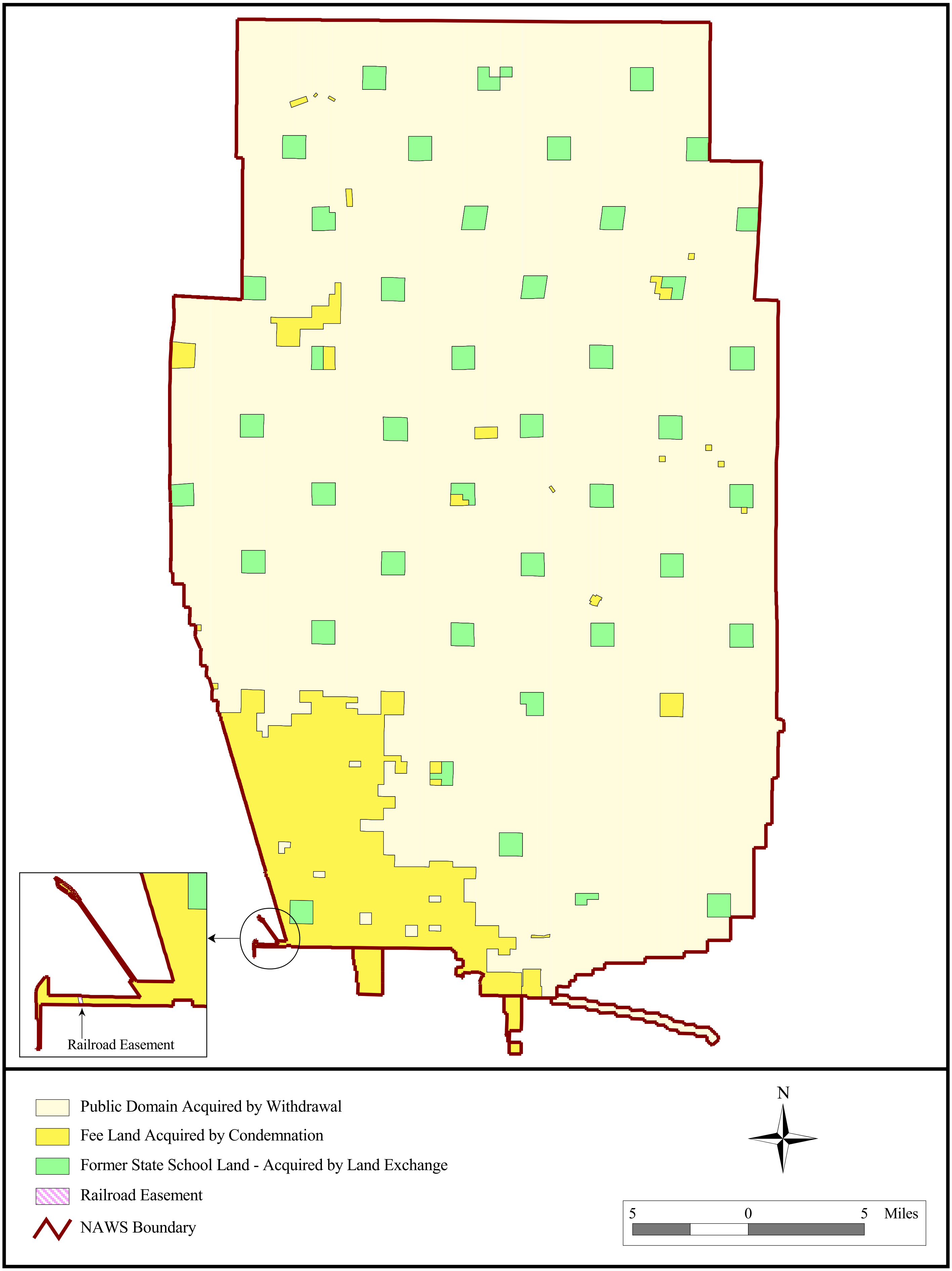


Figure 2-4 On-Station Land Ownership, North Range

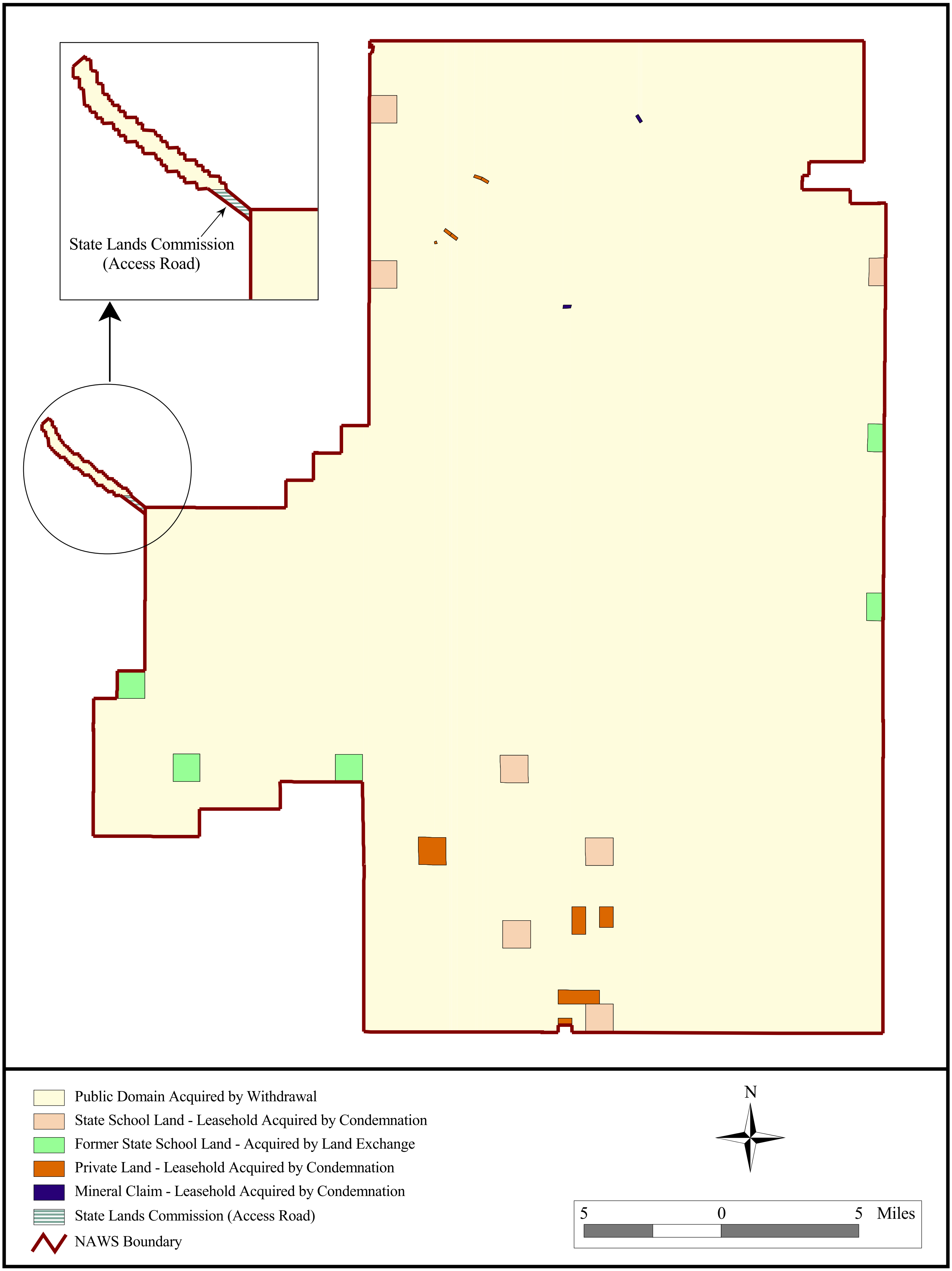


Figure 2-5 On-Station Land Ownership, South Range

2.2.3 Land Management Units

Because of the acreage involved, NAWS land areas are subdivided into smaller management units to facilitate the planning and management of activities occurring on these lands. Land management units represent areas that are generally defined by their operational uses. These land use areas are generally separated into two principal categories, those within the developed portions of the Station (Mainsite, Armitage Airfield, Main Magazines, and Propulsion Laboratories) and those that make up the test and training areas of the North and South Ranges (see Figures 2-6 and 2-7). These two main areas are further divided into 18 separate areas or land use management units, as described in Table 2-2, reflecting the location of distinct operational area boundaries for day-to-day management of military operations.

2.2.4 Developed Areas

Mainsite. The Mainsite land use management unit is on the southern portion of the North Range and covers approximately 8 square miles (21 square kilometers). This unit comprises the Station headquarters, principal laboratories, and most of the administrative and support functions of NAWS. Mainsite is the largest developed area at the Station.

Armitage Airfield. The Armitage Airfield land use management unit, covering 13 square miles (34 square kilometers), is on the North Range, northwest of Mainsite. Armitage Field consists of (1) three runways, (2) aircraft hangars, and (3) facilities for aircraft fuel-storage, aircraft maintenance, ordnance handling and storage, ground-support equipment-maintenance, and RDT&E. Activities on this management unit relate primarily to aircraft maintenance and modification, laboratory support, aviation supply, ready magazine (explosive storage), and fuel storage. The Range Control Center also resides in this management unit.

Main Magazines. The Main Magazines land use management unit, covering 5 square miles (13 square kilometers) on the North Range, comprises ordnance storage, administrative facilities, and safety areas. The Main Magazines are used to receive, store, and distribute explosives in support of RDT&E.

Propulsion Laboratories. The Propulsion Laboratories land use management unit covers 12 square miles (31 square kilometers) in the southeast corner of the North Range. The area consists of two discrete areas, the China Lake Propulsion Laboratory (CLPL) and the Salt Wells Propulsion Laboratory (SWPL), each of which contains complexes of more than 100 buildings and test facilities dedicated to the RDT&E of propellants and explosives.

Laurel Mountain Communication Site. The Laurel Mountain Communication Site covers 6.41 acres (2.59 hectares) and is located south of the City of Ridgecrest, with an access road off of U.S. Highway 395. The Navy is given right-of-way access on this road which is 50 feet (15.24 meters) wide and 4,390 feet (1,338 meters) long. The site is held under a communications permit and provides communication support to the China Lake Range Complex, the Randsburg Wash/Mojave B Complex, and the Federal Aviation Administration's (FAA) Edwards Air Traffic Control Facility. (See Appendix H for a map of the Laurel Mountain Communications Site location).

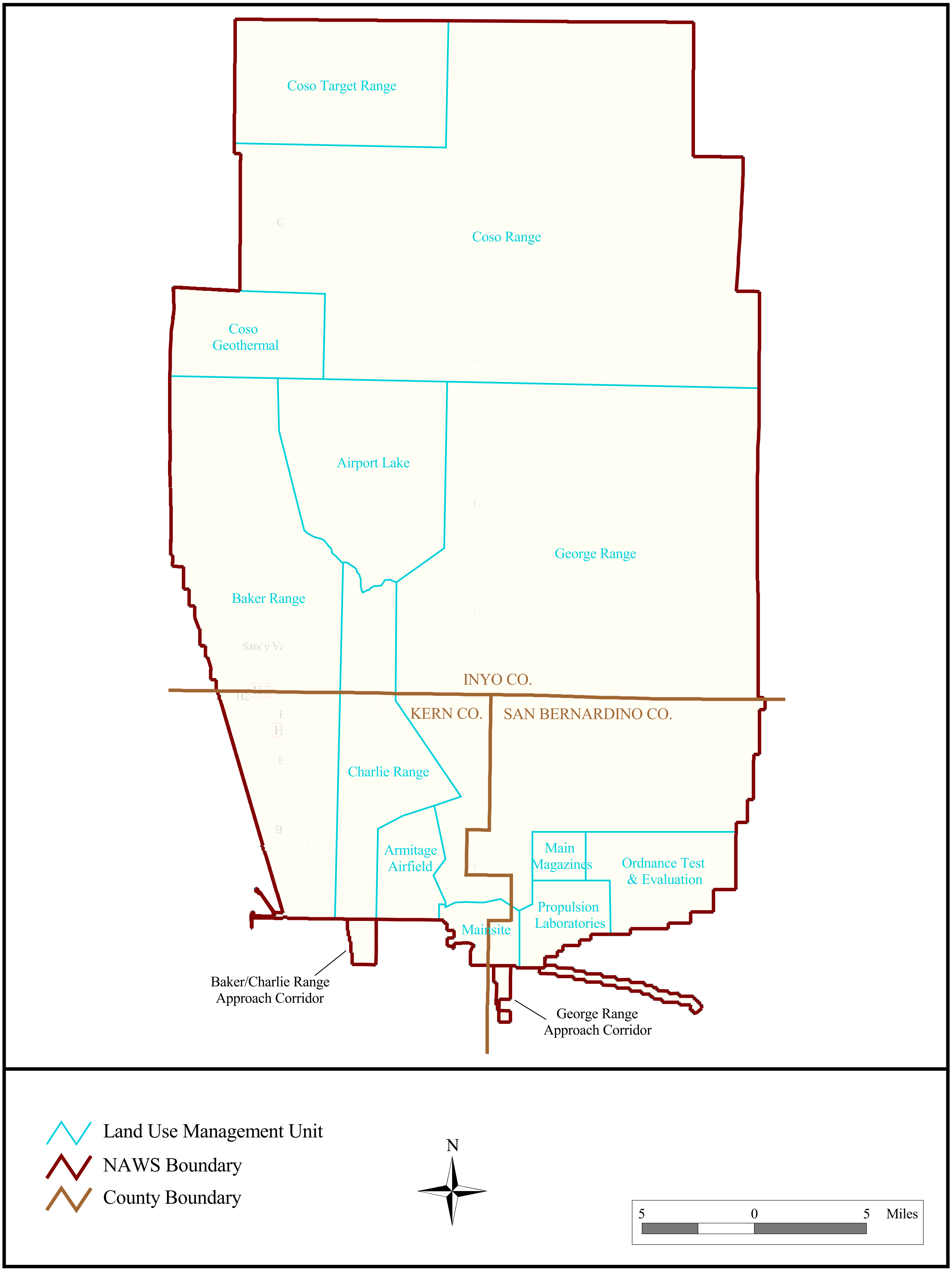


Figure 2-6 Land Use Management Units, North Range

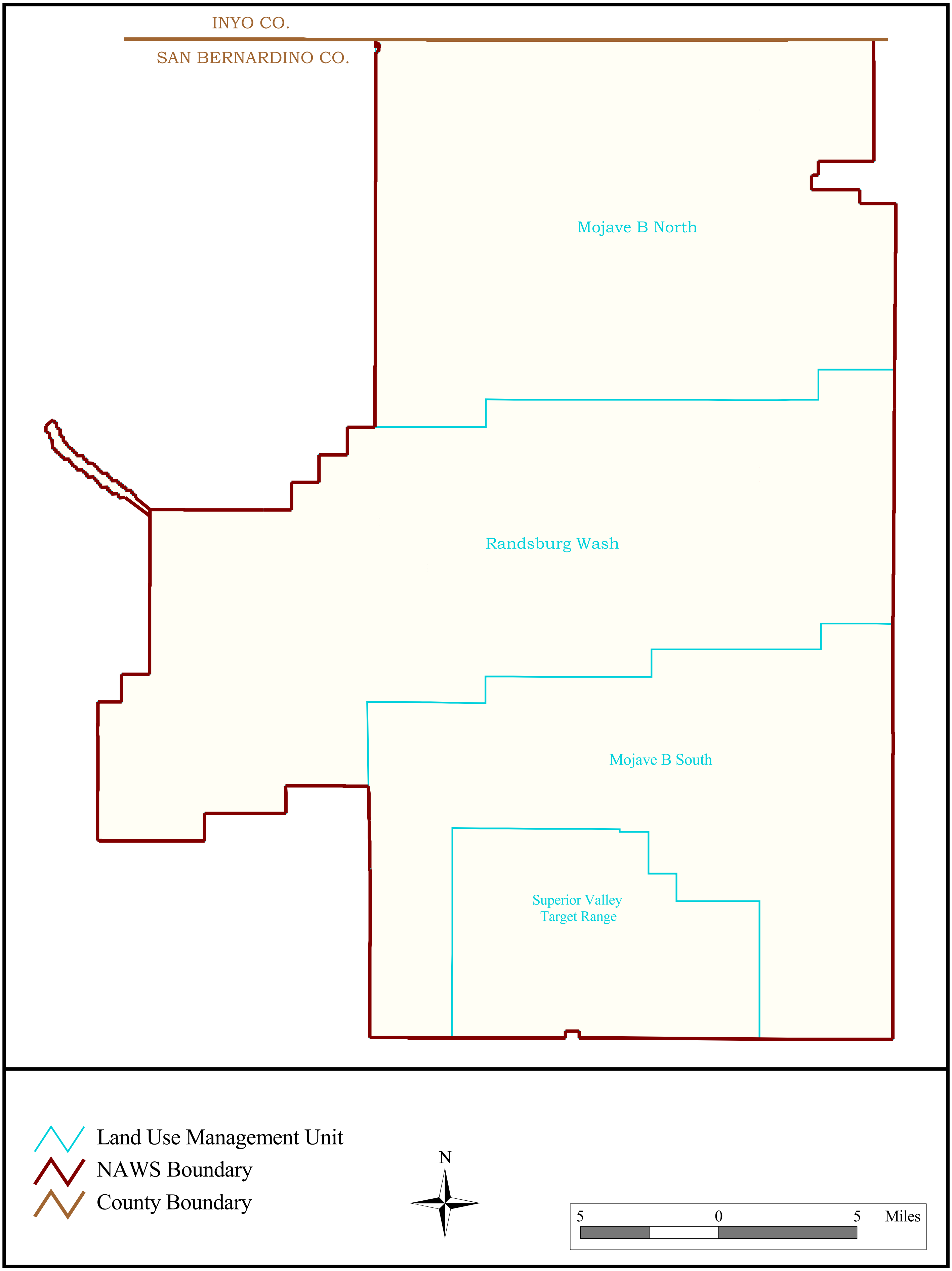


Figure 2-7 Land Use Management Units, South Range

Table 2-2. Land Use Management Units.

Management Unit	Principal Function
Mainsite	Headquarters, most administrative and support functions, principal laboratories (Michelson, Thompson, and Lauritsen), and Missile Engagement Simulation Arena
Armitage Airfield	Armitage Airfield (operational airfield), aircraft maintenance facilities, hangars, ordnance handling, and storage facilities
Main Magazines	Magazine storage for ordnance
Propulsion Laboratories	Research and development (R&D) laboratories (CLPL and SWPL)
Ordnance T&E	Weapons test sites, ordnance test areas
Baker Range	Weapon target sites, ordnance impact areas
Airport Lake	Weapons target sites, ordnance impact areas and ground troop training areas
Charlie Range	Weapon target sites, ordnance impact areas and high-speed track testing (Supersonic Naval Ordnance Research Track)
Baker / Charlie Range Approach Corridor	Aircraft approach corridor to Baker / Charlie (B / C) Ranges
George Range	Weapons test and target sites, ordnance impact areas, Aircraft Survivability and the Open Burn / Open Detonation facility
George Range Approach Corridor	Aircraft approach corridor to George (G) Range.
Coso Range	Weapons target sites, ordnance impact areas, aircrew training, and Junction Ranch test area that includes high-power microwave testing, Global Positioning System (GPS), and radar-cross-section
Coso Target Range	Weapons testing, inert ordnance impact areas, target sites, aircrew training, and light-infantry ground troop training
Coso Geothermal	Geothermal development and generation of electricity (power plants)
Randsburg Wash	Test range and laboratory for electronic combat systems, weapons testing, target sites, Charlie Airfield target, ordnance impact areas, aircrew training, and ground troop training
Mojave B North	Weapons target sites, Wingate Airfield target, ordnance impact areas, aircrew training, and ground troop training
Mojave B South	Operating areas supporting South Range testing, and aircrew and ground troop training
Superior Valley	Aircrew training, weapons target sites, ordnance impact areas, and ground troop training
Laurel Mountain	Communications site supporting China Lake Range Complex, the Randsburg Wash / Mojave B Complex, and the FAA's Edwards Air Traffic Control Facility.

2.2.5 Test and Training Ranges

North Range Test and Training Areas. Although land management units show specific designated use areas, those units can be used singularly or in combination to meet the specific needs of a test or training mission (Figure 2-8).

Ordnance T&E Area. The Ordnance T&E land use management unit covers 24 square miles (62 square kilometers) in the southeast part of the North Range. The unit contains several test sites for static testing of solid propulsion rocket motors and arena testing of HE warhead and other explosive devices. The unit also contains facilities for evaluating the reaction of weapons to various military hazards, such as aircraft fuel fires, bullet impacts, and drops (accidental displacement during transport). Facilities are available for testing the reaction of weapons to such various environmental factors as temperature, humidity, vibration, and salt spray.

Baker Range. The Baker Range land use management unit covers 121 square miles (313 square kilometers) in the western part of the North Range. Used for T&E of air-to-surface weapons and aircrew training in the use of air-to-surface weapon systems (e.g., rockets, guns, bombs), Baker Range also supports weapon system software validation, weapons ballistics, fuse functioning, and pilot proficiency in air-to-surface weapons delivery. Most of the bombs, rockets, and gunnery used on the Baker Range are inert. HE, when used, is dropped on two target areas: B-1A and B-2.

Charlie Range. The Charlie Range land use management unit covers 42 square miles (109 square kilometers) in the southern part of the North Range. Charlie Range is used for T&E of air-to-surface weapons and aircrew training in the use of air-to-surface weapon systems, weapon systems software validation, weapons ballistics, fuse functioning, and pilot proficiency in air-to-surface weapons delivery and HE use. Charlie Range is also used to accommodate unconventional tests (e.g., tethered balloon tests with sensors). T&E facilities include the Supersonic Naval Ordnance Research Track (SNORT), a heavy-duty 4.1-mile (6.6-kilometer) track, and the Vehicle Barrier Track.

Baker/Charlie Range Approach Corridor. The Baker/Charlie Range Approach Corridor land use management unit is an off-site parcel of approximately 1,500 acres directly south of the Charlie Range unit (Figure 2-9). This corridor is augmented by a right-of-way agreement for approximately 7,500 acres of BLM lands and is used to provide a safe approach and departure corridor for aircraft using the NAWS ranges and airfield.

Airport Lake Range. The Airport Lake Range land use management unit covers 57 square miles (148 square kilometers) in the central portion of the North Range used for T&E of air-to-surface weapons and aircrew training. This management area is the principle area for HE use. The range includes a large playa, surrounded on three sides by hills and mountains, on which mobile land targets, such as remotely operated wheeled and tracked vehicles and equipment can be used. Testing activities at the Airport Lake Range include T&E of air-to-surface weapons systems (e.g., bombs, rockets, guns, guided weapon systems) using HEs. Ground troop training exercises also take place in this unit.

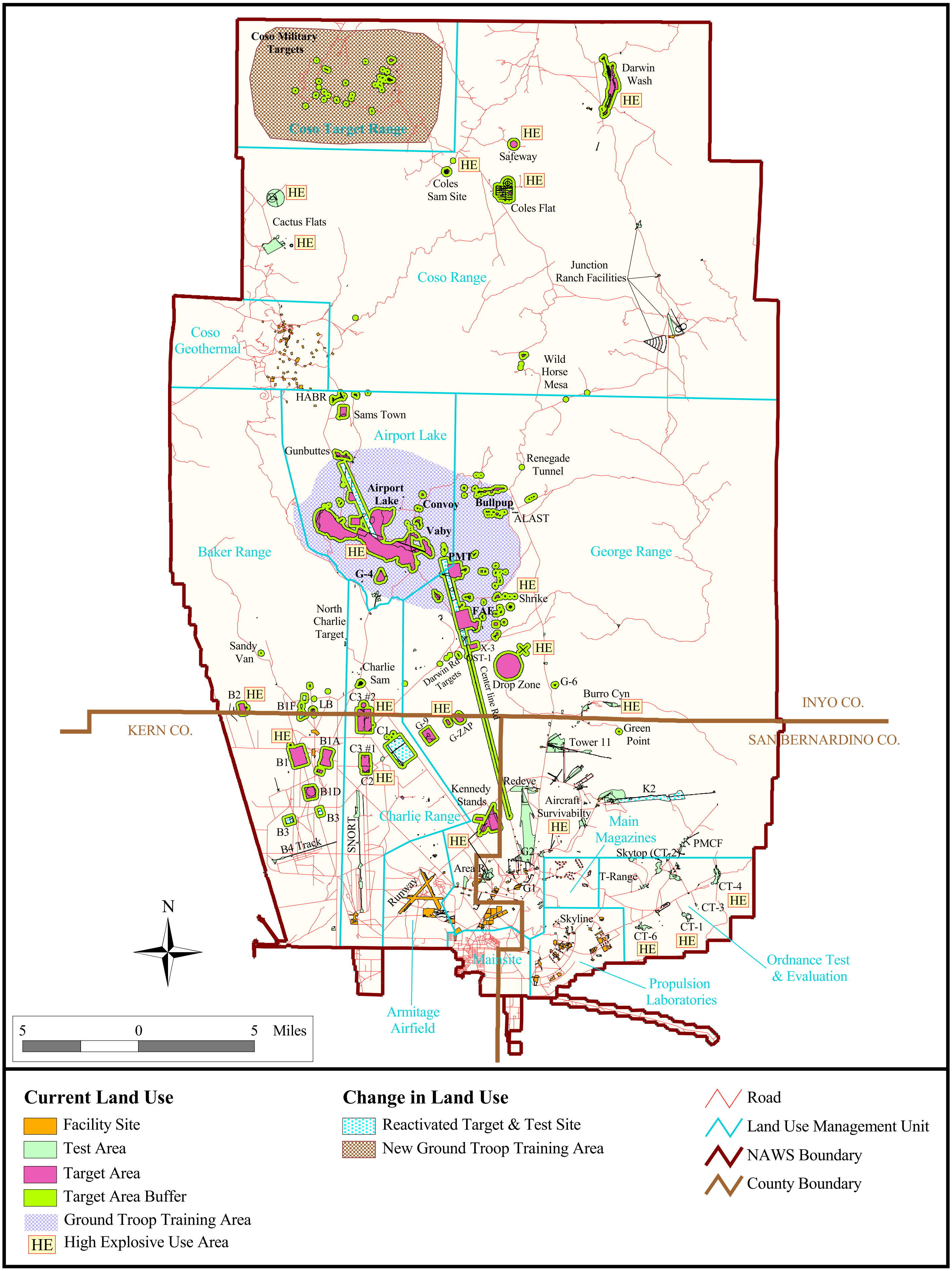


Figure 2-8 Military Land Uses and Proposed Changes, North Range

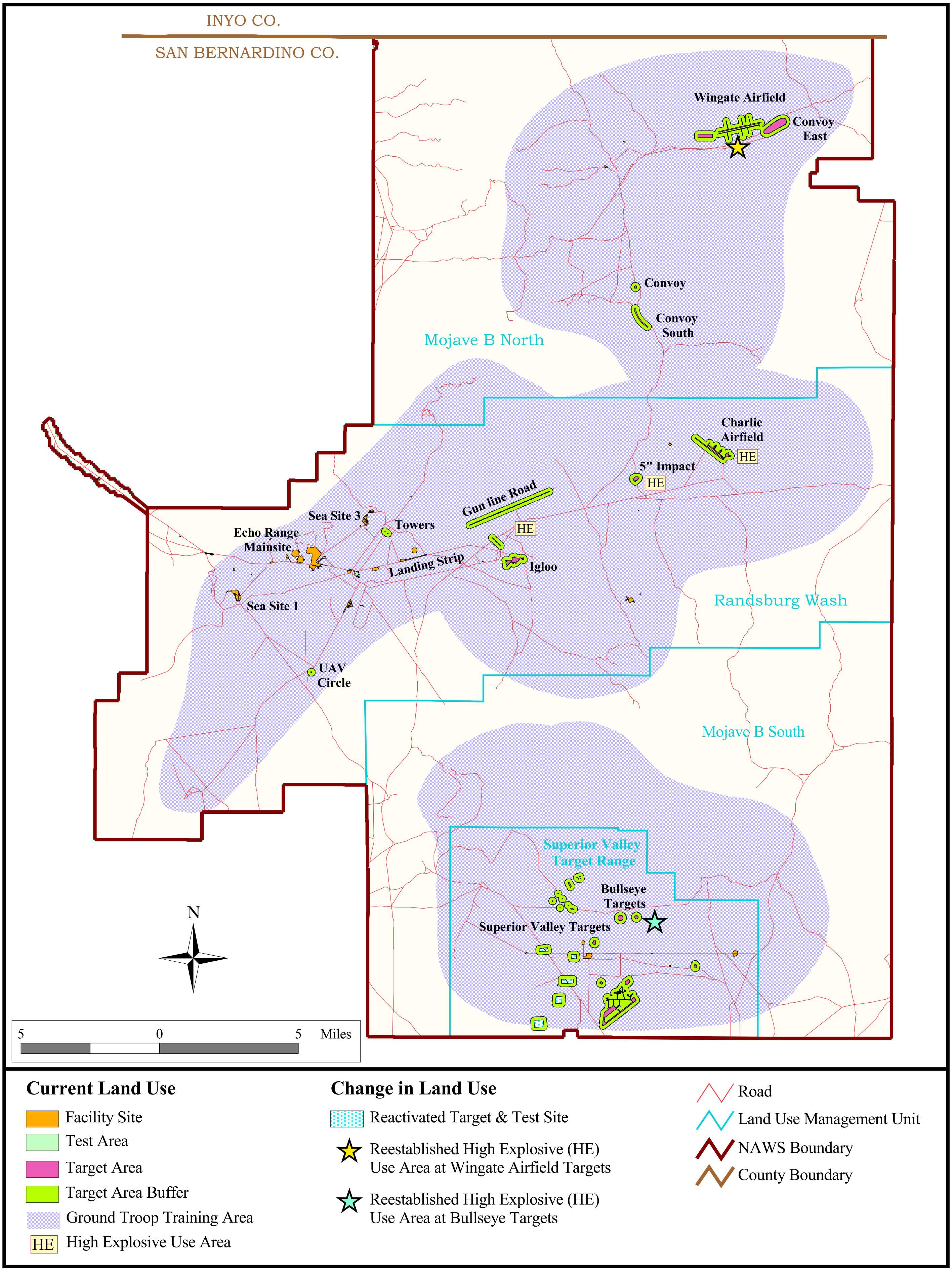


Figure 2-9 Military Land Uses and Proposed Changes, South Range

George Range. The George Range land use management unit, covering 305 square miles (790 square kilometers) in the central and eastern part of the North Range, is heavily instrumented with sophisticated data-acquisition equipment. The Argus Mountains on the east and the Coso Mountains on the north act as natural barriers for safety and security and as ideal vantage points for locating test instrumentation. George Range supports numerous test events on the North Range, including T&E of air-to-surface, surface-to-air, surface-to-surface, and air-to-air guided missiles and HE use.

George Range Approach Corridor. The George Range Approach Corridor land use management unit, an off-site parcel of approximately 850 acres, lies directly south of Mainsite (Figure 2-9). Augmented by a right-of-way agreement for approximately 2,500 acres of BLM lands, this corridor is used to provide a safe approach and departure for aircraft using the NAWS ranges and airfield.

Coso Range. The Coso Range land use management unit covers 266 square miles (689 square kilometers) in the northern half of the North Range and provides T&E and aircrew training in the use of air-to-surface weapons. The range consists of specialized target areas in the Coso and Argus mountainous region in its northeast corner. Target and test sites include Coles Flat, Wild Horse Mesa, Cactus Flats, Junction Ranch Radar Cross Section Range, and Darwin Wash. Because of their remote locations, many of these test areas are used for classified projects that require an isolated and secure environment. HE ordnance is not generally used in this management unit; however, the Cactus Flats area is used for mass detonation tests of up to 250,000 pounds net explosive weight, and the Cactus Flats target area will occasionally accommodate weapons with HE warheads.

Coso Military Target Range. The Coso Military Target Range land use management unit, covering 70 square miles (181 square kilometers) in the northwest corner of the North Range, provides a variety of realistic tactical military environments for T&E and aircrew training of air-to-surface weapons. Inert ordnance is used to support both test and training activities.

Coso Geothermal. The Coso Geothermal land use management unit covers 26 square miles (67 square kilometers) and is located in the southwest corner of the Coso Range. This management unit contains the Coso Known Geothermal Resource Area (KGRA) and currently supports a commercially developed geothermal field producing over 250 megawatts of electricity. No weapons impact areas exist in the Coso Geothermal area. However, this area does serve as a safety and security buffer for adjacent military operations and can support instrumentation sites when necessary for mission requirements. Because the area is in the hazard footprint for some weapons testing, it is occasionally evacuated as a safety precaution.

South Range Test and Training Areas. The test, evaluation, and training capabilities, air-to-surface tactical combat training facilities, and ground test ranges make the South Range a prime location for hazardous and security-sensitive testing and training. Key facilities and instrumentation include numerous threat emitter systems, simulated targets, and unmanned aerial vehicles (UAV) support facilities that are located in a largely clutter-free electronic environment.

Randsburg Wash. The Randsburg Wash land use management unit, covering 282 square miles (730 square kilometers) in the middle of the South Range, is an open-air test range and laboratory for engineering and T&E of electronic combat systems. This area supports a variety of uses for testing systems and technologies that have a role in countering or penetrating air defenses. Throughout the Randsburg Wash, more than 30 threat emitter systems are available for use in T&E and aircrew training operations. Ground troop training is conducted on this management unit, which contains a parachute drop zone for all types of parachute testing and training and a gun line for HE ammunition testing.

Mojave B North. The Mojave B North land use management unit covers 238 square miles (616 square kilometers) at the north end of the South Range. The area is used for testing inert air-to-air gunnery, air-to-ground gunnery, rockets, and ground-to-ground gunnery, and for small arms firing. HE use will be reestablished at the Wingate Target area. Mojave B North provides a realistic tactical military environment with threat emitters for attack and fighter aircrew training and also accommodates ground troop training activities.

Mojave B South. The Mojave B South land use management unit covers 180 square miles (466 square kilometers) in the southern section of the South Range. Airspace above this management unit is used to support testing activities in the Electronic Combat Range in Randsburg Wash and other testing activities in the South Range. Small ground troop training activities occasionally are conducted in this area. HE can be used.

Superior Valley. The Superior Valley land use management unit covers 74 square miles (192 square kilometers) at the southern end of the South Range. This unit, containing the Superior Valley Bombing Range, is used for aerial delivery of air-to-surface inert ordnance and provides tactical threat emitter systems. Superior Valley is used for aircrew readiness training by the Pacific Fleet. Most of the ordnance used is inert non-explosive. However, HE use is being reestablished at the Bullseye Target area. Ground troops occasionally train in this management unit.

2.3 MISSION-RELATED ACTIVITIES

NAWCWD is a major RDT&E and training installation for the U.S. Navy and DoD. NAWCWD operates and uses these RDT&E capabilities for air-to-air, air-to-surface, surface-to-air, and surface-to-surface testing environments. Support assets include an electronic warfare-testing environment, gun ranges, a radar cross-section range, high-speed test tracks, parachute testing areas, and munitions ordnance test facilities. Aircrew training and ground troop training activities occur throughout NAWS ranges.

China Lake Ranges were established during World War II to test newly developed rockets and to train pilots in the use of these weapons. Current R&D operations at NAWS occur within the laboratories, while T&E operations typically take place within the air and ground ranges. These ranges include the special-purpose ranges, such as the Junction Range Radar Cross Section facility and the SNORT facility. Aircraft operations are staged from Armitage Airfield. The type and tempo of RDT&E activities varies, depending on program demands and world events.

2.3.1 Research and Development

Weapons R&D supports all phases of weapon systems development, from the earliest concepts of a weapon to engineering and manufacturing, to Fleet use, and finally to the disposal of systems no longer needed by the military. The goal of weapons R&D is to explore the use of promising technology for the solution of the war-fighter needs.

At NAWS, research activities focus in the areas of weapons guidance and control, warheads, explosives, propellants, propulsion systems, airframes, and the basic chemistry and physics that support these areas. R&D activities generally take place in laboratories where basic and applied research is performed. NAWS laboratory facilities are primarily within the developed areas at Mainsite and in the Propulsion Laboratories areas. Seven main laboratories are situated between Mainsite and the Airfield: Michelson Laboratory, the Engineering Laboratory, Lauritsen Laboratory, Thompson Laboratories, Advanced Weapons Laboratories, and the Propulsion Laboratories Complex, at the southeast corner of the North Range, which is made up of CLPL and SWPL.

2.3.2 Test and Evaluation

Weapon systems and weapon components are tested and evaluated under realistic operating conditions in the air and on the ground ranges at NAWS. Target areas are designated for delivering ordnance such as bullets, missiles, rockets, and bombs, and may include the use of a physical object such as a billboard, tank, or electronic target. Test sites where weapons are tested under simulated conditions may include testing to determine how weapons would react to artillery fire, weather conditions, or other scenarios. Additional T&E capabilities include the following:

1. High-speed test tracks, which aid in testing weapons at operational speeds
2. Testing of weapons-related systems, such as parachutes
3. Environmental and safety test facilities, where tests are performed to evaluate a weapon or weapon system's reaction to atmospheric elements, such as vibration, impact, pressure, and extreme temperatures
4. Nondestructive test facilities, such as large x-ray facilities

Air Tests. Air weapons are tested at NAWS primarily on the North Range. Air tests include air-to-air and air-to-surface operations. Air-to-air operations generally employ aircraft, a weapon system, a target, countermeasure devices, such as flares or chaff, instrumentation sites, and range support facilities. Air test operations can also employ UAVs and/or target drones. Air-to-air testing assesses and evaluates weapons and weapon systems and the integration of weapon systems with the aircraft. At NAWS, air-to-air testing occurs primarily at George Range, with other operational areas providing maneuver space and safety and security buffers.

Air-to-surface testing assesses and evaluates weapon systems, the integration of air-to-surface weapons or weapon systems to the aircraft, warhead effectiveness and weapon systems and/or aircraft software and hardware modifications or upgrades. At NAWS, air-to-surface testing occurs primarily at George, Charlie, Airport Lake, Baker, and Coso Ranges.

Surface Tests. Surface tests take place on the North and South Ranges. These tests encompass surface-to-air, surface-to-surface, and ground tests and may involve missile launching, gun and artillery firing, and mass detonation testing of energetic materials (bombs and explosives).

North Range surface tests are conducted primarily on George Range, at the high-speed test tracks, aircraft survivability, and other ordnance T&E facilities. South Range surface tests occur primarily in the Randsburg Wash area and include the testing of electronic combat systems, threat emitters, light assault vehicles, surface-launched missiles, and large-caliber gun ammunition fuse testing.

2.3.3 Training Activities

NAWS also provides facilities and support for air and ground-based training activities by military units from all branches of DoD. These activities are accommodated on a noninterference basis with the primary RDT&E mission. The varied terrain and environmental conditions throughout the North and South Ranges support training in air-to-air and air-to-surface combat skills, including parachute systems training. Ground troop training is also an element of NAWS operations that uses the North and South Range targets and test areas, roads, and facility sites.

Aircrew Training. Aircrew training exercises occur over both the North and South Ranges. On the North Range, aircrew training takes place over the Coso Military Target Range, Baker Range, Charlie Range, George Range, and Airport Lake. Aircrew training in electronic combat over the South Range uses impact targets at Charlie Airfield in Randsburg Wash, Wingate Airfield in Mojave B North, and the Superior Valley Range. The Superior Valley Tactical Training Range is the heaviest used area for tactical training with air-to-surface weapon systems for Fleet squadrons. This Range is used primarily to deliver inert ordnance, including practice bombs, rockets, flare, chaff cartridges, and gun projectiles.

Ground Troop Training. Ground troop training activities are conducted on both the North and South Ranges. On the North Range, ground troop training occurs at the Airport Lake/Coso Basin area, with very limited use of Baker, Charlie, and George Ranges. On the South Range, training occurs in portions of Mojave B North, Randsburg Wash, Mojave B South, and Superior Valley Tactical Training Range.

Types I and II ground troop training activities have routinely been conducted on the ranges. Type I training activities include the use of foot soldiers only, with no mechanized surface vehicles. Type I activities may include Special Forces operations, forward observation and reconnaissance, and forward air controllers training, and other types of small team tactics. Type II training includes foot soldiers using associated wheeled support and tactical vehicles on existing roadways and disturbed areas only.

Both Types I and II can involve aircraft insertion of troops for realistic ground warfare training, reconnaissance training, and small- and large-caliber weapons firing. Because Type I uses no mechanized surface vehicles, these activities may occur in both disturbed and undisturbed areas throughout the ranges. Type II is limited to existing target and test areas and other areas that have been previously disturbed. All vehicles are limited to existing roads and previously disturbed areas.

With the development of the draft CLUMP, two new ground troop training operating areas are being established at NAWS. These operating areas include the use of Type 1 (light-infantry) training in the Coso Targets Management Unit and the introduction of Type III activity (heavy operations using tracked vehicles) at the Airport Lake Management Unit. Tracked vehicle operations have been an historic use at Airport Lake; however, these vehicles have been used largely as targets for test and aircrew training operations. The introduction of Type III training will accommodate company-sized operations (10 to 12 vehicles) with attendant support equipment and vehicles (repair, supply, and communication).

Parachute Testing and Training. Parachute drop zones are located on both the North and South Ranges. A drop zone in Randsburg Wash on the South Range is typically used to support parachute proficiency training. The drop zone in George Range, which is on the North Range, accommodates RDT&E and parachute crew training.

2.3.4 Support Activities

Most of the lands currently used for military support (e.g., administrative buildings, public works, family housing, and community center) are within Mainsite and the other developed areas in the southern portion of the North Range. Administrative offices, industrial buildings, laboratories, and storage areas are primarily at Mainsite, Armitage Airfield, and the Propulsion Laboratories Area. Mainsite facilities include the headquarters, administrative offices, Public Works Department compound, industrial buildings, and testing and research buildings. Operations, maintenance, medical, administration, housing, recreation, supply, public schools, fire and police stations, childcare center, religious facilities, and the exchange and commissary facilities are also at Mainsite.

Facilities at Armitage Airfield include three runways, aircraft maintenance facilities, aircraft fuel storage facilities, ordnance handling and storage facilities, ground support equipment maintenance facilities, a fire station, and aviation supply warehouses. The Propulsion Laboratories consist of building and test facilities dedicated to RDT&E of propellants and explosives. A few administrative facilities are also at the Range Operations Center in Randsburg Wash, at the SNORT facility on Charlie Range, and at Junction Ranch on the Coso Range. Other facilities and infrastructure are located throughout the North and South Ranges. Facilities occupy approximately 8,912 acres, or 1.5% of the North Range, and 527 acres, or 0.1% of the South Range.

2.3.5 Ordnance Use

Since many of the activities at NAWS involve the testing and use of explosives (live ordnance), extensive safety programs continue to be implemented to ensure the safety of personnel and property. Safety programs and operational procedures are employed through all phases of ordnance use, including the storage, transportation, loading, detonation, and cleanup of range test and target sites. Ordnance is generally classified as live or inert. Live ordnance generally contains an HE warhead. Inert ordnance does not have a live warhead but may contain a fuze, sensor, spotting charge, or other energetic materials that may pose a safety hazard. At China Lake approximately 90% of the ordnance used is inert. Of the approximately 10% HE ordnance used on-Station, most is used at the Airport Lake Target area.

Historic Ordnance Use. NAWS land ranges played a critical role in helping the U.S. meet the challenges and emergencies of World War II, the Korean Conflict, and Vietnam War. The testing and training that occurred on NAWS lands during those early years were not restricted to any particular target site and resulted in unknown quantities of ordnance, both live and inert, being released throughout the Station. As a result of this use and as an ongoing safety consideration, all remote areas of NAWS are considered to be potentially contaminated to some degree by unexploded ordnance. Figures 2-10 and 2-11 illustrate the anticipated extent of historic concentrated ordnance-use patterns on the NAWS ranges.

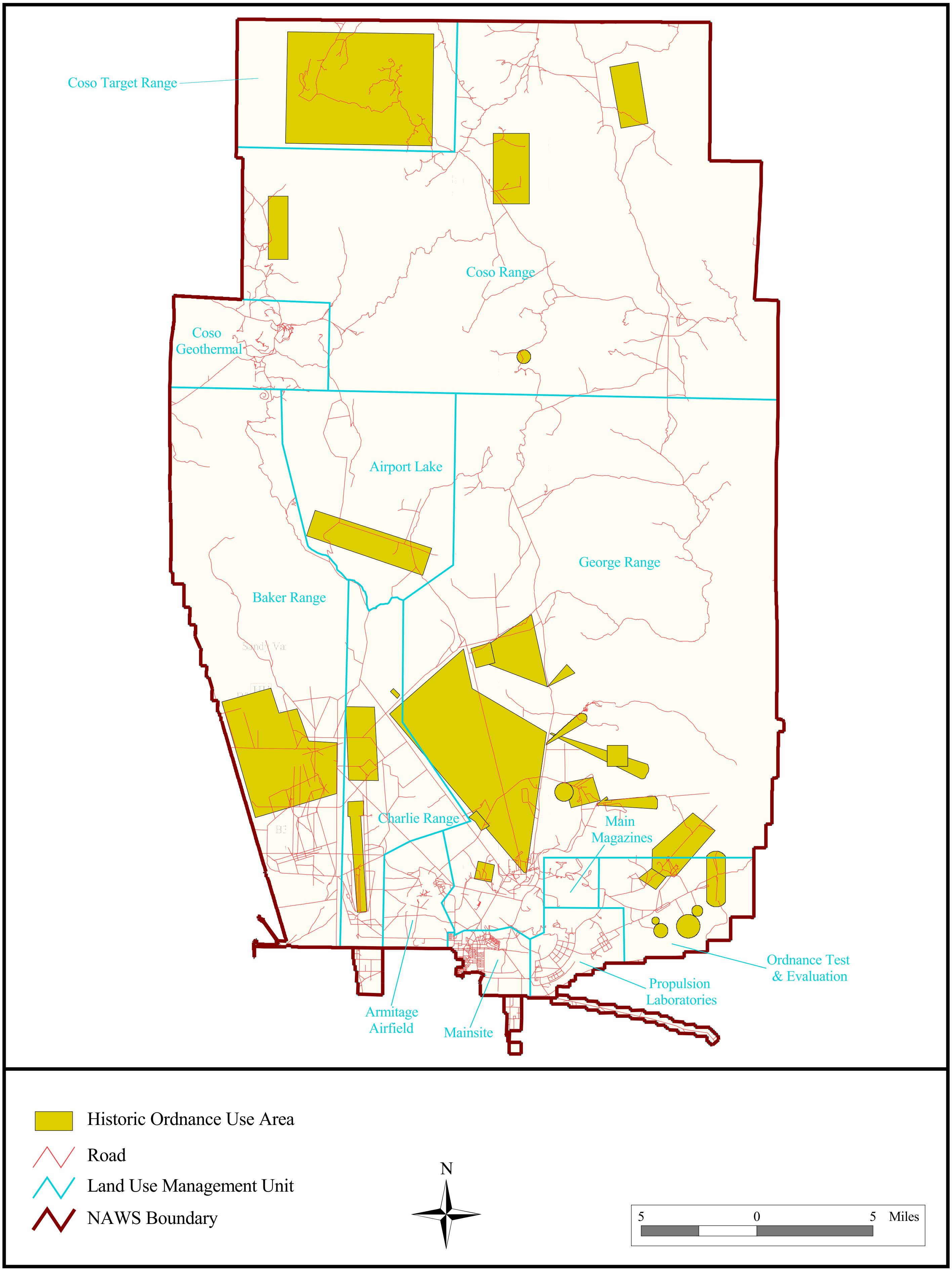


Figure 2-10 Historic Concentrated Ordnance Use Areas, North Range

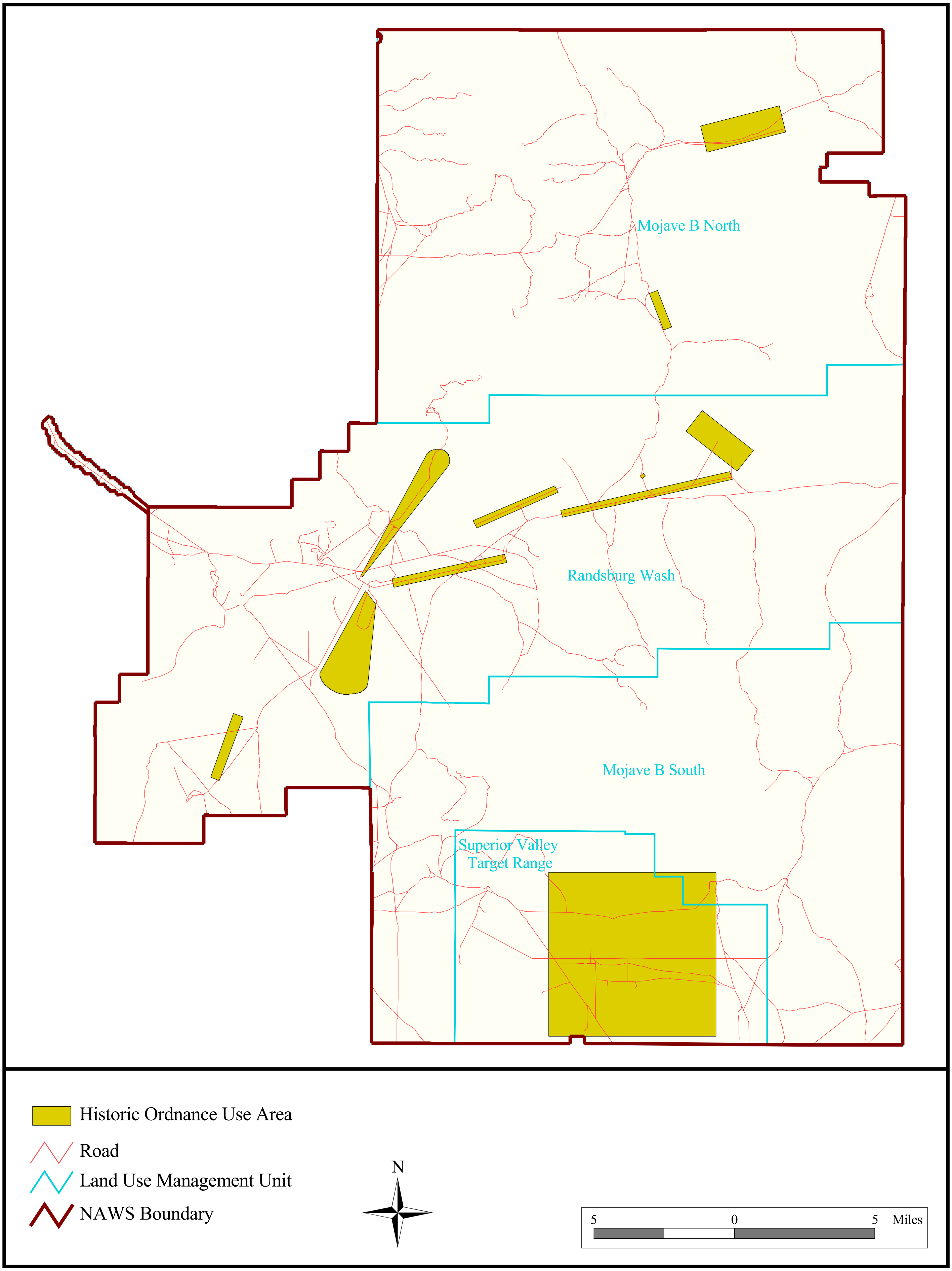


Figure 2-11 Historic Concentrated Ordnance Use Areas, South Range

Contemporary Ordnance Use. Today ordnance use on the ranges is carefully controlled and monitored. Inert and HE ordnance is used to meet defined mission requirements and is allocated to specific target and test sites (Figures 2-8 and 2-9). Authorized ordnance use on NAWS ranges is described in Appendix C by ordnance type and target location. Ordnance cleanup and disposal for range test and training activities are a standardized part of NAWS Range operations. Current policies and practices further minimize ordnance contamination. Explosives use must meet established criteria, and debris from tests is removed from the ranges and test sites as much as possible. Explosive ordnance disposal (EOD) crews perform this function, and customers are assessed a cleanup fee as part of the test cost. Unexploded ordnance is typically recovered upon its discovery, and related debris from previous test and training activities are recovered in accordance the Range Residue Program standard operating procedures.

The draft CLUMP formalizes established HE use on NAWS ranges (see Range Target and Ordnance Use Matrix, Appendix C). The CLUMP also reintroduces the use of HE at two historic locations on South Range—the Wingate Airfield target in the Mojave B North Range and the Bullseye Target in Superior Valley.

2.4 NONMILITARY LAND USE

The Navy may accommodate 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 NAWS lands. At the Commanding Officer's (CO) discretion, nonmilitary use will continue to be accommodated on a case-by-case basis when practicable. Because of safety and security concerns, public access will continue to be limited to certain areas and will be a privilege granted by the CO. Exercise of this privilege requires adherence to all NAWS traffic regulations, range procedures, area access limitations, and other applicable security and administrative regulations. The NAWS Public Access Policy (Appendix D) outlines the procedures, restrictions, and conditions for public access to the Station lands.

Native American Access

Access to the Coso Hot Springs and Prayer Site for traditional and religious purposes will continue to be allowed in accordance with the existing MOA between the Navy and local Native American tribes. Requests for access by other tribes and for other areas not covered under the MOA will continue to be considered on a case-by-case basis.

Education and Research Projects

Access to Station lands for educational programs and scientific research will continue to be encouraged and pursued. Emphasis will continue to be placed on efforts that further the knowledge and understanding of the physical, natural, and cultural resources of NAWS lands and their relationship in a regional or ecosystems perspective. Access for these activities will comply with the NAWS Public Access Policy and will be accommodated on a case-by-case basis.

Recreation

A variety of recreational activities have been accommodated on NAWS lands over the past 50 years. While most of these activities will continue to be supported, others may be temporarily or permanently discontinued. The following list presents the current scope and status of recreational activities at NAWS. These and other recreational activities will continue to be considered on a case-by-case basis.

1. **Hunting.** Hunting has been discontinued on Station. No hunts have occurred since 1988 as a result of budget constraints, reduced staffing levels, and the potential environmental sensitivity of historic hunting areas.

2. **Camping.** Camping at Birchum Springs campground will continue to be considered on a case-by-case basis and by reservation.

3. **Hiking.** Hiking on the established dirt trails at B Mountain will be allowed for Station employees who have proper area access.

4. **Equestrian Use.** Equestrian use of G-Corridor will be permitted on established dirt roads and trails for informal use and during formal public events scheduled by the BLM, provided such use does not conflict with mission requirements.

5. **Off-Road Vehicle Use.** The use of off-road vehicles (ORVs) and motorcycles will continue to be prohibited on the Station proper. ORV use may be accommodated on the Randsburg Wash Access Road for public events scheduled in accordance with established procedures between BLM and the Navy.

6. **Little Petroglyph Canyon Tours.** Tours by the Maturango Museum are expected to continue under a cooperative agreement with the Navy. Provided the tours do not conflict with mission requirements, the Museum will conduct six tours per month of Little Petroglyph Canyon, with no more than 50 visitors for each tour. In addition, tours will continue to be conducted by other authorized tour guides on a case-by-case basis. All tours will be scheduled through the Station's Public Affairs Office and Environmental Planning and Management Department (PAO and EPMD).

The public will continue to be allowed access to recreational facilities on Mainsite, such as the gymnasium and golf course.

Commercial

A variety of commercial activities have been accommodated on NAWS lands over the past 50 years. While most of these activities will continue to be supported, others may be temporarily or permanently discontinued. The following list presents the current scope and status of commercial activities currently being accommodated at NAWS. These and other commercial activities will continue to be considered on a case-by-case basis.

1. **Geothermal Production.** Geothermal production within the Coso KGRA will continue, as authorized by CDPA and in accordance with the Navy Private/Public Venture (PPV) Contract and the MOA between the Navy and the BLM. The Coso KGRA currently supports a commercially developed geothermal field producing over 250 megawatts of electricity. NAWS will continue to administer and manage this major geothermal resource located within the Station.

2. **Cattle Grazing.** Since 1959, NAWS has accommodated cattle grazing on Station-administered lands through a formal management agreement with BLM. Since 1998 cattle grazing has been accommodated on portions of the

North Range under a 2-year interim permit issued by BLM with concurrence from the NAWS Commanding Officer. The permit expired in June 2000. During the interim period, NAWS evaluated the cattle-grazing program to determine if management adjustments were needed to ensure the program complied with applicable environmental requirements and was still compatible with the Station's mission. Based on the findings of the NAWS grazing program review and analysis of environmental impacts from grazing, NAWS determined that cattle grazing will no longer be accommodated on China Lake lands.

3. **Commercial Filming.** Commercial filming activities on the North and South Ranges will continue to be considered on a case-by-case basis, provided these activities do not conflict with mission requirements of sensitive biological and cultural resources. All access will comply with the NAWS Public Access Policy.

4. **Easements.** Easements will continue to be considered on a case-by-case basis and will be processed according to established Station procedures among the Station, the proponent, and BLM as appropriate.

5. **Facility Use.** The CO may consider requests from municipal and commercial entities to lease existing facilities on a case-by-case basis. If required, the EPMD would review the application for conformance with the ICRMP and the INRMP. These leases would include primarily existing facilities, such as warehouse space and offices. Facilities that could be available are located principally at Mainsite.

2.5 ENVIRONMENTAL RESOURCES

NAWS lands contain a variety of physical, natural, and cultural resource features. The influences of topography, climate, history of human habitation, and land use over time have created the current landscape and environmental resource patterns. This section describes the general type of environmental resources found within the Station's boundaries. Cultural resources at NAWS generally include archaeological resources (prehistoric and historic ruins, sites, and artifacts), the historic built environment (historic buildings, structures, and other architectural and landscape features), and Native American resources (religious objects, burial sites, and traditional use locations). (Refer to the ICRMP for a description of the NAWS cultural resources management program.) Natural resources include federally listed threatened and endangered species; other sensitive species not formally listed but warranting special consideration; water resources, including surface and groundwater resources; diverse wildlife habitats; and feral animal management. (See INRMP for a more complete description of natural resources.)

2.5.1 Cultural Resources

"Cultural resources" is a generic term commonly applied to prehistoric, historic and Native American resources. Cultural resources at NAWS can include buildings, structures, archaeological sites, historic landscapes, traditional cultural places, Native American sacred sites, and objects of significance in history, architecture, archaeology, engineering, or culture. NAWS lands contain extensive and diverse cultural resources. A description of cultural resources occurring at China Lake and NAWS approach to manage these resources may be found in the NAWS draft ICRMP (Navy 1999).

Archaeological Resources. China Lake lands contain many significant archaeological resources. The high number of archaeological sites identified to date emphasizes the likelihood for other potentially significant archaeological resources throughout the Station. In the nearly 92,500 acres that have been fully surveyed, almost 1,736 archaeological sites have been recorded. Of the recorded archaeological sites, 1,592 sites contain prehistoric materials.

Prehistoric Archaeological Resources. A variety of prehistoric archaeological resources have been recorded at NAWS. In addition to the spectacular rock art at the Coso Rock Art District/National Historic Landmark (NHL) and the extensive obsidian quarries found in the Sugarloaf Archaeological District, other prehistoric resources have been identified at NAWS. These include lithic scatters, milling stations, rock shelters and other habitation sites, rock cairns and rock alignments, hunting blinds, and burials.

National Register eligibility evaluations have been completed for 697 (53%) of the recorded prehistoric archaeological sites. Of the sites that have been identified so far, 545 (41%) have been recommended as eligible and 152 (12%) recommended as not eligible for the National Register (Appendix E). Nominations to the National Register have been prepared for the Sugarloaf Archaeological District, the Cactus Flat Village Site, and the Pothunter Spring Site Complex. The Coso Rock Art District/NHL and the Coso Hot Springs site are listed on the National Register for prehistoric, historic, and Native American significance.

Historic Archaeological Resources. The earliest known historic site at NAWS is the 1860 Old Coso Village mining camp. Historic mining sites on NAWS reflect increased mining activities throughout the West during the late 1800s and again during the 1930s Depression era. Historic mining resources include structures in various states of decay, mineshafts and adits, prospects, headframes, and fairly extensive settlement remains at Mountain Springs Canyon, Copper City, Coso Village, and Granite Wells. The Layton monorail in the Mojave B North Range was used to transport mined salt deposits from a remote location. The route of the Twenty-Mule Team Borax Wagon Road (1882) from Death Valley to Mojave, California, also crosses the Mojave B North Range. Other historic sites are related to early ranching and homesteading from the 1920s and 1930s.

A recent historic resource overview prepared for NAWS identified 756 locations where historic resources may occur based on archival research of mining claims, homestead patents, transportation routes, early maps, and other documents. Historic themes have been identified for the types of historic resources located at NAWS, which includes sites for mining, homestead or ranching, water development, transportation or road, and recreation.

Navy-Built Environment Resources. China Lake buildings and structures associated with historic activities supporting World War II and Cold War programs have been evaluated for eligibility for listing on the National Register. Significant events in the history of American weapons development have occurred at NAWS. Many buildings and structures from that period are still present and retain their historic integrity.

With the completion of a detailed analysis of over 1,500 buildings and structures at NAWS, 158 buildings and structures were recommended as eligible, either as individual buildings or as large districts. The rest were recommended as ineligible.

Native American Resources. Coso Hot Springs, including the Prayer Site, is recognized as a traditional Native American use area within the boundaries of NAWS. Coso Hot Springs is listed on the National Register of Historical Places, recognizing its importance to local Native American groups. Access to the site is ensured through a Memorandum of Understanding (MOU) between NAWS and those Native American tribes who have expressed their interests to visit the site. Because additional Native American resources may be present on the NAWS ranges that have not yet been identified, standard protocols are being developed to address those sensitive resources that may be of interest to Native American tribes.

2.5.2 Natural Resources

Natural resources at NAWS include wildlife habitats, plant and wildlife species, and plant communities. Wildlife habitats are the natural environments of animals, consisting of biotic features (plant and animal assemblages) and abiotic features (air, water, and temperature regime). Wildlife includes invertebrates, fish, amphibians, reptiles, birds, and mammals. Plant communities are assemblages of plant species typically defined by the dominant plant species within the assemblage. Other natural resources addressed in this document include threatened, endangered and sensitive species; water resources; and grazing as it applies to the management of feral horses and burros. Details of natural resources occurring at China Lake and NAWS approach to manage these resources may be found in the NAWS Draft Integrated Natural Resources Management Plan (INRMP, Navy 2000).

Wildlife Habitat. The topography and diversity of habitats on NAWS ranges provides for varied wildlife on NAWS. Most of the land areas and associated habitat types found on Station lands are generally undisturbed. The vegetation at NAWS is influenced by the Station's location in a transition zone between two ecosystem provinces (Great Basin and Mojave) and the wide range of elevation changes related to the complex topography of the landscape. On NAWS, 18 different plant communities have been identified and at least 675 plant species recorded. Several of these species are considered sensitive in that they are rare or are known to have limited distribution. There are no known Endangered Species Act (ESA) listed plant species that occur on NAWS.

Although the desert is an arid environment, enough moisture is associated with permanent and seasonal water sources to support a two amphibian species. Thirty-one reptile species have been identified on Station lands. The desert tortoise, a federally listed threatened species, is generally found in suitable habitats below 4,500 feet in elevation.

To date, 310 bird species have been identified at the Station. Over 80 species of mammals, including 12 species of bats, are known to inhabit NAWS lands. Many are small mammals, although a number of wide-ranging carnivores are relatively common. Other larger mammals include mule deer and Nelson's bighorn sheep.

Threatened, Endangered, and Sensitive Species. NAWS lands contain only three federally listed threatened or endangered species: the desert tortoise, the Mojave tui chub, and the Inyo California towhee. The desert tortoise is found in the creosote bush scrub plant community at elevations generally below 4,500 feet. The Mojave tui chub, a minnow-like fish, was introduced into the Lark Seep lagoon and drainage system in 1971 as a species-conservation cooperative project. The Inyo California towhee's range includes the springs and canyon slopes of the Argus Range. Currently no federally listed threatened or endangered plant species are known to occur on NAWS lands. However, the recent listing of the Lane Mountain milk-vetch in the Superior Valley region increases the potential for such an occurrence on NAWS lands.

Other sensitive species include both plants and animals that are not federally listed now but are either state listed or on watch lists as a result of a species-limited distribution or other risk factors. The NAWS-Sensitive Species List will be updated as other resources are discovered or as their status changes over time. Currently approximately 21 plants, nine invertebrates, two amphibians, three reptiles, 55 birds, and 12 mammals on the NAWS-Sensitive Species List are known or expected to occur on NAWS lands (Appendix F).

Water Resources. Water resources at NAWS include surface water features, such as springs and seeps, and groundwater. Groundwater is the sole source of potable water at NAWS, while springs, seeps, and associated riparian areas are important sources of water and habitat for a wide variety of wildlife on Station lands.

The groundwater resource on NAWS lands and the adjacent Indian Wells Valley (IWV) depends on recharge originating in the Sierran watershed to the west of the Station boundary. Groundwater quality is generally good to very good, depending on source location and depth. Groundwater availability, based on known recharge and storage characteristic of the valley aquifer systems, is projected to meet demands over the next century.

More than 120 permanent and seasonal springs have been identified at NAWS. These springs range from small areas with almost imperceptible discharge to areas supporting extensive riparian vegetation. Another source of surface water occurs in the Lark Seep and G-1 Seep system, created primarily by leakage and percolation from the city of Ridgecrest's wastewater treatment facility located on Station lands. These seeps support the Mohave tui chub population.

Grazing. Historically, two types of grazing have been accommodated on NAWS lands: commercial grazing by cattle and grazing by feral horses and burros. As discussed previously in the commercial non-military land use description, cattle grazing will no longer be permitted on NAWS lands. NAWS will continue to actively manage feral horses and burros according to established objectives described below and in the Station's INRMP.

Feral Horses and Burros. Burros and horses were introduced on the Station and surrounding lands by miners and ranchers in the late 1800s. The number of feral horses and burros increased dramatically between the late 1960s and early 1980s, causing significant environmental damage, as well as safety concerns for aircraft operations and motorists on Station. Since that time, a formal management program has been in effect, and to date more than 9,500 burros and 3,280 horses have been removed from the Station at Navy expense from the Station. The animals have been placed in the cooperative adoption program with BLM. The Navy's management objectives for feral animals are to completely remove burros from Station lands and to maintain a wild horse herd of approximately 170 animals. Horse and burro management is a cooperative program conducted in partnership with the BLM.

2.5.3 Public Health and Safety Programs

NAWS continues to implement a wide variety of programs to address specific health and safety needs that include range safety, flight safety, ordnance safety, and other operational considerations. Two public health and safety management concerns identified during the CLUMP and EIS public scooping meetings included the Station's hazardous waste management and noise-abatement programs. These programs continue to be implemented to ensure the health and safety of the Station's employees and that of the local communities. NAWS waste management programs include the ongoing management of hazardous materials and wastes generated at the Station, and the cleanup of sites from past waste disposal practices through the ongoing implementation of the Installation Restoration Program. Noise-abatement programs include the update to the AICUZ plan, a noise complaint reporting process, and outreach efforts to coordinate and cooperate with area communities and agencies (see Appendix G). The Station is updating the AICUZ plan to characterize the noise environment and safety management areas (Accident Potential Zones) associated with NAWS airfield operations. The

AICUZ plan will also update proposed guidelines for compatible off-Station land uses, and present a plan for implementation of these guidelines with partnering agencies and communities.

CHAPTER 3
LAND USE MANAGEMENT

This chapter describes the CLUMP land use management framework that will be implemented to facilitate the Navy's near- and long-term land use and environmental management requirements. The CLUMP management strategy and approach for defining land use and environmental zoning is presented. General land use guidelines are provided to help NAWS activities achieve the CLUMP goals described in Chapter 1. The CLUMP land use management process will support the current and evolving military mission, ensure environmental compliance, ensure the continued protection of public health and safety, and serve as the implementing vehicle for the other keystone management plans.

3.1 MANAGEMENT STRATEGY

The CLUMP employs a straightforward strategy to guide and direct the land use management process at NAWS. This strategy capitalizes on the use of existing information and processes and augments these capabilities with enhanced information management and the integration of process improvements. The CLUMP land use management process includes the following steps to support the NAWS and NAWCWD mission:

1. Control and direct ongoing and new land use to avoid sensitive resources, to minimize adverse effects, and to use a decision process based on the National Environmental Policy Act (NEPA), resulting in informed land use decisions.
2. Enhance environmental planning processes by integrating the natural and cultural resources management plans and programs, and public health and safety initiatives with test and facility land use planning procedures.
3. Continue to monitor land use and environmental resource conditions to determine the effects of ongoing use and to document effectiveness of management processes.
4. Use GIS for management of data describing land use and environmental resource patterns.
5. Make informed process adjustments as needed over the term of the plan.

The CLUMP will continue to accommodate the Navy's land use needs by implementing a comprehensive process that controls and directs ongoing and new land use activities in a manner that protects and conserves sensitive environmental resources. The CLUMP will use the following general strategies to accomplish the land use management goals at NAWS:

1. Continue to direct military operations and nonmilitary activities to traditional land use locations.

2. Locate new use or significant additional changes to existing ground-disturbing activities, whenever possible, in previously disturbed areas or in areas that are not environmentally sensitive.
3. Continue to implement standard and impact minimization practices for ongoing and new land use in, or adjacent to, sensitive environmental resource areas.
4. Continue to apply a clearly defined environmental review and approval process for ongoing and new land use.
5. Accommodate nonmilitary use on a case-by-case basis in locations that are compatible with the military mission.
6. Concentrate additional environmental resource field surveys in buffer areas of higher-intensity land use and in areas that contain high-value environmental resources until baseline inventories are completed and entered into the GIS database.
7. Continue to inventory environmental resources and monitor land use effects in accordance with Navy directives and best management practices.
8. Maintain and update baseline data concerning land use, environmental resources, and other appropriate features, as needed to support land use management processes.
9. Pursue appropriate partnerships with agencies, academic institutions, and organizations to augment environmental resources research and management efforts.
10. Implement an amendment process to periodically update (annual review) the plan in response to evolving management requirements and to complement the updates of other keystone plans.
11. Continue coordination efforts with interested off-Station agencies and organizations and maintain participation in mutually beneficial land use and environmental planning and management initiatives.

3.2 LAND MANAGEMENT FRAMEWORK

The CLUMP combines land use and environmental resource descriptions (Chapter 2) with the management goals and direction provided by keystone management plans to create the baseline conditions for the land management framework. These land use and environmental resource conditions are mapped using GIS technology to create an accessible corporate database delineating land use and environmental resource management zones. These management zones create the framework upon which new land use proposals or significant changes to existing activities will be compared. Proposed land use (continuing or new) will be analyzed to determine conformity to the Navy's CLUMP and EIS ROD and compatibility with existing military land use. The CLUMP land use decision process is further described in Chapter 4.

3.2.1 Land Use Zones

The CLUMP uses a three-zone planning method that is a modified version of the process proposed in the draft China Lake RMP. This method employs different zone designations to define areas that have traditionally received various types and intensities of use and identifies environmentally sensitive areas where intensive land use will be discouraged. The land use zoning concept acknowledges that select areas of the Station will continue to receive more intensive RDT&E, support, and training activities than other locations. For example, selected target and test areas may receive varying degrees of impacts from ordnance use, while other areas receive little or no direct ground disturbances. This zoning concept also recognizes that China Lake lands are not homogenous; some areas possess greater ecological or cultural resources than other locations. These areas will continue to be managed for the protection and conservation of the environmental resources in accordance with the priorities assigned in their respective management plans.

The CLUMP zoning system accurately reflects the baseline land use patterns that define the activity type, location and the anticipated use intensity. The CLUMP zoning system also establishes environmental management areas for natural and cultural resources. These areas are defined by resource type, location, and management priority. The management strategies for these zones incorporate the Station's primary military use for an area in balance with the requirements to protect and conserve the Station's environmental resources. The zoning system was developed using archival information (management plans, technical reports), Station-wide aerial imagery (1996), and field surveys using GPS technology.

Figures 3-1 and 3-2, Land Use Zones, illustrate the zoning patterns applied to the military activity land use patterns described in Chapter 2.

Intensive Use Zones. Intensive Use Zones are those areas that have historically been intensively used for RDT&E, support, or training activities. These areas receive a high degree of surface disturbances and are generally cleared of naturally occurring surface features. Intensive Use Zones accommodate a wide variety of land uses, such as administrative and industrial facilities and associated infrastructure, airport facilities, administrative buildings, base housing, and recreational facilities. Intensive land use areas on the ranges include targets and test sites for ordnance use, instrumentation sites, special use ranges, remote facilities and associated infrastructure, ground troop training areas, roads, rights-of-ways. A limited number of nonmilitary land uses are also accommodated, such as geothermal power generation and public utility easements.

Primary Buffer Zones. Primary Buffer Zones are those areas that surround or are directly adjacent to targets and test sites intensive-use zones located throughout the China Lake Ranges. The shape and size of these buffer zones were established in accordance with existing operational uses.

Primary Buffer Zones receive intermittent and localized impacts associated with operations in the Intensive Use Zones. These buffer zones are based on the results of extensive field surveys that determined that ground-disturbing effects associated with target and test area use are generally concentrated to within 200 meters of the area boundary. These associated effects are caused by impacts from missing target centers, ordnance skips, fragment-throw patterns, and test item recovery activities. The 200-meter radius around targets and test sites is often referred to as splash zones.

Safety and Security Zones. Safety and security zones are those lands adjacent to the intensive use zones and the primary buffer zones and have historically received minimal disturbance from military activities. Disturbances in these areas are unplanned and have generally been the result of weapons or weapon system failures during testing or training. These areas provide additional safety and security buffers for Station-wide air- and ground-related military operations and may accommodate other mission-compatible nonmilitary land uses. These areas comprise the majority of NAWS lands and contain most of the known protected biological and cultural resources management areas.

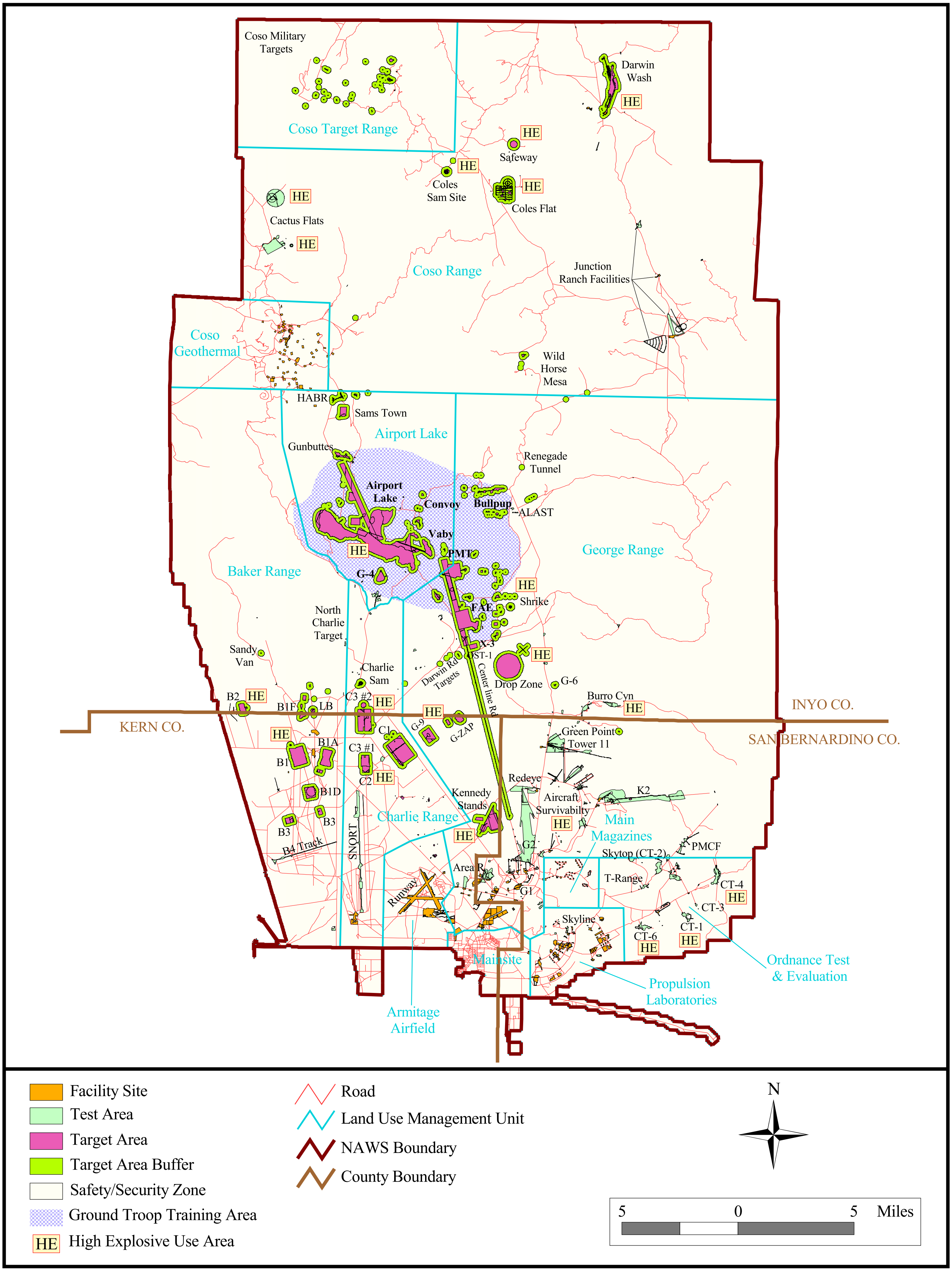


Figure 3-1 Current Land Use Zones, North Range

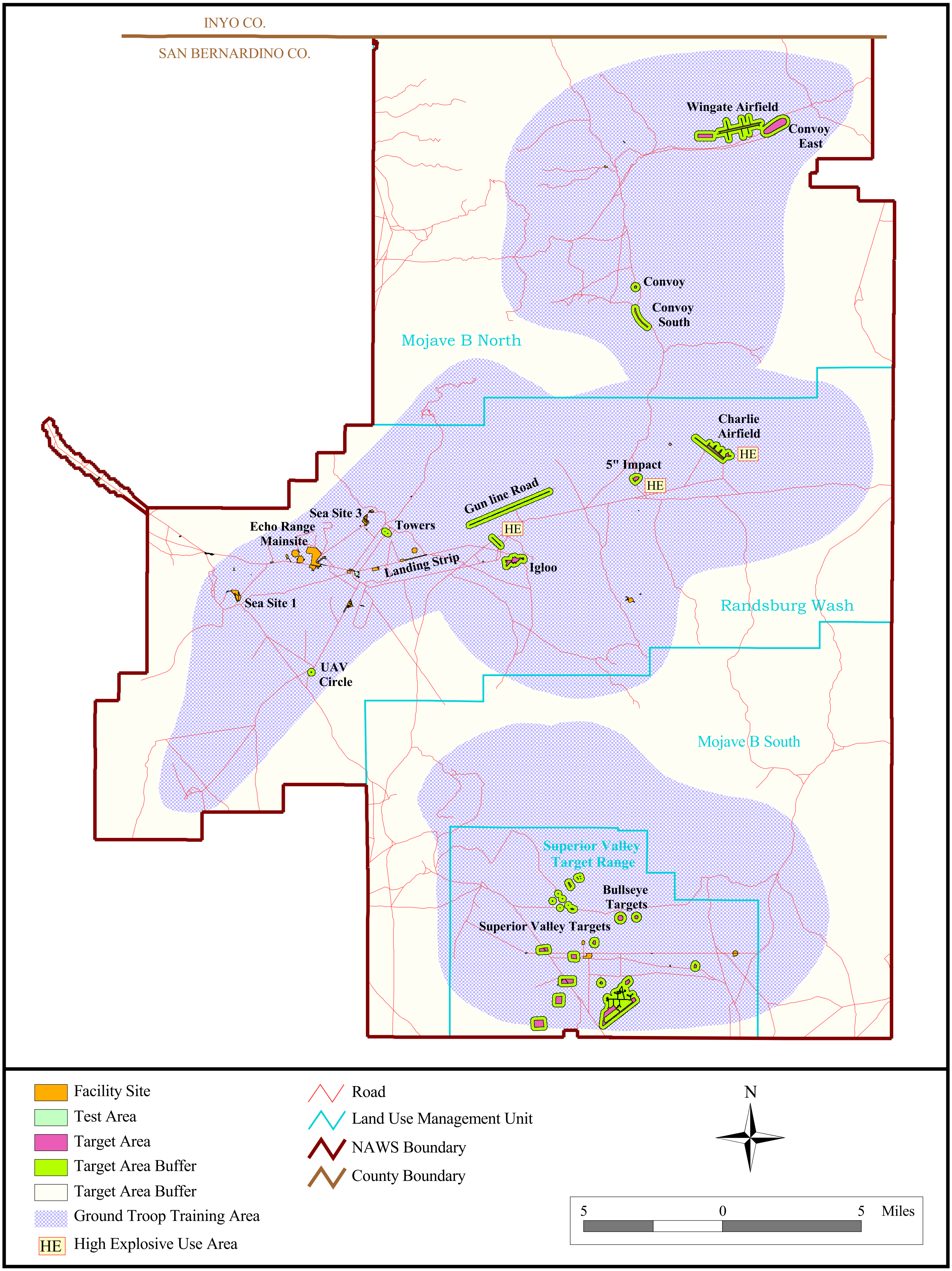


Figure 3-2 Current Land Use Zones, South Range

3.2.2 Environmental Resource Management Areas

Environmental resource management areas were established at NAWS in accordance with the management priorities described in the respective draft integrated resources management plans (INRMP and ICRMP) and other supporting technical documentation. Baseline resource information was summarized and mapped to provide an accurate representation of an environmental resource management priority ranking based on the protection status (sensitivity) of known cultural and natural resources occurring on-Station. Descriptions of these resources features are provided in the management plans for the INRMP and the draft ICRMP, the Natural and Cultural Resources Report (NCRR, U.S. Navy 1997), and the Land Use Compatibility Analysis Report (LUCAR, U.S. Navy 1997) that were prepared to support the development of the CLUMP. Baseline land use patterns and priority environmental resource management areas may change over the term of the CLUMP in response to changing resource management requirements or as additional information on resource conditions becomes available.

Resource Priorities. Natural and cultural resource management areas are identified and ranked according to a management priority classification ranging from priority no. 1 (high resource sensitivity) through priority no. 4 (low resource sensitivity). This classification scheme incorporates a range of resource values that includes areas of the highest management priority, where every effort will be made to protect and conserve sensitive resource values, to areas of the lowest priority, which include areas where minimum environmental conservation efforts will be employed (Table 3-1).

Priority no. 1 designations are assigned to the most sensitive resource management areas (critical habitat, surface water resources, National Register Historic Places (NRHP)* sites, and surveyed areas containing NRHP-eligible cultural resources). These areas will be managed for the protection and conservation of those resource values.

Priority no. 2 areas include habitats of desert tortoise and other threatened and endangered species not designated as critical habitat, and raptor nesting sites, areas surveyed for cultural resources containing identified but unevaluated resources and areas not yet surveyed for cultural resources in proximity to intensive-use zones.

Priority no. 3 areas are the general wildlife habitat areas, which include NAWS-sensitive (non-listed) species and areas that have been surveyed for cultural resources.

Priority no. 4 lands are those disturbed or developed lands containing facilities, infrastructure, targets, test sites, and other previously disturbed areas. Also included in this designation are areas that have been surveyed but in which no cultural resources are present. These areas are generally not managed for resource conservation, however, in the event of a sensitive species (i.e., a desert tortoise) or a sub-surface archaeological resource being discovered, appropriate conservation measures are employed.

Management priorities for environmental resources are illustrated in maps in Figures 3-3, 3-4, 3-5, and 3-6. Table 3-2 illustrates the relative distribution of environmental resource priorities by land management unit.

*NRHP is more commonly referred to as the National Register.

Table 3-1. Environmental Resources Management Priorities NAWS.

Environmental Resources	Management Priorities			
	No. 1	**No. 2**	**No. 3**	**No. 4**
Biological Resources	Mojave tui chub, desert tortoise, and Inyo California towhee Critical habitats for Mojave tui chub, desert tortoise, and Inyo California towhee Habitat management areas for desert tortoise and Inyo California towhee Surface and groundwater resources	Desert tortoise habitat not included in critical habitat designation or habitat management areas Known raptor nesting and breeding areas	NAWS Sensitive Species (Non-listed) Undisturbed natural habitat not supporting any federally listed or protected biological resources	Disturbed areas
Cultural Resources	Big and Little Petroglyph Canyon NHL Sugarloaf Archaeological District Salt Wells Pilot Plant and China Lake Pilot Plant Historic Districts Other cultural resources listed or determined eligible for the NRHP	Non-surveyed areas adjacent to intensive-use zones (test and target sites) Surveyed lands with identified but unevaluated cultural resources	Other Station lands non-surveyed for cultural resources.	Disturbed areas and surveyed areas with no cultural resources found

Source: NAWS. Integrated Natural Resources Management Plan (1999) and Integrated Cultural Resources Management Plan (1999).

Table 3-2. Environmental Resources at NAWS: Resource Management Priorities by Land Management Unit.

Resource Type	Biological Resources				Cultural Resources			
Management Priorities	**No. 1**	**No. 2**	**No. 3**	**No. 4**	**No. 1**	**No. 2**	**No. 3**	**No. 4**
	Critical Habitat and Habitat Management Areas	**Desert Tortoise Habitat**	**NAWS Sensitive Species/General Habitat**	**Disturbed Areas**	**National Historic Landmark, National Register Districts, Eligible Resources**	**Surveyed Areas with Known Cultural Resources and Non-surveyed Areas Adjacent to Targets and Test Sites**	**Non-surveyed Areas not in NHL Districts**	**Surveyed Areas without Cultural Resources**
Management Units	**Acres**	**Acres**	**Acres**	**Acres**	**Acres**	**Acres**	**Acres**	**Acres**
Developed Areas								
Mainsite		3,198	86	1,858			5,191	
Armitage Airfield		6,979		1,276		945	7,346	1
Propulsion Labs Area		5,906	911	788	1,811		5,749	50
North Range Area								
Baker		39,015	37,263	915	7,555	3,504	65,575	635
Charlie		25,932	14	1,182	15,630	1,985	25,082	59
Airport Lake		26,700	8,090	2,525		3,226	16,043	2,560
George	9,793	81,562	99,208	4,616	17,155	8,201	168,076	1,675
Coso	892	6,627	205,831	1,489	51,141	10,755	152,892	184
Coso Geothermal		7,305	8,944	299	16,676			
Ordnance T&E Area		11,855	1,400	2,001		62	15,233	
Main Magazine		2,731	521	20			3,076	196
South Range Area								
Randsburg Wash	76,119	89,147	14,696	728	172	6,445	173,078	996
Mojave B North	27,685	52,463	71,824	163		8,433	141,472	2,230
Mojave B South	75,874	23,068	16,030	1	2,978	14,830	96,190	1,075
Superior Valley	46,791			688		10,651	33,957	2,895
Corridors/Roads			5,352					5,362
Totals	**237,154**	**382,487**	**470,170**	**18,549**	**113,118**	**69,037**	**908,880**	**17,908**

Acreage calculations in this table are based on draft GIS mapping data acreage totals by theme and location. Acreage totals may vary due to area/resources overlap or by variations in the baseline GIS data.

Natural Resource Management Areas. Sensitive natural resources at NAWS include one federally listed endangered species; two federally listed threatened species; surface waters, including springs and riparian areas; and several NAWS-sensitive species. The Station's INRMP establishes the management goals and priorities for these resources. The location and characteristics of each natural resource feature are discussed in the following sections. Figures 3-3 and 3-4 illustrate the location of the natural resource management areas at NAWS.

Priority no. 1 designations are those areas identified as either critical habitat or a habitat management area for the federally threatened desert tortoise and Inyo California towhee, as well as the federally endangered Mojave tui chub. These areas include a total of approximately 237,154 acres (21% of total land area). Areas with a management priority no. 1 include the southern and eastern portion of the South Ranges, riparian habitat in both the Mountain Springs Canyon and the Birchum Springs area in the east-central portion of George Range, the Lark Seep drainage system at the southeastern edge of George Range, and other surface water features.

Priority no. 2 designations are those portions of the desert tortoise habitat not included in the critical habitat designation or habitat management areas. This habitat covers approximately 382,487 acres (38% of total land area) at NAWS. Known raptor breeding areas, riparian areas, springs and seeps, bat maternity colonies, and nesting areas are also designated as priority no. 2 management areas. Areas with a management priority no. 2 include much of the lower elevations in Panamint Valley in Mojave B North and the western and middle portions of Randsburg Wash in the South Range. This habitat designation includes most of the IWV, Salt Wells Valley, and Coso Basin in the North Range. This designation is also applied to scattered isolated raptor nesting and breeding sites throughout the North and South Ranges.

Priority no. 3 designations include areas hosting NAWS-sensitive (non-listed) species and most of the remaining open or undisturbed wildlife habitat on NAWS. These land areas account for approximately 470,170 acres (42% of total land area) and support several plant and animal species identified for special management consideration. NAWS-sensitive species are fully described in the INRMP. China Lake recognizes the importance of these species and will manage them in a manner that is consistent with regional ecosystem management considerations in an effort to prevent their becoming listed as threatened or endangered. These species and their habitats are not federally listed or protected by federal laws. However, NAWS has designated them as sensitive species for one of the following reasons:

1) California recognizes them as threatened or endangered,

2) California or the BLM has designated them for special management consideration prompted by concerns of other public resource agencies or professionally recognized scientific organizations or specialists, and

3) NAWS technical staff has recognized them as unique or of scientific interest.

Priority no. 3 management areas, located throughout the Coso and Argus mountain ranges and Coles Flat area, make up the largest category of biological resource values on the North Range. On the South Range, management priority no. 3 areas are in the Slate Range in the western portion of Mojave B North, Brown Mountain, and Quail Mountain along the eastern edge of Mojave B North, Robbers Mountain in Randsburg Wash, and the Eagle Crags in Mojave B South.

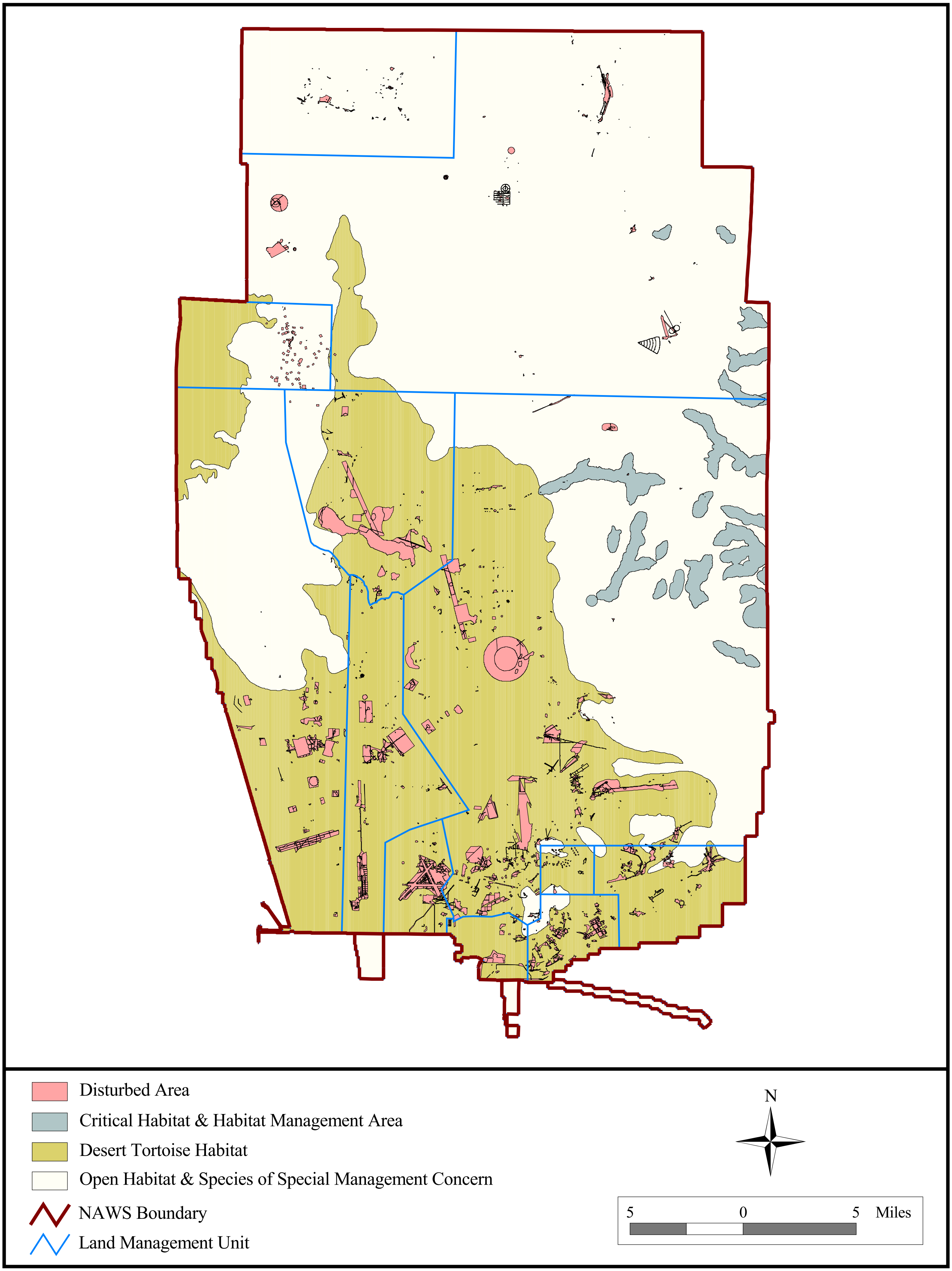


Figure 3-3 Natural Resources Management Priorities, North Range

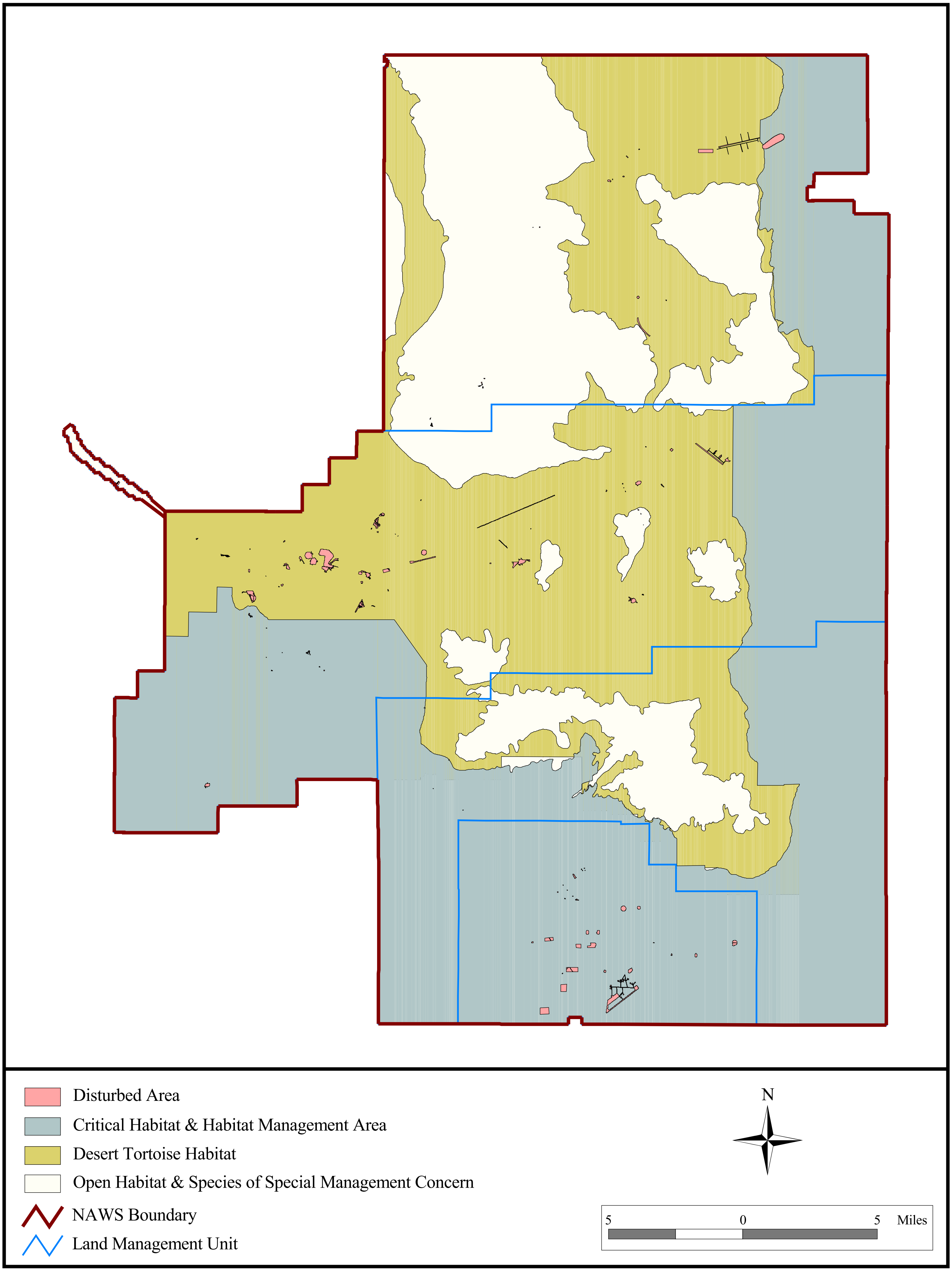


Figure 3-4 Natural Resources Management Priorities, South Range

Priority no. 4 designations refer to previously disturbed land areas associated with established land use patterns. Because of their continuing and intensive use as facility locations, roads, target and test sites, and other developed (high-intensity use) areas of concentrated activities, these areas are assigned a resource management priority no. 4. These areas account for approximately 18,549 acres (less than 2% of the total land area) of NAWS administered lands. Disturbed areas on the North Range are found at Armitage Airfield, Mainsite, Ordnance T&E, and Propulsion Laboratories land use management units. These areas also include the targets, test sites, and infrastructure locations throughout the North and South Ranges.

Cultural Resource Management Areas. Cultural resource management areas presented in this CLUMP are based on the current state of knowledge regarding cultural resources at NAWS. As our knowledge of these resources increases, these priority areas may change to reflect new data. The draft ICRMP for China Lake summarizes the existing cultural resources inventory, provides an historic context by which to evaluate resources for the National Register, identifies resource management goals and priorities, and describes the procedures to meet these goals. Figures 3-5 and 3-6 provide a general illustration of the cultural resources occurring on China Lake including areas that have been listed or recommended as eligible for the National Register (priority 1), areas where inventories and evaluations have not been completed (priority 2), areas where resources have been determined ineligible (priority 3), and areas where the ground surface is so distributed that intact resources could not be identified (priority 4).

Priority no. 1 designations refer to NHL and National Register Districts. Cultural resource management areas designated as priority no. 1 include all lands within the NHL boundaries, lands within the boundaries of the Sugarloaf Archaeological District, Salt Wells Pilot Plant, NAWS Pilot Plant Historic Districts, and all quarter sections of land that contain portions of National Register-listed or -eligible resources. This priority area totals approximately 113,118 acres (10% of total land area). Because of the large size of the NHL and the Sugarloaf District, most of the known high-priority areas are in the northwest and north-central portions of the North Range. Other priority no. 1 areas occur throughout the Station where National Register-eligible resources have been identified.

Priority no. 2 areas include quarter sections of land that contain recorded cultural resource areas where the National Register eligibility status is currently undetermined and non-surveyed areas located adjacent to intensive use zones. This area designation accounts for approximately 69,037 acres (6% of total land area). Recorded but unevaluated resources occur on all parts of the Station. Many recorded sites on both ranges are associated with other known cultural resources and are often found clustered around historic mining areas, such as Coso Village, Copper City, Junction Ranch, Wingate Pass, and Airport Lake, and in the eastern portion of Randsburg Wash and the Superior Valley.

Priority no. 3 areas include all non-surveyed lands that are not within the boundaries of the NHL or designated historic districts. Areas that have not been surveyed may contain resources that could be eligible for protection. Lands characterized as priority no. 3 management areas include large tracts of undeveloped land on both North and South Ranges. This area designation accounts for approximately 908,880 acres (82% of total land area).

Priority no. 4 management areas include surveyed areas where no eligible cultural resources have been found. This designation also includes previously disturbed areas, such as facilities, roads, equipment staging areas, target areas, and test sites. This area designation accounts for approximately 18,549 acres (2% of total land area).

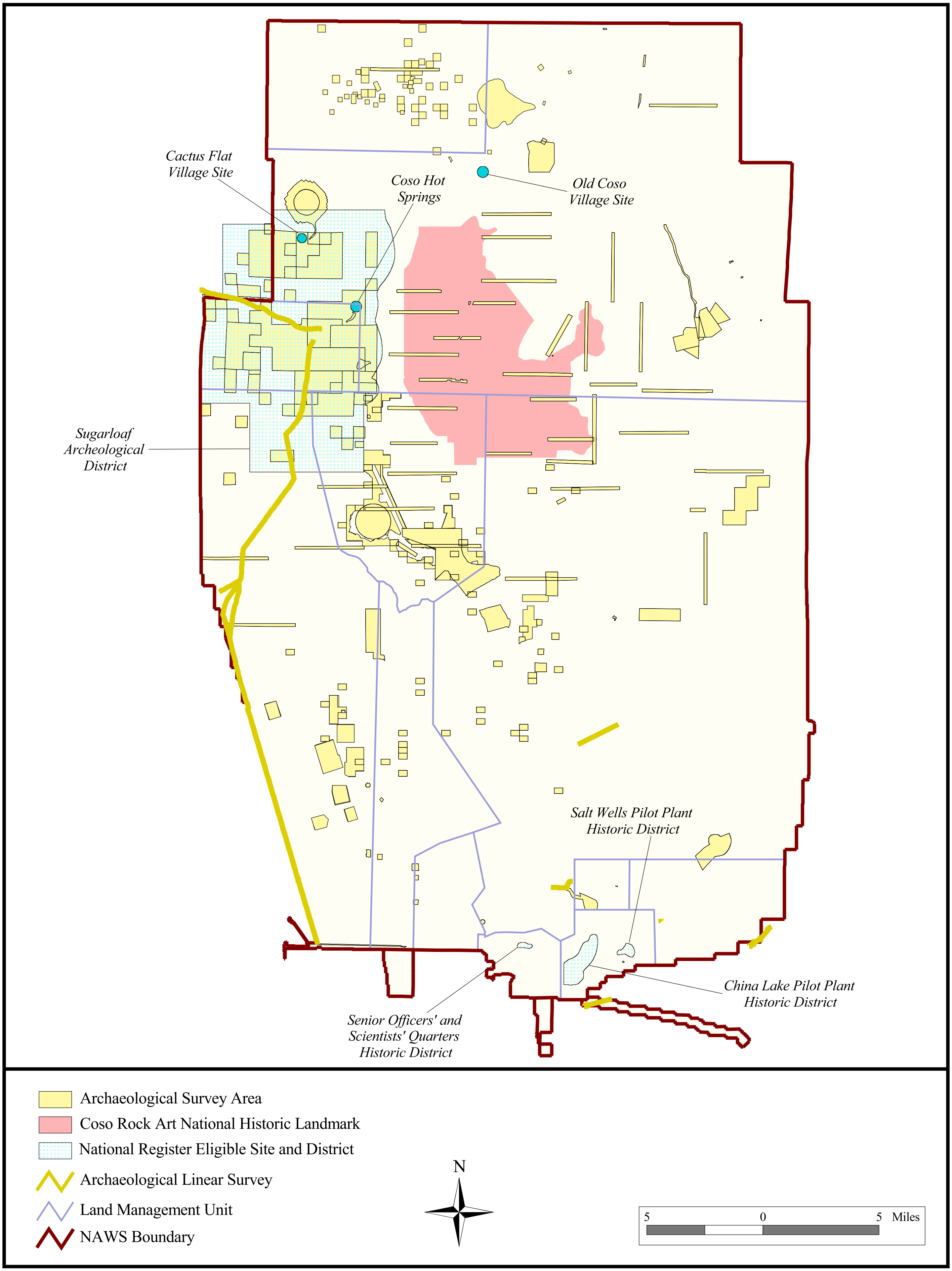


Figure 3-5 Cultural Resources, North Range

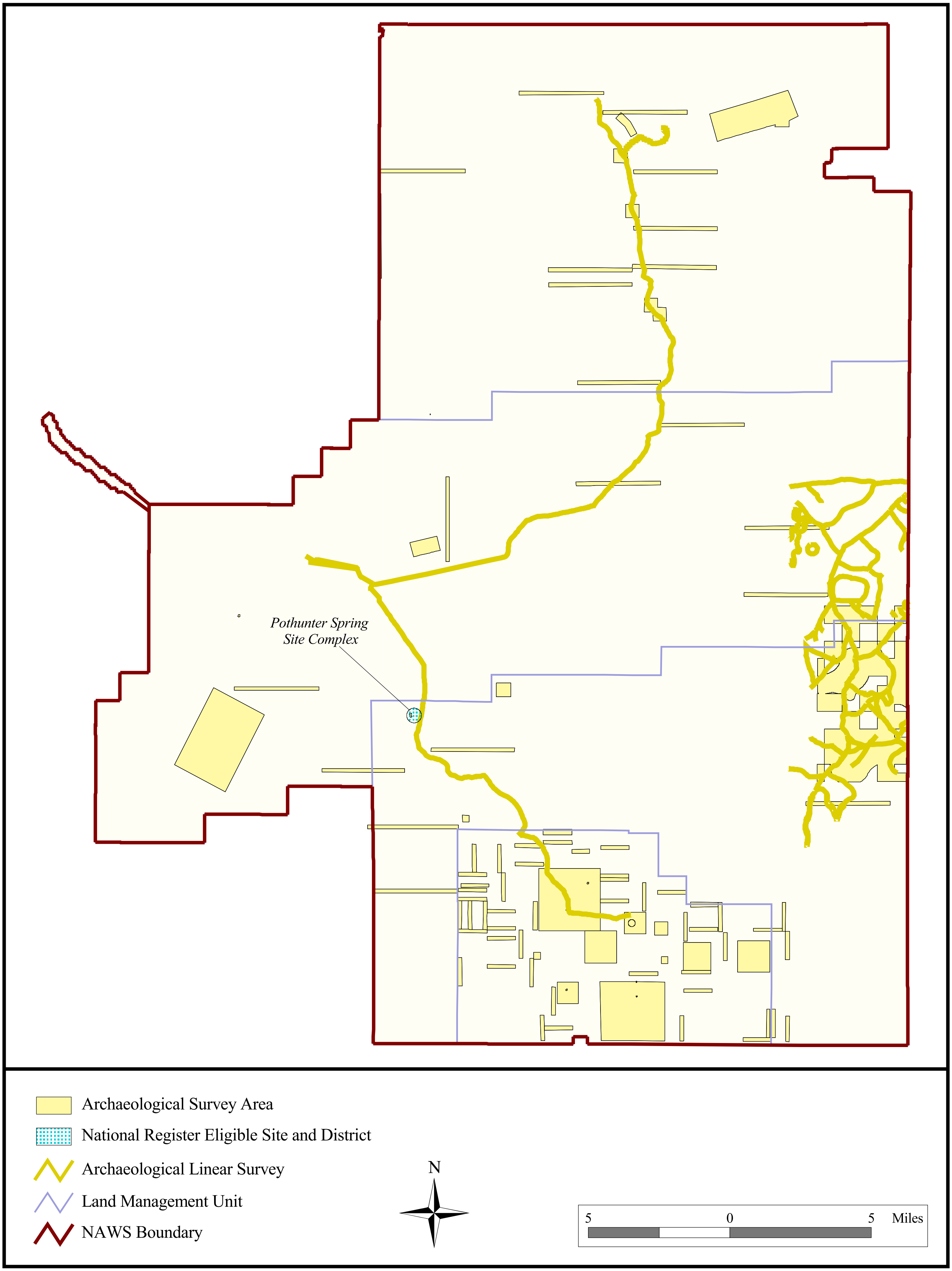


Figure 3-6 Cultural Resources, South Range

3.3 LAND USE MANAGEMENT OBJECTIVES AND GUIDELINES

Land use objectives and guidelines contained in this section describe China Lake's approach to achieving the land management goals established in Chapter 1. The land use management objectives and guidelines, which were developed from the keystone management plans referenced in Section 1.10, are intended to provide general guidance and direction for the management of Navy administered lands at China Lake over the term of this CLUMP. These guidelines were developed in accordance with the Station's land use management policies as noted in Section 1.5. Objectives and guidelines are presented in this Section for all referenced land use management goals except goal no. 2, *Improve the efficiency of land use management practices*, which is addressed Chapter 4.

3.3.1 Military Land Use

The following objectives and guidelines address the military land use goals described in Section 1.3 and were developed in accordance to the Station's policy that "all NAWS lands, whether held in fee simple or withdrawn from the public domain, are dedicated to meeting current and evolving Navy/DOD missions." NAWS policy advocates the placement of continuing and evolving military land uses, to the extent practicable, in previously disturbed areas to fully utilize existing operational assets and minimize adverse effects to sensitive resources.

CLUMP Goal No. 1.: Maintain and enhance core RDT&E, training and support capabilities.

Support Operations: Includes ongoing and emerging activities at Mainsite, airfield, ordnance storage magazines, the propulsion laboratories, and the ranges.

Objective 1-1: **Maintain and enhance existing and proposed facilities and infrastructure to meet current and evolving mission needs while complying with environmental requirements and ensuring military operational readiness.**

Guidelines

1. Locate new facilities within existing facility footprints or other previously disturbed areas to the extent practicable.
2. Coordinate all facilities siting, relocations, expansions, and/or changes in use through established screening and site approval processes.
3. Maintain and enhance core Station support operations facilities and infrastructure per requirements defined in the Station Facilities, Equipment, and Space Master Plan.
4. Withdraw from service any surplus facilities identified for retention (meet or exceed minimum codes/standards) and future reuse.
5. Demolish excess and/or substandard facilities and reclaim landscape to standards defined in the AMP (or applicable reclamation standard).
6. Site and construct new facilities and infrastructure in previously disturbed areas to the extent practicable and in accordance with applicable requirements.
7. Review proposed new uses or alterations to existing buildings or structures, in consultation with EPMD, to determine the eligibility of affected structures for National Register contributing elements. As needed, analyze for potential impacts in accordance with guidelines established for National Register-eligible buildings.

8. Conduct appropriate environmental surveys on any proposed new land use within an undeveloped area to identify sensitive natural and cultural resources and environmental resources, installation, restoration, project sites (IRP) (has waste cleanups).

Range Operations: Includes ongoing and emerging range use for military RDT&E and training activities.

Objective 1-2: **Develop and promote improved land range capabilities.**

Guidelines

1. Increase test and training realism though more realistic operational scenarios (i.e., night operations, countermeasures, GPS jamming, operating over a broader environment—open ocean, desert, mountains), simulations, target augmentation, and linkages with other services and ranges.
2. Pursue additional military use for the range that is compatible with the primary RDT&E mission.
3. Increase capability to schedule combinations of sub-ranges to support complex tests or exercises with large footprints.
4. Maintain and enhance electromagnetic (EM) capabilities at Etcheron Valley, Darwin Wash, and Coles Flat in the Coso Range, George Range, and the Electronic Combat Range in the Randsburg Wash Management Unit.
5. Support nonmilitary use to the extent consistent with RDT&E mission.

Objective 1-3: **Maintain capability to safely conduct test and training activities using live ordnance.**

Guidelines

1. Maintain and enhance dedicated target and test areas utilization with controlled access and restrictions on adding incompatible functions.
2. Continue policies and practices to direct the use of HEs to designated target and test sites, reintroduce the use of HE at historic use locations range-wide and accommodate tempo increases in response to customer needs.
3. Continue policies and practices to remove unexploded ordnance and range residue from ranges and test sites, to the extent possible, to avoid interference with acquisition of test data and to ensure the safety of personnel during test preparation and post-test recovery of test items for analysis.

Objective 1-4: **Modernize and expand networking capabilities, inter- and intra-range**.

Guidelines

1. Incorporate new technology compatible with all range-user requirements.
2. Link open-air range testing with laboratory facilities and personnel.
3. Link with other DoD test and training ranges to support RDT&E of long-range weapon systems, enhance realism, efficiently use test resources, and enhanced Fleet training.
4. Develop a phased plan to establish maximum instrumentation and communications coverage to appropriate portions of the ranges.

Objective 1-5: **Expand combined test and training operations**.

Guidelines

1. Support increased use of T&E ranges for RDT&E mission compatible training.
2. Promote compatible joint-service use of land, airspace, and facilities.
3. Increase integration of Fleet and joint-force training activities with weapons T&E and tactics development.
4. Promote increased use of Fleet firings to obtain RDT&E data.
5. Encourage foreign national use of test and training ranges.

Objective 1-6: **Protect unique characteristics of the range.**

Guidelines

1. Maintain land and airspace control to ensure safety, security and operational readiness.
2. Promote policies and practices that enhance and conserve the environmental quality of Range lands.
3. Control the electromagnetic environment to maintain and enhance EM capabilities.
4. Review new and modifications to existing facility locations to ensure compatibility with established land uses.
5. Conduct live-ordnance operations in a manner that does not degrade RDT&E resources and capabilities.
6. Maintain and enhance liaison with off-Station land management agencies to avoid mission encroachment from incompatible land uses.
7. Conduct training operations on previously disturbed land areas to the extent possible, minimizing new disturbances.

3.3.2 Environmental Management

The following objectives and guidelines for goal no. 3 are developed in accordance with the Station's INRMP and ICRMP, and Station policy, which states "NAWS will continue to comply with all applicable statutory and regulatory requirements (OPNAVINST 5090.1B) concerning its natural and cultural resources." In addition, it is Navy policy to protect and conserve environmental resources, to the extent practicable, located on its lands.

CLUMP Goal no. 3: Ensure compliance with statutes and regulations to protect and conserve sensitive natural and cultural resources, to maintain environmental quality, and to exercise responsible stewardship of Navy administered lands.

Natural Resources: Includes threatened and endangered species; NAWS-designated sensitive species; surface water resources, groundwater resources, wildlife habitat conservation, and management of feral animals.

Objective 3-1: **Maintain viable populations of endangered and threatened species on NAWS ranges. Listed species include the Mojave tui chub, desert tortoise, and the Inyo California towhee.**

Guidelines

1. Ensure compliance with the Federal Endangered Species Act, including adherence to existing Section 7 consultation agreements, biological opinions, and negotiated habitat management plans.
2. Ensure protection and conservation of species of special management concern.

3. Track, evaluate, and implement requirements of new laws and regulations, and modifications of existing laws and regulations as they pertain to natural resource management.

4 Formalize and continue the implementation of procedures to minimize the occurrence and effects of wildland fires in the Superior Valley portion of the Desert Tortoise Management Area.

Objective 3-2: **Acquire, maintain and update baseline data for protected and sensitive species. Ensure these data area available, as appropriate, to meet the Station's planning and management needs.**

Guidelines

1. Track the listing status of species being proposed for listing under the Federal Endangered Species Act.
2. Develop an accurate and complete GIS database of all federally listed species, species of special management concern and related features.
3. Develop and implement a bird/animal aircraft strike hazard (BASH) plan.

Objective 3-3: **Continue to inventory, protect, and enhance springs, seeps, other water sources and associated habitats**.

Guidelines

1. Complete inventory at springs, seeps, and other water sources and associated habitats to protect and conserve.
2. Continue the long-term program to complete the characterization of springs, seeps, and other water sources located on Station lands.
3. Design and implement procedures to monitor, assess, protect, and enhance Station surface water resources.
4. Provide appropriate protection to high-value habitats and water resources through the construction of fencing, and ensure the availability of water for designated species outside fenced areas.

Objective 3-4: **Continue the management of groundwater resources through the implementation of the goals and guidelines contained in the IWV Cooperative Groundwater Management Plan to ensure the availability of high-quality potable water to meet the Station's long-term needs.**

Guidelines

1. Continue to limit additional large-scale pumping in areas designated in the IWV Cooperative Groundwater Management Plan.
2. Distribute new groundwater production in a manner that minimizes adverse effects on existing use patterns.
3. Continue to advocate the use of treated water, reclaimed water, and recycled, gray, and lower-quality waters for appropriate applications.
4. Explore the utility of other groundwater management methods, such as water transfer, banking, imports, and replenishment.
5. Continue cooperative groundwater data-acquisition and coordination efforts.
6. Explore potential for improvements to cooperative management framework.

Objective 3-5: **Continue programs to conserve and protect wildlife habitat quality**.

Guidelines

1. Continue participation in range-wide land use planning processes to ensure that habitat impacts are minimized through avoidance of sensitive habitat areas.
2. Develop a complete and accurate GIS database of habitat types identifying biologic components and associated features.
3. Continue to conduct roundups and adoptions of horses and burros until designated management goals are attained.

Objective 3-6: **Participate, as needed, in potential off-Station cattle grazing operations in the Lacey-Cactus-McCloud Allotment.**

Guideline

Continue coordination with BLM concerning potential continued use of the Lacey-Cactus-McCloud grazing allotment on nonmilitary lands.

Objective 3-7: **Continue implementation of the wild horse and burro management program to maintain the wild horse herd at approximately 170 head and completely remove wild burros.**

Guidelines

1. Continue efforts to achieve INRMP goal to attain a feral burro population of 0 animals; continue implementation of burro removal with BLM and other land management agencies.
2. Continue efforts to achieve and maintain feral horse herd at approximately 170 animals, develop herd management plan in cooperation with BLM.
3. Develop, implement and maintain appropriate water development and distribution systems to achieve and maintain INRMP goals for water-related habitat management.

Cultural Resources: Includes prehistoric, historic, and Native American resource, artifact curation, and data management.

Objective 3-8: **Conserve and protect significant prehistoric, historic, and Native American resource**.

Guidelines

1. Develop and implement an ICRMP to formalize the NAWS Cultural Resource Management Program and integrate this program with other mission planning efforts.
2. Establish and implement efficient and cost-effective procedures for complying with Section 106 of the National Historic Preservation Act.
3. Develop and implement a Programmatic Agreement (PA) with the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (Council) regarding the implementation of the CLUMP and the draft ICRMP, for compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C.

Part 470). The proposed agreement would establish a more efficient, timely, and cost-effective way for the Station to meet its Section 106 and other historic preservation responsibilities.

4. Identify, evaluate, and implement appropriate conservation measures for National Register-eligible cultural resources.
5. Identify potential Native American traditional and religious sites and implement appropriate consultation and conservation measures.
6. Identify historic buildings and structures suitable for adaptive reuse.
7. Integrate Cultural Resources Management goals and guidelines into other appropriate planning and management processes.
8. Prioritize field studies to survey areas adjacent to Intensive Use Zones and Primary Buffer Zones. Integrate field study results in Station GIS data management system
8. Continue and enhance tribal, interagency, and public relations outreach efforts.

Objective 3-9: **Provide adequate curation of archaeological material recovered from the field and (2) the access to data acquired through field and archival research and oral history.**

Guidelines

1. Ensure that archaeological materials recovered from Station lands are appropriated curated.
2. Ensure that access to recovered materials is accommodated for appropriate, authorized research and educational efforts.

Objective 3-10: **Maintain and update complete and accurate baseline data for cultural resources management.**

Guidelines

1. Compile complete and accurate baseline data for cultural resource features and develop confidential GIS database of all cultural resource inventory data including results of evaluation and data recovery efforts.
2. Plan and implement a long-range sample survey of the entire installation to fill in data gaps for areas not previously surveyed.
3. Maintain and update database (maps, site records, and reports) to be accessible for reference, research, planning and management purposes.

3.3.3 Public Health and Safety

The following objectives and guidelines for CLUMP goal no. 4 were developed from existing management plans and processes, and are intended to ensure the health and safety of Station personnel and that of the neighboring communities.

CLUMP Goal no. 4: Continue to ensure a safe and secure military operating environment on NAWS administered lands.

Range Safety and Security

Objective 41: **Maintain control of access to range operational areas to prevent personnel exposure to test hazards and continue to provide adequate security measures for classified programs.**

Guidelines

1. Implement and disseminate, as needed, revised policy and procedures for accessing NAWS land.
2. Provide security patrolling of NAWS ranges.
3. Use appropriate gates to control range access.
4. Require special identification for all persons entering controlled access areas.
5. Install site-specific security measures for facilities and areas with special security needs.
6. Ensure that safety and security requirements are incorporated into decisions relating to nonmilitary use of lands.
7. Use appropriate safety and security procedures (Range Safety Manual (RSM) (NAWCWD Instruction 5100.2A)) for scheduling of military missions with other range-related activities.
8. Continue procedures to ensure safety and security when multiple activities occur on the NAWS lands.

Hazardous Substances Management

Objective 42: **Reduce the risk to human health and the environment from hazardous substance contamination caused by past operations at NAWS in a cost-effective manner.**

Guidelines

1. Comply with the procedural and substantive requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) and related state laws.
2. Follow the regulations set out in the National Contingency Plan (NCP) to identify, assess, and remediate past releases that pose a significant risk to human health or the environment.
3. Use a risk-management philosophy for programming, budgeting, and executing the program.
4. Seek out opportunities in each phase of the Installation Restoration Program (IRP) to accelerate remediation efforts.
5. Develop and implement stakeholder programs to ensure active participation by all affected parties.
6. Continue the application of appropriate restrictions for re-use of remediated land areas as described by applicable Records of Decision (see Appendix I).

AICUZ and Noise Abatement Programs

Objective 43: **Ensure compatible land use on- and off-Station, and implement efforts to minimize aircraft and mission-related noise effects on-Station and in surrounding communities, and minimize accident and incident risks to personnel and property from airfield and range aircraft operations on-Station.**

Guidelines

1. Minimize aircraft noise in the community while maintaining operational readiness and safety requirements through continued implementation of established noise abatement procedures.
2 Encourage mission compatible on- and off-Station land uses through participation in agency land use planning processes.
3 Maintain and enhance continued liaison with local and regional communities
4. Update the NAWS AICUZ plan in partnership with local community and agencies. Provide updated AICUZ plan to local governments for consideration in their comprehensive planning efforts. Use the AICUZ program guidelines to support land use planning and management to minimize incompatible use on surrounding lands.

3.3.4 Interagency Coordination

The following objectives and guidelines for CLUMP goal no. 5 are listed below. Per Station policy "the Navy will coordinate initiatives in the region, as appropriate, with other planning and management agencies involved in ecosystem management."

CLUMP Goal no. 5: Maintain and enhance coordination and cooperation with neighboring communities, agencies, and organizations.

Objective 5-1: **Continue to coordinate land-management initiatives with off-Station land-management agencies to ensure compatible land use development on adjacent lands**.

Guidelines

1. Maintain and enhance liaison with off-Station land-management agencies, including other military installations; local communities, including Ridgecrest, Trona, Inyokern, the Kern, San Bernardino and Inyo county agencies; Bureau of Land Management; National Park Service; United States Forest Service; Inyokern Airport Commission; and other agencies as needed.
2. Continue participation with the DoD/DOI Desert Managers Group and other appropriate collaborative land use and environmental management initiatives in the region to ensure compatible development of public lands adjacent to NAWS.

3.3.5 Nonmilitary Land Use

The following objectives and guidelines address CLUMP goal no. 6 describing the Station's approach to managing nonmilitary land uses in accordance with NAWS policy that "the Navy intends to accommodate nonmilitary land uses to the extent that these activities are compatible with the military mission and do not create adverse safety, security, fiscal, regulatory, or environmental effects." Nonmilitary land uses are grouped into four categories: (1) Native American interests, (2) educational and research activities, (3) recreational activities, and (4) commercial activities. The Navy will regulate nonmilitary land uses to avoid adverse effects to the Station's natural and cultural resources, and mission support capability while exercising the Station's public lands stewardship responsibility.

CLUMP Goal no. 6: Provide reasonable accommodation of compatible nonmilitary land use to the extent practicable.

Native American Access

Objective 6-1: **Continue and enhance efforts to accommodate tribal member access to sacred sites and traditional use areas to the extent practicable and consistent with military mission and security.**

Guidelines

1. Continue accommodation of site visitations according to the terms of the Navy and Tribal MOA and on a case-by-case basis as needed.
2. Continue to communicate with tribes on a nation-to-nation basis.
3. Continue to provide timely notice to and consult with tribal governments before taking actions that may have the potential to significantly affect sacred sites and traditional use areas.
3. Maintain and enhance effective communication, coordination, and co operation with tribes.

Education and Research

Objective 6-2: **Continue to provide access to China Lake lands for appropriate research and education efforts to the extent practicable and consistent with the military mission and security.**

Guidelines

1. Continue to seek and encourage the submittal of appropriate research proposals relating to environmental features of China Lake lands.
2. Continue to accommodate requests for access to NAWS lands for educational purposes
3. Provide direction and encourage the linkage of research proposals to fill data gaps in NAWS resource inventories.
3. Continue to require that the Station receive copies of any studies completed through education and research activities at China Lake.

Recreation

Objective 6-3: **Continue reasonable accommodation of public access for hiking, camping, photography, and petroglyph tours on a case-by-case, noninterference basis.**

Guidelines

1. Maintain current policies and procedures regarding public access to Little Petroglyph Canyon.
2. Maintain current policies and procedures regarding public access for other mission compatible recreational activities
3. Monitor the effects of recreational use / public access on natural and cultural resources.

Objective 6-4: **Update and implement policies and procedures for accommodating public access to NAWS ranges on a noninterference basis for recreational purposes.**

Guideline

1. Continue the case-by-case review of public access requests at NAWS.

Commercial Activities—Geothermal Development

Objective 65: **Continue geothermal production at NAWS in the existing Coso KGRA and continue geothermal exploration on the NAWS ranges.**

Guidelines

1. Continue current geothermal production operations in accordance with existing agreements and environmental documentation.
2. Continue to coordinate geothermal exploration efforts with appropriate NAWS and NAWCWD stakeholders
3. Continue efforts to minimize impacts to natural and cultural resources from geothermal production and exploration activities.
3. Coordinate geothermal production and exploration within the Coso KGRA with the BLM.

Commercial Activities—Cattle Grazing

Objective 6-6: **Participate in off-Station cattle grazing operations occurring in the Lacey-Cactus-McCloud Allotment.**

Guideline

Continue coordination with BLM concerning potential continued use of the Lacey-Cactus-McCloud grazing allotment on nonmilitary lands.

Commercial Activities—Easements

Objective 6-7: **Accommodate easement requests on a case-by-case basis.**

Guidelines

1. NAWS will consider appropriate easement requests on a case-by-case basis.
2. NAWS will continue to process approved easements in accordance with existing Navy regulations and other applicable guidance.
3. NAWS will continue to coordinate issuance of easements with the BLM per CDPA guidelines.

Commercial Activities—Filming

Objective 6-8: **Accommodate filming requests on a case-by-case basis.**

Guidelines

1. NAWS will consider appropriate requests for commercial filming activities on NAWS lands on a case-by-case basis.
2. NAWS may update and implement policies and procedures, as needed, for public access related to commercial filming.
3. All permitted commercial filming will comply with public access policy.
4. Commercial filming may be considered on the South Range access road. No commercial filming will be permitted on the South Range beyond the access road (Christmas Canyon Gate) because of safety and security considerations.

CHAPTER 4
PROJECT ADMINISTRATION AND IMPLEMENTATION

4.1 LAND USE MANAGEMENT PROCESS

The Station's land use management process facilitates NAWS ongoing military mission and stewardship responsibilities through the formal integration of land use planning, environmental resource management, and Navy procedures for implementing NEPA into a unified corporate management process.

To accomplish this integration and address CLUMP goal no. 2, land use planning, environmental resource management, and environmental review functions are consolidated into a comprehensive land use management and decision-making process. As stated in Chapter 1 (page 1-2) CLUMP goal no. 2 is to improve the efficiency of land use management practices to accommodate the ongoing and evolving military RDT&E, training, and support mission. Controlling land use and conserving environmental resources are land management responsibilities assigned to the CO of NAWS through the MOA, (Appendix B) between the Department of the Navy and the DOI. This MOA, established in accordance with the provisions of the CDPA, is consistent with Navy environmental management regulations defined in the Navy's Environmental and Natural Resources Program Manual (OPNAVINST 5090.1B).

This chapter describes the CLUMP implementation process that will be formalized through a NAWCWD instruction to be developed after Navy's ROD on the CLUMP and EIS. Oversight for CLUMP implementation will be the responsibility of the CO of NAWS. CLUMP implementation will include participation from the Pacific Ranges and Facilities Department, Research and Engineering Competency, EPMD, Public Works Department, PAO, General Counsel's Office, Air Operations Department, and others as assigned by the Commander of NAWCWD and/or the CO of NAWS.

4.2 LAND USE MANAGEMENT DECISION PROCESS

The NAWS land use management decision process comprises three basic components: land use planning, environmental resource management, and the NEPA process for the environmental review of ongoing and new land uses. This process is designed to evaluate the potential environmental effects of a proposed action and to use this information to make an informed decision how to accommodate the proposed use. A brief overview of the components and processes for making land use decisions is provided in the following sections.

4.2.1 Land Use Planning

Land use planning efforts are conducted for military activities occurring within Station boundaries and for off-Station activities involving city, county, state, or federal agency activities with the potential to affect NAWS operations.

On-Station Land Use Planning Efforts. On-Station land use planning efforts fall into three general categories: (1) test planning for range operations, (2) facilities planning for operations and maintenance (including R&D operations planning), and (3) planning for other nonmilitary activities. Off-Station planning efforts are conducted with agencies and the general public throughout the region involved in land use and environmental resource management initiatives.

Test Planning for Range Operations. Test planning for range operations involves all aspects of military T&E activities and aircrew and ground troop training activities.

Facilities Planning for Operations and Maintenance. Facilities planning efforts involve the siting, construction, and/or operation and maintenance of facilities and infrastructure throughout the developed areas of the Station and at remote facilities, targets and test sites, and other locations throughout the land ranges.

Planning for Other Nonmilitary Activities. Nonmilitary land use accommodated by NAWS include public access for Native American religious and traditional uses, research projects and educational programs, public recreational activities, such as the use of the Station's gymnasium, golf course, petroglyph tours, and other compatible activities, and commercial uses, such as the Coso Geothermal Project.

Off-Station Land Use Planning Efforts. Off-Station land uses are generally monitored by an ad-hoc process and are coordinated through the Land Use and Airspace Steering Committee (LUASC). The LUASC was established at NAWS in 1991 to review new land use proposals being generated both on and off the Station. These proposed actions are reviewed to ensure new land use being considered is compatible with existing military land use patterns and does not create a significant mission constraint or encroachment. Off-Station interagency coordination efforts are implemented through participation with city, county, state, and federal land management agencies involved in regional land use planning and environmental resource management projects.

4.2.2 Environmental Resource Management

The continued conservation and protection of sensitive environmental resources is ensured by the integration and implementation of the INRMP and ICRMP described in Chapter 1. These plans formally establish priority management areas, management goals, and guidelines for NAWS and define the baseline environmental resource conditions used in the CLUMP.

4.2.3 Public Health and Safety

Health and safety practices are implemented at NAWS through a variety of programs and instructions. These established practices address a wide range of military test, training and operational support activities.

Access to the NAWS ranges is controlled by NAWCWD Instruction 5520.2A and applies to all personnel entering the ranges. Safety procedures for range flight and ground operations are addressed in two primary directives, the RSM and Naval Air Systems Command Instruction 3960.4A. NAVAIR Instruction 3960.4A provides policies and procedures for the conduct of flight, ground and laboratory testing of air vehicles, weapons and installed systems. The RSM establishes safety guidelines and procedures for all aspect of range test and training operations conducted at the NAWS ranges.

Airfield flight operations safety considerations are addressed through the implementation of the Navy's AICUZ program as described in OPNAV Instruction 11010.36B. The AICUZ program is designed to protect public health and safety, and to prevent incompatible off-Station land uses from degrading the operational capability of military air installations. The

AICUZ program characterizes the noise environment associated with the Station's airfield operations (see Appendix G.2), and provides recommendations for land uses that are compatible with noise levels, accident potential and flight clearance requirements associated with military airfield operations. Flight safety considerations related to BASH are addressed through implementing the Station's BASH management plan. The BASH plan provides aviators with information on bird habitat and movements in the vicinity of the range and airfield.

Safety procedures related to ammunition and explosives use on the ranges are governed by Navy regulations published in NAVSEA OP.5, Volume I, and standard operations procedures contained in the RSM. Ordnance debris and unexploded ordnance on the ranges, called range residue, is addressed in accordance to DoD Directive 4715.11, "Environmental and Explosives Safety Management on Department of Defense Active and Inactive Ranges."

4.2.4 Applying the NEPA Process to Land Use Decisions

The NEPA process is implemented through a formal environmental review procedure that is applied to all proposed land use actions on NAWS-administered lands. This process, described in NAWCWD Instruction 5090.1A, defines the types of activities requiring environmental review and approval. The process flowchart (Figure 4-1) depicts the overall review process involved in making land use management decisions.

Through the NEPA process, environmental screening factors are applied to ongoing and new military test and training activities, facilities construction, operation and maintenance efforts, other related support activities, and nonmilitary use. These screening factors are used to examine the potential effects of the action on cultural resources, including prehistoric and historic values, Native American concerns, biological values, air quality, water quality, and hazardous waste/materials and other associated safety and environmental quality considerations. By analyzing the potential effects of proposed actions on sensitive resources, decision-makers ensure that potential environmental effects are factored into the land use decisions and that proposed use is implemented in accordance with environmental compliance requirements.

The NAWS land use decision process, illustrated in Figure 4-1, comprises the following four sequential steps.

Step 1. Description of Proposed Action. A project description (PD) is prepared by the proposing department's Environmental Coordinator (EC) in consultation with its customer. The PD describes the type of activity being proposed, the location of the activity, and the expected tempo of the action. The PD provides sufficient detail to support an analysis of the potential effects of the action on sensitive environmental resources (natural and cultural), environmental quality (air, water, noise pollution), safety, fire hazard, and its compatibility with other established land uses.

Step 2. Environmental Review. To start the process, an initial environmental review of the PD is performed by the Department's EC in consultation with EPMD, using the best available data, including CLUMP GIS-based decision support system. The purpose of this review is to determine if the proposed action conforms to existing environment documentation or the ROD for the CLUMP and EIS and its implementation plan. Review criteria to be used in this analysis include, but are not limited to, those listed in Section 4.3.2. If the EC and the EPMD concur that the criteria are met, the activity may proceed without further environmental review. The decision is rendered in a record of environmental consideration (REC) prepared by the EC and coordinated with the EPMD.

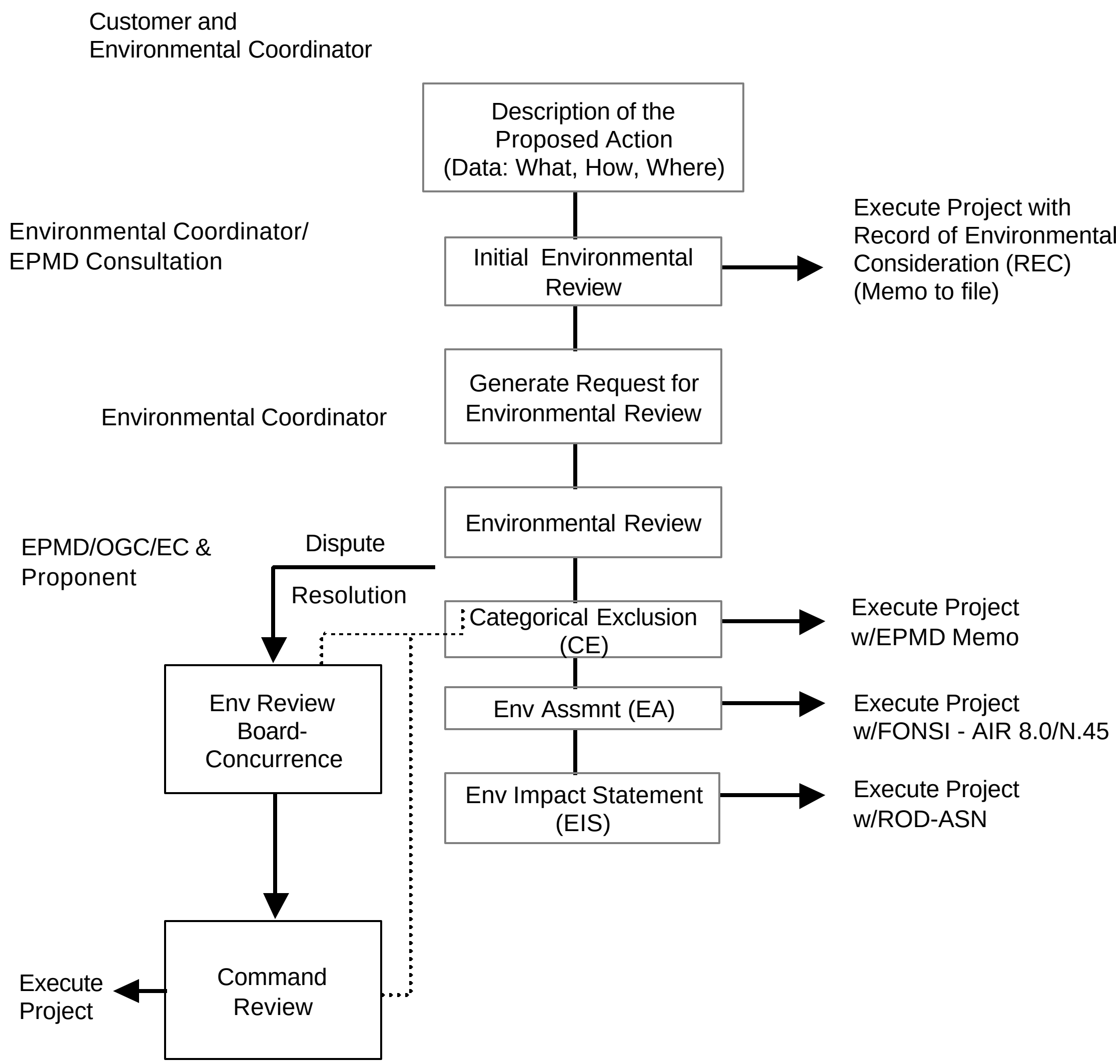


Figure 4-1. Environmental Review Process for Land Use Decisions.

If the initial environmental review concludes that the proposed action does not conform to existing documentation, the ROD criteria or if any uncertainty exists about the potential effects of an action, the proposing EC will forward a request for environmental review (NAWCWPNS form 5090/1) to the EPMD. The EPMD will then conduct a multidisciplinary review of the proposed action to determine which level of environmental analysis and documentation is required for that action, per the guidance described in NAWCWPNSINST 5090.1. Three outcomes are possible from this review:

1. If the environmental review concludes that the proposed action was, after all, in compliance with the ROD criteria or is already covered under an existing environmental document (Environmental Assessment (EA) or EIS), this conclusion is documented as an REC and processed accordingly.
2. If the proposed action meets the criteria of a categorical exclusion (CE), that determination is documented by an EPMD memorandum citing the appropriate exclusion per OPNAVINST 5090.1B.
3. If the proposed action does not meet the criteria for a REC or CE and has the potential for significant environmental impact, the action will undergo review by an EA or EIS, as appropriate.

All records of environmental reviews (REC, CE, EA, EIS) will be maintained by the EPMD, with copies provided to the project proponent. The Office of General Counsel (OGC) supports the environmental review process. In the event that the EC and the EPMD do not agree, the issue will be resolved in accordance with the process described in Figure 4-1. Initial resolution is sought through an environmental review board. If disagreement persists, resolution is then pursued through consultation of the Environmental Review Board (ERB) staff with the proposing department head and the NAWS CO.

Step 3. Land Use Decision. After receiving the results of the environmental review, the proponent decides how to proceed with the proposed action.

Step 4. Environmental Document. Environmental documentation of the land use decision will be prepared in accordance with the environmental review process described in OPNAVINST 5090.1B.

4.3 IMPLEMENTATION TOOLS

4.3.1 Project Review Process and Factors

The project review process uses the information provided by the project proponent (project description) and baseline environmental information contained in the GIS to perform a compatibility and compliance analysis. Applying the compatibility and compliance factors described in the following paragraphs allows the reviewer to determine if the proposed action has the potential to adversely affect existing mission-support capabilities and sensitive environmental resources.

Land Use Compatibility. Project review process and factors for land use compatibility are determined as follows.

1. Is the proposed use similar to historical land use (types and tempo)?
2. Is the proposed use similar to current land use (types and tempo)?
3. Is the proposed use similar to adjacent land use (types and tempo)?
4. Will the proposed land use have adverse or limiting effects on existing or adjacent use?
5. Will the proposed use result in additional land surface disturbances?
6. Is ordnance use consistent with the Range Target and Ordnance Use Matrix, as described in Appendix C?
7. Is the proposed use compatible with applicable CERCLA and RCRA requirements?

Environmental Compliance. Project review process and factors for environmental compliance are determined as follows.

Does the proposed use affect

1. Natural resources, including threatened, endangered, or NAWS-sensitive species?
2. Eligible archaeological resources?
3. Eligible historic structures?
4. Surface water resources?
5. Groundwater resources?
6. Existing air quality attainment status/conformity?

7. Noise levels on and off Station?
8. Permits for generating and storing hazardous wastes?
9. CERCLA and RCRA requirements?

4.3.2 Geographic Information System

The CLUMP GIS is a computer-based information management system that links planners, technicians, managers, and customers to available baseline information, describing a variety of physical, land use, and environmental features of NAWS lands. NAWS CLUMP GIS allows users to access detailed site information about any location at NAWS and to support planning and management decision processes. The CLUMP GIS is designed to support range operations planning, facilities planning, and management efforts, environmental resource management programs, and the environmental review process.

4.3.3 Keystone Management Plans

The keystone management plans described in Chapter 1 establish the respective management goals and guidelines to be achieved through the implementation of the CLUMP. The baseline environmental resources and land use patterns defined by these plans will be updated as needed. This information will be integrated into the CLUMP GIS database to ensure that the most complete and accurate information is available to support the land use decision-making process at NAWS. The implementing organizations for each of the keystone plans will be responsible for monitoring progress toward achieving their respective goals. The CLUMP will remain a living document that provides accurate, complete, and easy to use guidance for land use and environmental management initiatives for the Navy, its customers, partnering and interested agencies, and the general public.

The keystone management plans described in Chapter 1, Section 1.10 will continue to define baseline conditions at NAWS and to identify specific management objectives and priorities for the CLUMP.

4.4 Implementation Requirements

A CLUMP implementation plan will be developed in response to the Navy EIS/ROD. This plan will be made operational through a NAWCWD instruction defining organizational roles, responsibilities, and implementing procedures.

The NAWCWD NEPA instruction will be updated to include the criteria for developing project descriptions, to accommodate changes (if any) required by the EIS/ROD, and to apply consistent processes and direction between NAWS' China Lake and Point Mugu sites.

A GIS business and environmental decision support system implementation plan will be developed to include a description of the concept of operations, a list of system users, data management requirements, networking requirements, and an operations and maintenance plan.

Compatibility review criteria for the GIS decision support system will be further developed and maintained to facilitate the CLUMP implementation and environmental review process as needed to meet NAWS and NAWCWD mission-support requirements.

TITLE VIII--MILITARY LANDS AND OVERFLIGHTS

SEC. 801. SHORT TITLE AND FINDINGS.

(a) SHORT TITLE - This title may be cited as the `California Military Lands Withdrawal and Overflights Act of 1994'.
(b) FINDINGS - The Congress finds that--
(1) military aircraft testing and training activities as well as demilitarization activities in California are an important part of the national defense system of the United States, and are essential in order to secure for the American people of this and future generations an enduring and viable national defense system;
(2) the National Park System units and wilderness areas designated by this Act lie within a region critical to providing training, research, and development for the Armed Forces of the United States and its allies;
(3) there is a lack of alternative sites available for these military training, testing, and research activities;
(4) continued use of the lands and airspace in the California desert region is essential for military purposes; and
(5) continuation of these military activities, under appropriate terms and conditions, is not incompatible with the protection and proper management of the natural, environmental, cultural, and other resources and values of the Federal lands in the California desert area.

SEC. 802. MILITARY OVERFLIGHTS.

(a) OVERFLIGHTS - Nothing in this Act, the Wilderness Act, or other land management laws generally applicable to the new units of the National Park or Wilderness Preservation Systems (or any additions to existing units) designated by this Act, shall restrict or preclude low-level overflights of military aircraft over such units, including military overflights that can be seen or heard within such units.
(b) SPECIAL AIRSPACE - Nothing in this Act, the Wilderness Act, or other land management laws generally applicable to the new units of the National Park or Wilderness Preservation Systems (or any additions to existing units) designated by this Act, shall restrict or preclude the designation of new units of special airspace or the use or establishment of military flight training routes over such new park system or wilderness units.
(c) NO EFFECT ON OTHER LAWS - Nothing in this section shall be construed to modify, expand, or diminish any authority under other Federal law.

SEC. 803. WITHDRAWALS.

(a) CHINA LAKE - (1) Subject to valid existing rights and except as otherwise provided in this title, the Federal lands referred to in paragraph (2), and all other areas within the boundary of such lands as depicted on the map specified in such paragraph which may become subject to the operation of the public land laws, are hereby withdrawn from all forms of appropriation under the public land laws (including the mining laws and the mineral leasing laws). Such lands are reserved for use by the Secretary of the Navy for--
(A) use as a research, development, test, and evaluation laboratory;
(B) use as a range for air warfare weapons and weapon systems;
(C) use as a high hazard training area for aerial gunnery, rocketry, electronic warfare and countermeasures, tactical maneuvering and air support;

(D) geothermal leasing and development and related power production activities; and
(E) subject to the requirements of section 804(f) of this title, other defense-related purposes consistent with the purposes specified in this paragraph.

(2) The lands referred to in paragraph (1) are the Federal lands located within the boundaries of the China Lake Naval Weapons Center, comprising approximately one million one hundred thousand acres in Inyo, Kern, and San Bernardino Counties, California, as generally depicted on a map entitled `China Lake Naval Weapons Center Withdrawal--Proposed', dated January 1985.

(b) CHOCOLATE MOUNTAIN- (1) Subject to valid existing rights and except as otherwise provided in this title, the Federal lands referred to in paragraph (2), and all other areas within the boundary of such lands as depicted on the map specified in such paragraph which may become subject to the operation of the public land laws, are hereby withdrawn from all forms of appropriation under the public land laws (including the mining laws and the mineral leasing and the geothermal leasing laws). Such lands are reserved for use by the Secretary of the Navy for--

(A) testing and training for aerial bombing, missile firing, tactical maneuvering and air support; and
(B) subject to the provisions of section 804(f) of this title, other defense-related purposes consistent with the purposes specified in this paragraph.

(2) The lands referred to in paragraph (1) are the Federal lands comprising approximately two hundred twenty-six thousand seven hundred and eleven acres in Imperial County, California, as generally depicted on a map entitled `Chocolate Mountain Aerial Gunnery Range Proposed--Withdrawal' dated July 1993.

SEC. 804. MAPS AND LEGAL DESCRIPTIONS.

(a) PUBLICATION AND FILING REQUIREMENT - As soon as practicable after the date of enactment of this title, the Secretary shall--

(1) publish in the Federal Register a notice containing the legal description of the lands withdrawn and reserved by this title; and
(2) file maps and the legal description of the lands withdrawn and reserved by this title with the Committee on Energy and Natural Resources of the United States Senate and the Committee on Natural Resources of the United States House of Representatives.

(b) TECHNICAL CORRECTIONS - Such maps and legal descriptions shall have the same force and effect as if they were included in this title except that the Secretary may correct clerical and typographical errors in such maps and legal descriptions.

(c) AVAILABILITY FOR PUBLIC INSPECTION - Copies of such maps and legal descriptions shall be available for public inspection in the appropriate offices of the Bureau of Land Management; the office of the commander of the Naval Weapons Center, China Lake, California; the office of the commanding officer, Marine Corps Air Station, Yuma, Arizona; and the Office of the Secretary of Defense, Washington, District of Columbia.

(d) REIMBURSEMENT - The Secretary of Defense shall reimburse the Secretary for the cost of implementing this section.

SEC. 805. MANAGEMENT OF WITHDRAWN LANDS.

(a) MANAGEMENT BY THE SECRETARY OF THE INTERIOR - (1) Except as provided in subsection (g), during the period of the withdrawal the Secretary shall manage the lands withdrawn under section 802 of this title pursuant to the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 et seq.) and other applicable law, including this title.

(2) To the extent consistent with applicable law and Executive orders, the lands withdrawn under section 802 of this title may be managed in a manner permitting--

(A) the continuation of grazing pursuant to applicable law and Executive orders were permitted on the date of enactment of this title;
(B) protection of wildlife and wildlife habitat;
(C) control of predatory and other animals;
(D) recreation (but only on lands withdrawn by section 802(a) of this title (relating to China Lake));
(E) the prevention and appropriate suppression of brush and range fires resulting from nonmilitary activities; and
(F) geothermal leasing and development and related power production activities on the lands withdrawn under section 802(a) of this title (relating to China Lake).

(3)(A) All nonmilitary use of such lands, including the uses described in paragraph (2), shall be subject to such conditions and restrictions as may be necessary to permit the military use of such lands for the purposes specified in or authorized pursuant to this title.
(B) The Secretary may issue any lease, easement, right-of-way, or other authorization with respect to the nonmilitary use of such lands only with the concurrence of the Secretary of the Navy.
(b) CLOSURE TO PUBLIC - (1) If the Secretary of the Navy determines that military operations, public safety, or national security require the closure to public use of any road, trail, or other portion of the lands withdrawn by this title, the Secretary may take such action as the Secretary determines necessary or desirable to effect and maintain such closure.
(2) Any such closure shall be limited to the minimum areas and periods which the Secretary of the Navy determines are required to carry out this subsection.
(3) Before and during any closure under this subsection, the Secretary of the Navy shall--

(A) keep appropriate warning notices posted; and
(B) take appropriate steps to notify the public concerning such closures.

(c) MANAGEMENT PLAN - The Secretary (after consultation with the Secretary of the Navy) shall develop a plan for the management of each area withdrawn under section 802 of this title during the period of such withdrawal. Each plan shall--

(1) be consistent with applicable law;
(2) be subject to conditions and restrictions specified in subsection (a)(3);
(3) include such provisions as may be necessary for proper management and protection of the resources and values of such area; and
(4) be developed not later than three years after the date of enactment of this title.

(d) BRUSH AND RANGE FIRES - The Secretary of the Navy shall take necessary precautions to prevent and suppress brush and range fires occurring within and outside the lands withdrawn under section 802 of this title as a result of military activities and may seek assistance from the Bureau of Land Management in the suppression of such fires. The memorandum of understanding required by subsection (e) shall provide for Bureau of Land Management assistance in the suppression of such fires, and for a transfer of funds from the Department of the Navy to the Bureau of Land Management as compensation for such assistance.
(e) MEMORANDUM OF UNDERSTANDING - (1) The Secretary and the Secretary of the Navy shall (with respect to each land withdrawal under section 802 of this title) enter into a memorandum of understanding to implement the management plan developed under subsection (c). Any such memorandum of understanding shall provide that the Director of the Bureau of Land Management shall provide assistance in the suppression of fires resulting from the military use of lands withdrawn under section 802 if requested by the Secretary of the Navy.
(2) The duration of any such memorandum shall be the same as the period of the withdrawal of the lands under section 802.
(f) ADDITIONAL MILITARY USES - Lands withdrawn under section 802 of this title may be used for defense-related uses other than those specified in such section. The Secretary of Defense shall promptly notify the Secretary in the event that the lands withdrawn by this title will be used

for defense-related purposes other than those specified in section 802. Such notification shall indicate the additional use or uses involved, the proposed duration of such uses, and the extent to which such additional military uses of the withdrawn lands will require that additional or more stringent conditions or restrictions be imposed on otherwise-permitted nonmilitary uses of the withdrawn land or portions thereof.

(g) MANAGEMENT OF CHINA LAKE - (1) The Secretary may assign the management responsibility for the lands withdrawn under section 802(a) of this title to the Secretary of the Navy who shall manage such lands, and issue leases, easements, rights-of-way, and other authorizations, in accordance with this title and cooperative management arrangements between the Secretary and the Secretary of the Navy: *Provided,* That nothing in this subsection shall affect geothermal leases issued by the Secretary prior to the date of enactment of this title, or the responsibility of the Secretary to administer and manage such leases, consistent with the provisions of this section. In the case that the Secretary assigns such management responsibility to the Secretary of the Navy before the development of the management plan under subsection (c), the Secretary of the Navy (after consultation with the Secretary) shall develop such management plan.

(2) The Secretary shall be responsible for the issuance of any lease, easement, right-of-way, and other authorization with respect to any activity which involves both the lands withdrawn under section 802(a) of this title and any other lands. Any such authorization shall be issued only with the consent of the Secretary of the Navy and, to the extent that such activity involves lands withdrawn under section 802(a), shall be subject to such conditions as the Secretary of the Navy may prescribe.

(3) The Secretary of the Navy shall prepare and submit to the Secretary an annual report on the status of the natural and cultural resources and values of the lands withdrawn under section 802(a). The Secretary shall transmit such report to the Committee on Energy and Natural Resources of the United States Senate and the Committee on Natural Resources of the United States House of Representatives.

(4) The Secretary of the Navy shall be responsible for the management of wild horses and burros located on the lands withdrawn under section 802(a) of this title and may utilize helicopters and motorized vehicles for such purposes. Such management shall be in accordance with laws applicable to such management on public lands and with an appropriate memorandum of understanding between the Secretary and the Secretary of the Navy.

(5) Neither this title nor any other provision of law shall be construed to prohibit the Secretary from issuing and administering any lease for the development and utilization of geothermal steam and associated geothermal resources on the lands withdrawn under section 802(a) of this title pursuant to the Geothermal Steam Act of 1970 (30 U.S.C. 1001 et seq.) and other applicable law, but no such lease shall be issued without the concurrence of the Secretary of the Navy.

(6) This title shall not affect the geothermal exploration and development authority of the Secretary of the Navy under section 2689 of title 10, United States Code, except that the Secretary of the Navy shall obtain the concurrence of the Secretary before taking action under that section with respect to the lands withdrawn under section 802(a).

(7) Upon the expiration of the withdrawal or relinquishment of China Lake, Navy contracts for the development of geothermal resources at China Lake then in effect (as amended or renewed by the Navy after the date of enactment of this title) shall remain in effect: *Provided,* That the Secretary, with the consent of the Secretary of the Navy, may offer to substitute a standard geothermal lease for any such contract.

SEC. 806. DURATION OF WITHDRAWALS.

(a) DURATION - The withdrawals and reservations established by this title shall terminate twenty years after the date of enactment of this title.
(b) DRAFT ENVIRONMENTAL IMPACT STATEMENT - No later than eighteen years after the date of enactment of this title, the Secretary of the Navy shall publish a draft environmental impact statement concerning continued or renewed withdrawal of any portion of the lands withdrawn by this title for which that Secretary intends to seek such continued or renewed withdrawal. Such draft environmental impact statement shall be consistent with the requirements of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.) applicable to such a draft environmental impact statement. Prior to the termination date specified in subsection (a), the Secretary of the Navy shall hold a public hearing on any draft environmental impact statement published pursuant to this section. Such hearing shall be held in the State of California in order to receive public comments on the alternatives and other matters included in such draft environmental impact statement.
(c) EXTENSIONS OR RENEWALS - The withdrawals established by this title may not be extended or renewed except by an Act or joint resolution of Congress.

SEC. 807. ONGOING DECONTAMINATION.

(a) PROGRAM - Throughout the duration of the withdrawals made by this title, the Secretary of the Navy, to the extent funds are made available, shall maintain a program of decontamination of lands withdrawn by this title at least at the level of decontamination activities performed on such lands in fiscal year 1986.
(b) REPORTS - At the same time as the President transmits to the Congress the President's proposed budget for the first fiscal year beginning after the date of enactment of this title and for each subsequent fiscal year, the Secretary of the Navy shall transmit to the Committees on Appropriations, Armed Services, and Energy and Natural Resources of the United States Senate and to the Committees on Appropriations, Armed Services, and Natural Resources of the United States House of Representatives a description of the decontamination efforts undertaken during the previous fiscal year on such lands and the decontamination activities proposed for such lands during the next fiscal year including--

(1) amounts appropriated and obligated or expended for decontamination of such lands;
(2) the methods used to decontaminate such lands;
(3) amount and types of contaminants removed from such lands;
(4) estimated types and amounts of residual contamination on such lands; and
(5) an estimate of the costs for full contamination of such lands and the estimate of the time to complete such decontamination.

SEC. 808. REQUIREMENTS FOR RENEWAL.

(a) NOTICE AND FILING - (1) No later than three years prior to the termination of the withdrawal and reservation established by this title, the Secretary of the Navy shall advise the Secretary as to whether or not the Secretary of the Navy will have a continuing military need for any of the lands withdrawn under section 802 after the termination date of such withdrawal and reservation.
(2) If the Secretary of the Navy concludes that there will be a continuing military need for any of such lands after the termination date, the Secretary of the Navy shall file an application for extension of the withdrawal and reservation of such needed lands in accordance with the

regulations and procedures of the Department of the Interior applicable to the extension of withdrawals of lands for military uses.

(3) If, during the period of withdrawal and reservation, the Secretary of the Navy decides to relinquish all or any of the lands withdrawn and reserved by this title, the Secretary of the Navy shall file a notice of intention to relinquish with the Secretary.

(b) CONTAMINATION - (1) Before transmitting a notice of intention to relinquish pursuant to subsection (a), the Secretary of Defense, acting through the Department of the Navy, shall prepare a written determination concerning whether and to what extent the lands that are to be relinquished are contaminated with explosive, toxic, or other hazardous materials.

MEMORANDUM OF AGREEMENT
between the
SECRETARY of the INTERIOR
and
SECRETARY of the NAVY
regarding
Management of Withdrawn Lands
at the
Naval Air Weapons Station, China Lake

This Memorandum of Agreement (MOA) is entered into this 11 day of March, 1996.

WHEREAS, the California Desert Protection Act (the Desert Act), Public Law 103-433, 1994, reauthorized the withdrawal of certain public lands within California for continued use by the Department of the Navy for military research, development, test and evaluation, training and demilitarization activities;

WHEREAS, Section 805, subsection (g), of the Desert Act provided the Secretary of the Interior the authority to assign management responsibility for these withdrawn lands to the Secretary of the Navy;

WHEREAS, the Naval Air Weapons Station, China Lake and the Bureau of Land Management in California enjoy a long-standing cooperative relationship concerning land resources management in the California Mojave Desert region;

WHEREAS, in furtherance of this cooperation, the Secretary of the Interior, acting through the California State Director, Bureau of Land Management desires to formally assign land management responsibility for China Lake withdrawn lands to the Secretary of the Navy and establish the cooperative arrangements described in Section 805, subsection (g) of the Desert Act;

WHEREAS, the Secretary of the Navy desires to accept such responsibility and, through the Commanding Officer, Naval Air Weapons Station, China Lake, to cooperatively develop a land management plan for China Lake and to otherwise meet all applicable requirements of the Desert Act.

NOW THEREFORE, the parties hereby agree as follows:

1. The Secretary of the Interior;
Does hereby assign management responsibility of the China Lake withdrawn lands to the Secretary of the Navy in accordance with the provisions of the Desert Act and the terms of this agreement.

2. The Secretary of the Navy;
Does hereby accept the management responsibility for the China Lake withdrawn lands and, through the Commanding Officer, Naval Air Weapons Station, China Lake, agrees to manage these withdrawn lands in accordance with the Desert Act and the terms of this agreement.

3. The Naval Air Weapons Station (NAWS), China Lake will:

a. Cooperatively develop the management plan and supporting documentation for China lake withdrawn lands in partnership with the Bureau of Land Management (BLM) and other agencies as required by the Desert Act.

b. Develop and submit to the BLM annual reports to Congress on the status of natural and cultural resources and values of the withdrawn lands as required by the Desert Act.

c. Continue cooperative management programs with the BLM on China Lake withdrawn lands in accordance with the provisions of section 805 of the Desert Act.

d. Continue decontamination programs at China Lake and submit annual status reports to Congress as required by the Desert Act.

e. Participate, to the fullest practical extent, in regional ecosystem management and biodiversity initiatives such as the Western Mojave Coordinated Management Plan and the Mojave Desert Ecosystem Initiative.

4. The Bureau of Land Management (BLM) will;

a. Provide the necessary resources to cooperatively support the timely preparation and review of the China Lake management plan and other documents required by the Desert Act.

b. Provide the necessary resources to support cooperative management programs at China Lake.

c. Review and route to appropriate Congressional committees those annual reports on natural and cultural resources and values of withdrawn lands prepared by the NAWS in accordance with the provisions of the Desert Act.

5. Administration;

a. For the purposes of this Agreement, the Commanding Officer of NAWS China Lake shall act as the representative of the Secretary of the Navy and the California State Director of BLM shall act as the representative of the Secretary of the Interior.

b. Nothing in this MOA shall be construed as obligating the NAWS or the BLM to expend funds in excess of appropriations authorized by law.

c. The NAWS and the BLM agree to coordinate the development and implementation of the plans and reports, described herein, as required by the Act and other appropriate directives.

d. This MOA will be reviewed by both parties every three years to determine its adequacy, effectiveness, and need for revision.

e. NAWS and the BLM may enter into supplemental agreements as necessary to further clarify working relationships or for specific projects or activities. Supplemental agreements may provide for the transfer of funds to accomplish mutually beneficial programs or services.

f. Either party may propose changes to this MOA during its term. Such changes will be in the form of amendments and will become effective upon signature by both parties. Such amendments may be signed by the signatory or that person's successor or designee.

g. This MOA will become effective upon signature by both parties and will remain in effect until amended by mutual written agreement.

Bureau of Land Management	Department of the Navy
Ed Hastey	Duncan Holaday
California State Director	Deputy Assistant Secretary (Installations and Facilities)
Date 10/31/95	Date 11 March 96

Appendix C. Range Target and Ordnance Use Matrix

APPENDIX C. RANGE TARGET AND ORDNANCE USE MATRIX

Source for all Tables: US Navy 1998**.**

Table C-1. Weapon Systems Tested on Baker Range.

Target	HE Use	Bombs	Rockets/Missiles	Guns	Other
B-1 (inert only)	No	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in., Unguided	7.62 to 40mm	Flares, Chaff, Smoke
B-1A	No	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in., Unguided	7.62 to 40mm	Flares, Chaff, Smoke
B-1D	No	N/A	N/A	N/A	Passive Target
B-1F	Yes	Practice, Gravity, Guided, Inert Cluster, Fuel Air Explosives (FAE)	2.75 to 5.0 in., Unguided	7.62 to 40mm	Flares, Chaff, Smoke
B-2	Yes	Practice, Gravity, Guided, Inert Cluster, Fire	2.75 to 5.0 in., Unguided	7.62 to 40mm	Flares, Chaff, Smoke
B-3	No	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in., Unguided	7.62 to 40mm	Flares, Chaff, Smoke
LB	No	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in., Unguided	7.62 to 40mm	Flares, Chaff, Smoke
Sandy Van	No	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in., Unguided	7.62 to 40mm	Flares, Chaff, Smoke

Static and moving land targets are also used on Baker Range target areas.

Table C-2. Weapon Systems Tested on Charlie Range.

Target	HE Use	Bombs	Rockets/Missiles	Guns	Other
C-1	Yes	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in.	7.62 to 40mm	Flares, Chaff, Smoke
C-2	Yes	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in.	7.62 to 40mm	Flares, Chaff, Smoke
C-3 #1	Yes	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in.	7.62 to 40mm	Flares, Chaff, Smoke
C-3 #2	Yes	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in.	7.62 to 40mm	Flares, Chaff, Smoke
C-3 SAM	Yes	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in., Cruise	7.62 to 40mm	Flares, Chaff, Smoke
North Charlie Target	No	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in.	7.62 to 40mm	Flares, Chaff, Smoke

Table C-3. Weapon Systems Tested on Airport Lake.

Target	HE Use	Bombs	Rockets/Missiles	Guns	Other
APL	Yes	Practice, Gravity, Guided, HE Cluster, Fire, FAE	2.75 to 5.0 in., Guided, Anti-radiation, Cruise	7.62 to 155mm, Rocket-Assisted Projectiles	Flares, Chaff, Smoke
HABR	Yes	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in., Guided, Anti-radiation, Cruise	7.62 to 155mm, Rocket-Assisted Projectiles	Flares, Chaff, Smoke
Sams Town	Yes	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in., Guided, Cruise	7.62 to 155mm, Rocket-Assisted Projectiles	Flares, Chaff, Smoke
Convoy	Yes	Practice, Gravity, Guided	2.75 to 5.0 in., Guided, Cruise	7.62 to 155mm, Rocket-Assisted Projectiles	Flares, Chaff, Smoke
Gunbutts	Yes	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in., Guided, Cruise	7.62 to 155mm, Rocket-Assisted Projectiles	Flares, Chaff, Smoke
Maverick Road	Yes	Practice, Gravity, Guided	2.75 to 5.0 in., Guided, Cruise	7.62 to 155mm, Rocket-Assisted Projectiles	Flares, Chaff, Smoke
Vaby	Yes	Practice, Gravity, Guided	2.75 to 5.0 in., Guided, Cruise	7.62 to 155mm, Rocket-Assisted Projectiles	Flares, Chaff, Smoke

- Much of what goes into Airport Lake is live, i.e., HE.
- Static and moving land targets are used throughout the Airport Lake area.
- Air-to-air missiles and aerial drone targets occasionally impact into this area.

Table C-4. Weapon Systems Tested on George Range.

Target	HE Use	Bombs	Rockets/Missiles	Guns	Other
PMT	Yes	Practice, Gravity, FAE, Guided	2.75 to 5.0 in., Guided, Cruise	7.62 to 155mm, Rocket-Assisted Projectiles	Flares, Chaff, Smoke
FAE	Yes	Practice, Gravity, Fire, Guided, FAE, HE Cluster	2.75 to 5.0 in., Guided, Cruise	7.62 to 155mm, Rocket-Assisted Projectiles	Flares, Chaff, Smoke
Shrike	Yes	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in., Anti-radiation, Guided, Cruise	7.62 to 155mm, Rocket-Assisted Projectiles	Flares, Chaff, Smoke
G-6	No	Guided	2.75 to 5.0 in., Anti-radiation, Guided	7.62 to 155mm	Flares, Chaff, Smoke
Bullpup	Yes	Practice, Gravity, Guided	2.75 to 5.0 in., Anti-radiation, Guided, Cruise	7.62 to 155mm, Rocket-Assisted Projectiles	Flares, Chaff, Smoke
Darwin Road	Yes	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in., Guided	7.62 to 155mm, Rocket-Assisted Projectiles	Flares, Chaff, Smoke
G-9	No	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in.	7.62 to 40mm	Flares, Chaff, Smoke
GZAP	Yes	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in., Anti-radiation, Guided, Cruise	7.62 to 40mm	Flares, Chaff, Smoke
DZ	Yes	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in., Anti-radiation, Guided, Cruise	7.62 to 155mm	Flares, Chaff, Smoke, Parachutes, Subscale Drones
Kennedy Stands	Yes	N/A	N/A	7.62 to 40mm	Flares, Chaff, Smoke
Renegade Tunnel	Yes	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in., Anti-radiation, Guided, Cruise	7.62 to 155mm, Rocket-Assisted Projectiles	Flares, Chaff, Smoke
OST-1	Yes	Practice, Gravity, Guided, Inert Cluster	2.75 to 5.0 in., Anti-radiation, Guided, Cruise	7.62 to 155mm, Rocket-Assisted Projectiles	Flares, Chaff, Smoke
Green Point	No	Practice	N/A	N/A	Flares, Chaff, Smoke
FLR-3	No	N/A	Surface-to-Surface	N/A	N/A
3- & 5-in. Impact Areas	Yes	N/A	N/A	3 to 5 in. HE Projectiles	N/A

Static targets are used throughout George Range; moving land targets are used in several areas.
Air-to-air missiles and aerial drone targets frequently impact on the northern portion of George Range.
Gun/artillery munitions fall over most of the George range area.

Table C-5. Weapon Systems Tested on Coso Range.

Target	HE Use	Bombs	Rockets/Missiles	Guns	Other
Coles Flat	Yes	Guided	Anti-radiation, Cruise	N/A	Flares, Chaff, Smoke
Coles SAM Site	Yes	Practice, Gravity, Guided, Inert Cluster	Anti-radiation, Guided, Cruise	N/A	Flares, Chaff, Smoke
Safeway	Yes	Practice, Gravity, Guided, HE Cluster	Guided, Cruise	Rocket-Assisted Projectiles	Flares, Chaff, Smoke
Darwin Wash	Yes	Practice, Gravity, Guided, Inert Cluster	Anti-radiation, Guided, Cruise	Rocket-Assisted Projectiles	Flares, Chaff, Smoke
Wild Horse Mesa	Yes	Guided	Anti-radiation, Cruise	N/A	Flares, Chaff, Smoke

Table C-6. Weapon Systems Tested on Coso Tactical Range.

Target	HE Use	Bombs	Rockets/Missiles	Guns	Other
Coso Military Targets	No	Practice, Gravity, Laser-Guided. All weapons fired into this area are inert.	N/A	N/A	N/A

Table C-7. Weapon Systems Tested on Randsburg Wash Range.

Target	HE Use	Bombs	Rockets/Missiles	Guns	Other
Towers	Yes	N/A	2.75 in., Guided	7.62 to 155mm	Flares
5 in. Impact Area	Yes	N/A	N/A	3- to 5-in. Projectiles	N/A
Charlie Airfield	Yes	Practice, Gravity, Guided, LGTRs	2.75 to 5 in., Cruise	7.62 to 40mm	Flares, Chaff, Smoke

Table C-8. Weapon Systems Tested on Mojave B North Range.

Target	HE Use	Bombs	Rockets/Missiles	Guns	Other
Wingate Airfield	Yes	Practice, Gravity, Guided, LGTRs	2.75 to 5 in., Cruise	7.62 to 40mm, Mortars	Flares, Chaff, Smoke
Convoy	Yes	Practice, Gravity, Guided, LGTRs	2.75 to 5 in., Cruise	7.62 to 40mm, Mortars	Flares, Chaff, Smoke

Table C-9. Weapon Systems Tested on Mojave B South Range.

Target	HE Use	Bombs	Rockets/Missiles	Guns	Other
Superior Valley	Yes	Practice, Gravity, Guided (Bullseye Target only)	2.75 to 5 in., Cruise	7.62 to 40mm, Mortars	Flares, Chaff, Smoke
Superior Valley All others	No	Practice, Gravity, Guided	2.75 to 5 in., Cruise	7.62 to 40mm, Mortars	Flares, Chaff, Smoke

Naval Air Weapons Station China Lake Range Access Policy

January 2003

THE RANGE ACCESS POLICY

The Naval Air Weapons Station (NAWS) China Lake allows access to its ranges when possible. This policy allows groups or individuals access to certain areas on the ranges for limited recreational purposes and scientific research that benefits the Station. Such access is contingent on non-interference with operational commitments and is subject to cancellation without advance notice due to operational, safety, security, environmental, and fiscal considerations.

Scientific research has included geological and cultural resource surveys, archaeological excavations, site examinations, earthquake monitoring, bird counts, and insect studies. Any group or individual seeking access for such research must have professional or academic standing in the field of study, and the results of the study must be shared with the Station.

Recreational access on the ranges includes petroglyph tours, camping at Birchum Springs, and day-time hikes up B Mountain. All petroglyph tours and camping requests are subject to approval and require at least two Command-approved tour guides. Hikes up B Mountain are restricted to individuals who have the proper access requirements or are joining a Command-authorized event.

Petroglyphs are found throughout NAWS China Lake.

PROCESS FOR OBTAINING ACCESS

Organizations or individuals seeking access for research need to submit their request in writing to the Public Affairs Office, Code 750000D, 1 Administration Circle, China Lake, CA 93555-6100. The request should include the organization or individual requesting access, what professional or academic organization is being represented, the purpose of the visit, the location being requested, what is being proposed and why (benefits), the number of people requesting access, possible dates for access, and the type of product the Station will receive at the end of the research period.

Petroglyph tours are grouped into two types – public and private. Call the Public Affairs Office at 760.939.1683 to request a packet for details on how to arrange a tour.

Overnight camping at Birchum Springs normally is approved only in conjunction with a petroglyph tour or research trip, and approval is on a case-by-case basis. Due to heightened security restrictions, not many requests will be approved.

NAWS continually reviews its access policy. For specific input on an activity or area that may be of interest to the general public, please submit a request to the Public Affairs Office.

FOR MORE INFORMATION

For more information regarding public access, contact the Public Affairs Office at 760.939.1683.

RECREATION / RANGE ACCESS APPLICATION

☐ RECREATION PASS ☐ NON-OPERATIONAL OFFICIAL ACCESS

(Privacy Act Statement on reverse)

REQUESTING ORGANIZATION	POINT OF CONTACT	TELEPHONE NO.	
LEAD ESCORT	LEAD ESCORT SSN	HOME TELEPHONE NO.	WORK TELEPHONE NO.
CO-ESCORT	CO-ESCORT SSN	HOME TELEPHONE NO.	WORK TELEPHONE NO.
CO-ESCORT	CO-ESCORT SSN	HOME TELEPHONE NO.	WORK TELEPHONE NO.
CO-ESCORT	CO-ESCORT SSN	HOME TELEPHONE NO.	WORK TELEPHONE NO.
DATE OF TOUR	DEPARTURE TIME	RETURN TIME *(leave blank)*	
DESTINATION	ROUTE		
PURPOSE			
NUMBER OF VEHICLES	NUMBER OF PEOPLE	OVERNIGHT CAMPING ☐ YES ☐ NO	CAMERAS/BINOCULARS REQUESTED ☐ YES ☐ NO

REVIEW/APPROVAL	YES	NO	INITIAL	DATE	REVIEW/APPROVAL	YES	NO	INITIAL	DATE
750000D RECOMMEND					841300D RECOMMEND				
8G0000D RECOMMEND					841000D APPROVAL				

1. You are required to bring water for all purposes. You are required to carry out all rubbish. You are responsible for compliance with the policy and procedures of Chapter 12 in the NAWS CL Physical Security Instruction.

2. I read and I understand the provisions of Chapter 12 in the NAWS CL Physical Security Instruction.

POINT OF CONTACT *(signature)*	DATE

VEHICLE INFORMATION

DRIVER'S NAME	VEH. LICENSE/ STATE	NO. IN VEH.	DRIVER'S NAME	VEH. LICENSE/ STATE	NO. IN VEH.

Appendix E. National Register Listed and Recommended Eligible Sites and Districts at NAWS China Lake

APPENDIX E - NATIONAL REGISTER LISTED AND RECOMMENDED ELIGIBLE SITES AND DISTRICTS AT NAWS CHINA LAKE

Table E-1.
National Register Listed and Recommended Eligible Sites and Districts at NAWS China Lake

Name	Location	Description	Comments
Coso Rock Art District/National Historic Landmark (Big and Little Petroglyph Canyon NHL)[1]	North Range/Coso Range, George Range, and Airport Lake Range	Prehistoric Rock Art	NHL nominated in 1966. Boundaries revised and listed in 1999 as Coso Rock Art District/NHL (Gilreath 1997; n.d.)
CA-INY-281 (Little Petroglyph Canyon)[1]	North Range/Coso Range	Prehistoric Rock Art	Located within the Coso Rock District/NHL
CA-INY-283 (Big Petroglyph Canyon)[1]	North Range/Coso Range	Prehistoric Rock Art	Located within the Coso Rock District/NHL
Coso Hot Springs[1]	North Range/Coso Range	Native American Traditional Site/Historic Health Spa.	(Smith-Madsen 1977)
CA-INY-174 (Cactus Flat Village Site)	North Range/Coso Range	Prehistoric Habitation Site	Located within the Sugarloaf Archaeologist District boundaries (Clewlow 1985a)
CA-SBR-47, -48, -49, -50 (Pothunter Spring Site Complex: Also known as the Pilot Knob Cave Complex)	South Range/Mojave B South	Prehistoric Rock Shelters	(Clewlow 1985b)
Seep Spring	South Range/Mojave B South	Prehistoric Rock Shelters with Rock Art	(Clewlow n.d.)
Headquarters Building	North Range/Mainsite	Historic Navy built-environment[2]	(JRP Historical Consulting Services 1997a)
Dispensary Building	North Range/Mainsite	Historic Navy built - environment[2]	(JRP Historical Consulting Services 1997b)

Table E-1. (Contd.)

Name	Location	Description	Comments
Michelson Laboratory	North Range/Mainsite	Historic Navy built-environment[2]	(JRP Historical Consulting Services 1997c)
Bennington Plaza Theater	North Range/Mainsite	Historic Navy built-environment[2]	(JRP Historical Consulting Services 1997d)
Senior Officers' and Scientists' Quarters Historic District	North Range/Mainsite	Historic Navy built-environment[2]	District of buildings with 20 contributing elements (JRP Historical Consulting Services 1997e)
China Lake Pilot Plant Historic District	North Range/Propulsion Laboratories	Historic Navy built-environment[2]	District of buildings with 76 contributing elements (JRP Historic Consulting Services 1997g)
Salt Wells Pilot Plant Historic District	North Range/Propulsion Laboratories	Historic Navy built-environment[2]	District of buildings with 38 contributing elements (JRP Historical Consulting Services 1997h)
Camel Drop Test Buildings	North Range/Thompson Lab Area	Historic Navy built-environment[2]	5 buildings and structures (Mikesell 1997d)
Drop Test Tower (Building 31512)	North Range/Area R	Historic Navy built-environment[2]	1 building (Mikesell 1997d)
Supersonic Naval Ordnance Research Track (SNORT)	North Range/Charlie Range	Historic Navy built-environment[2]	7 buildings and structures (Mikesell 1997d)
CT Camera Shelter	North Range/CT-4	Historic Navy built-environment[2]	1 building (Mikesell 1997d)
Randsburg Wash Towers	South Range/ Randsburg Wash	Historic Navy built-environment[2]	5 buildings and structures at the Randsburg Wash Gun Line (Mikesell 1997d)

Source: US Navy 1997

1 Sites and districts that are listed on the National Register. The remainder are recommended eligible sites, buildings and structures, and districts for which nomination forms have been prepared. Sites that have been recommended eligible but for which no nomination forms have been prepared are not listed in this table.

2 Significant for association with military history and for architecture.

Appendix F. Biological Resources

APPENDIX F - BIOLOGICAL RESOURCES

Table F-1.
Federally Listed Threatened and Endangered Wildlife Species on NAWS.

Common Name	Scientific Name	North or South Range Complex	Habitat on NAWS	Status Federal/State
Mojave tui chub	*Gila bicolor mohavensis*	North	Lark Seep, G-1 Seep	Endangered/endangered
Desert tortoise	*Gopherus agassizii*	Both	Creosote bush scrub, saltbush scrub, and Joshua tree woodland. Critical Habitat on South Range	Threatened/threatened
Inyo California towhee	*Piplio fuscus eremophilus*	North	Riparian habitats in the southern Argus Range. Critical Habitat on North Range	Threatened/endangered

Source: California Department of Fish and Game 1997a, 1997c, 1997d; U.S. Fish and Wildlife Service 1995a, 1995b, 1996; U.S. Navy 1997b

Table F-2.
NAWS-Sensitive Plant Species Known or Suspected to Exist at NAWS.

Species Common Name ***Scientific Name***	**North or South Range Complex**	**Elevation (feet above MSL)**	**Associated Plant Community at NAWS**	**Status Federal/State/CNPS or Reason for NAWS-Sensitive Species**
Plants Confirmed at NAWS				
Pinyon rock cress *Arabis dispar*	North	4,000-8,000	Pinyon woodland, Great Basin mixed scrub, sagebrush scrub, Joshua tree woodland, blackbush scrub	--/--/2
Darwin mesa milk-vetch *Astragalus atratus* var. *mensanus*	North	5,800-7,800	Pinyon woodland, Great Basin mixed scrub, sagebrush scrub, Joshua tree woodland, blackbush scrub	--/--/1B
Desert bird's beak *Cordylanthus ememicus* ssp. *eremicus*	North	4,900-8,400	Pinyon woodland, Great Basin mixed scrub, sagebrush scrub, Joshua tree woodland, blackbush scrub, desert transition scrub	--/--/4
Yerba desirto *Fendlerella utahensis*	North	4,900-8,400	Pinyon woodland, Great Basin mixed scrub, desert transition scrub	---/--/4
Creosote clones *Larrea tridentata*	North	2,000-3,000	Mojave sand field	Scientific value (extreme age)
Coso Mountains lupine *Lupinus magnificus* var. *glarecola*	North	5,000-8,000	Pinyon woodland, Great Basin mixed scrub, sagebrush scrub, Joshua tree woodland, blackbush scrub	--/--/4
Crowned muilla *Muilla coronata*	North	3,000-5,700	Joshua tree woodland, blackbush scrub, desert transition scrub, Mojave mixed scrub, hopsage scrub, shadscale scrub, creosote bush scrub	--/--/4
Death Valley round-leaved phacelia *Phacelia mustelina*	South	300-6,000	Joshua tree woodland, blackbush scrub, Mojave mixed scrub	--/--/1B
Charlottes phacelia *Phacelia nashiana*	North	2,000-7,200	Joshua tree woodland, Mojave mixed scrub, hopsage scrub, shadscale scrub, creosote bush scrub	FSC/--/1B
Mohave Indigobush *Psorothamnus arborescens* var. *arborescens*	South	Above 2,500	Joshua tree woodland, blackbush scrub, Mojave mixed scrub, hopsage scrub	--/--/4
Mojave fish-hook cactus *Sclerocactus polyancistrus*	Both	2,000-7,000	Great Basin mixed scrub, Joshua tree woodland, blackbush scrub, desert transition scrub, Mojave mixed scrub, shadscale scrub, creosote bush scrub	--/--/4
DeDecker's clover *Trifolium macilentum* var. *dedeckerae*	North	6,900-11,500	Pinyon woodland	--/--/1B

Table F-2.
NAWS-Sensitive Plant Species Known or Suspected to Exist at NAWS *(continued).*

Species Common Name ***Scientific Name***	**North or South Range**	**Elevation (feet above MSL)**	**Associated Plant Community at NAWS**	**Status Federal/State/CNPS or Reason for NAWS-Sensitive Species**
Plants with unconfirmed records at NAWS				
Darwin rock cress *Arabis pulchra* var. *munciensis*	North	3,500-6,500	NA	--/--/2
Shining milk-vetch *Astragalus lentiginosus* var. *micans*	North	2,000-3,500	Creosote bush scrub, saltbush scrub, alkaline sink scrub	FPT/--/1B
Naked milk-vetch *Astragalus serenoi* var. *shockleyi*	North	4,000-7,000	Sagebrush scrub, pinyon pine	--/--/2
Panamint mariposa lily *Calachortus panamintensis*	North	6,500-8,100	Pinyon woodland, Great Basin mixed scrub, sagebrush scrub	--/--/4
Booth's evening-primrose *Camissonia boothii* ssp. *boothii*	North	2,500-4,500	NA	--/--/4
Desert Cymopterus *Cymopterus deserticola*	South	3,000-4,000	NA	--/--/4
Winged cryptantha *Cryptantha holoptera*	South	3,000-4,000	NA	--/--/4
Mount Pinos larkspur *Delphinium parryi* ssp. *purpureum*	North	3,000-8,500	NA	--/--/4
Panamint dudleya *Dudleya saxosa* ssp. *saxosa*	South	3,000-7,100	Creosote bush scrub, pinyon woodland	FSC/--/4
Clark mountain heerman buckwheat *Eriogonum heermannii* var. *floccosum*	North	5,000-6,000	NA	--/--/4
Barstow Wooly Sunflower *Eriophyllum mohavense*	South	3,000-4,000	NA	--/--/4
Ripley's Gilia *Gilia ripleyi*	South	3,000-4,000	NA	--/--/4
Inyo hulsea *Hulsea vestita* ssp. *inyoensis*	North	4,600-7,600	Mixed desert scrub, sagebrush scrub, pinyon woodland	--/--/2
Caespitose evening primrose *Oeonothera caespitosa* ssp. *crinita*	North	3,800-11,000	Mixed desert scrub, pinyon woodland, bristlecone pine forest, subalpine coniferous forest	--/--/4

Table F-2.
NAWS-Sensitive Plant Species Known or Suspected to Exist at NAWS *(continued).*

Species Common Name ***Scientific Name***	**North or South Range**	**Elevation (feet above MSL)**	**Associated Plant Community at NAWS**	**Status Federal / State / CNPS or Reason for NAWS-Sensitive Species**
Plants with habitat at NAWS				
Lane Mountain milk-vetch *Astragalus jaegerianus*	South	3,000-4,000	Creosote bush scrub, Joshua tree woodland	FPE / -- / 1B
Pygmy poppy *Canbya candida*	North	2,000-4,000	NA	-- / -- / 1B

Sources: California Department of Fish and Game 1997a, 1997c, 1997d; Hickman 1993; Skinner and Pavlik 1994; U.S. Fish and Wildlife Service 1995a, 1995b, 1996; U.S. Navy 1997.

Notes: CNPS = California Native Plant Society
NA = information not available

Federal Status
FPE = Proposed endangered
FPT = Proposed threatened
FSC = Species of concern (formerly C2)
-- = No status definition

State Status
-- = No status definition

CNPS (California Native Plant Society) Status
1B = List 1B, plants rare and endangered in California and elsewhere.
2 = List 2, plants rare, threatened, or endangered in California, but more common elsewhere.
4 = Plants of limited distribution – a watch list.

Table F-3.
NAWS-Sensitive Wildlife Species Known or Suspected to Exist at NAWS.

Species Common Name ***Scientific Name***	**North or South Range**	**Habitat on NAWS**	**Legal Status Federal/State**	**Reason for NAWS-Sensitive Species Status**
Invertebrates:				
Giant Fairy shrimp *Branchinecta gigas*.	North	Playas	--/--	Species occurs in a protected habitat
Jerusalem Crickets *Stenopelmatus* spp	North	Creosote bush scrub, sandy areas	--/--	May be an endemic species of limited distribution
Dune Cockroaches *Arenavaga* sp.	North	Sand dunes	--/--	May be an endemic species or subspecies
Darwin Tieminn's beetle *Megacheuma brevipennis tiemannii*	North	Associated with Parry saltbush, which occurs near playas	--/--	Has a limited distribution
Argus land snail *Eremariontoides argus*	Both	Revenue Canyon, Homewood Canyon, Slate Range, Mountain Springs Canyon	--/--	Species of limited distribution
Dune weevils *Trigonoscuta* sp.	North	Sand dunes	--/--	Species of limited distribution
Butterfly (No common name) *Plebejulina emigodonis*	North	Near the El Conejo Gate	--/--	Species of limited distribution
Butterfly (No common name) *Euphilotes baueri vernalis*	North	Louisiana Butte	--/--	Species of limited distribution
Butterfly (No common name) *Cercyonis sthenele*	North	Argus Range, Coso Range, Etcheron Valley	--/--	Species of limited distribution
Amphibians:				
Western toad *Bufo boreas*	North	Haiwee Spring	--/--	BLM indicator species
Pacific tree frog *Hyla regilla*	North	Haiwee Spring	--/--	BLM indicator species
Reptiles:				
Chuckwalla *Sauromalus obesus*	Both	Argus Range, Coso Range, rocky areas to 6,000 feet above MSL	--/--	BLM indicator species
Panamint alligator lizard *Gerrhonotus panamintina*	North	Argus Range, Coso Range, Margaret Ann Spring, Hiawee Spring	FSC/CSC	Legal status
Gilbert's skink *Eumeces gilberti*	North	North Range springs and riparian habitat	--/--	BLM indicator species
Birds:				
Neotropical migrant birds Numerous species	Both	Riparian areas	Variable	Species may include migrant threatened or endangered species.
Raptors Numerous species	Both	Throughout	Variable	Federally endangered and California-listed species are migrants
Wetlands Birds Numerous species	Both	Playas, riparian areas	Variable	Birds use wetlands resources

Table F-3.
NAWS-Sensitive Wildlife Species Known or Suspected to Exist at NAWS *(continued)*.

Species Common Name ***Scientific Name***	**North or South Range**	**Habitat on NAWS**	**Legal Status / Federal / State**	**Reason for NAWS-sensitive species Status**
Mammals:				
Mohave ground squirrel *Spermophilus mohavensis*	Both	Brown Mountain, Pilot Knob Valley, Superior Valley, Coso geothermal area	--/CT	Legal status
Vole unknown species	Both	Lark Seep, Paxton Ranch, Margaret Ann Spring, Eagle Crags	FE*/SE*	*The species has not been positively identified, but may be the Amargosa vole (*Microtus californicus sciroensis)*
Nelson's bighorn sheep *Ovis canadensis nelsoni*	Both	Transient in the Argus Mountains and Eagle Crags	--/--	Limited distribution in California; have been reintroduced to NAWS by the Navy, BLM, and the California Department of Fish and Game.
Argus Mountains kangaroo rat *Diodomys panamintinus argusensis*	North	Upper Cactus Flat, Darwin Wash	--/--	BLM Sensitive Species
Pallid bat *Antrozous pallidus*	Both	Water sources and roosting places, such as old buildings and mines	--/CSC	Legal status
Townsend's big-eared bat *Corynorhinus townsendii*	Both	Water sources and roosting places, such as old buildings and mines	FSC/CSC	Legal status
Spotted bat *Euderma maculatum*	Both	Water sources and roosting places, such as old buildings and mines	FSC/CSC	Legal status
Western mastiff bat *Eumops perotis*	Both	Water sources and roosting places, such as old buildings and mines	FSC/CSC	Legal status
Ringtail *Bassiriscus astutus*	North	Argus Range, Coso Range	--/--	BLM Sensitive Species
American badger *Taxidea taxus*	Both	All slopes on the North and South Ranges.	--/CSC	BLM Sensitive Species, Legal status
Mountain lion *Felis concolor*	North	Argus Range, Coso Range	--/--	Low numbers on NAWS

Sources: California Department of Fish and Game 1997a, 1997c, 1997d; U.S. Fish and Wildlife Service 1995a, 1995b, 1996; U.S. Navy 1997.

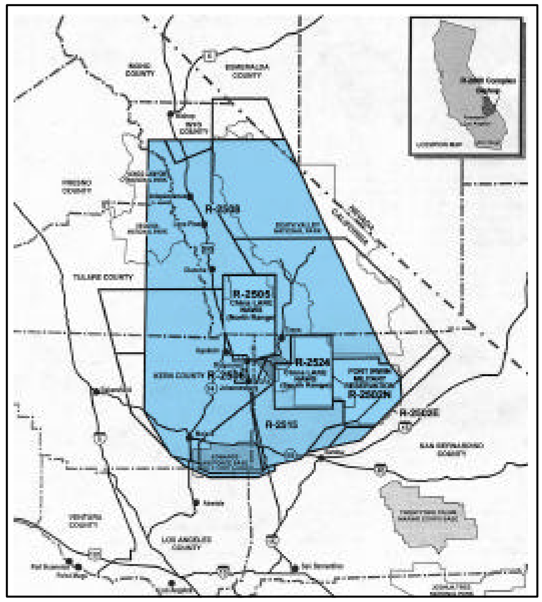
Notes: NA = information not available

Federal Status	State Status
FE = Endangered	SE = Endangered
FSC = Species of Concern (formerly C2)	CSC = California species of special concern
-- = No status definition	-- = No status definition

China Lake Noise Fact Sheet

January 2003

Naval Air Warfare Center Weapons Division China Lake manages three restricted airspace areas overlying the land addressed in the Comprehensive Land Use Management Plan (CLUMP). These areas are known as R-2505, R-2524 and R-2506.   A restricted airspace area is designated by the Federal Aviation Administration (FAA) to support military activity. While concurrent use by civil aviation is precluded for safety and security reasons, airspace is made available to the public when possible. Altitude blocks are released to the FAA to allow joint use by civil and other military aircraft.



Modern aircraft and weapons systems are faster and have longer ranges than their predecessors. Because of this, aircraft maneuvers require the additional airspace provided by the R-2508 Complex (outlined on map).

The R-2508 Complex, which extends into the Owens Valley a few miles south of the town of Bishop, is a special use airspace that surrounds and includes China lake's restricted areas, as well as the restricted airspace for the Air Force Flight Test Center, Edwards Air Force Base and the National Training Center Fort Irwin. Management of the R-2508 Complex is the responsibility of the Commanders of the three military bases.

Generally, noise from military operations in the vicinity of China Lake is caused by one of the following sources: Navy airfield operations conducted from Armitage Airfield; range test operations, such as ordnance explosions, supersonic sled tests, and related aircraft operations; and finally, other military flight activities operating in the R-2508 Complex airspace.

The Naval Air Weapons Station China Lake conducted several noise-related studies to support the development of the Draft Environmental Impact Statement. These studies characterized the noise effects associated with current and proposed increases to established range flight operations, ordnance use on the China Lake ranges, and flight operations at the Armitage Airfield. These data were also used to support the development of an updated Air Installation Compatible Use Zone (AICUZ) plan that addresses noise generated by the airfield operations.

Atmospheric conditions like heavy cloud cover over the area will sometimes multiply the effects of noise by focusing or redirecting sound waves back to the ground. Noise is also amplified when it occurs in a valley between two mountain ranges, such as the Owens Valley between the Sierra and Inyo mountains.

"Noise is an inescapable byproduct of what we do," according to Capt. Alex Hnarakis, Commanding Officer of NAWS China Lake. "And what we do here prepares the modern warfighter for success when he or she is asked to go into harm's way on behalf of their country."

Every effort is made at China Lake to mitigate noise created by military operations. NAWS China Lake has developed a comprehensive noise complaint program to better serve the local communities.

Although an operation causing noise may appear to be conducted in support of China Lake's ranges or airfield, it might also be the result of another military activity operating in the R-2508 Complex. Any Public Affairs Office from the tri-services can accept an initial noise complaint and start an investigation. The identified unit is directed to correct any problems, and the reporting person is contacted for final closeout of the investigation. The Public Affairs Office receiving the initial complaint is the point of contact throughout the process, regardless of the aircraft identification. Those reports involving damage claims may be forwarded to a different command for claims processing, but the original Public Affairs Office maintains continuity throughout the process. This ensures that the reporting person is not referred from one person to another to get a response to a complaint.

Persons with reports of noise or aircraft flying too low should contact one of the three Public Affairs offices as soon as possible. Receiving reports within 15 days after the incident is important to ensure FAA flight data is available to support the investigation. Reports received after that time will still be investigated, but identification of the specific activity involved may be difficult to determine.

To report a complaint, or for more information about the process, please contact the China Lake Public Affairs Office at (760) 939-3511.

NOISE COMPLAINT INFORMATION

When reporting a complaint, be prepared to provide the following information:

Incident Date: ____________________ **Incident Time:** ____________________

What Happened? Provide information on the following:

Location: (Also describe relative position of aircraft to your position when incident observed.)

Description of aircraft (when seen):

Prop or jet?

High or low wing?

Number of intakes/engines?

Color? (Describe and note is single or multiple colors and/or color scheme.)

Additional Markings? (Describe.)

Note: You may not be able to answer all of these questions but try and supply what you can remember. A general description with this information is sometimes more useful than trying to specify type (i.e.; F-16, F/A-18, etc.)

Direction of flight: (Use cardinal directions, i.e.; north, south, east, west; or use references towards known visible points from your location; i.e.; turned towards Mt. Whitney, crossed the highway eastbound.)

Approximate altitude: (Please try and clarify "low" or "too low." If not possible to estimate height above ground, describe relation to known reference points; i.e., above, below, same height as. . . .)

Any other observation of the aircraft's operations: (include sonic booms, attitude [climbing, descending, level flight], number of passes, etc.)

Other pertinent information: (Include cloud coverage, frequency of occurrence, description of damage [if any], etc.)

Contact NAWS China Lake Public Affairs Office at (760) 939-3511. After normal working hours, phone calls to this number are forwarded to the NAWS Quarterdeck. If a message is left, please leave your name and number so we can call you back.

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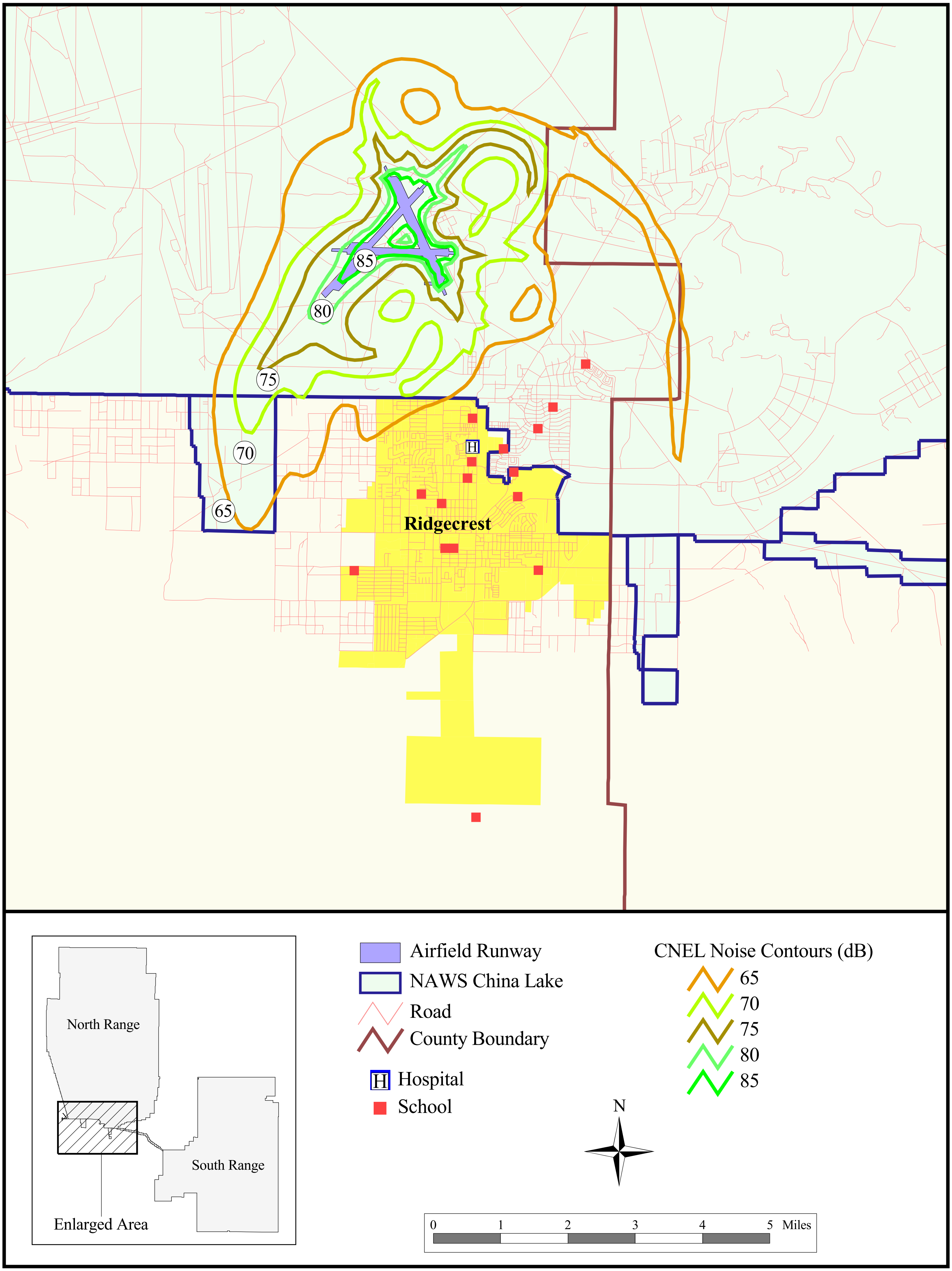

Figure G2-1 Current Noise Contours for Airfield Operations

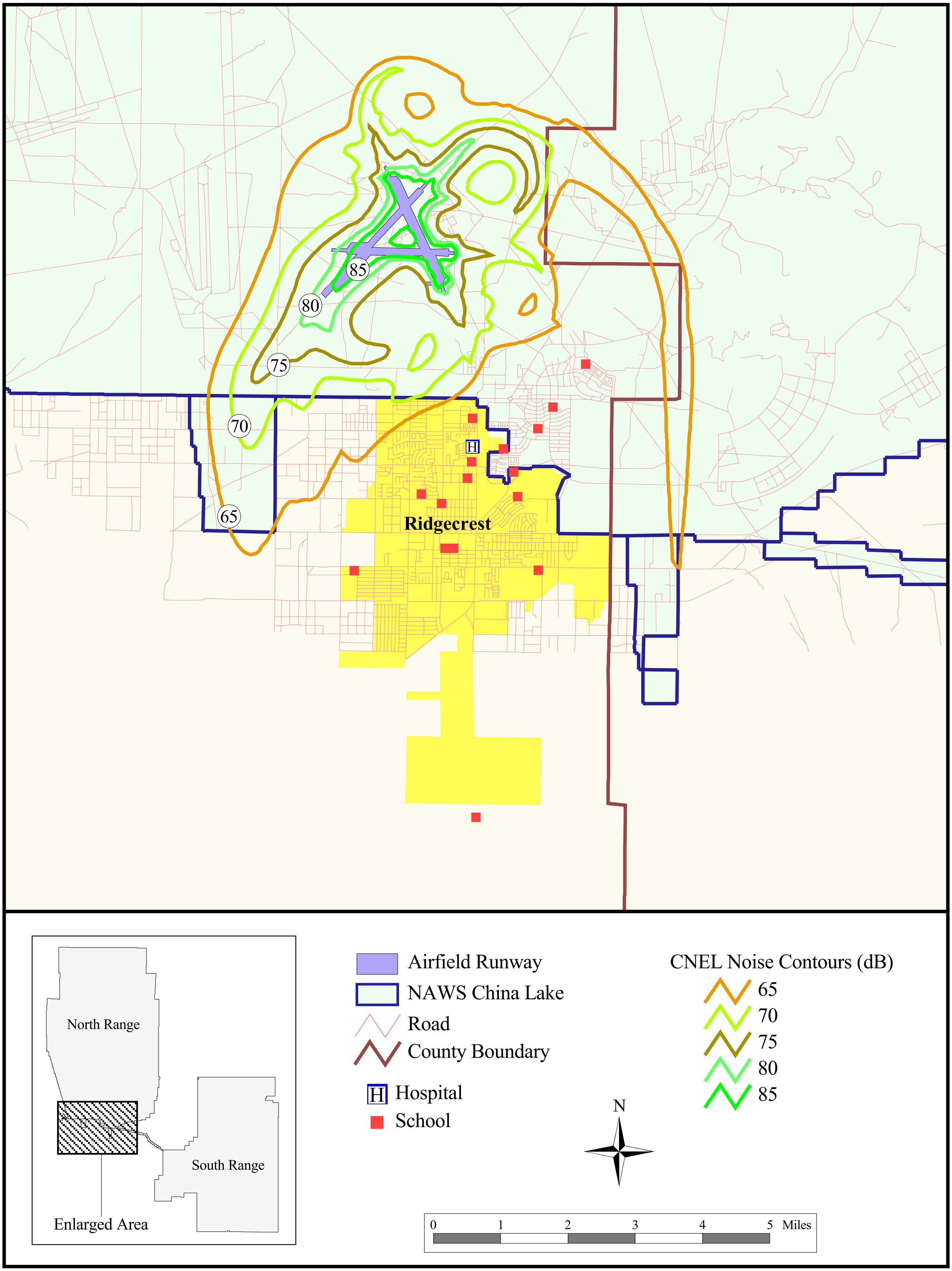

Figure G2-2 Proposed Noise Contours for Airfield Operations

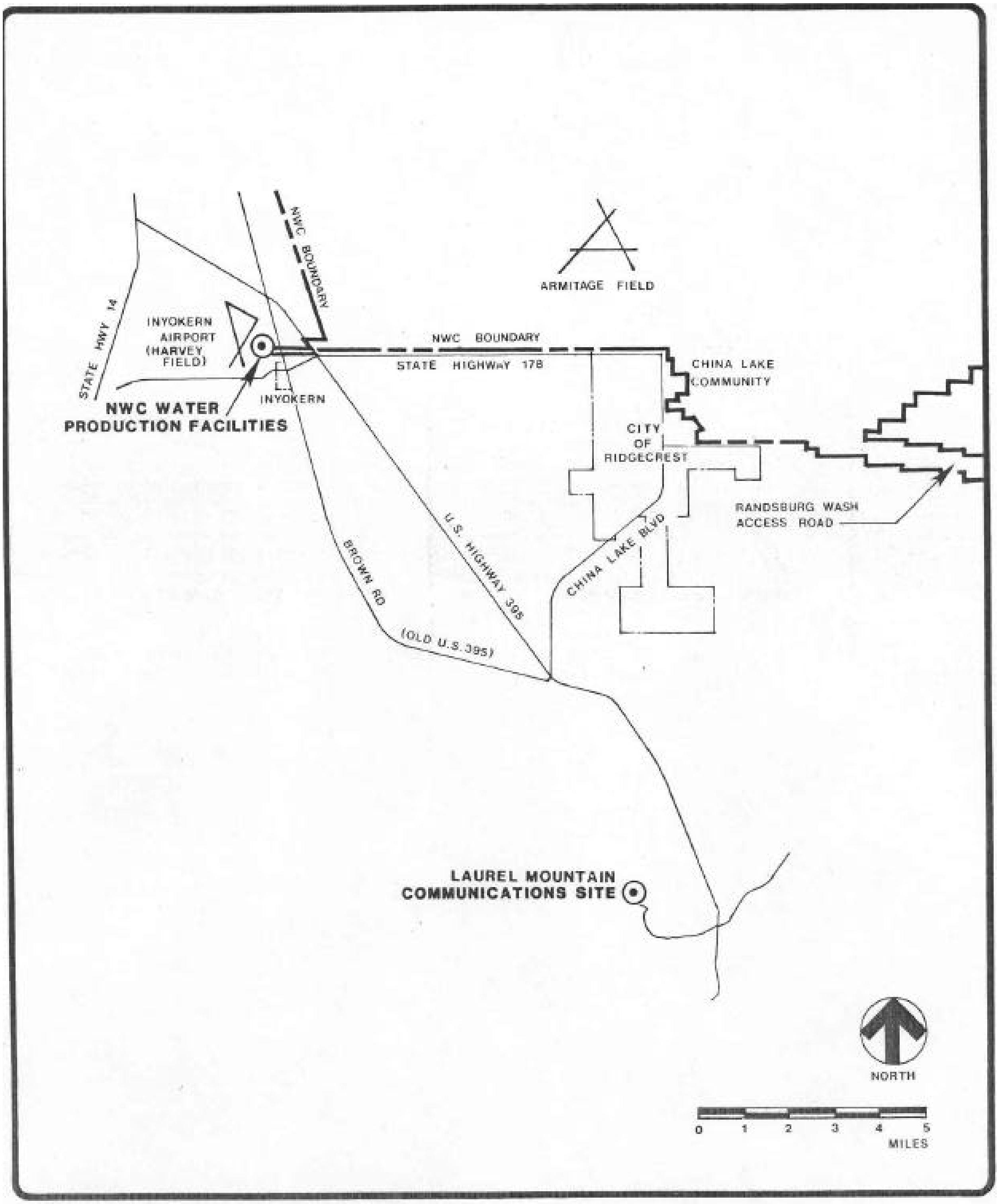

Figure H-1. Map of the Location of the Laurel Mountain Communications Site

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LAND USE CONTROL IMPLEMENTATION WORK PLAN

NAVAL AIR WEAPONS STATION CHINA LAKE, CALIFORNIA

EXECUTIVE SUMMARY

ACRONYMS/ABBREVIATIONS

1.0 INTRODUCTION AND BACKGROUND

1.1 Background
1.2 Purpose
1.3 Scope

2.0 LOCATION AND DESCRIPTION

2.1 NAWS China Lake Background
2.2 Site 12

3.0 LAND USE CONTROLS

At sites where contaminants are left in place, such as the SNORT Road landfill (Installation Restoration Program [IRP] Site 12), land use controls (LUC) are used to ensure that the contaminants do not pose an unacceptable risk to human health or the environment. LUCs generally consist of engineering controls and/or institutional controls that are specified, implemented, monitored, and enforced in an efficient, cost-effective manner that ensures long-term protectiveness.

3.1 Land Use Control Objectives

- Ensure remedial action objectives remain in tact
- Ensure no residential use or residential development of the property
- Ensure no groundwater production or use
- Provide a narrative for the LUC to be recorded in the base master plan
- Inspections and monitoring of LUC for 5-year review period

3.2 Land Use Controls Specific to Site 12
3.2.1 Re-grading Land Surface
3.2.2 Fencing and Signing Improvements
3.2.3 Land Survey/Monument
3.2.4 Groundwater Monitoring
3.2.5 Five-Year Review

4.0 IMPLEMENTATION
4.1.1 Master Plan Amendments OR CLUMP Amendments
4.1.2 Station Order (roles and responsibilities)
4.1.3 Enforcement of LUCS (who's responsible for enforcement? Station order outline?)
4.1.4 Location of LUC Implementation Plan (who controls document?)

5.0 SITE 12 MONITORING AND REPORTING
5.1 Site 12 Land Use Control Implementation Actions

APPENDICES (**As appropriate**)

CNO MEMORANDUM: DON ENVIRONMENTAL POLICY MEMORANDUM ON LUC

UNDERSECRETARY OF DEFENSE MEMORANDUM: GUIDANCE ON LAND-USE CONTROL AGREEMENTS WITH REGULATORY AGENCIES

UNDER SECRETARY OF DEFENSE POLICY ON LAND-USE CONTROLS ASSOCIATED WITH ENVIRONMENTAL ACTIVITIES

PROPOSED APPLICATION FOR DECLARATION OF ENVIRONMENTAL RESTRICTION

STATION ORDER

RESPONSE TO COMMENTS (does document go out for comment?)

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Appendix I

Integrated Natural Resources Management Plan (INRMP)

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

NAVAL AIR WEAPONS STATION CHINA LAKE, CALIFORNIA

APPROVAL

This Integrated Natural Resources Management Plan meets the requirements of the Sikes Act (16 U.S.C. 670a *et seq.*) as amended in November 1997.

J.R. Seaman Captain, USN Commanding Officer Naval Air Weapons Station China Lake	____________________ ____________________ Date
Michael C. Stroud Program Lead, Natural and Cultural Resources, Specialist Support Team NAVFACENJCOM-SWDIV	____________________ ____________________ Date
Michael J. Spear Director Region 1, U.S. Fish and Wildlife Service Portland, Oregon	____________________ ____________________ Date
Jacqueline E. Schafer Director California Department of Fish and Game Sacramento, California	____________________ ____________________ Date

Date of Annual Installation Review	**Name and Title of Reviewer(s):**
____________________	__________________________
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INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

NAVAL AIR WEAPONS STATION CHINA LAKE CALIFORNIA

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1.0 INTRODUCTION

1.1 Purpose, Mission, and Goals

1.1.1 Purpose of the Integrated Natural Resources Management Plan

The purpose of this Integrated Natural Resources Management Plan (INRMP) is to provide a viable framework for the management of natural resources at the Naval Air Weapons Station, China Lake (NAWS/CL). This INRMP specifically guides implementation of the natural resources program on the NAWS/CL from 2000 through 2004.

This INRMP is intended to:

- establish NAWS/CL natural resources planning and management processes;
- support a strategic framework for daily land use and natural resources management;
- support resolution of land use conflicts and constraints;
- provide baseline descriptions of natural resources (type, location, legal status, etc.);
- define natural resources management objectives and guidelines;
- establish an institutional memory for natural resources; and
- provide guidance for annual natural resources management reviews, internal compliance audits, and annual budget submittals.

The INRMP is designed to facilitate compliance with natural resources protection laws and meet requirements of the Sikes Act (USC 670)(as amended), applicable Department of Defense (DOD) and Department of the Navy (DON) regulations, the California Desert Protection Act (CDPA), Section 805 of the Military Lands Withdrawal Act, 1994, and the Federal Land Policy and Management Act (FLPMA) 1979. It fulfills the requirements of the Naval Operations Instruction (OPNAVINST 5090.1B), *Environmental and Natural Resources Program Manual,* which requires Navy installations with suitable land and water resources to establish a natural resource management plan. This INRMP provides a practical framework to support the decisions of the Commanding Officer and specific management activities which can be implemented by the NAWS/CL Environmental Project Office.

1.1.2 Military Mission

The Naval Air Warfare Center, Weapons Division China Lake (NAWC-WD) is responsible for the research, development, test, and evaluation of weapons systems for Navy, Air Force, Army, Joint Service, commercial, and foreign military weapons systems. China Lake is involved in all aspects of developing weapons systems, including propulsion, guidance, fuzing, and warhead. China Lake also develops and tests airborne electronic warfare systems and performs aircraft weapons integration.

NAWC-WD Mission

... to be the Navy's full spectrum Research Development Testing and Evaluation (RDT&E) engineering center for weapons systems for air warfare, missiles, and missile subsystems, aircraft weapons

integration, and assigned airborne electronic warfare systems at the component, subsystem, and system levels.

NAWS China Lake operates and maintains base facilities and provides support services, including airfield operations, for NAWC-WD organizations, assigned tenants, and transient units. NAWS is responsible for managing all lands within the Station boundaries to support the NAWC-WD mission at China Lake, maintain environmental compliance, and exercise responsible stewardship of public lands.

NAWS/CL Mission

... to operate and maintain base facilities and provide base support services, including airfields, for the Naval Air Warfare Center Weapons Division organization at China Lake, assigned tenants and activities, and transient units.

1.1.3 INRMP Goals

Goals established in this INRMP are compatible and consistent with the DOD's natural resources program goals (DOD Instruction 4715.3, *Environmental Conservation Program*) and goals defined in the DON Natural Resources Conservation Strategic Plan (DON, 1994).

Goal 1: Conserve, protect, and enhance natural ecosystems (natural resources) and biodiversity while guaranteeing continued access to NAWS/CL lands, waters, vegetation, and wildlife resources for the military mission.

Goal 2: Manage NAWS China Lake lands in a manner that accommodates ongoing and evolving military mission support requirements and conserves and protects land-based environmental resources in accordance with compliance requirements and stewardship principles.

Goal 3: Provide for the organizational capacity, support, and communication linkages necessary for the successful implementation and administration of the INRMP and NAWS/CL's natural resources.

1.1.4 Key Natural Resources Issues

Natural resources and the management actions needed to meet the Goals discussed above (Section 1.1.3) fall into five general program categories. The discussion of NAWS/CL natural resources (Chapter 2) and the management Objectives and Guidelines for specific species and issues (Chapter 3) are organized by general program categories. These programs, which are discussed below, are considered to represent the key natural resources issues at NAWS, China Lake.

1.1.4.1 Threatened, Endangered, and Sensitive Species Management

Management of federally listed threatened and endangered species will continue to be accomplished by managing land uses in close coordination with the U. S. Fish and Wildlife Service and with other State and federal land managers. At this time, listed species include the Mojave tui chub, the desert tortoise, and the Inyo California towhee. The Lane Mountain Milk Vetch, which was listed as endangered by the U.S. Fish and Wild Life Service in 1998, occurs south and southeast of the NAWS/CL. Seemingly suitable habitat is located on NAWS/CL lands, although it has not been found here to date. The State listed Mohave ground squirrel is also known to occur on station lands. Sensitive species are managed primarily by minimization of impacts to the species or its habitat.

1.1.4.2 Habitat Conservation Management

Continuation of habitat conservation efforts, particularly in areas supporting listed or sensitive species, is considered a key element of the natural resources management program. The protection of habitats supporting listed species and identified NAWS Sensitive Species will continue to be accomplished by implementation of impact elimination or minimization measures whenever practicable.

1.1.4.3 Water Resources Management

The protection and enhancement of surface and groundwater resources continues to be a major focus of natural resource management efforts. There are currently more than 120 springs or other surface water features known on the Station. Although many of these water resources have been protected, the majority continue to be impacted by feral horses and burros and domestic cattle. Long-term spring protection efforts, primarily through the construction of exclosure fences, are being continued at this time. Protection of groundwater resources is also considered a key program element. Groundwater provides the Station and local community with its only source of potable drinking water. Management of this resource is accomplished through implementation of management practices provided by the Indian Wells Valley Cooperative Groundwater Management Plan.

1.1.4.4 Grazing Management

Since 1981, the Station has removed over 9,500 feral burros and 3,200 wild horses from Station lands. The long-term management goal is to completely eliminate burros and maintain a high quality herd of approximately 168 horses. Excess animals continue to be gathered and adopted by the BLM on an annual basis. There are currently about 150 burros and 220 horses on NAWS/CL. Cattle grazing currently occurs on Station and adjoining BLM lands approximately 7 months each year. Grazing is managed by the BLM. The Station is currently evaluating the suitability and impacts associated with the grazing operation on its portion of the grazing allotment.

1.1.4.5 Resources Inventory and Data Management

The inventory and recordation of biological field data, and development of a computerized retrieval system for this data is an ongoing effort at NAWS/CL. Knowledge of the distribution of listed, sensitive, and potentially rare species facilitates mission accomplishment by allowing project planners to assess potential impacts to these resources early-on in the planning process. This is particularly important for those species which may be, or are currently being, considered for listing under the provisions of the Endangered Species Act.

1.2 INRMP Design, Use, and Management Strategy

The Integrated Natural Resources Management Plan for NAWS is designed with an abbreviated organizational structure (five chapters) and a clear delineation between natural resources existing conditions (Chapter 2) and management programs (Chapter 3).

1.2.1 INRMP Organization

Each chapter is summarized below:

Chapter 1. Introduction. Chapter 1 describes the NAWS/CL mission statement, INRMP goals, real estate and facilities, history of the site and installation, military mission, compliance requirements, responsible parties, and major natural resources issues.

Chapter 2. Resources Setting. Chapter 2 describes the physical setting, climate, flora and fauna, and cultural resources at NAWS/CL.

Chapter 3. Natural Resources Management. Chapter 3 describes natural resources management programs existing or proposed to enable NAWS/CL to meet its compliance and stewardship requirements while supporting the military mission.

Chapter 4. Planning for Compatible Use of Natural Resources. Chapter 4 provides for ongoing and evolving mission support requirements and specifically addresses commercial forestry and agriculture, landscaping and grounds maintenance, and outdoor recreation.

Chapter 5. Planning and Administration. Chapter 5 describes the implementation of the National Environmental Policy Act (NEPA) at NAWS/CL, the installation's role in regional planning, and INRMP implementation, including staffing, funding, and project priorities.

1.2.2 Plan Revisions

This INRMP is dynamic, and it will require updating (*i.e.*, new military missions, sensitive species listing changes, compliance changes, improved inventories of natural resources, new management techniques) to remain relevant. This INRMP will be updated as needed, but at a minimum the INRMP will be revised and updated every five years to comply with the Sikes Act and OPNAVINST 5090.1B. NAWS/CL will coordinate Plan updates and revisions with its partners as needed.

1.2.3 Ecological Strategy

NAWS/CL intends to use an ecosystem management strategy to plan and implement natural resources management on lands entrusted to its use. This overall strategy is described at Department of Defense and Department of Navy levels, as summarized below:

Biological diversity (biodiversity) refers to the variety and variability among living organisms and the environment in which they occur. Biodiversity has meaning at various levels including ecosystem diversity, species diversity, and genetic diversity. The Department of Defense has developed *A*

Department of Defense (DoD) Biodiversity Management Strategy (The Keystone Center, 1996). This Strategy identifies five reasons to conserve biodiversity on military lands:
(1) *sustain natural landscapes* required for the training and testing necessary to maintain military readiness;
(2) *provide the greatest return on the Defense investment* to preserve and protect the environment;
(3) *expedite the compliance process* and help avoid conflicts;
(4) *engender public support* for the military mission; and
(5) *improve the quality of life* for military personnel.

The Keystone Center report (1996) notes that the challenge is *"to manage for biodiversity in a way that supports the military mission."* This strategy identifies the INRMP as the primary vehicle to implement biodiversity protection on military installations. The model process developed within the strategy includes the following principles:

- support the military mission;
- use joint planning between natural resources managers and military operations personnel;
- integrate biodiversity conservation into INRMP and other planning protocols;
- involve internal and external stakeholders up front;
- emphasize the regional (ecosystem) context;
- use adaptive management;
- involve scientists and use the best science available; and
  concentrate on results.

The Department of Defense (DoD Instruction 4715.3, *Environmental Conservation Program*) describes ecosystem management as, "*a process that considers the environment as a complex system functioning as a whole, not a collection of parts, and recognizes that people and their social and economic needs are a part of the whole*." The Department of Defense goal with regard to ecosystem management is, *"To ensure that military lands support present and future training and testing requirements while preserving, improving, and enhancing ecosystem integrity. Over the long term, that approach shall maintain and improve the sustainability and biological diversity of terrestrial and aquatic (including marine) ecosystems while supporting sustainable economies, human use, and the environment required for realistic military training operations*."

The Department of the Navy has published an ecosystem management policy[1] which expands on Department of Defense principles and guidelines. The Navy *"goal is to preserve and enhance ecosystem integrity, and to sustain both biological diversity and continued availability of those resources for military and other human uses."* The Navy policy lists the following three aspects of ecosystem-based management:

- a shift from single species to multiple species conservation,
- formation of partnerships necessary to consider and manage ecosystems that cross boundaries,

[1] OPNAVINST 5090.1B, *Environmental and Natural Resources Program Manual*, 1 Nov 94, Department of the Navy, Washington, D.C., 22-12.

and

- use of the best available scientific information in decision-making and adaptive management techniques in natural resource management.

1.3 Real Estate

1.3.1 Location and Surrounding Lands

NAWS/CL is in the Upper Mojave Desert of California, approximately 150 miles northeast of Los Angeles (Figure 1.3.1). The station is composed of the North Range, of which the southwest region is in Kern County, the northern two-thirds in Inyo County, and the southeast region in San Bernadino County. The station also includes the South Range, which is entirely in San Bernadino County (Naval Air Weapons Station, 1998).

The headquarters area, Mainsite, is located along the southern border of the North Range. The City of Ridgecrest adjoins Mainsite to the south. Other nearby communities are Inyokern, 10 miles west of Mainsite, and Trona, 18 miles east of Mainsite.

Immediately to the northeast and east of the North Range is Death Valley National Park. Fort Irwin National Training Center lies immediately to the east of the South Range. The Bureau of Land Management has several wilderness areas adjoining NAWS/CL. Figure 1.3.1 shows the location of NAWS/CL in relation to its neighbors.

The NAWS/CL is the Navy's largest land holding with more than 1.1 million acres. These lands represent approximately 55% of the Navy's land holdings worldwide. A significant portion of China Lakes lands (92%) are withdrawn from the public domain and are assigned by the Department of the Interior to the Department of the Navy for use to meet its air warfare research, development, test and evaluation, and training missions.

1.3.2 Real Estate and Facilities Summary

NAWS/CL is one of three sites comprising the NAWC-WD. The other sites are at Point Mugu, California and at White Sands, New Mexico.

NAWS/CL includes a complex of laboratories and test-range facilities with a physical plant conservatively estimated to be worth about $2.2 billion (excluding land). The station covers 1,110,443 acres and is situated under restricted military airspace of nearly 17,000 square miles, making it the Navy's largest land activity. A summary of NAWS/CL land assets is shown in the below table.

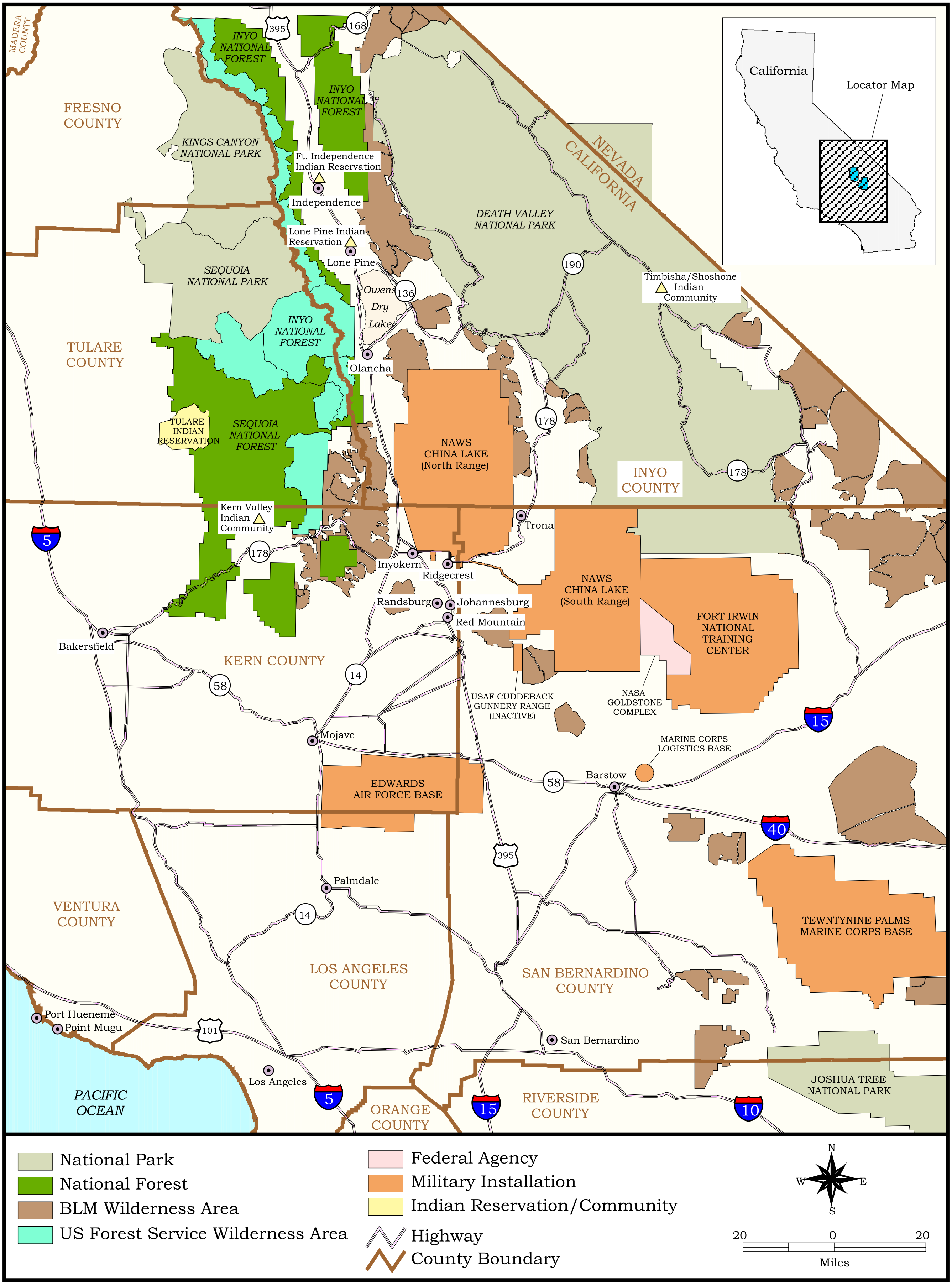

Figure 1.3.1 Regional Vicinity Map of NAWS China Lake

Summary of NAWS/CL Land Assets, 1998

Fee Simple (owned by U.S. Navy)	86,479 acres
Withdrawn from Public Domain (Expiration 30 Sep 2014)	1,023,777 acres
License/Permit/Agreement	54 acres
Easement (purchase and/or condemnation)	16 acres
In-Leased (from various sources)	117 acres
Total Land Assets, NAWS/CL	1,110,443 acres

The irreplaceable land assets of China Lake--some 1,735 square miles--are complemented by a huge restricted airspace complex, extensive air and ground ranges, and an extraordinary collection of laboratories and specialized facilities.

1.4 Historic Land Use

1.4.1 Pre-Navy Land Use

In ancient times the region had a relatively humid climate, and a system of interconnected pluvial lakes dominated the landscape. The area was rich in animal life as evidenced by large numbers of fossils in the now-dry lake bed at China Lake. Migrant Indian tribes used the water holes and left over 14,000 petroglyph images, many dating to 3,000 years ago. Trappers, missionaries, and settlers traversed the area beginning in about 1830, but they found little reason to stay. Homesteading was sporadic and occurred mostly in the early 1900s. By the beginning of World War II there were fewer than 100 people residing in the region (SRS Technologies, 1994).

1.4.2 Historic Navy Land Use

The China Lake complex and Naval Air Warfare Center had its origins in the Navy's rapidly expanding air combat role during World War II. By summer 1943 the Navy had concluded that a new and larger range was urgently needed to support an increasingly technology-dependent weapons development and testing program. Navy requirements for air-to-air and air-to-ground ordnance testing, including explosive warheads and aircraft rockets, had outstripped the capacity of existing test sites. Surveys of California inland deserts were quickly narrowed down to the Indian Wells Valley area. Its ability to support the requirements for such a facility (large size and suitable geography; availability of water, electricity, and telephone service; road, air, and rail access) were apparent. Excellent visibility due to the area's pristine air quality was also important. Equally important was the area's relative lack of human inhabitants, making land acquisition feasible.

Implementing the decision to obtain the Inyokern site as a West Coast Navy proving ground was not without difficulties. The Inyokern airfield had been nominally assigned to the U.S. Army Fourth Air Force as a dispersal field and glider school several years prior, and the Army did not willingly give up their claim. Private land ownership or use claims (including a large number of mining stakes and grazing licenses on public lands within the proposed reservation area) also had to be adjudicated, both for initial acquisition and subsequent expansions. However, the Navy eventually prevailed, setting the stage for construction of the Naval Ordnance Test Station.

The 650-square mile site was officially established as the Naval Ordnance Test Station, Inyokern, California, on 8 November 1943, with facilities construction already underway. The initial activity had a dual purpose. The immediate charter was to support the California Institute of Technology’s rocket development work for the World War II Office of Scientific Research and Development, to test air-launched rocket weapons, and to furnish primary training in the use of those weapons. Its long range role was to serve as a nucleus from which could evolve a permanent major postwar research, development, and test and evaluation center for naval weaponry (*China Lake Master Plan, Vol I*, pp. 2-5; Innis Tenebaum Architects, Inc., 1989). The isolated location of this permanent Research, Development, Testing, and Engineering (RDT&E) facility attracted other missions almost from its inception, and in 1944 an additional 380 square miles were added to the station (Christman, 1971).

The first technical facility built at China Lake was a propellant processing plant, which was urgently needed for fabrication of extruded rocket motor grains. Within a few years several large test ranges, research laboratories, and small highly specialized production plants were added. Among these was the Salt Wells Pilot Plant, which pioneered the development of chemical high-explosives booster charges for nuclear weapons (1945 to 1954). An 11,063-acre Naval Air Facility became operational in 1946.

Michelson Laboratory, a $14-million structure at the time of its construction, now housing more than $200 million in research and technical equipment, was completed in 1947. The Randsburg Wash Target Range was established in 1952; the Supersonic Naval Ordnance Research Track in 1953; and permanent ranges in 1955. China Lake test ranges have been used not only for the testing of weapons developed on-site but also by other laboratories and agencies (*China Lake Master Plan, Vol I*, pp. 2-5; Innis Tenebaum Architects, Inc., 1989). Throughout the 1940s and 1950s, major RDT&E missions included rocket systems, propulsion systems, nuclear weapons support, underwater ordnance support, and guided missile and other fire control work (NAWS, 1998).

It was necessary for the Navy to provide facilities for nonmilitary personnel support to successfully recruit skilled professional employees. Temporary accommodations were ready in January 1944. Over the next few years, these accommodations were rapidly replaced with permanent family residences and bachelor apartments. Because only minimal shopping facilities or cultural resources existed within 100 miles, China Lake was developed as a self-sufficient community complete with schools, a shopping center, a bank, a service station, and cultural, religious and recreational facilities. As the adjacent City of Ridgecrest developed, most of the Center’s civilian employees have moved into the city and surrounding community, and the majority of Navy owned family housing has been declared excess (*China Lake Master Plan, Vol I*, pp. 2-5; Innis Tenebaum Architects, Inc., 1989).

Throughout its history, NAWC-WD has been able to support the Navy and DoD’s expanding test and evaluation needs. In recognition of its ever-expanding mission and increasing capabilities, Naval Ordnance Test Station was renamed the Naval Weapons Center, China Lake in July 1967. In 1970-71 the Naval Ordnance Laboratory in Corona, California was declared excess and was absorbed by the new Center, together with its responsibilities for the Navy’s important fuse programs. In 1979 the National Parachute Test Range at El Centro, California was relocated with its mission and personnel to China Lake. On January 1, 1992 China Lake was officially combined with the Navy’s Point Mugu Sea Range and White Sands Missile Range Detachment and placed under the combined organization of NAWC-WD. In 1993 the installation name was changed to Naval Air Weapons Station, China Lake in 1993.

Throughout the history of the China Lake ranges numerous technology transfer events have occurred as a result of original research and development of new technologies at China Lake, to be later applied to commercial purposes. The Electromechanical Shuttered Video Camera, invented in 1975 by China Lake range personnel to improve images of test events, was ultimately applied to professional sports and is responsible for the high quality stop-action video images now commonly used in sports broadcasting. Other examples include artificial neural networks and energetic materials.

1.5 Land and Airspace Use

At the largest scale, NAWS/CL is divided into a North Range and a South Range, sometimes called the North Range Complex and the South Range Complex. Within the North Range and South Range are air ranges, ground test ranges, and specialty facilities.

NAWS/CL can be classified in terms of 14 distinct units in terms of military use. These include Mainsite, Armitage Airfield, Propulsion Laboratories, Main Magazines (ordnance storage areas located north of the Propulsion Laboratories), Ordnance Testing and Evaluation, five air ranges on the North Range, and four air ranges on the South Range.

1.5.1 Ranges

The brief summaries of air ranges and Ordnance T&E descriptions provided below are taken from the draft *China Lake Range Management Plan* (SRS Technologies, 1996) and the draft *Land Use Pattern Report* (Tetra Tech, Inc. and EDAW, Inc., 1997), unless denoted otherwise. Ranges are depicted on Figures 1.5.1a and 1.5.1b for North and South ranges respectively.

1.5.1.1 North Ranges

The Airport Lake Range contains 38 square miles in the west-central portion pf the North Range. The primary feature of this range is a large playa, surrounded on three sides by hills and mountains. The large playa is an ideal site for operating mobile land targets such as tanks and dune buggies. Typical devices tested in this area include mines, cluster weapons, runway penetrating weapons, air-to-surface missiles and rockets, cruise missiles, and air to surface gunnery. Airport Lake also serves as the impact site for test items launched from the G-4 Track.

The isolated nature and the natural, protected depression of the playa provide a relatively self-contained setting for testing live ordnance. Live ordnance is approved for specific areas. Much of the live ordnance is expended against moving targets, including remotely-piloted vehicles such as dune buggies, trucks, and tanks. The Airport Lake Target Area is the primary impact area at Airport Lake Range. The Airport Lake Range also contains areas that are cleared for aerial delivery of cluster weapons and mines and for use as a “race track” for mobile land targets.

The G-4 track is a 3,000-foot-long, precisely aligned, dual rail track. The muzzle overlooks a wide, deep valley, which facilitates ballistic launch trajectories several hundred feet above impact point. The G-4 track is located in a remote area, removed from occupied facilities, and is suited for tests with large hazard footprints.

The Airport Lake Range has been used for mass detonation testing with large amounts of ordnance (net explosive weights up to 500,000 pounds) expended during a single event. Small caliber gun tests and surface-to-surface rockets have occasionally been used in this area, particularly when high explosives (HE) or moving targets are required.

Baker Range

Baker Range comprises 75 square miles in the southwestern North Range. Primary test activities at Baker Range include test and evaluation of aircraft air-to-surface weapon systems (rockets, guns, and bombs), weapons system software validation, weapons ballistics, fuse functioning, and pilot proficiency in training air-to-surface weapons delivery.

Baker Range supports both inert and limited live HE ordnance testing; however, 95 percent of ordnance dropped onto Baker Range is inert, which do not have high explosive warheads, but frequently have small explosive components, such as destruct charges, fuse actuators, or spotting charges to validate fuse function and assist in scoring.

Charlie Range

Charlie Range includes 40 square miles in the southwestern North Range, east of Baker Range. Several impact areas have been developed on Charlie Range over the last 50 years. One impact area, C-3 Target Center 2, receives regular use, while others receive only occasional use.

Charlie Range has been used for many years as an air-to-surface test range, including T&E of air-to-surface weapon systems (rockets, bombs, and guns); T&E of weapons system software; and validation of unguided weapons ballistics, fuse functioning, sensor technology, flares, and pilot proficiency on air-to-surface weapons delivery.

Charlie Range can support inert and live HE ordnance. However, the vast majority of ordnance dropped in this area today is inert items that frequently have small explosive components.

Charlie Range is used for unusual tests, such as tethered balloon tests with sensors mounted on the balloon platform. Charlie Range is a site for testing sensor equipment, which can be tested against aircraft involved in other tests (targets of opportunity).

The Supersonic Naval Ordnance Research Track (SNORT) is a 4.1-mile-long heavy duty dual rail track, capable of propelling monorail or test vehicles at speeds up to 4,500 feet per second. A series of towers/poles are available trackside at SNORT, including a simulated rain field for erosion testing. Test vehicles weighing up to 136,000 pounds have been run on the track.

The Vehicle Barrier Track is a 100-foot-long section of rail secured onto a flat concrete pad, available for testing motorized vehicles against anti-terrorist barricades. Tests typically involve propelling specially adapted vehicles into barricades at the end of the track.

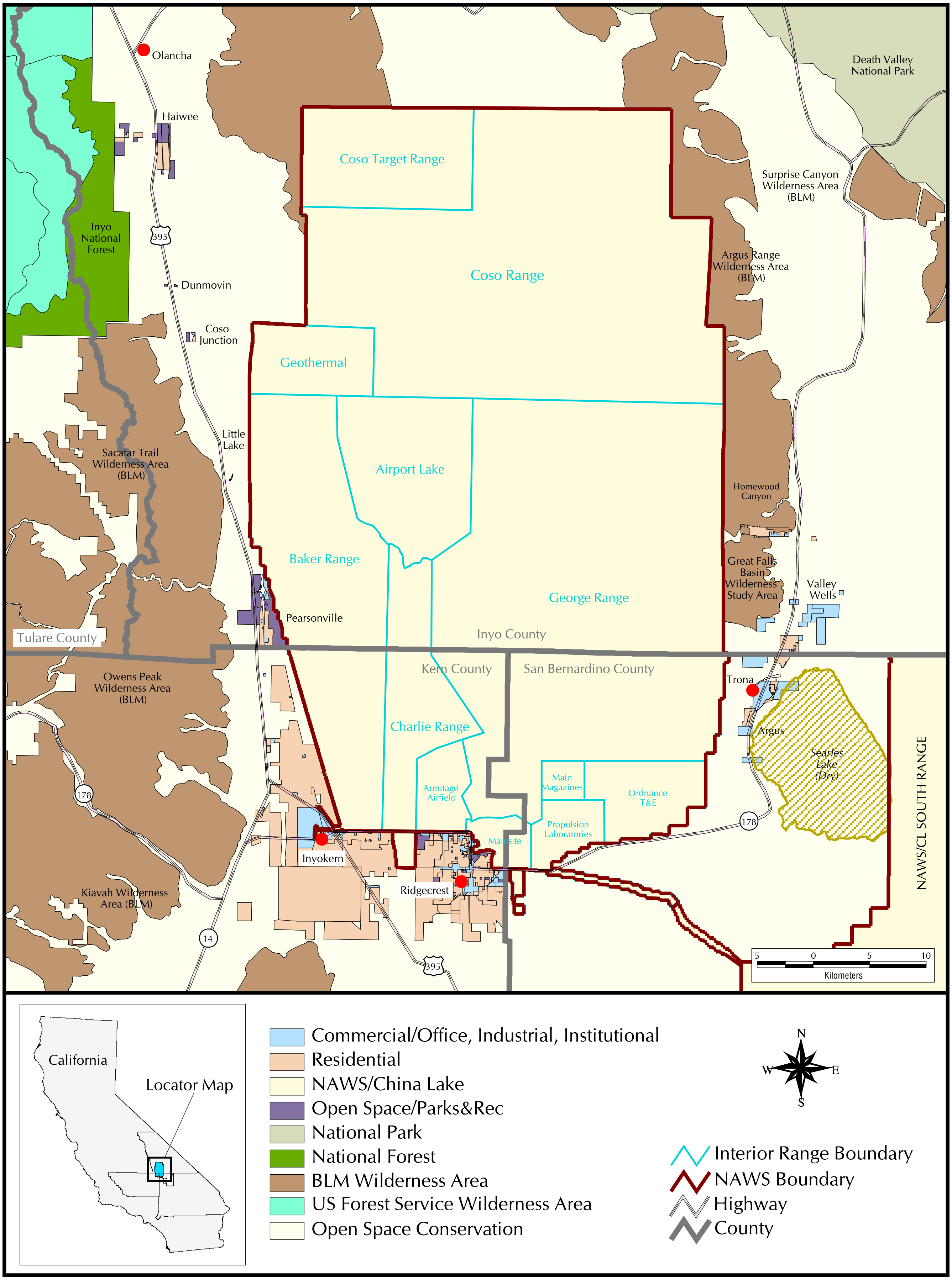

Figure 1.5.1a NAWS/CL North Range Interior Ranges and Off-station Land Use

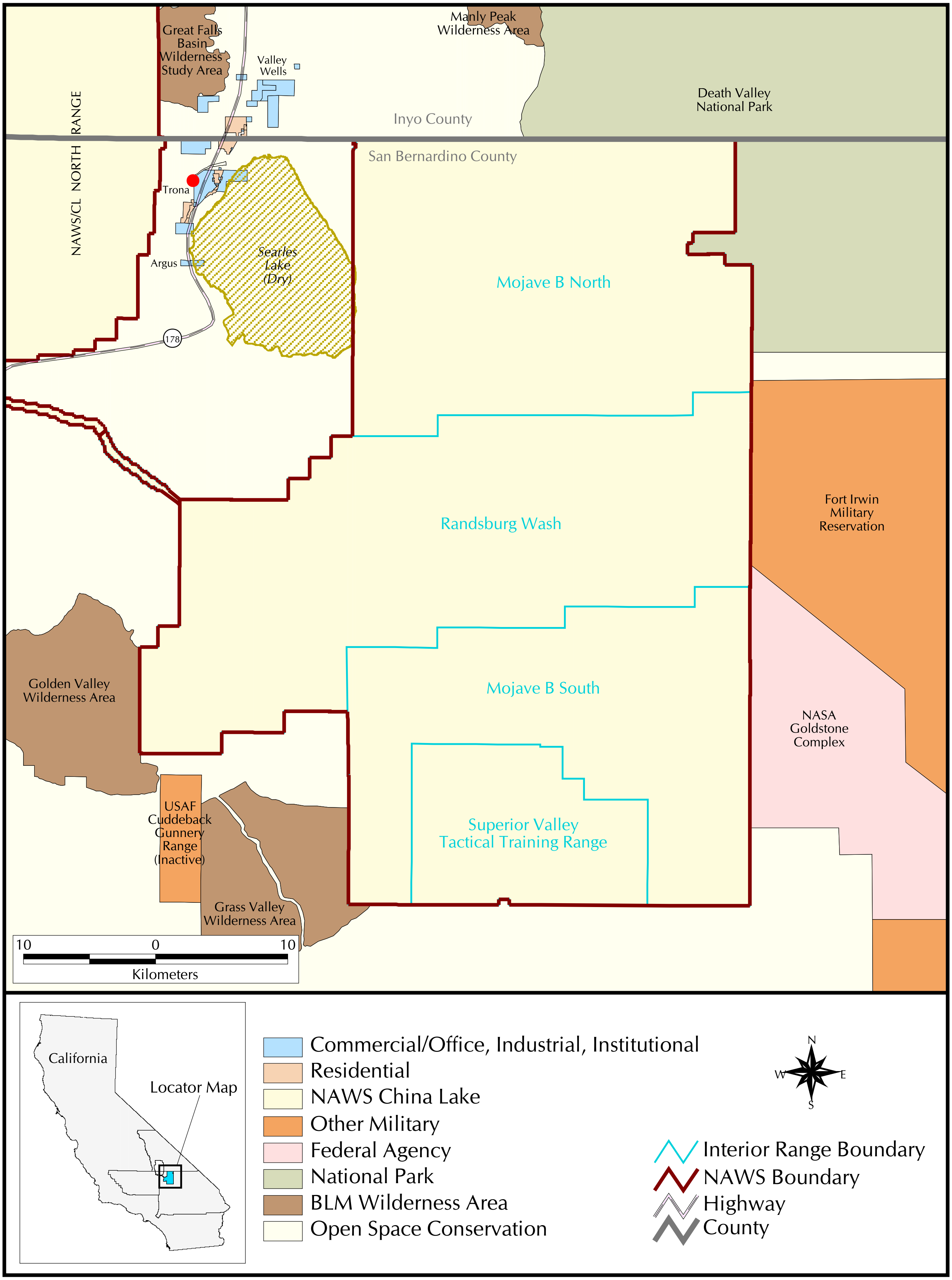

Figure 1.5.1b NAWS/CL South Range Interior Ranges and Off-station Land Use

Other associated facilities include the Accidental Bomb Release Facility which is a 100-foot length of rail used to simulate shipboard scenarios where warheads accidentally released from aircraft tumble across the deck of a ship before impacting against a superstructure. Test items are accelerated over the rail prior to release. A stationary ejection test stand is used for static seat ejection tests. Testing of seat ejections from aircraft cockpits is common at this facility.

Coso Range

The Coso Range (or Coso Military Target Range) is in the northern North Range. Included in this area are the Coso Tactical Range, Coles Flat, Wild Horse Mesa, Cactus Flats, Junction Ranch Radar Cross Section Range, Darwin Wash, and the Coso Known Geothermal Resource Area.

The Coso Tactical Range provides a realistic tactical military environment for test and evaluation activities and aircrew training. The large variety of conditions and terrain in Coso Range presents pilots with unexpected, realistic conditions that are not duplicated at other aircraft test ranges. Expanded inert ordnance is removed to retain the natural appearance of target areas.

The Coles Flat Target Area contains 30 radio frequency (RF) targets used for Anti-Radiation Missile (ARM) testing and a cleared area developed originally for cruise missile testing and currently used by the Joint Stand-Off Weapon program. The Wild Horse Mesa Target Area contains nine RF targets used for ARM testing.

Numerous sites on the North and South ranges have been used for mass detonations; however, Cactus Flats is the only site permanently configured for such tests. The upper Cactus Flats facility is used as a large-scale and small-scale explosive safety test arena for performing safety testing. The 1,157-acre site consists of a 4,000-foot-radius recovery zone with a cleared innermost radius of 1,000 feet. Lower Cactus Flats test activities include structural response, sympathetic detonation, safety testing, certification testing, and storage configuration testing.

Darwin Wash is in northeastern Coso Range. Darwin Wash has been used as an impact site for rocket-propelled gun ammunition and, more recently, for classified projects involving weapons testing in an isolated and secure environment.

The Junction Ranch Radar Cross Section Range is an isolated outdoor test facility for radar cross section testing of ground, air, and sea-based vehicles, test articles, and components. It encompasses about 65 square miles in the northeastern quadrant of the North Range. Most Junction Ranch facilities are in Etcheron Valley. Surrounding terrain limits visual line-of-sight into the Junction Ranch area and helps minimize security and electromagnetic interference.

George Range

George Range (G-Range) encompasses the desert floor of northeastern Indian Wells Valley. The Argus Mountains on the east and Coso Mountains to the north make natural buffers for safety and security along with ideal vantage points for test instrumentation.

G-Range is the primary air-to-surface test range at NAWS/CL. As the largest and most heavily instrumented range, G-Range supports the largest number of test events on the North Range and is used primarily for test and evaluation of air-to-air, air-to-surface, and surface-to-air guided missiles. Target/impact areas on G-Range support weapons testing in all formats conducted at NAWS/CL.

G-Range can be split into areas that support tests that require airspace only and areas for tests that require impact of the land area with some type of weapon or test article. Guided missiles, free fall weapons (bombs), and aircraft guns plus all types of parachute retardation and emergency egress recovery systems are tested on this range. The range is used as a target area for cruise missiles that are launched from the Sea Range, approximately 150 miles southwest of NAWS/CL.

As the primary T&E range, G-Range experiences even more unusual or different types of tests than other ranges, from simple sensor and seeker tests, to ditch trials in support of Desert Storm, to Unmanned Air Vehicle tests and parachute systems tests.

There are several facilities on G-Range which provide a wide variety of capabilities to support ground test scenarios, which can be designed to evaluate surface-launched rockets, guided missiles, and gun-fired projectiles (Innis-Tennebaum Architects, Inc., 1989). Ground ranges located on G-Range include: K-2 Gun Range, Tower 11 Gunline, Guided Missile Range (G-1 Range), Exterior Ballistics Range (G-2 Range), Small Missile Range (Redeye Range), and Antiship Missile Defense Range (G-6 Range).

The Parachute Drop Zone is a cleared 1-mile-diameter area on G-Range. It is the primary test facility for the Parachute Operations Division. The Drop Zone is 10 miles northeast of Armitage Airfield. It is surrounded by instrumentation and buffered by several miles of unobstructed terrain.

Warhead testing involves arena testing to measure effectiveness of operational and developmental weapons, fuel-air testing, gun testing, and a large variety of specialized testing and research and development activities. Test facilities located on G-Range include: Area R, Burro Canyon, and Weapons Survivability Laboratory, each self-sufficient with utilities, control rooms, instrumentation for control of the test area, as well as synchronized photographic coverage.

Test Support Facilities in George Range include: T-Pad, the main telemetry receiving site; Instrumentation Operations Building, primarily used for photo optical instrumentation work and staging for instrumentation operations; and G-1 and G-2 Assembly Areas, used to prepare ordnance.

Also located within G Range is the Burro Canyon Open Burn/Open Detonation facility. This facility is used to treat explosive hazardous waste. The waste consists of energetic waste generated from R&D laboratory activities as well as munitions waste (both nonstandard items that are no longer useful to RDT&E purposes and standard items that are expired, excessed, or unsafe). The primary means of treatment is through open detonation. Open burning of wastes typically occurs no more than once each year and id conducted in a burn pan. A total of 300,000 pounds of energetic wastes are authorized for destruction on an annual basis. The facility currently operates under an interim permit, although a multi-year permit application was prepared and submitted to the state regulators for approval. Part of the permit application process has required the preparation of both Human Health Assessment and ecological Risk Assessment. These assessments are complete and are being coordinated with appropriate regulatory agencies including the Department of Toxic Substance Control, the Great Basin Unified Air Pollution Control District and the California Department of Fish and Game.

Ordnance T&E Area

The Ordnance Operations Division manages and operates test facilities for static testing of solid propulsion rocket motors, arena tests of warheads and other explosive devices, and evaluating weapon reactions to military hazards, such as aircraft fuel fires, bullet impacts, and drops.

Skytop test facilities are used for static testing (firing) of a complete range of solid fuel rocket propulsion systems. Isolated test areas and facility designs permit testing large, high energy, high risk systems. Skytop test facilities contain eight static test facility bays and a Contained Burn Assessment Test chamber for evaluating combustion characteristics of various solid rocket motors. The Aeroheat Test Facility (T-Range) provides for the test and evaluation of ramjet components, connected-pipe tests of ramjet engines, and a ground test capability for aerodynamic heating materials. CT-6 Facilities are used to test Fuel Air Explosives and other non-fragmenting ordnance. There are facilities for testing Liquid Gun Propellant and two 180-foot towers, multiple firing circuits, high-speed camera, video camera, data acquisition systems, and a bunkered control room. The CT-1 facility contains two major test sites; fast and slow cook-off. One control bunker provides data acquisition, video monitoring, or other documentation for all test areas. The CT-4 facility contains three fast cook-off sites, a bullet impact area, and a 40-foot drop tower. The Radiographic Inspection Facility in the Salt Wells Area contains non-destructive, in-door testing facilities, radiographic inspection facilities, high energy computed tomography, and conventional X-ray machines.

1.5.1.2 South Range

The Electronic Combat Range (ECR) is the primary occupant of the South Range and uses air space in Mojave B North, Mojave B South, and Randsburg Wash areas. Test, evaluation, and training capabilities; air-to-surface tactical combat training facilities; and ground test ranges make the South Range a prime location for testing and training. Key facilities and instrumentation include numerous threat emitter systems, a largely clutter-free environment, simulated targets, and Unmanned Aerial Vehicle facilities.

Randsburg Wash

The Randsburg Wash Area covers 418 square miles in the middle of the South Range in an isolated 15-mile-long valley surrounded by Robbers Mountain, Straw Peak, and Brown Mountain. The primary mission at Randsburg Wash is to provide, maintain, and continuously improve an open-space test range and laboratory for engineering, testing, analysis, and electronic combat training, conditions ideal for testing systems and technologies that have a role in countering or penetrating air defenses.

The range supports all types of airborne electronic combat testing and provides multiple threat systems (actual and simulated) employing a large spectrum of technologies. Specific examples include testing radar warning receivers to ensure or verify hardware and software accuracy and response, ARM weapons flight testing, seeker evaluation, development and evaluation of tactics against surface-to-air threats, and hardware-in-the-loop testing.

The Time Space and Position Information (TSPI) Site is used for three Nike radars to provide TSPI tracking radars. Charlie Airfield is located in the eastern half of Randsburg Wash. This simulated airfield is 7,000 feet long and has multiple targets available for bombing of all types of inert ordnance. It can accommodate as much as 2,000 pounds; however, special coordination is required for any forward firing. This site is also used for Fleet Training and by Special Forces to train and conduct exercises.

At the Randsburg Wash Fuse Range gun projectiles and ballistic and guided missiles are fired against targets suspended between two towers to measure fuse sensitivity and fuse patterns and to determine how aspects of targets affect fuse performance. Most tests do not use weapons with explosive warheads, but these items often contain small explosive charges to demonstrate fuse function.

The North Towers are two 350-foot-tall wooden towers. Full scale aircraft targets and shapes can be suspended 250 feet above the ground, providing fuse test environments that closely simulate tactical conditions. Ordnance fired at targets between the towers is generally inert or may have small spotting charges. Ordnance fired down the firing line to the east is frequently live. The towers are also used to test parachute characteristics and related life support equipment.
The Randsburg Wash Howitzer Range is used to test the application of variable-time fuses for different types of bombardment firings with a variety of inert, high-explosive-loaded, or pyrotechnic-loaded projectiles. This range is also used to test fuse arming performance and reproducibility of minimum arming distance or time.

The Parachute Drop Zone is located on the north side of the Randsburg Wash Landing Strip. The drop zone has a 400-foot-diameter circle surrounded by a road network. All types of parachute testing and training are conducted at this site.

The Randsburg Wash Landing Strip, 5,100 feet by 60 feet, is one mile east of the two North Towers and is primarily used for parachute testing. The Landing Strip is under construction to upgrade the strip to support landing craft used by the parachute group.

The UAV Site enables South Range users to test UAVs in an electronic combat environment without the need for a chase aircraft. The UAV site has three graded and compacted runway surfaces forming a triangle, with the longest runway oriented in the prevailing wind. The three runways are 2,000 feet by 90 feet, 1,100 feet by 75 feet, and 1,000 feet by 75 feet. This site also provides Special Forces a location for training. A nearby dry lake is often used for light model (UAV) take-offs and landings.

The Black Mountain site supports integration of a permanent land based surface-to-air threat simulator. This site also is the location for a remote Global Positioning System (GPS) site, solar powered and unmanned.

Laser Line Road is in a prime location for laser testing. The valley location provides adequate eye protection for personnel.

Mojave B North Range

Mojave B North includes 205 square miles in the northern South Range. The Range has two valley floors, one with a south-north orientation and the other east-west. High mountains surround each valley. Various land targets are located in the southwestern and northeastern corners of the range. Mojave B North provides a realistic tactical military environment for attack and fighter aircrew training. This range also provides an area for Special Forces to train in conjunction with Fleet exercises.

Mojave B North supports all types of inert air-to-air gunnery, air-to-ground gunnery, rockets, ground-to-ground gunnery, and small arms firing. Some missions have conducted ground and air lasing for target designation. The Mojave B North Range is excellent for tests that require special access due to its control of entry and exit points.

The Brown Mountain GPS site is one of four remote GPS sites on South Range. This site tracks air and ground platforms at a low level or in areas not covered by other tracking radars. Straw Peak is a one-mile square cleared area which contains a GPS, a calibration tower, a radio repeater, a weather station, and two concrete pads approximately 30 feet by 50 feet. The Slate Range Facility is a radar and data acquisition support facility on a mountain top in the southwestern corner of Mojave B North. It supports flight and data requirements in the South Range. The Photovoltaic Field is a 200-foot by 200-foot photovoltaic field constructed on the Mojave B North Range. This field will provide power to radar that will be established in the Mojave B North Range in the future.

Wingate Airfield is an 8,000-foot dirt runway used for air-to-ground ordnance delivery. There are hulk aircraft frames at the airfield that are used for targets. The airfield is used for attack and fighter aircraft, as well as helicopter bomb drops of up to 2,000 pounds of inert ordnance. Air-to-air gunnery exercises are also conducted over the airfield. Other typical tests conducted at or near the airfield include inert rockets, 20 mm guns, 50 cal. guns, 7.62 mini gun, small arms, chaff, day flares, night flares, laser-guided practice bombs, and cruise missile overflights. This area has the capability to be used for live HE type ordnance.

The Convoy North area is one mile south of Wingate Airfield, about 50 yards south of the main road. The Convoy South area is two miles north of the southern gate (Marine Gate). Both target areas are used to give attack and fighter aircraft, as well as helicopter and ground troops, a tactical, authentic looking layout of attacking forces. Tests incorporating inert rockets, 20 mm guns, 50 cal. guns, 7.62 mini gun, small arms, chaff, day flares, night flares, and lasers are conducted at and around the airfield.

Mojave B South Range

The Mojave B South Range includes 101 square miles in the southern South Range, surrounding the Superior Valley Tactical Training Range on the west, north, and east. The Mojave B South Range is used as airspace support of the ECR and other South Range testing. A few events each year require mobile radar at two sites to support specific air tests.

Pyramid Point is a 100-foot by 40-foot surveyed site with radar corner reflectors and radio repeaters. Future plans include the installation of microwave repeaters, a utility corridor, and an additional radio repeater. Pilot Knob is a 50-foot by 50-foot surveyed site with a GPS repeater.

Superior Valley Tactical Training Range

The Superior Valley Tactical Training Range contains 76 square miles of secluded land and airspace within Mojave B South and provides targets and accommodations for the aerial delivery of conventional training ordnance. Range size, facilities, and targets provide the opportunity to operate from an isolated ground position within which to mark targets and direct aircraft to drop ordnance. The Northwest Tactical Target Complex can be used for light/heavy inert bomb deliveries and high-angle strafing.

The Bullseye Target is an area where loft deliveries of conventional weapons and high-angle strafe are dropped on the main bomb circle. Although nuclear weapons delivery proficiency is not currently required for Naval strike crews, the Superior Valley Range has such facilities and procedures available for use by other services. The Southeast Airfield Target Range Complex is used for bomb deliveries; however, the southern portion of the Complex is a no-drop zone. Low-High Angle Strafe Areas are used for low and high-angle strafing for aircraft with small to medium caliber gun systems.

1.5.2 Categories of Operations

Activity at NAWC-WD generally falls into one of four major categories: Research and Development (R&D), Test and Evaluation (T&E), Training, and Support. These major categories, functionally defined below, all play important roles in meeting DOD research, test, acquisition, and operational requirements.

The draft *China Lake Range Management Plan* (SRS Technologies, 1996) describes the NAWC-WD military mission and operation of ranges at China Lake in considerable detail, including range operations management processes, examples of test scenarios, safety, relationships with Point Mugu Sea Range, current and future trends in range use, and strategic planning for range use. The below brief summary of the military mission is taken from this document, unless referenced otherwise.

1.5.2.1 Research and Development

The Department of Defense and the Navy conduct research, development, test, and evaluation of electronic combat systems and munitions to ensure technological superiority and force readiness. Research and development activities support the early stages of the DoD weapon system acquisition process and are closely linked to test and evaluation in the overall weapons development cycle. Laboratories perform basic and applied research on promising technologies to determine their feasibility for production and use. Programs also conduct developmental tests and evaluations during the concept exploration and demonstration/validation phases of acquisition as a part of their overall RDT&E efforts. Such activities are routinely conducted and/or supported at NAWC-WD, which boasts many unique, specialized facilities that contribute to research efforts in energetic materials, propellants, and models and simulations.

1.5.2.2 Test and Evaluation

Test and evaluation of weapons systems is a continuous activity that occurs throughout a system's life cycle. Test and evaluation includes developmental testing (part of the RDT&E acquisition process), operational testing (to accept new systems into inventory), and follow-on T&E (to verify continued reliability). Typical weapons programs progress through a common set of test and evaluation activities.

Models and Simulations

Models and simulations are software representations of system hardware, processes, and environments, designed to faithfully replicate individual systems' interactive characteristics. Such tools are used to conduct analysis of weapons systems at the system, subsystem, or component level. Modeling and simulation can provide various degrees of fidelity and realism, based on needs and objectives of the program. It is often conducted early in the test program as a stepping stone towards subsequent "hands on" T&E activities but can also be applied during other phases of the program as required.

Measurement Testing

Measurement testing is typically employed at the component or subsystem level and is used to measure physical or performance characteristics of test articles prior to system integration tests. Examples of measurement testing means include radio frequency signature measurement instrumentation, mass/physical property measurement devices, and sled tracks, among others.

System Integration

System integration testing evaluates the interaction of multiple system components in a controlled environment. Such tests are used to investigate the performance of each element when operating within its larger system context, as well as to provide preliminary insights into interface and interoperability issues.

Hardware-in-the-Loop Tests

Hardware-in-the-loop tests involve a mixture of tactically representative hardware (prototype or actual development) and simulation. Such tests are conducted to confirm that critical weapon system hardware operates as expected based on modeling and simulation predictions. These tests allow the hardware to be operated over a range of simulated conditions that may never occur during more integrated tests or operations when all the pieces of the system are operating interactively.

Open-Air Range Tests

Open-air range tests are perhaps the most tactically representative means of testing, used to evaluate weapon systems under natural operating conditions and to replicate realistic employment/operational scenarios to the maximum extent practicable. Air and land ranges within NAWC-WD (Chapter 5) can accommodate a wide variety of open-air range test requirements. Open-air testing may be captive carry (no release of the test article) or full-up employing ordnance, either inert or live.

1.5.2.3 Training

Another major category of operations at China Lake is providing suitable facilities and support for training activities by operational military units from all military Services. Proficiency training involves DoD personnel who are training to maintain or practice operational skills and military capabilities. Training for air-to-air and air-to-surface combat is a significant element of NAWC-WD operations, with many ranges well suited to support the scheduling and conduct of air training activities as well as test and evaluation. Air-to-air training involves multiple aircraft, often with emulated red-force units, and requires a large airspace, good range instrumentation, and well-coordinated range planning and management. “Top-Gun” training/graduation exercises, regularly hosted at China Lake, are one example of such training.

Air-to-ground training can involve weapons release/engagement (gunnery, bomb, and rocket) as well as non-weapons tactics and operations training. A variety of practice targets and tailored training sites located throughout the North and South ranges provide the varied terrain and environmental conditions necessary to support the challenging training regimes required by the military aviation community. Many China Lake ranges also have an inherent capability for other types of air and ground training and exercise. For example, jump facilities accommodate parachute practice and exercise activities.

1.5.2.4 Support

A broad range of management, planning and oversight activities are conducted by NAWS/CL to provide requisite support for the R&D, T&E, and training missions of NAWC-WD. Airfield operations and services, resident Test Squadron support, environmental management, safety, financial management, procurement, security and intelligence, public affairs, and legal services are some major support activities resident within the NAWS/CL support structure. Base host services, such as medical, police, and fire services; civil engineering; personnel, logistics, communications, and real property management; and maintenance/ repair, are also provided. The resourcing for and maintenance of test and range equipment/instrumentation to support range activities are also part of the overall support category.

1.5.3 Station Population

NAWC-WD employed over 4,600 civilian and over 1,081 military personnel at China Lake in 1996. This force was augmented by nearly 1,500 contract employees. In Fiscal Year 1993 NAWC-WD procured about $642 million in goods and services, including salaries. Ongoing government budget and personnel cutbacks are eliminating nearly 1,000 positions with even more proportionally severe declines in support contractor payrolls (SRS Technologies, 1996).

1.5.4 The Military Mission and Natural Resources

The military mission affects the land and its natural resources, and the military mission is, in turn, affected by the nature of the land and its resources. The challenge at China Lake is to conduct the military mission while conserving natural and cultural resources, maintaining compliance with environmental laws, and providing stewardship of public lands.

There are several important points regarding the military mission and natural resources at NAWS/CL:

- Navy use of land is not particularly land intensive.
- Existing test sites are routinely re-used, which takes advantage of existing instrumentation and infrastructure and avoids costs associated with establishing new areas.
- Large areas remain undisturbed and serve as safety and security buffer zones.
- Most high value resource areas are in locations not intensively used for ground-related military activities.

NAWS/CL is developing a *Land Use Pattern Report* (Tetra Tech, Inc. and EDAW, Inc., 1997) as part of its materials for the *Comprehensive Land Use Management Plan* (NAWS, 1998). This report evaluates impacts of the military mission on the land at China Lake. Below materials were taken from this report, unless indicated otherwise.

Operations at NAWS China Lake include RDT&E for air warfare systems, training activities, and base support activities. Research and development operations take place within the laboratories, while testing, evaluation, and training typically occur within the air and ground ranges, including the special purpose ranges. Armitage Airfield operations include RDT&E and support and training activities (Innis-Tennebaum Architects, Inc., 1989).

1.5.4.1 Research and Development

Most R&D for NAWC-WD occurs within laboratories at NAWS/CL. Laboratory operations occur both indoors and outdoors for each laboratory.

Operations for Mainsite laboratories (Michelson, Lauritsen, Engineering, Solid State Devices, Thompson, and MESA) take place entirely within their respective facilities. Because some R&D involves energetic materials, laboratory facilities must be maintained according to strict fire and safety standards. Outdoor operations occur at some facilities in the Propulsion Laboratories area including detonation physics testing of relatively small items. The firing is remotely controlled. Outdoor operations at the thermal research area include thermal characterization of fast cook-off (open air flame) and small-scale and large-scale cook-off of energetic material. Because these operations take place outdoors, they contribute more directly to the land use patterns at NAWS China Lake. However, operations at these facilities are confined to the Propulsion Laboratories area, a developed area that is an existing zone of disturbance, with an established land use pattern confined to the zone of disturbance. Further disturbance to natural resources is not anticipated.

1.5.4.2 Test and Evaluation

Weapons testing and evaluation is conducted in the air and on ground ranges at NAWS/CL. Tests can include air-to-air, air-to-surface, surface-to-air, surface-to-surface, and test operations involving ordnance T&E, parachutes, mass detonation, high-speed test tracks, and radar cross section. Operation profiles are described for each of these in the draft *Land Use Pattern Report* (Tetra Tech, Inc. and EDAW, Inc., 1997). Of greatest concern to natural resources management are the target and impact areas (Zones of Disturbance) (Figures 1.5.4.2a and 1.5.4.2b) that result from the testing and evaluation operations.

1.5.4.3 Training

A variety of practice targets and tailored training sites located throughout North and South ranges provide the varied terrain and environmental conditions necessary to support training in air-to-air and air-to-surface combat skills. Many NAWS China Lake ranges also have the capability to provide training in other types of air and ground training and exercise.

Fleet Training

Training activities in the North Range include proficiency training for DoD personnel who are training to maintain or practice operational skills and military capabilities. Training in the North Range includes air-to-air and air-to-surface combat operations (Coso Tactical Training Range). Air-to-air training involves multiple aircraft, and requires a large air space. Fleet Training exercises on the South Range can involve targets located at either Charlie Airfield, Wingate Airfield, or both. The target location is dependent on customer needs. A tactical exercise, which may involve radar evasion, could also include a simulated bomb/ordnance drop. These exercises do not directly impact the ground and its natural resources.

Superior Valley is used for tactical training with air-to-surface weapons systems for fleet squadrons from Naval Air Station Lemoore, Naval Air Station Fallon, and other Navy and DOD installations. This range is used for delivery of ordnance including practice bombs, rockets, flares, chaff cartridges, and gun projectiles by Navy pilots.

Special Forces

Special Forces exercises at the South Range are operations in which inert ordnance may be dropped at Wingate Airfield or Charlie Airfield. Other Special Forces training operations take place Station-wide but particularly at the South Convoy in the South Range. Activities can involve the insertion of troops, with the troops engaged in operational ground training in warfare-like scenarios, including weapon firing and target lasing. In addition, the operation may involve reconnaissance training or weapon firing.

1.5.4.4 Summary of Zones of Disturbance

Ground-disturbing land uses at NAWS/CL include:

- facility sites,
- inactive target disturbance areas,
- active target disturbance sites,
- special use sites,
- test facilities,
- instrumentation sites, and
- roads.

A significant component of the land use pattern is the target disturbance areas, which are categorized as either active or underutilized to distinguish a difference in potential effects to environmental resources. Active disturbance areas consist of locations currently being used as target points and underutilized targets will be used as the need arises.

Figures 1.5.4.2a and 1.5.4.2b show zones of disturbance at NAWS/CL. Due to the large land area of NAWS China Lake (and the resultant scale of maps used to delineate facilities, instrumentation (emitters, both existing and proposed, and Range Control Center Integration and Processing System (RIPS)), special use sites, test facilities, and targets are shown with symbols that are larger than their actual size. The RIPS sites include cameras, launch area, radar, targets, and other sites.

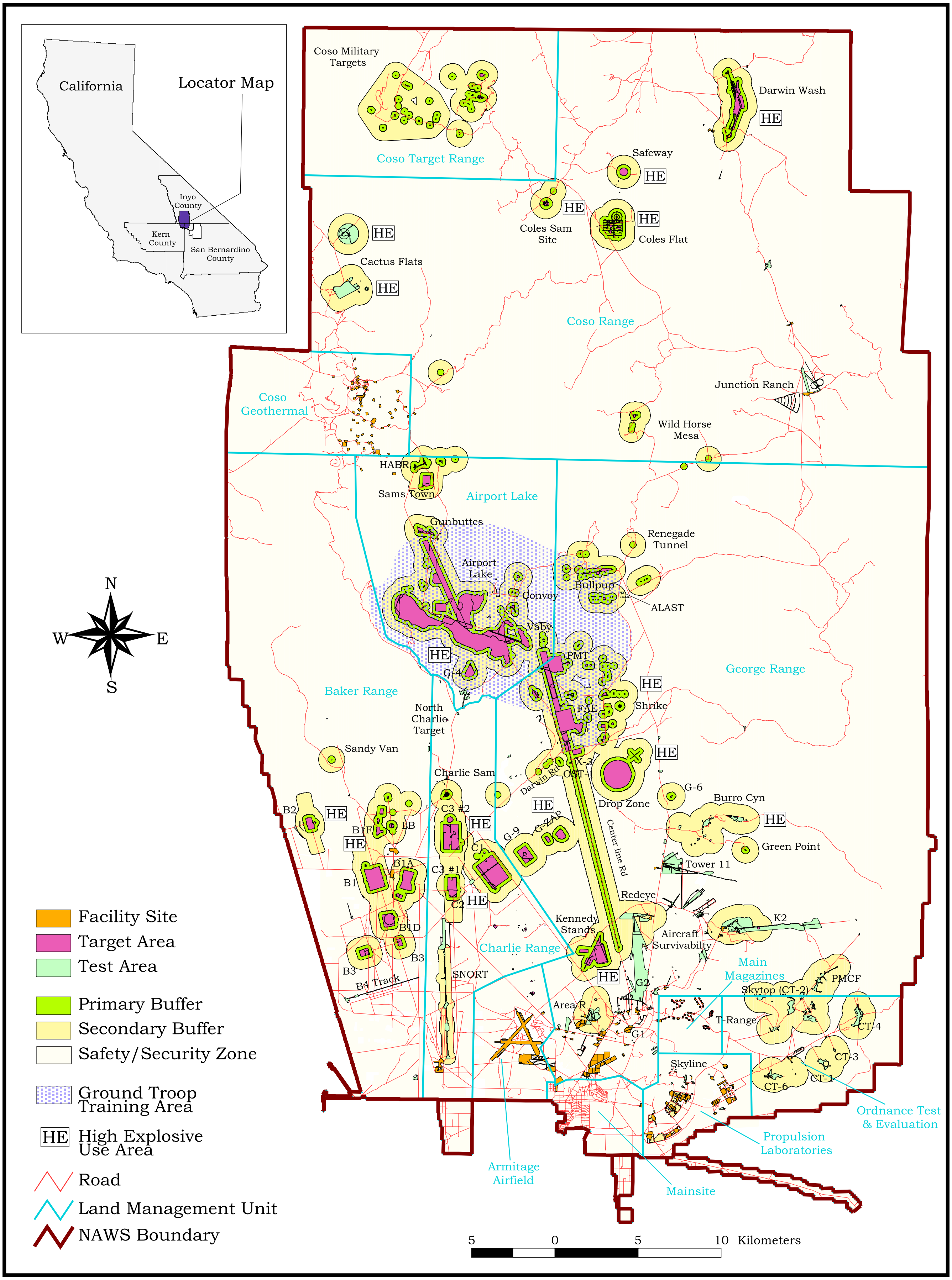

Figure 1.5.4.2a NAWS/CL North Range Zones of Disturbance

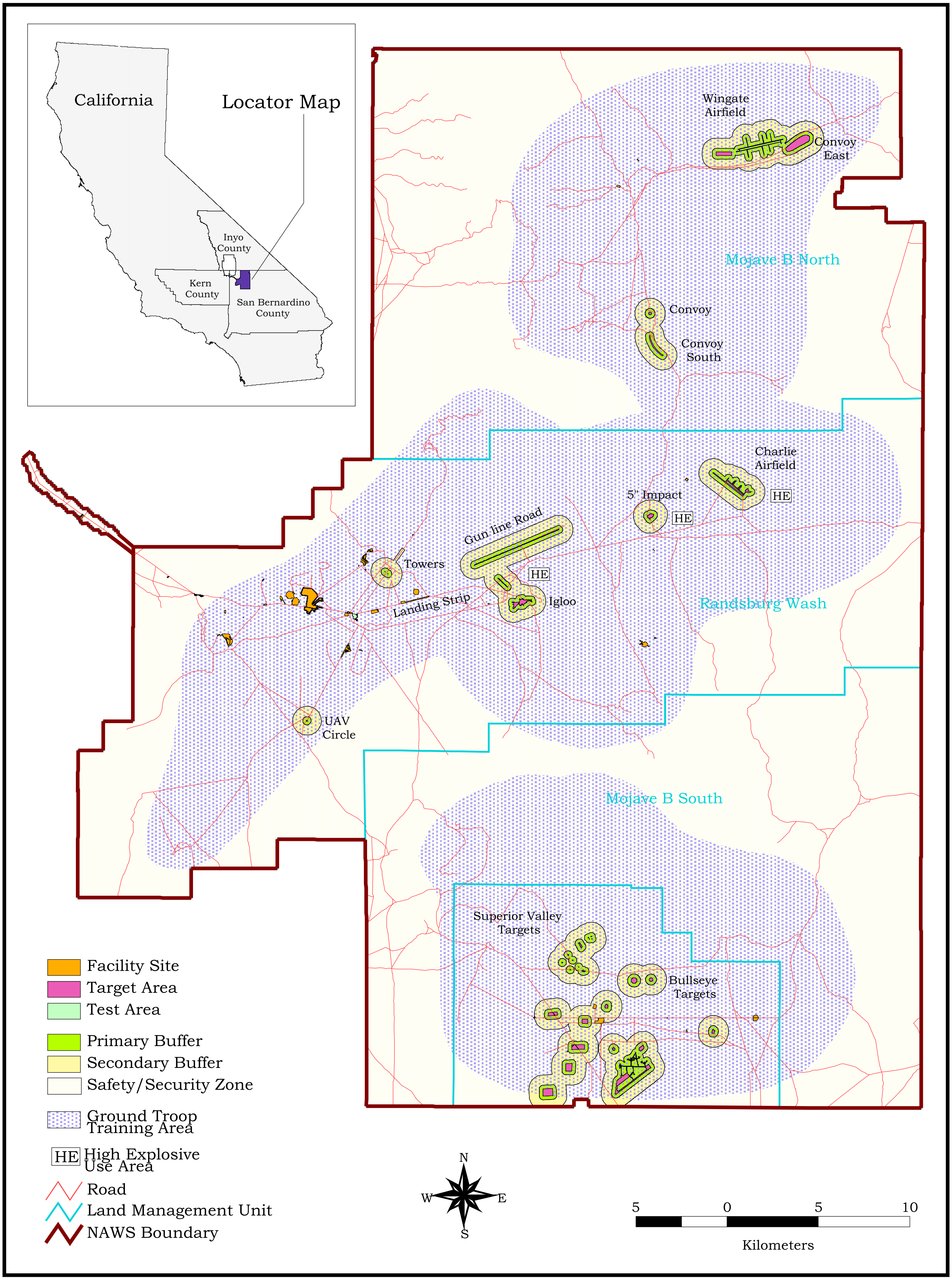

Figure 1.5.4.2b NAWS/CL South Range Zones of Disturbance

Uses and operations create clear land use patterns. The most significant grouping occurs in Baker, Charlie, and the Airport Lake ranges, where the greatest number of T&E operations occur. Numerous other uses are located throughout the installation, with their locations partly driven by access roads required to reach remote targets and instrumentation.

1.5.4.5 Historic Ordnance Use

Areas with unexploded ordnance (duds) may present unique challenges to natural resources management. All test and training areas on China Lake have unknown quantities of ordnance from unrestricted test and training exercises during WWII, the Korean War, and the Vietnam War. These ranges are defined by NAWC-WDINST 5510.1 and include all range areas except those occupied by continuously non-range functions from the earliest history of the Station (NAWS, 1998). The draft *Comprehensive Land Use Management Plan* (NAWS, 1998) includes maps of areas with the greatest levels of historic ordnance use.

North Range

The principal source of general ordnance on the North Range Complex's range areas was the testing and training activities during the first few years (1943-1947) of the station's history. The complex was established during World War II to provide an area to test newly developed rockets and to train pilots in the use of these weapons. Because these weapons were urgently needed for the war effort, tests and training commenced before the ranges were fully established or instrumented. Range boundaries were not clearly established in these early days, and the failure rate of early rockets was very high compared to experimental weapons of today.

With inexperienced pilots flying over unfamiliar terrain and attempting to locate target areas that were hastily established and not clearly delineated, target misses were inevitable. The number of duds on the remote areas of the North Range Complex cannot be determined with certainty; however, it is reasonable to assume that they are numerous.

By the early 1950s test ranges were well delineated, and tests were more closely controlled than they had been in the 1940s. This helped minimize additional ordnance contamination. However, additional unexploded ordnance is probable due to the increased testing and training tempos during the Korean Conflict (early 1950s) and the Vietnam Era (late 1960s and early 1970s).

South Range

Unexploded ordnance on the South Range Complex from early use is, if anything, more pervasive than on the North Range. Originally established as an aerial gunnery range to support World War II training operations for Marines, the entire area was principally devoted to training from 1943 until the Randsburg Wash Test Range (RWTR) was established in 1950. As basically a free play training area, there were few, if any, restrictions on where ordnance was dropped. After the RWTR was established, this central area was mainly devoted to testing of guns, fuses, and rockets. Training in the RWTR area was then restricted to specific sites, thus minimizing additional general unexploded ordnance. However, free play training activities continued in the North and South Mojave B areas until the early 1970s. Training after 1950 usually used inert training rounds, but training rounds often have small explosive charges to expel smoke puffs and to actuate fuses. Since these devices do not always function, even debris from inert training rounds can constitute an explosive hazard. Records do not exist for the type and amount of ordnance expended on Mojave B ranges in those early days.

Current policies and practices minimize further unexploded ordnance. Explosives use must meet established criteria, and debris from current tests is removed from the ranges and test sites to the extent possible. Customers are assessed a clean-up fee as part of the test cost, and contract Explosive Ordnance Disposal (EOD) crews are employed to perform this function. Designated test sites and impact areas must be kept clear of ordnance and test debris to avoid interference with acquisition of test data and to assure the safety of personnel during test preparation and post-test recovery of test items for analysis (NAWS, 1998).

Ordnance cleanup and disposal for current range operations is routine and consistent. EOD and contract crews, whose primary responsibility is cleanup from current testing and training on the North Range Complex, also clear ordnance from areas contaminated by early use when time and budgets permit. On the South Range most ordnance expenditures are for training exercises and most of that is on the Superior Valley Training Range. An EOD crew periodically clears ordnance items from Superior Valley. This crew also clears ordnance from other South Range sites when time and budgets permit (NAWS, 1998).

1.5.4.6 Security

Access to remote range areas is tightly controlled to reduce exposure to hazardous conditions and operations. Personnel required to access the ranges are logged in and out and closely controlled by the designated range control authority. Road blocks, barricades, locked gates, and guards are also used to prevent entry into areas with imminent hazards. Searches are conducted for individuals who do not log out at expected times or who are unaccounted for when tests or training exercises are scheduled to begin. In addition, roving patrols regularly check remote areas for signs of unauthorized entry.

Security requirements minimally impact natural resources management at NAWS/CL in several ways. In a few cases security requirements make it difficult to schedule natural resources management activities, but these same security procedures provide protection of natural resources from illegal activities. Security is a major factor in the determination of use of NAWS/CL natural resources for outdoor recreation.

1.5.4.7 Airspace

NAWS/CL has over 17,000 square miles of restricted-use airspace. However, use of airspace has fewer impacts on natural resources management at NAWS/CL than do ground-oriented military missions.

The Airspace Management Office is responsible for the preservation and enhancement of the airspace asset at NAWS/CL. In accordance with the Federal Aviation Act of 1958, the Federal Aviation Authority has total management authority and responsibility for all U.S. airspace. NAWS/CL has four (R-2505, R-2524, R-2506, and R-2508) assigned restricted air space designations. R-2508 is shared with four other military installations in the region.

1.6 Land Use Management and Environmental Planning

Both the INRMP and the CRMP contribute baseline resource descriptions (type, location, legal status, etc.) and management guidelines and procedures that will be integrated with mission planning and management processes to support military land use requirements. NAWS/CL has elected to implement these resource management requirements through the development and implementation of a Comprehensive Land Use Management Plan (CLUMP). The CLUMP will integrate cultural and natural resource management requirements with military land use requirements to achieve environmental resources management goals, facilitate NEPA compliance, and improve military readiness support.

1.6.1 Regulatory Framework

The preparation and implementation of this INRMP is required by the Sikes Act (16 U.S.C. 670a *et seq*.), Department of Defense Instruction 4715.3 (*Environmental Conservation Program*), and Navy Instruction OPNAVINST 5090.1B (*Environmental and Natural Resources Program Manual*). This INRMP was prepared using guidance within the *Natural Resources Management Procedural Manual* (NAVFAC P-73) with some modifications to better facilitate ecosystem management and implement 1997 revisions to the Sikes Act planning (both affected after NAVFAC P-73 was approved). This INRMP helps NAWS/CL comply with other federal and state laws, most notably laws associated with environmental documentation, wetlands, endangered species, and wildlife management in general. This plan describes how NAWS/CL will implement provisions of OPNAVINST 5090.1B and NAVFAC P-73.

This INRMP has the signatory approval of the U.S. Fish and Wildlife Service. This signature approval includes agreement that the INRMP complies with the Endangered Species Act. Review of the INRMP is considered informal consultation with regard to the Endangered Species Act. Additional informal or formal consultations will still be required for project proposals which may affect listed species.

The Sikes Act, as amended in November 1997, requires that INRMPs include:

- fish and wildlife management, land management, forest management, and fish- and wildlife-oriented recreation;
- fish and wildlife habitat enhancement or modifications;
- wetland protection, enhancement, and restoration where necessary for support of fish, wildlife, or plants;
- integration of, and consistency among, various activities conducted under the Plan;
- establishment of specific natural resource management goals and objectives and time frames for proposed action;
- sustainable use by the public of natural resources to the extent that the use is not inconsistent with the needs of fish and wildlife resources;
- public access to the military installation that is necessary or appropriate for sustainable use by the public of natural resources to the extent that the use is not inconsistent with the needs of fish and wildlife resources, subject to requirements necessary to ensure safety and military security;
- enforcement of applicable natural resource laws (including regulations);
- no net loss in the capability of military installation lands to support the military mission of the installation;

- regular review of this INRMP and its effects, not less often than every five years;
- exemption from procurement of services under Office of Management and Budget Circular A-76 and any of its successor circulars; and
- priority for contracts involving implementation of this INRMP to state and federal agencies having responsibility for conservation of fish and wildlife.

The *California Desert Protection Act of 1994* (CDPA, Public Law 103-433) requires the Department of the Navy to develop a plan for management of withdrawn lands at China Lake. NAWS/CL is developing a Comprehensive Land Use Management Plan (CLUMP) to meet this requirement. This INRMP provides natural resources management information for the development of the CLUMP.

The *Federal Land Policy and Management Act of 1976* (FLPMA, Public Law 94-579) defines the planning approach and strategy for public lands, such as those withdrawn at China Lake. While the CLUMP is the overall land use plan for NAWS/CL, this INRMP also uses planning principles in Section 202(c) of FLPMA.

NAWS/CL is required to comply with other federal laws affecting natural resources. Federal laws not mentioned above with which NAWS/CL must comply include the National Environmental Policy Act (NEPA, 42 U.S.C. 4321-4347), the Migratory Bird Treaty Act (16 U.S.C. 703 *et seq*.), the Bald and Golden Eagle Protection Act (16 U.S.C. 668), the Taylor Grazing Act of 1934 (43 U.S.C. 315), and the Clean Water Act (33 U.S.C. 1344).

1.6.2 Relationship of INRMP to Existing Plans

This INRMP establishes the first formal natural resources management plan for NAWS/CL and is intended to be compatible with other station planning and management processes. It replaces and updates the natural resources baseline descriptions contained in the station's 1986 Activity Master Plan (AMP). The AMP contains information describing protected and sensitive natural resources at NAWS/CL and lists natural resources management programs.

Natural resources management issues and programs are also described in the 1989 Report of Real Property Utilization. This report provides detailed descriptions of the NAWS/CL military mission and illustrates established military land uses by type and location. It also describes the Class 1 property (real estate) management and acquisition methods and presents compatible land use (encroachment) management issues of concern, both on- and off-station.

1.6.3 Relationship of INRMP to Other Plans in Development

Several significant planning and management efforts are being conducted at NAWS/CL. The 1994 passage of the California Desert Protection Act (CDPA) reauthorized the continued use of withdrawn public lands at NAWS/CL to meet the Navy's RDT&E and training missions. The CDPA also established the requirement for NAWS/CL to develop a land use management plan to guide the use and conservation of NAWS/CL withdrawn lands.

Cultural resources are also a land-based resource value of significance at NAWS/CL. Cultural resources are managed at NAWS/CL under a separate integrated Cultural Resources Management Plan (Tetra Tech, Inc. and Far Western Anthropological Research Group, 1998).

In response to the CDPA, the Navy chose to develop a Comprehensive Land Use Management Plan (CLUMP) as the implementing vehicle for this INRMP, the draft Cultural Resources Management Plan, and the draft Range (Operations) Management Plan, which are being developed concurrently with this INRMP. The CLUMP is being developed by NAWS/CL in partnership with the BLM. The CLUMP will incorporate an update to the airfield AICUZ report. The CLUMP will establish a planning and management framework to facilitate environmental compliance for natural and cultural resources management, assure no net loss of military mission support capability by defining and controlling compatible land uses on-station, and effectively support the evolving military mission at NAWS/CL.

This INRMP will be used to support the development of a Bird/Animal Air Strike Hazard (BASH) Plan. This INRMP will establish a revised natural resources baseline condition at NAWS/CL. It defines natural resources goals, management priorities, and guidelines and serves as a keystone element of the CLUMP. The baseline condition described in this INRMP describes the Station's approach to protection and conservation of natural resources at NAWS/CL. This information will be shared with other agencies and public interests participating in regional land use and environmental resources management initiatives in accordance with command directives. Ongoing regional planning initiatives include the West Mojave Cooperative Management Plan, the Northern and Eastern Mojave Management Plan, and the Mojave Desert Ecosystem Program (see Section 5.2).

1.6.4 Roles and Responsibilities

1.6.4.1 Naval Air Warfare Center, Weapons Division China Lake

The Naval Air Warfare Center, Weapons Division, under the Naval Air Systems Command, conducts critical test and evaluation work for Naval air warfare weapons systems (Section 1.1) and integrates Navy shore facilities at China Lake and Point Mugu, California as well as detachments at White Sands Missile Range, New Mexico. NAWC-WD is headquartered at China Lake. The draft *China Lake Range Management Plan* (SRS Technologies, 1996) has more detail on functions of NAWC-WD.

1.6.4.1.1 Naval Air Weapons Station China Lake

The Naval Air Weapons Station provides the land, facilities, and other services to support the military mission at China Lake. As such, NAWS/CL is the land manager of the installation.

The Commanding Officer, NAWS/CL is responsible for implementing policies and instructions of the Department of the Navy. This includes responsibility for management of natural resources as summarized below[2]:

[2] OPNAVINST 5090.1B, *Environmental and Natural Resources Program Manual*, 1 Nov 94, Department of the Navy, Washington, D.C., 22-19-20.

- acting as a trustee for natural resources, developing and maintaining an effective conservation program, and using technical assistance from Engineering Field Divisions;
- integrating natural resources requirements into the day-to-day decision-making process;
- requesting funding to support implementation of this INRMP;
- ensuring preparation and implementation of this INRMP, as required by the Sikes Act;
- appointing an installation Natural Resources Manager whose duties include ensuring that the Commanding Officer is informed of the status of natural resources and its programs, including potential or actual conflicts between mission requirements and natural resources mandates;
- implementing programs to reduce the potential for collisions between aircraft and wildlife;
- ensuring that information copies of applications, decision documents, or proposals to create or fill wetlands are forwarded to the Chief of Naval Operations to help the Navy meet the “no overall net loss of wetlands” policy compliance;
- ensuring incorporation of soil and water conservation measures and landscaping in preliminary engineering, design, and construction of facilities and inclusion of these costs as a specific item in new project investigations and reports;
- reviewing non-excess land to identify areas that may be suitable for agricultural outleasing or commercial forestry;
- seeking the aid of and coordinating natural resources management with Federal, State, and local agencies;
- coordinating proposals for new and continuing actions that affect natural resources with managers of natural resources;
- documenting the presence of threatened or endangered species to identify habitat for these species and assisting in determining whether such habitats should be designated as “critical habitat”; surveys shall include the presence and distribution of proposed threatened and endangered species;
- requesting Engineering Field Division support to consult under the Endangered Species Act with the USFWS, when required;
- taking action to avoid adverse impacts of new construction on wetlands and Waters of the U.S.;
- ensuring that actions affecting natural resources are given proper consideration in the environmental review and public notification process;
- maintaining records to monitor and evaluate natural resources and providing information to agencies and the public; and
- ensuring that natural resources management principles are integrated with environmental protection programs.

Environmental Project Office

The Environmental Project Office (EPO) is responsible for management of natural resources at China Lake as part of the NAWS/CL overall environmental program. EPO, acting through its Natural Resources Manager, is responsible for preparation and implementation of this INRMP. This is the direct “vehicle” for accomplishment of many of the above responsibilities of the Commanding Officer.

Public Works Department

The Land Use Planning Office (LUPO), Public Works Department, is responsible for the comprehensive oversight and planning of all land use issues relating to NAWC-WD China Lake. As such, the LUPO is responsible for preparing the Comprehensive Land Use Management Plan and the accompanying EIS. Section 5.1.1 further describes the function of the LUPO.

Office of Legal Counsel

The Office of Legal Counsel provides legal services to EPO on a variety of environmental matters. Particularly pertinent to natural resources management are review of National Environmental Policy Act (NEPA) documentation, contract specification review, and legal interpretations involving compliance with natural resources law.

Public Affairs Office

The Public Affairs Office is directly involved in aspects of the environmental program involving public use of lands at China Lake. These include petroglyph tours, Christmas bird counts, public involvement within the NEPA process, and similar activities.

1.6.4.1.2 Pacific Ranges and Facilities Department

The Pacific Ranges and Facilities Department is responsible for accomplishment of the military mission at NAWS/CL. As such, the Pacific Ranges and Facilities Department and land and natural resource managers at NAWS/CL must coordinate to minimize conflicts between mission requirements and stewardship/ compliance aspects of natural resources management and to effectively use natural resources management to support the military mission. The draft *China Lake Range Management Plan* (SRS Technologies, 1996) has more detail on functions of the Pacific Ranges and Facilities Department.

1.6.4.1.3 Propulsion Laboratories

The Propulsion Laboratories Complex, made up of the China Lake Propulsion Laboratory and the Salt Wells Propulsion Laboratory, is located in the southeastern corner of the North Range. Propulsion Laboratory environmental personnel and land and natural resource managers at NAWS/CL will continue to coordinate to minimize conflicts between mission requirements and stewardship/compliance aspects of natural resources management.

1.6.4.2 Other Defense Organizations

1.6.4.2.1 U.S. Army Corps of Engineers

The Army Corps of Engineers, Los Angeles District, provides support to NAWS/CL with regard to compliance with the Clean Water Act, particularly Section 404. NAWS/CL is preparing a permit application for activities that may affect Waters of the U.S.

1.6.4.2.2 Southwest Division, Naval Facilities Engineering Command

The Southwest Division, NAVFACENGCOM is responsible for providing support for natural resources management at NAWS/CL. Specifics of this support are within OPNAVINST 5090.1B, Section 22-6.2. The Southwest Division is providing contracting support for preparation of the *Comprehensive Land Use Management Plan* and its EIS.

1.6.4.2.3 Planning and Coordination of Interagency Desert Environmental Resource Managers

Department of Defense installations in the Mojave Desert have formed a team to coordinate and discuss land use issues of mutual interest. Installations involved include NAWS/CL, Fort Irwin NTC, Edwards AFB, MCAGCC Twentynine Palms, and Marine Corps Logistics Base, Barstow. These installations have many mutual interests, particularly involving ecosystem management of the Mojave Desert, as evidenced by regional initiatives identified in Section 5.2.

1.6.4.3 U.S. Department of Interior

1.6.4.3.1 U.S. Fish and Wildlife Service

The USFWS has been a very active partner in the endangered species program at NAWS/CL. The Service provided financial support for a Mohave tui chub habitat enhancement project in 1997, and it provided assistance with preparation of a scope of work for a tui chub genetic study. NAWS/CL anticipates continued support from the USFWS during 2000-2004, particularly with regard to endangered species. The USFWS is a signatory cooperator in implementation of this INRMP in accordance with the Sikes Act.

1.6.4.3.2 Bureau of Land Management

Almost all land at China Lake is withdrawn from the public domain, administered by BLM. Per provisions within the CDPA, the Department of Interior assigned management responsibility to the Navy via a Memorandum of Agreement. The *Comprehensive Land Use Management Plan* being developed by NAWS/CL is specifically required by that agreement.

The BLM administers the grazing allotment which is partially on NAWS/CL. BLM and NAWS/CL jointly conduct horse and burro roundups which includes disposal of excess animals through the Wild Horse and Burro Adoption Program. The BLM reviews land management actions that involve external parties, including this INRMP.

1.6.4.3.3 National Park Service

With expansion of Death Valley National Park, the National Park Service is now an immediate neighbor of China Lake, sharing the north border of South Range. NAWS/CL and the National Park Service are exploring areas of mutual interest which could lead to ecosystem management partnerships. One possibility is coordination of burro removal since success of this program on NAWS/CL and Death Valley are mutually dependent on removal success on both parcels of land as well as on adjacent BLM land.

1.6.4.3.4 U.S. Geological Survey

The U.S. Geological Survey (USGS) assists in the groundwater management program on NAWS/CL, but this is not an emphasis of this INRMP. The USGS also provides maps for use in natural resources management on China Lake.

1.6.4.4 State Agencies

1.6.4.4.1 California Department of Fish and Game

The California Department of Fish and Game (CDFG) is responsible for management of most fish and wildlife within the State, including those on Federal lands. The CDFG maintains a California Natural Diversity Database (CNDDB) which is useful for management of natural resources at NAWS/CL.

The CDFG assists with Mohave tui chub management, including the chub habitat enhancement program. The agency has an interest in streambed management, transplanted bighorn sheep onto NAWS/CL in 1983 and 1987, and over 20 years ago installed numerous gallinaceous guzzlers on NAWS/CL. The CDFG would regulate hunting if NAWS/CL' security and safety conditions were to change to accommodate this option. The CDFG coordinates the transplant program for mountain quail and chukars between NAWS/CL (provider) and the Nevada Division of Wildlife (receiver), State of California, and other western states. The CDFG is a signatory cooperator in implementation of this INRMP.

1.6.4.4.2 Lahonton Regional Water Control Board

The Lahonton Regional Water Control Board, a regional office of the California Water Control Board, is responsible for implementation of Section 401 of the Clean Water Act, and as such, it interacts with NAWS/CL. The primary interest at NAWS/CL is any degradation of Waters of the U.S., water quality in general, and groundwater issues. Most of these are managed at NAWS/CL by EPMD programs other than natural resources management.

1.6.4.4.3 California Department of Toxic Substance Control

The California Department of Toxic Substance Control is interested in the NAWS/CL Installation Restoration Program (IRP). Some IR sites were investigated due to their proximity to Mohave tui chub habitat. The NAWS/CL natural resources program provides input and otherwise supports the IRP.

1.6.4.5 Local Governments

There is limited direct involvement in the NAWS/CL natural resources program by local county and municipal governments. Air emissions are a concern of county agencies, but most are not related to natural resources management at NAWS/CL. The Inyo County Health Department has expressed some concern over possible water contamination at NAWS/CL in water used for human consumption by the residents of the town of Darwin. The Station continues to work with the City of Ridgecrest to manage the tui chub and its relationship with the operation of the Wastewater Treatment facility and with respect to waterfowl use of city property and potential BASH hazard issues.

1.6.4.6 Universities

Regional universities have provided specialized expertise to help manage natural resources on China Lake. The University of California, Riverside has been funded under the Legacy program for butterfly and other invertebrate studies, and the University of Nevada has done Ph.D. research on the ecology of mountain quail at China Lake. NAWS/CL anticipates the continued use of university expertise to better understand ecosystem functionality during the next five years and beyond.

1.6.4.7 Other Interested Parties

1.6.4.7.1 Kerncrest Audubon Society

The Kerncrest Audubon Society has been active with bird surveys at NAWS/CL for many years. The Society conducts the annual Christmas bird count as well as other bird counts. The Society has 10 years of detailed data on bird use of the sewer ponds (800 surveys), a valuable long-term monitoring effort. Members are available to assist NAWS/CL with other wildlife surveys.

1.6.4.7.2 Kern-Kaweah Chapter of the Sierra Club

The Kern-Kaweah Chapter of the Sierra Club has a long-standing interest in the management of natural resources at NAWS/CL. To date, this interest is more general than specific to a particular issue, place, or group of species.

2.0 RESOURCES SETTING

2.1 Regional Summary

NAWS/CL is surrounded primarily by federally owned land, but includes areas of private land interspersed with the federal land. Privately-owned land exists immediately to the south and along the western boundary of the North Range and to the south of the South Range. The City of Ridgecrest is adjacent to NAWS/CL to the south of the North Range.

Death Valley National Park is located directly north and east of NAWS/CL. The Death Valley National Park boundary was realigned to be contiguous with portions of the South Range boundary as part of the California Desert Protection Act of 1994. Inyo National Forest lands are located west of NAWS/CL.

The Bureau of Land Management manages about 12 million acres of land in the California Desert Conservation Area (CDCA), established by FLPMA in 1967. These lands include 10 wilderness areas located around NAWS/CL.

Fort Irwin Military Reservation is adjacent to the eastern boundary of the South Range. The U.S. Air Force's inactive Cuddeback Gunnery Range is west of Mojave B South in the South Range.

2.2 Physical Setting

The descriptions provided below of the physical environment at NAWS/CL are primarily taken from the *Naval Weapons Center, China Lake, Master Plan, Volume 1, Center-wide Analysis* (Innis-Tennebaum Architects, Inc., 1989) unless stated otherwise. More detail on the physical environment at NAWS/CL is generally available in the Master Plan.

2.2.1 Physiography

NAWS/CL is located within two physiographic provinces: the Basin and Range Province and Mojave Desert Province, both characterized by north-south trending fault block mountains separated by deep alluvial valleys. The Basin and Range Province and the Mojave Desert Province are separated by the east/west trending Garlock fault. General topography at NAWS/CL consists of low- and medium-height mountain ranges and hills with intervening basins.

North Range

The North Range is within the Basin and Range Province. The southern half is predominantly in the Indian Wells Valley with some portions in Salt Wells Valley and the southwestern Argus Range. The northern half of the North Range lies mainly in the Coso and Argus ranges with the Coso Basin and northern Indian Wells Valley in the south, Etcheron Valley in the southeast, Sugarloaf Mountain and Volcano Peak in the southwest, Maturango Peak in the east, Darwin Wash in the northeast, Coso Peak in the north, Coles Flat in the center, and Cactus Flats and Cactus Peak in the west (Figure 2.2.1a).

The Indian Wells Valley, a structural and topographic depression, is bordered on the north by the Coso Range, on the east by the Argus Range and Salt Wells Valley; on the south by the Rademacher Hills, El

Paso Mountains, and Spangler Hills; and on the west by the steep escarpment of the southern Sierra Nevada. Indian Wells Valley has an average elevation of 2,300 feet above mean sea level (msl) and contains three major playa lakes; China, Mirror, and Satellite and numerous other unnamed playas.

The Coso Range has an average elevation of 6,500 feet above msl with Coso Peak highest at 8,156 feet. The Coso Range joins the Argus Range in the central portion of North Range and is separated by the Darwin Wash and Etcheron Valley areas. The highest peak in the Argus Mountains is Maturango Peak at 8,839 feet above msl.

South Range

The northern half of the South Range is in the Basin and Range Province, and the southern half is in the Mojave Desert Province. The South Range is within three valleys: Panamint Valley to the north, Pilot Knob Valley in the center, and Superior Valley to the south (Figure 2.2.1b).

Panamint Valley trends north-south, bordered by the Slate Range on the west and the Panamint Range and Brown Mountain on the east. The Slate Range has an average elevation of 4,500 feet above msl with Straw Peak the highest at 5,578 feet. Wingate Wash is a northeast-trending drainage between the Panamint Range and Brown Mountain and the Quail Mountains in the northeastern portion of the South Range.

The Pilot Knob Valley, which trends east-west, bisects the South Range. This valley is bordered by the Slate Range and the Quail Mountains to the north; the Granite Mountains to the east; Black Mountain, Robbers Mountain, Black Hills, and Eagle Crags (5,512 feet above msl) to the south; and the Lava Mountains to the west.

Superior Valley is in the southeastern portion of South Range. It is bordered by Slocum Mountain (5,124 feet above msl) to the southwest, Granite Mountain and Pilot Knob (5,428 feet above msl) to the northwest, and the Eagle Crags to the north.

2.2.2 Geology

The China Lake region has experienced periods of faulting, active volcanoes, Ice Age rainfall and the subsequent formation of Pleistocene lakes, and erosion and sedimentation. The North and South ranges are separated by the Pleistocene basin of Searles Lake (dry).

North Range

The northern half of the North Range has gently sloping to very steep granitic mountains and volcanic flows (U.S. Navy, 1994). The Coso and Argus ranges consist of Mesozoic granitic and metamorphic rocks underlying Pliocene and Pleistocene volcanic flows and sedimentary deposits of the Coso volcanic field. The Coso geothermal area, in the northwestern portion of North Range, is characterized by rhyolite domes, rhyolite flows, pyroclastic deposits, exposures of pre-Cenozoic granitic and metamorphic rocks, and Quaternary alluvial deposits. The Argus Range is mostly quartz monzonite with intrusive dikes of altered andesites. Volcanic fields are either predominantly basalt with rhyodacite, dacite, andesite, and rhyolite or as equal amounts of basalt and rhyolite.

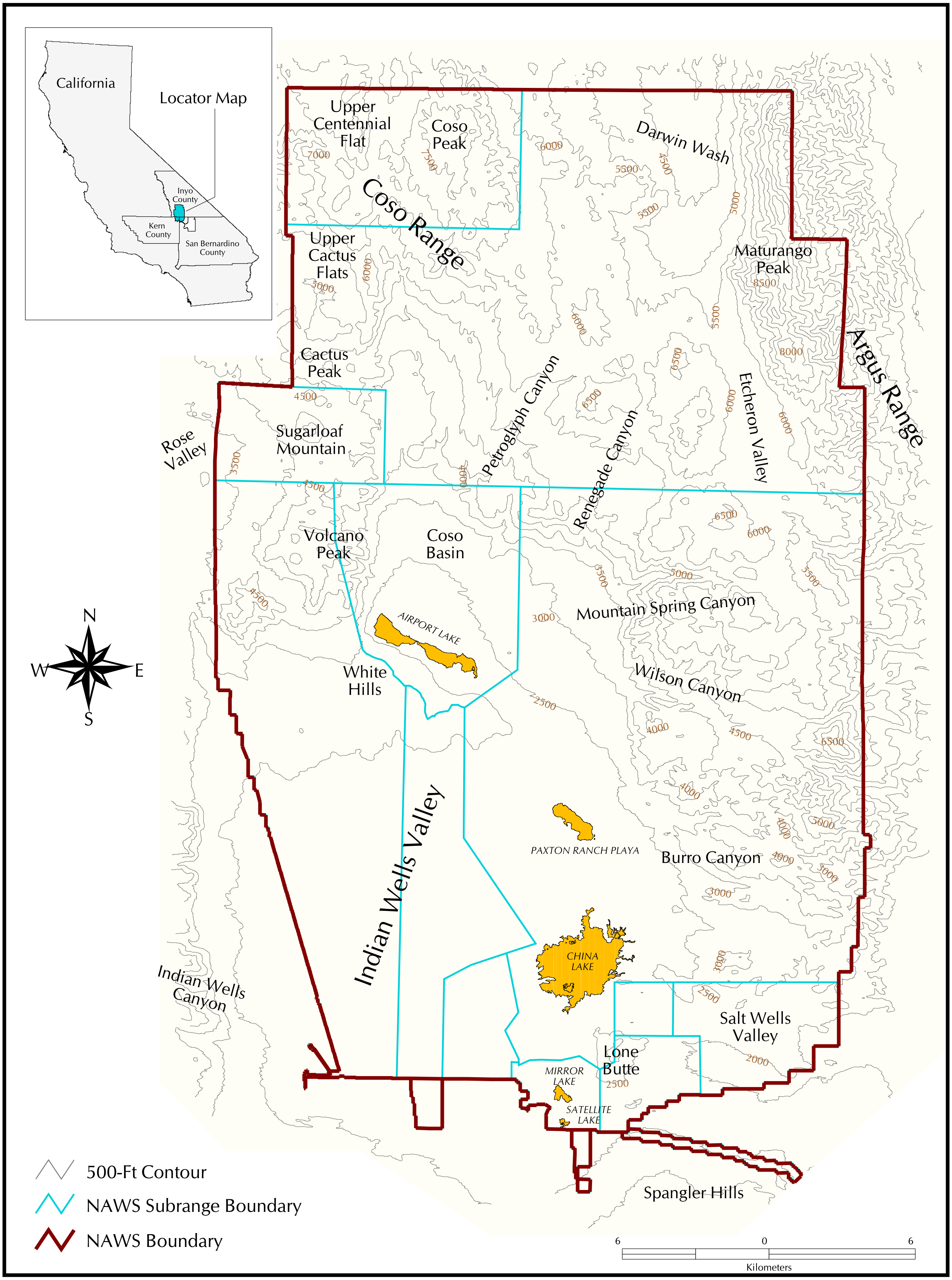

Figure 2.2.1a NAWS/CL North Range Topography

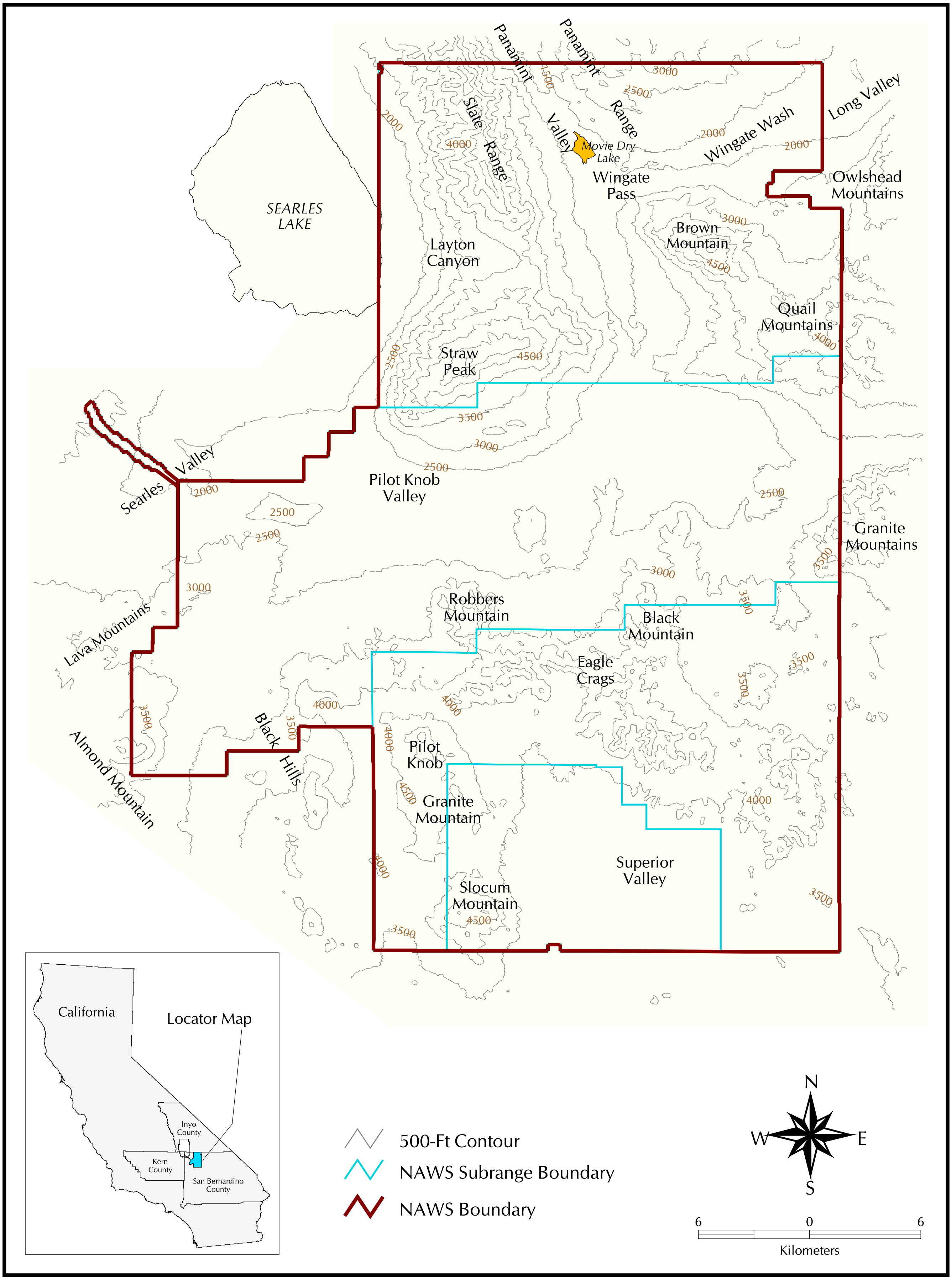

Figure 2.2.1b NAWS/CL South Range Topography

The southern half of the North Range is characterized by granitic and volcanic ranges with alluvial plains and basin floors with minor components of alluvial fans, fan terraces, and low hills. The Indian Wells Valley is filled with sediments composed of unconsolidated gravel, sand, salt, and clay which is exposed throughout most of the valley and originates from the Coso, Argus, and El Paso mountains, Rademacher Hills, and the southern Sierra Nevada. Ancestral lake deposits composed of clay, silt, and sand overlie the alluvium in the eastern part of the valley and form a rising hill on which Mainsite is built. Sediments containing basalt, tufaceous materials, and agate are exposed near Mirror Lake.

South Range

The South Range has granitic and volcanic mountain ranges with alluvial plains and basin floors and minor components of alluvial fans, fan terraces, and low hills. The Slate Range is the dominant mountain range, consisting of metamorphic and granitic rocks. The southern portion of the South Range contains the Eagle Crags Mountains, a small range of volcanic material. The Garlock Fault runs in an east-west direction, generally dividing the South Range in half, and separates the Basin and Range Province and the Mojave Desert physiographic province.

Seismic Activity

NAWS/CL is in one of the more seismically active areas in California. Active and potentially active fault zones in the region include the Owens Valley, Sierra Nevada, Garlock, Panamint Valley, Saline Valley, Wilson Canyon, and Death Valley-Furnace Creek (U.S. Geological Survey, 1992). The Garlock Fault, another potentially active feature, cuts across the South Range about 13 miles south of the North Range. NAWS/CL is subject to major earthquakes along these faults and is also subject to earthquakes from several local faults, primarily from Little Lake, Airport Lake, and associated unnamed faults in the east and northcentral portions of the valley. The Airport Lake and Little Lake fault zones intersect about six miles northwest of Armitage Field and combine to form a single, wide zone that strikes northwest-southeast across the Indian Wells Valley. Considerable detail on area seismicity and their effects is available in the *Naval Weapons Center, China Lake, Master Plan, Volume 1, Center-wide Analysis* (Innis-Tennebaum Architects, Inc., 1989).

2.2.3 Geothermal Resources

The information below on geothermal resources and its development at NAWS/CL is taken from the *Naval Weapons Center, China Lake, Master Plan, Volume 1, Center-wide Analysis* (Innis-Tennebaum Architects, Inc., 1989).

NAWS/CL has numerous areas with actual and potential geothermal resources. These areas include the Coso Known Geothermal Resources Area (KGRA) which is being used to produce electricity, Millspaugh, Indian Wells Valley, and Searles Valley potential areas in the China Lake Complex; Myrick potential area in the Randsburg Wash/Mojave B Complex; Christmas Canyon potential area just west of Randsburg Wash and including the Randsburg Wash Access Road; and the Red Mountain-Lava Mountain potential area which adjoins the southwestern corner of the South Range.

The Coso KGRA includes land on and off-NAWS/CL. Its heat source is a shallow body of magma, basically a hot water reservoir with some dry steam. Temperatures range from 400 to 450ºF. Coso KGRA resources are projected capable of producing 1,000 mW for 1,000 years, which would provide for the electric needs of one million residences for 1,000 years.

Coso KGRA is approximately 2 miles wide and 3.5 miles long, located along the western boundary of Coso Range and BLM lands. Of the 106,000 acres within the Coso KGRA, 72,000 acres are within the NAWS/CL boundary. Coso KGRA has four power plants: Navy One, Navy Two, BLM East, and BLM West. BLM East and BLM West geothermal plants are on withdrawn lands (BLM-leased land), and Navy geothermal plants (Navy One and Navy Two) are on Navy fee-owned lands. All four plants are operated by California Energy Company, and power from all the plants is sold to Southern California Edison (Tetra Tech, Inc., 1997, using data from Ken Newton, personnel communication, 1996).

There are 127 wells within the Coso KGRA. Of these, 82 wells are used for production, 29 for injection wells, and the remaining 16 wells are shut-in and awaiting future use (Tetra Tech, Inc., 1997, using data from Ken Newton, personal communication, 1996).

The Navy is developing geothermal resources at NAWS/CL for three purposes (Innis-Tennebaum Architects, Inc., 1989):

- to provide an alternative energy source and allow the Navy to become independent of foreign fuels,
- to save Navy and taxpayer dollars, and
- to protect the NAWS/CL mission from encroachment through the development of multiple use programs.

NAWS/CL received authority for geothermal projects on acquired lands (Navy-fee owned lands) under the Military Construction Act of 1979 (Innis-Tennebaum Architects, Inc., 1996). A Memorandum of Understanding between the Secretary of the Navy and the Secretary of the Interior was signed which allows BLM to lease certain Navy-controlled lands within the KGRA for commercial geothermal development, with stipulations to make geothermal operations compatible with the NAWS/CL mission. Navy constraints on geothermal operations on land were incorporated by amendment in 1980. The Master Plan (Innis-Tennebaum Architects, Inc., 1989) summarizes the history of geothermal development at NAWS/CL in more detail.

2.2.4 Petroleum and Minerals

Land on what is now NAWS/CL was first mined in the 1860s. Mineral commodities prospected for or produced include gold, silver, tungsten, lead, mercury, iron, evaporates, pumice, perlite, and aggregate (Austin *et al.*, 1979; 1983). Several mines produced enough to support a family or two but not much more. In 1943, when NAWS/CL was formed, about 200 patented and unpatented mine claims were obtained by condemnation. All NAWS/CL lands are withdrawn from appropriation under the mining and mineral leasing laws because exploration for, and mining of, minerals are not compatible with the testing and evaluation of weapons and weapons systems.

Aside from the fact that mining is not allowed on NAWS/CL, most mining properties at NAWS/CL would not qualify as mineral discoveries in the context of today's mining laws, but are described as mineral occurrences. Austin *et al.* (1979 and 1983) conducted literature and field surveys of past mining activities at NAWS/CL. Gold and lead-silver-zinc ores were found at some old digs in quantities that would be of interest to “week-end” miners but not to minerals explorationists or mining companies. Occurrences of other metallic mineral and strategic metal resources are likewise of no commercial value. A potentially- commercial uranium deposit occurs in the Coso Range outside the northwestern boundary of the station, but does not extend onto the base. There is a potential for uranium deposits on NAWS/CL in the Coso KGRA, but they are unlikely to be of commercial value. No beryllium was found in samples.

Non-metallic mineral resources were also assessed. Travertine and diatomite are found in too low of quantities to have commercial value. Evaporite minerals (carbonates, chlorides, sulfates, nitrates, borates, phosphates, lithium, and strontium) have not been found in commercial volume or grade and are considered commercially unimportant as many of these are found in superior deposits on nearby non-withdrawn lands. Commercially-viable deposits of perlite and pumice are found on NAWS/CL, but equal deposits off NAWS/CL provide sufficient quantities to meet market demand. Volcanic cinder and other aggregates have been produced in small quantities within the Complex but are also plentiful off-base. There is little potential for oil and gas production. Very limited amounts of opal and chalcedony suitable for gem cutting occur in South Mojave B, and facing stone and volcanic ash could be produced. However, the latter can be produced locally from non-withdrawn land.

2.2.5 Soils

In general, soils at NAWS/CL are coarse-textured with cemented zones at depths from 5 to 18 feet, underlain by light brown, decomposed granite. Surface soils are deficient in nitrogen and high in salt accumulation.

Soils in the Coso Range typically have a clay accumulation below the surface layer. Loamy or clayey subsoils with a layer of clay accumulation occur on volcanic flows. Mountain valley fan terraces contain deep alluvial soils with sandy surface textures and sandy or loamy subsoils.

Soils in the Indian Wells Valley are mostly sandy with some areas exhibiting stratified soils with variations in clay contents. Silica or carbonate cemented soils also occur, representing hard pan deposits. Near playas, soils are predominantly silts and clays, exhibiting very low dry densities and high moisture content. Soils in playas range from sand to clays with high salt concentrations.

2.2.6 Water Resources

Surface Water

NAWS/CL is within the South Lahontan Basin groundwater management area, generally categorized as arid to semi-arid with a low mean annual rainfall of 4.24 inches. Surface runoff generally results from rainfall, snowpack melt, or natural springs. Major playa lakes on NAWS/CL are China, Mirror, Satellite, and Airport lakes, all within the North Range, and Movie Lake in the South Range. In addition, there are as many as 80 smaller playas ranging from hundreds of acres to less than one acre.

There are over 80 known springs on the North Range primarily in the Argus and Coso ranges. Springs range from small areas of imperceptible seepage to fairly large areas of riparian vegetation and flows to six gallons per minute and an artesian well at Paxton Ranch. Many springs were developed by miners and ranchers prior to the Navy assuming management of the lands. A few springs are maintained by the Navy for remote facility use or by the lessee for a grazing program in the Coso Range. Lark Seep and G-1 Seep are brackish marshes formed on the edge of the China Lake playa from leakage and percolation from the City of Ridgecrest wastewater treatment facility facultative/evaporation storage ponds with a lesser amount contributed by the golf course and NAWS/CL housing areas. Coso Hot Springs is a series of geothermal-fed springs of hot, non-potable mineral water. Figure 2.2.6a shows surface water resources on the North Range. Included are springs, dry lake beds and playas, and riparian zones.

Indian Wells Valley forms a natural basin which receives drainage from the southern Sierra Nevada, Coso and Argus ranges, Rademacher Hills, the El Paso Mountains, and the Spangler ranges. The most significant surface flows originate in the El Paso Mountains and southern Sierra Nevada, southwest of Ridgecrest, and are conveyed to the China Lake, Mirror Lake, and Satellite Lake dry basins via ephemeral flow through local washes, typical of ephemeral desert channels with small capacities and coalescing alignments.

There are 42 known springs or seeps on the South Range (Figure 2.2.6b). There are no naturally occurring ponds or standing water other than ephemeral pools or playas on the South Range, which receives drainage from the Slate Range, Panamint Range, Quail Mountains, Eagle Crags, Brown Mountain, Pilot Knob, Slocum Mountain, Robbers Mountain, and Granite Mountain. Appendix B, Section 2.2.6 contains a spread sheet of surface water sources for the North and South ranges.

Although precipitation in the South Lahontan Basin is low, intense cloudbursts may result in occasional flooding. Stormwater flooding has been a significant problem for developed areas on the North Range near Mainsite. Outlying range areas and the South Range have also been affected by flooding from seasonal runoff, but floods in these areas have caused less damage. Most runoff in Indian Wells Valley comes from the south and west and forms four major ephemeral streams: the El Paso, Little Dixie, Ridgecrest, and Bowman washes. There are also other, smaller, ephemeral washes which discharge into China, Satellite, and Mirror lakes.

Groundwater

Groundwater is the sole source of water for NAWS/CL. Pumping has been concentrated in areas where aquifer characteristics, water quality, and water elevations are known throughout the Indian Wells Valley (except China Lake Playa). Groundwater elevation data for the Indian Wells Valley shows a gradual

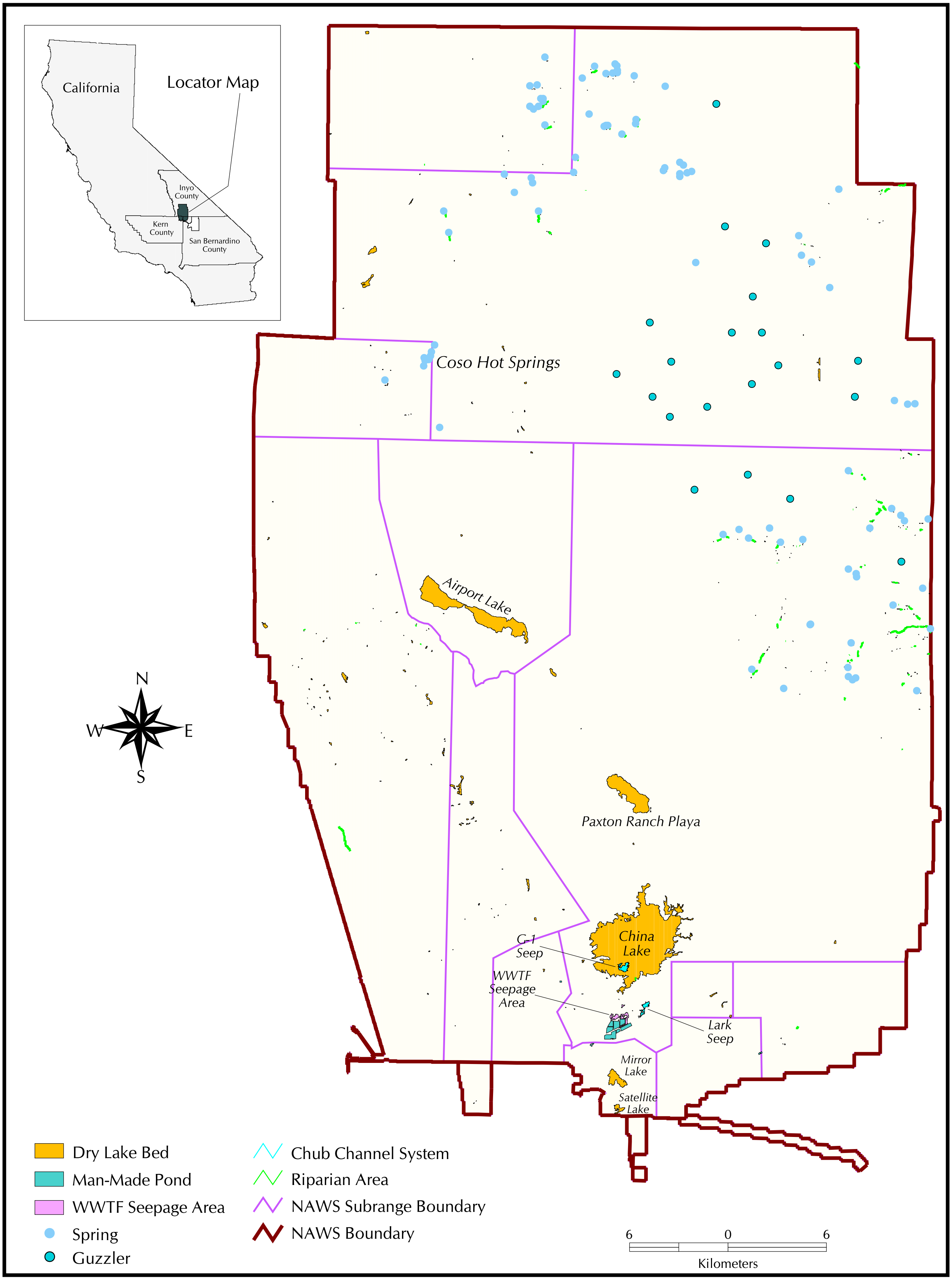

Figure 2.2.6a Surface Water Resources of NAWS/CL North Range

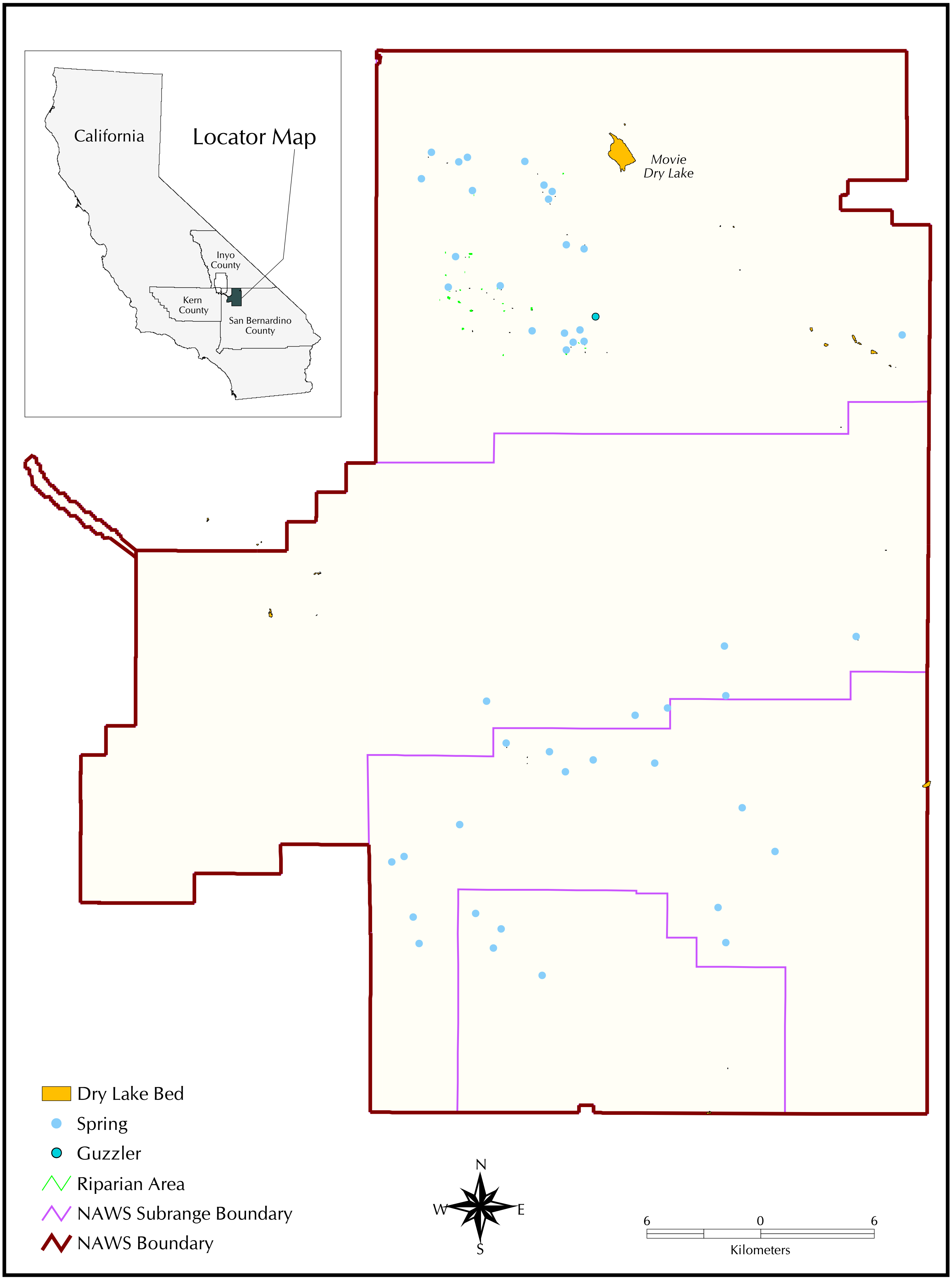

Figure 2.2.6b Surface Water Resources of NAWS/CL South Range

decline in most areas. Local water experts have been debating the meaning of this decline as well as the quantity of natural recharge and safe yield from groundwater aquifers underlying the Indian Wells Valley, some of which is within the boundaries of NAWS/CL. Average published recharge estimates range from 10,000 to 15,800 acre-feet per year, although on-going efforts by the Navy to refine these estimates suggest that this is a conservative estimate. Current groundwater withdrawals by all users, including the Navy, are approximately 20,000 acre-feet per year. Based on current groundwater recharge and storage estimates, the aquifer system within the Indian Wells Valley is considered more than adequate to meet current demands for up to 200 years (U. S. Bureau of Reclamation, 1993).

The U.S. Bureau of Reclamation (1993) completed a study to refine estimates of the life of groundwater resources in the Indian Wells Valley and to identify management concepts to conserve and extend the useful life of the resources. This study determined the following:

- Indian Wells Valley sedimentary fill consists predominately of sands and fine gravels in the heavily pumped areas west of Ridgecrest, in the Southwest Wellfield area, and along the extreme western boundary of the basin.
- Water quality patterns suggest that the Sierra Nevada watershed contributes a major portion of groundwater recharge into the Indian Wells Valley.
- Good quality water was found at depths to 2,000 feet in the Intermediate Wellfield and Southwest Wellfield, indicating there is a greater quantity of high quality water in storage at depth in these areas than previously known.
- Poor quality water was found in the northwestern and north-central portions of the Indian Wells Valley associated with a thick organic-bearing clay deposit.
- Temperature profiles indicate geothermal sources underlying the Indian Wells Valley.

The major water producing entities within Indian Wells Valley, including NAWS/CL, have discussed groundwater issues for many years. On 21 September 1996 these entities signed the Indian Wells Valley Cooperative Groundwater Management Plan. Goals of the plan include:

Signatories take an active role in resource management and meet monthly to discuss groundwater issues and distribute groundwater data collected and analyzed by the various entities. Subcommittees have been assigned to investigate such issues as groundwater sampling protocols, water level monitoring, and water banking/transfers and other supplemental water supplies for Indian Wells Valley (Tetra Tech, Inc., 1997).

Groundwater underlying the South Range has not been studied in any detail but is assumed to be limited to the area underlying Pilot Knob Valley. Two wells on the Electronic Combat Range provide water for industrial and domestic use. Recharge into groundwater systems occurs by direct infiltration (limited if any) of precipitation, subsurface flow from adjoining basins, and percolation of infrequent runoff that occurs during flash floods from surrounding mountains.

2.2.7 Climate

The China Lake region is characterized by hot summers, cool to cold winters, large daily temperature fluctuations, low rainfall and humidity, and little cloudiness or visibility restrictions. Temperatures exceed 100ºF an average of 67 days annually and temperatures drop below 32ºF an average of 77 days annually. Rainfall averages 4-6 inches annually with measurable rainfall about 22 days annually and measurable snowfall about three days annually. Thunderstorms occur primarily during August and September, and most precipitation occurs from November through March (Tetra Tech, Inc., 1997). Winds are primarily from the south-southwest during all months.

The *China Lake Range Management Plan* (Appendix C) (SRS Technologies, 1996) contains monthly climatic summaries from 1960-93. Selected data from that source are presented below:

Month	Mean Temperature (^{o}F)	Mean Relative Humidity (%)	Mean Rainfall (inches)	Mean Wind Speed/Direction (knots/direction)
January	43.7	54	0.79	3.5/S-SW
February	49.5	51	0.86	4.9/S-SW
March	54.9	47	0.74	6.4/S-SW
April	61.8	39	0.15	7.3/S-SW
May	70.9	35	0.12	7.3/S-SW
June	79.4	29	0.04	7.0/S-SW
July	85.8	28	0.25	6.4/S-SW
August	84.2	29	0.29	5.9/S-SW
September	76.4	32	0.19	5.4/S-SW
October	65.0	35	0.50	4.6/S-SW
November	52.0	42	0.44	4.2/S-SW
December	43.1	50	0.58	3.5/S-SW

2.3 Biological Setting

2.3.1 Flora

2.3.1.1 General

Approximately 675 unique vascular plant taxa are known to occur on NAWS/CL. Vascular plants include Angiosperms (monocots and dicots), Gymnosperms (conifers and ephedras), and Pteridophytes (ferns and fern allies). Excluding cultivated plants, another 20+ plant taxa, mostly in the form of naturalized weeds, occur only in the China Lake main complex. All major plant groups (angiosperms, gymnosperms, fungi, etc.) occur at NAWS/CL.

Vascular plants from NAWS/CL include 69 plant families and 278 genera. Approximately one-third of NAWS/CL vascular plant taxa are classified below the species level and are divided into subspecies, varieties, or forms. Approximately 50 exotic plant taxa (7% of NAWS/CL plant taxa) have been recorded from the North and South ranges.

Annual plants comprise 46% of NAWS/CL vascular plant taxa. Biennials, herbaceous or low growing perennials, grasses, and ferns comprise 32%. The remainder of NAWS/CL vascular plant taxa (22%) includes woody and semi-woody species from sub-shrubs to trees. NAWS/CL vascular plant composition is shown in the table below.

Plant Type	% of NAWS/CL Flora	NAWS/CL Total Taxa	North Range Taxa	South Range Taxa
Trees	2.2	15	14	6
Shrubs	17.9	120	115	56
Cacti	1.1	8	8	5
Perennial Grasses	4.4	31	30	10
Perennial Herbs	27.9	187	180	42
Perennials - Total	53.5	361	347	119
Annual Herbs	46.5	314	308	109
Sensitive Taxa (CNPS)*	2.6	18	15	5
Range Specific Taxa			445	21
Total Taxa	100	675	655	228

* CNPS - California Native Plant Society

Several vascular plant families are well represented at NAWS/CL. The composite family (Asteraceae) is the most diverse, with 131 taxa known from NAWS/CL. The buckwheat, phlox, grass, and legume families are also diverse at NAWS/CL with over 40 taxa each. The genus *Eriogonum* (buckwheats) is the most diverse of vascular plant genera present at NAWS/CL, with 35 species recorded. This genus is host to a diverse group of butterfly species (Pratt, 1995). Twenty-three taxa from the genus *Gilia* have been reported from NAWS/CL. Six other genera with 10 or more taxa occur at NAWS/CL.

Families with the most species at NAWS/CL are:

- Asteraceae (Composite family) - 131 taxa
- Polygonaceae (Buckwheat family) - 46 taxa
- Poaceae (Grasses) - 43 taxa
- Polemoniaceae (Phlox family) - 43 taxa
- Fabaceae (Legume family) - 43 taxa
- Brassicaceae (Mustard family) - 35 taxa

- Boraginaceae (Borage family) - 32 taxa

Genera with the most species at NAWS/CL are:

- *Eriogonum* (Buckwheats) - 35 taxa
- *Gilia* (Gilias) - 23 taxa
- *Phacelia* (Phacelias) - 17 taxa
- *Cryptantha* (Forget-me-nots) - 16 taxa
- *Camissonia* (Evening primroses) - 16 taxa
- *Lupinus* (Lupines) - 13 taxa
- *Astragalus* (Milk-vetch) - 13 taxa

Non-vascular plants, such as lichens, mosses, liverworts, algae, and fungi, are important ecological components of the flora of NAWS/CL. The species diversity and ecology of non-vascular plants in native ecosystems at NAWS/CL is undocumented. The most important non-vascular plants in the ecology of NAWS/CL are mycorrhiza fungus, soil algae, and blue-green algae *(Cyanobacteria)*, which help to form crusts, stabilize soils, and may be vital to repopulation and survival of many shrub species. Lichens, a symbiotic association of algae and fungus, are the most conspicuous forms of non-vascular plants at NAWS/CL, especially orange lichens *(Caloplaca)*, which form radiating crusts on the north sides of boulders. Other types of non-vascular plants at NAWS/CL are inconspicuous or microscopic. Mosses and liverworts are found infrequently around springs and shady microhabitats. Fungi are common at NAWS/CL; however the only forms frequently observed are those with conspicuous fruiting bodies, such as the desert puffball mushrooms *(Podaxis)*, wood-rotting fungi of pinyon pine, and rusts that affect shrubs. Red algae are sometimes conspicuous during favorable seasonal conditions when playas become flooded. These playas and associated salt crusts turn bright red with algal blooms if temperatures and flooding are adequate.

Unlike non-vascular plants, most (60-70 %) vascular plants that potentially occur at NAWS/CL have probably been recorded. Vascular plant taxa new to NAWS/CL are still being discovered and documented, including recent discoveries of a few shrubs and small trees. In general, vascular plant forms have been well documented at NAWS/CL. Most large perennial plants produce some growth each year and can usually be identified throughout the seasons.

Other plant forms, however, have been more difficult to inventory. Some forms have fluctuating populations based on localized events and yearly and multi-year climate trends. Some are suppressed by activities of exotic plants and animals at NAWS/CL. Many have highly restricted habitats. During dry years, most plant taxa remain dormant as seeds, taproots, rhizomes, or bulbs. Annual plants, including many exotic weeds, are probably under-represented among NAWS/CL known flora. These plant forms, especially at low desert elevations, can only be detected infrequently. Many annual plant species do not appear for years, and when they do, their identification period is often brief, some species available in identifiable form or phenology for only two weeks.

Approximately 170 taxa new to NAWS/CL (25% of those known) have been identified within the last four years. Approximately 200 other vascular plant taxa are known to occur within 10 miles of NAWS/CL. About 50 of these taxa are expected at NAWS/CL. Other vascular plant taxa new to NAWS/CL will probably be added from electronic herbarium searches when these databases go on-line during the next 5-15 years. The total number of known (675 taxa) and undiscovered vascular plants of

NAWS/CL may be close to 900 unique taxa. In comparison, approximately 3,000 vascular plant taxa are known from the California desert region. Thus, NAWS/CL plant diversity probably represents 20-30% of the taxa known for a region within which NAWS/CL occupies only 2-3%.

Transmontane California is botanically divided into three major floristic provinces; California, Great Basin, and Desert (Hickman, 1993). These three provinces converge in the region northwest of NAWS/CL. NAWS/CL vegetation, especially on the North Range, is a diverse, transitional composition wedged among these major provinces. Vegetation diversity is also enhanced by wide elevation gradients, complex geology, and numerous springs within NAWS/CL boundaries.

In addition to major floristic regions, NAWS/CL vegetation is further influenced by local floristic regions. Nearby floristic areas or subregions west of NAWS/CL (Hickman, 1993) are desert-transitional versions of the California Floristic Province. These subregions are characterized by diverse annual and herbaceous plant species. Floristic influences contributing to the unique floral resources of NAWS/CL are discussed in Appendix A, Section 2.3.1.1.

The North and South ranges have notable differences in terms of diversity of plants and animals, generally due to their locations, geological diversity, and altitudinal ranges. The North Range has greater plant species diversity than the South Range. Ninety-six percent of NAWS/CL known plant taxa can be found on the North Range, and 66 % can be found on South Range. This higher diversity is attributable to the North Range's higher elevations and location closer to the junction of California's major floristic provinces. Mesic microhabitats become more numerous with elevation and provide a niche for species uncharacteristic to desert regions. Such microhabitats are typically associated with springs but also include canyon bottoms, cliffs, tree shaded areas, and crevices in lava flows. Other features which contribute greatly to the North Range's floral and faunal diversity are plateaus, lava flows, and rolling terrain formed at the junction of the Coso and Argus mountain ranges. This topographical feature provides a more stable island than typical desert ranges for the survival of relictual species that were once more widespread (Betancourt *et al.,* 1990) but have since retreated to higher elevations with the drying of the Mojave region in recent geologic time.

Though fewer species are known from the South Range, the potential for undocumented species is equal to or greater than the North Range because little floristic work has been done there. Only 3 % of NAWS/CL known plant taxa are known from the South Range only. Documentation of new plant species on the South Range is further limited by the nature of the flora, Mojavean, which has numerous annual species that are seasonally and climatically restricted. There is also a great diversity of the geology and topography on the South Range, and an island for relictual plant species has been created by the range of mountains from the Black Hills to the Eagle Crags. This area of higher elevation supports several unique plant occurrences and loosely divides endemic flora of the western Mojave, central Mojave, and eastern Mojave.

2.3.1.2 Plant Communities

Plant communities are usually classified by consistent and widespread tree, shrub, or herbaceous plant cover patterns. Most are generally classified based on the most prominent plant in widespread areas of similar plant formations. Minor divisions are based on regional variations, ecotonal zones, and unique stands, often determined by a more strict assessment of cover values and local dominants.

Early plant community treatments for the Southwest were lists of common vegetation patterns, usually arranged by life zones and ecological differences. Since then, plant communities have mostly been classified into loose hierarchical systems. Recent plant classification treatments have also included smaller plant communities which are prominent or unique. Some minor plant communities are named after the plant that is the most characteristic, well-recognized, or prominent rather than the dominant cover species.

Names and classification of vegetation units are usually determined by the structure and relationship of dominant cover species. Plant community levels and types are often expressed as formations, series, or associations. Plant formations, series, and associations are further discussed in Appendix A, Section 2.3.1.2a.

A specific plant community system for NAWS/CL was created for natural resource management purposes and is shown in Appendix A, Section 2.3.1.2b. Rankings for CNDDB terrestrial plant communities that are similar to those known on NAWS/CL are also shown in Appendix A, Section 2.3.1.2b. Appendix A, Section 2.3.1.2c shows distribution and estimated percentages of NAWS/CL occupied by each plant community. Detailed descriptions of plant communities are in Appendix A, Section 2.3.1.2d. Classes are series-based with simplified names. Community descriptions are based on field data (a review of past documents and 1996-97 Vegetation Map data) and are cross-referenced to the following published classification systems: Brown *et al.*, 1982; Holland, 1986; Munz and Keck, 1968; and Sawyer and Keeler-Wolf, 1995. Analogous plant communities are discussed in Appendix A, Section 2.3.1.2e. Plant communities found on the North and South ranges of NAWS/CL are shown at Figure 2.3.1.2a and Figure 2.3.1.2b respectively.

2.3.1.3 NAWS/CL Plant Species of Concern

Plants and animals are defined as NAWS/CL species of concern (NAWS/CL-SC) when they fall into one of the following categories:

- Federally-listed;
- State-listed;
- proposed for federal listing or a former USF&WS Category 2 or 3 species;
- are considered rare;
- have limited distribution;
- are undescribed taxonomy;
- an endemic species;
- on the CNDDB, Audubon Blue, BLM Sensitive, or USFS Significant list; and/or
- identified as being of scientific interest.

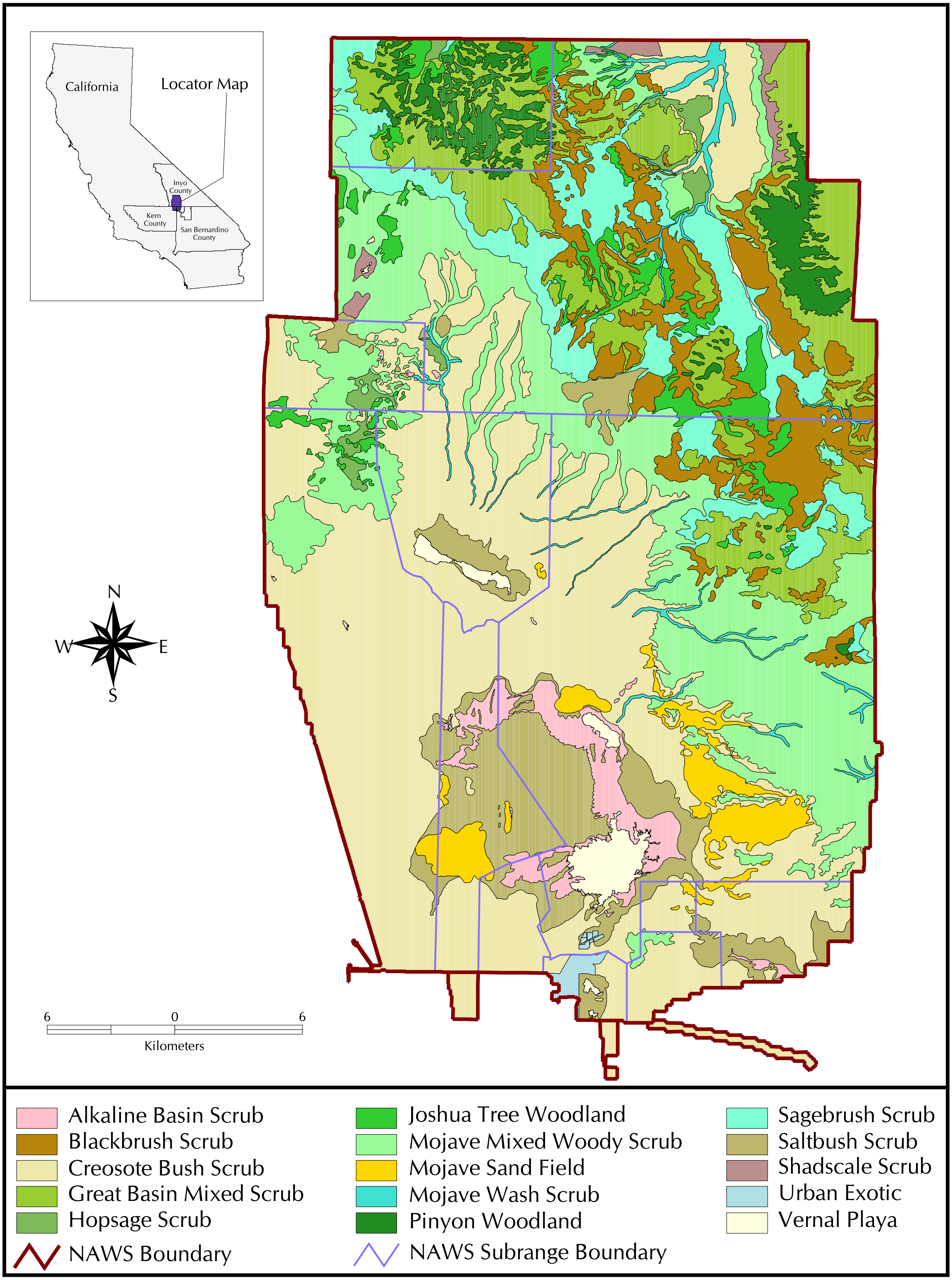

Figure 2.3.1.2a Plant Communities on NAWS/CL North Range

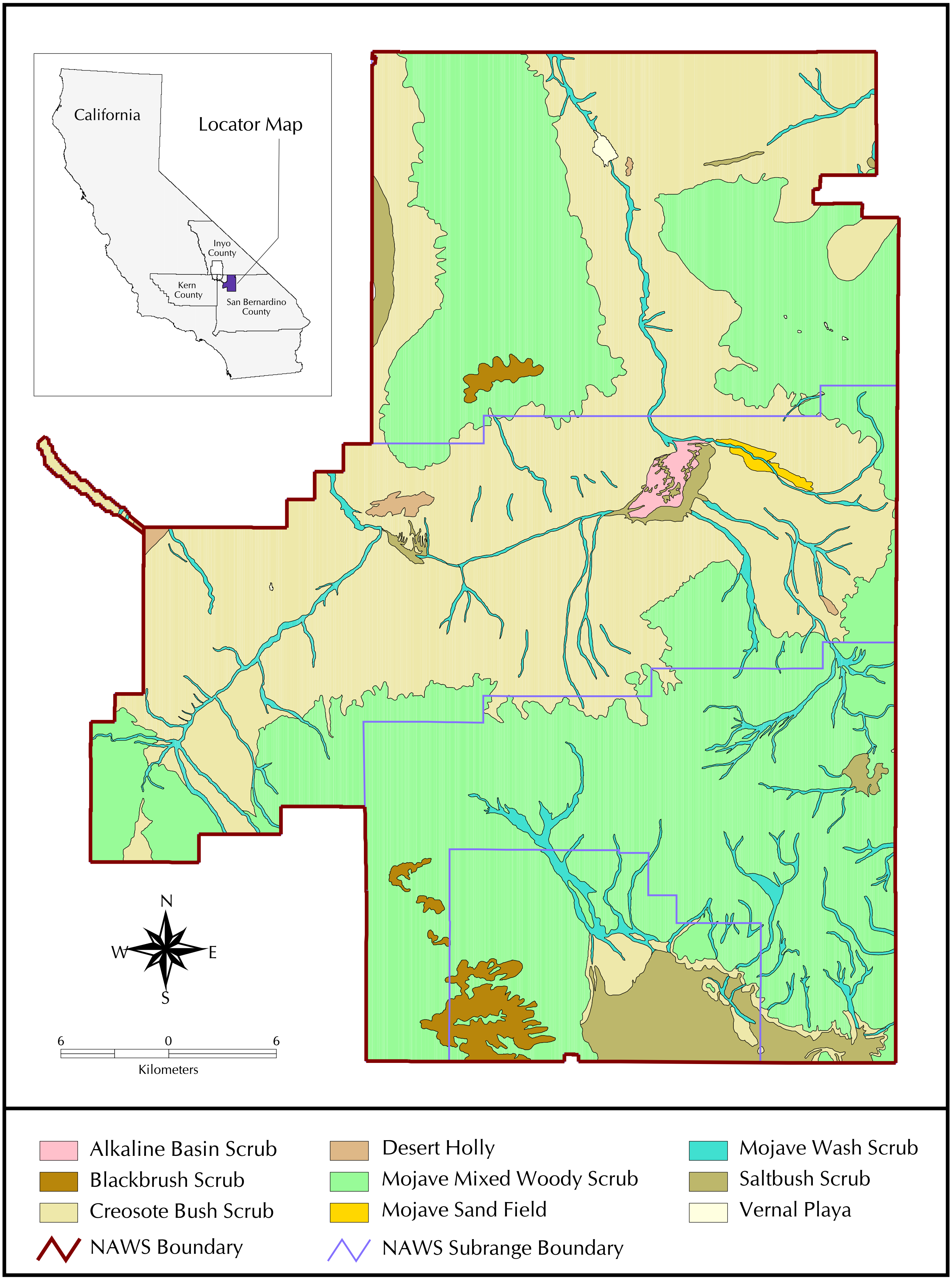

Figure 2.3.1.2b Plant Communities on NAWS/CL South Range

NAWS/CL-SC plants are divided into three priority categories. Category 1 (Status Plants) are endangered with federal protections or have required legal processes that are applicable to NAWS/CL. This includes ESA-listed species. Wetlands-delineating plants are not included but receive other consideration and protection by being part of a riparian plant community.

NAWS/CL has no federally-listed endangered or threatened plant species. Shining milk-vetch was proposed as a threatened species but it has been withdrawn from the proposed rulemaking. Shining milk-vetch is commonly found in the China Lake basin. However, further taxonomic determinations are necessary to verify the species. Lane Mountain milk-vetch (*Astragalus jaegerianus*), listed as federally endangered, and half-ring milk-vetch (*Astragalus mohavensis* var. *hemigyrus*), a former federal candidate species, have not been found on NAWS/CL but are known from sites within five miles of NAWS/CL. Limited surveys to date have not discovered Lane Mountain milk-vetch or half-ring milk-vetch on NAWS/CL. These species may occur on NAWS/CL.

NAWS/CL-SC Category 2 (Sensitive Plants) have no legal implications to NAWS/CL but are listed as rare, threatened, or endangered by an agency (other than the USF&WS) or other recognized entity. This category includes nine species that are well known and documented, eight species that have probable records on-Station but need further verification, five species that have suspect records and are probably reporting errors or nomenclature changes, and 11 species known from NAWS/CL that are potentially sensitive and are being reviewed for future listing by California Native Plant Society (CNPS) .

NAWS/CL-SC Category 3 (Unique Plant Localities) are localities having rich vegetation and the highest number of sensitive and unique plants at NAWS/CL. These include areas such as Coso Peak Lava Flow, Coso Known Geothermal Resource Area, springs, mines, and plants that are essential hosts to NAWS/CL-SC animals, such as riparian trees, parry saltbush (*Atriplex parryi*), and creosote clonal rings.

Categories of NAWS/CL-SC plants, mitigating factors for plant conservation, and criteria used for considering non-status plants, plant taxon, and habitats are discussed in Appendix A, Section 2.3.1.3a. NAWS/CL-specific ecological sensitivity rankings for NAWS/CL-SC plants known or suspected to occur on NAWS/CL are shown in Appendix A, Section 2.3.1.3b. Sensitivity rankings are somewhat subjective and are based on the species, or closely related species, known or suspected sensitivity to various types of impacts. Sensitivity rankings were developed through field observations at NAWS/CL, literature reviews, and consultations with other knowledgeable botanists.

Ecological aspects, such as plant community associations, geology, soils, and elevation, of NAWS/CL-SC plants known or suspected to occur on NAWS/CL are shown in a table in Appendix A, Section 2.3.1.3c. This table also lists estimated numbers of plants for populations of some sensitive plant species occurring on NAWS/CL.

Rankings of rareness, endangerment, and status of NAWS/CL-SC plants known or suspected to occur on NAWS/CL are shown in the table below.

Rankings of Rareness and Endangerment for Sensitive Plant Species Known to, or Suspected to Occur on NAWS/CL

Sensitive Plants Known or Suspected to Occur on NAWS/CL (Ordered by rarity and endangerment)	ESA Federal Status	Presence at NAWS/CL	CNPS R-E-D Code	CNPS List #	Global Rank	State Rank	Future Status Rank Change
Lane Mountain Milk-vetch *Astragalus jaegerianus*	FE	Potential	3-3-3	1B	G1	S1.1	
Half-ring Milk-vetch *Astragalus mojavensis* var. *hemigyrus*	C2**	Potential	Extinct in CA?	1A	G3T2	SH	Increasing Status
Clokey Cryptantha *Cryptantha clokeyi*	?	Verified	3-3-3	1B	G1	S1.?	Increasing Status
Mono Phacelia *Phacelia monoensis*	C2**	Verified	3-3-2	1B	G2	S2.1	Increasing Status
Shining Milk-vetch *Astragalus lentiginosus* var. *micans*	PT	Reported	3-2-3	1B	G5T1Q	S1.2	
Darwin Milk-vetch *Astragalus atratus* var. *mensanus*	none	Verified	3-1-3	1B	G4T2?	S?	
DeDecker's Clover *Trifolium macilentum* var. *dedeckerae*	C3c**	Verified	3-1-3	1B	G?T2	S2.3	
Darwin Rock Cress *Arabis pulchra* var. *munciensis*	none	Reported	3-1-1	2	G5T?	S1?	
Inyo Hulsea *Hulsea vestita* ssp. *Inyoensis*	C3c**	Historic Record	2-2-1	2	G5T2T3	S2	
Naked Milk-vetch *Astragalus serenoi* ssp. *shockleyi*	none	Reported	2-2-1	2	G4T2	S2?	
Weasel Phacelia *Phacelia mustelina*	C3c**	Verified	2-1-2	1B	G2G3	S?	
Desert Cymopterus *Cymopterus deserticola*	none	Potential	2-1-2	---	G5?	?	
Barstow Wooly Sunflower *Eriophyllum mohavense*	none	Potential	2-1-2	---	G5?	?	
Ripley's Gilia *Gilia ripleyi*	none	Potential	2-1-2	---	G5?	?	
Pinyon Rock Cress *Arabis dispar*	none	Verified	2-1-1	2	G3	S3	Decreasing Status
Charlotte's Phacelia *Phacelia nashiana*	C2**	Verified	1-2-3	1B	G3	S3.2	Decreasing Status
Panamint Live-forever *Dudleya saxosa* ssp. *saxosa*	C2**	Reported	1-2-3	4	G4T1T3	S?	Increasing Status

Sensitive Plants Known or Suspected to Occur on NAWS/CL (Ordered by rarity and endangerment)	ESA Federal Status	Presence at NAWS/CL	CNPS R-E-D Code	CNPS List #	Global Rank	State Rank	Future Status Rank Change
Crowned Muilla *Muilla coronata*	C3c**	Verified	1-2-2	4	G3Q?	S?	Increasing Status
Mohave Fish Hook Cactus *Sclerocactus polyancistrus*	C3c**	Verified	1-2-2	4	G4	S3.2	
Gypsum Linanthus *Linanthus arenicola*	C3c**	Verified	1-2-1	2	G2?	S2.2	Decreasing Status
Evening Primrose *Oenothera caespitosa* ssp. *crinita*	none	Reported	1-2-1	4	G5T?	S?	Decreasing Status
Panamint Mariposa Lily *Calachortus panamintensis*	none	Reported	1-1-3	4	G2	S2?	
Coso Mountains Magnificent Lupine *Lupinus magnificus* var. *glarecola*	none	Verified	1-1-3	4	G3T3?	S?	
Panamint Bird's Beak *Cordylanthus eremicus* ssp. *eremicus*	C3c**	Verified	1-1-3	4	G3T2	S2?	Decreasing Status
Indigo bush *Psosrothamnus arborescens* var. *arborescens*	C3c**	Verified	1-1-1	4	G4T3	S?	Decreasing Status
Booth Evening Primrose *Camissonia boothii* ssp. *boothii*	none	Reported	1-1-1	4	G?	S?	Increasing Status
Utah Fendlerella *Fenderella utahensis*	none	Reported	1-1-1	4	G5	S?	Decreasing Status

Federal Status: ** Former Federal candidate rankings
FE - Former Endangered
PT - Proposed Threatened

CNPS R-E-D Code: **R**areness - CNPS **R**-E-D
Endangerment at NAWS - CNPS R-**E**-D
Distribution - CNPS R-E-**D**
(1 = low, 3 = high)

CNPS List: Described in Skinner, M.W., and B.M. Pavlik. California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California. Special Publication No. 1. Fifth edition. February, 1994. CNPS, Sacramento, CA.

Global Rank: The global rank is a reflection of the overall condition of an element throughout its global range.
Gl = Less than 6 viable element occurrences or less than 1,000 individuals or less than 2, 000 acres.
G2 = 6-20 element occurrences or 1,000 -3,000 individuals or 2, 000 - 10,000 acres.
G3 = 21-100 element occurrences or 3,000-10,000 individuals or 10, 000 - 50,000 acres.
G4 = Apparently secure; this rank is lower than G3 but factors exist to cause some concern; *i.e.*, there is some threat, or somewhat narrow habitat.
G5 = Population or stand demonstrably secure to ineradicable due to being commonly found in the world.
Subspecies Level = Subspecies receive a T-rank attached to the G-rank. The G-rank reflects the condition of the entire species, whereas the T-rank reflects the global situation of the subspecies or variety.

State Rank: The state rank is assigned much like the global rank, except state ranks in California often also contain a threat designation attached to the "S" rank.
S1 = Less than 6 element occurrences or less than 1,000 individuals or less than 2, 000 acres.
Sl.l = Very threatened
Sl.2 = No current threats known
Sl.3 = Very threatened
S2 =6-20 Element occurrences or 1,000 -3,000 individuals or 2, 000 - 10,000 acres.

S2.1 = Very threatened
S2.2 = No current threats known
S2.3 = Very threatened
S3 = 21-100 Element occurrences or 3,000-10,000 individuals or 10, 000 - 50,000 acres.
S3.1 = Very threatened
S3.2 = No current threats known
S3.3 = Very threatened
S4 - Apparently secure within California; this rank is clearly lower than S3 but factors exist to cause some concern; *i.e*. there is some threat, or somewhat narrow habitat. No threat rank.
S5 - Demonstrably secure to ineradicable in California. No threat rank.

Future Status Rank: Decreasing Status - plants that are in the process of, or have the potential to, decrease in rankings of
Increasing Status - Plants that are in the process of, or have the potential to increase in rankings of rareness and endangerment, or added to new listings.

Known distribution and potential range of NAWS/CL-SC plants are shown at Figure 2.3.1.3. Maps for each individual NAWS/CL sensitive plant species are in Appendix A, Section 2.3.1.3d. Background information, including status, distribution, biology, and ecology, for each NAWS/CL-SC plant and unique plant locality is discussed in Appendix A, Section 2.3.1.3e.

NAWS/CL has a general policy prohibiting plant collection without specific approval of the Commanding Officer of NAWS/CL. Appendix A, Section 2.3.1.3f includes a discussion of legal protection afforded sensitive species under federal and state law.

2.3.1.4 Floral Inventory

Botanical explorations and inventories at NAWS/CL are mostly the result of surveys conducted prior to NAWS/CL occupation. Most herbarium records are pre-NAWS/CL. Inventory was frequently associated with many historic features on NAWS/CL, such as old mines and ranches. The first NAWS/CL-associated botanical surveys for which there are data was performed in 1978 (Henry, 1972-78, unpublished data), which created plant lists for specific regions of the North Range. Much of Henry's work was reflected in DeDecker's report on the flora of the NAWS/CL region (DeDecker, 1980) and subsequent publication on the northern Mojave Desert (DeDecker, 1984). These projects have provided the bulk of plant species occurrence and distribution data at NAWS/CL.

More recently, vegetation surveys have become a frequent component of the environmental assessment process at NAWS/CL. Areas that have had significant plant surveys include Cactus Flats; K2 Track; Mountain Springs Canyon; Randsburg Wash; Moscow, Wilson, Haiwee, and Margaret Ann springs; and the Coso Geothermal Area. Plant species which have received special survey attention include creosote bush clonal rings (*Larrea tridentata*), the Mojave fishhook cactus *(Sclerocactus polyancistrus),* Panamint bird's beak (*Cordylanthus eremicus* ssp. *eremicus*), Coso Mountains lupine (*Lupinus magnificus* var. *glarecola),* and gypsum linanthus *(Linanthus arenicola).* General floristic and plant community surveys are being conducted in association with GIS development, the NAWS/CL Range Environmental Impact Statement, and INRMP development (Silverman and Tetra Tech).

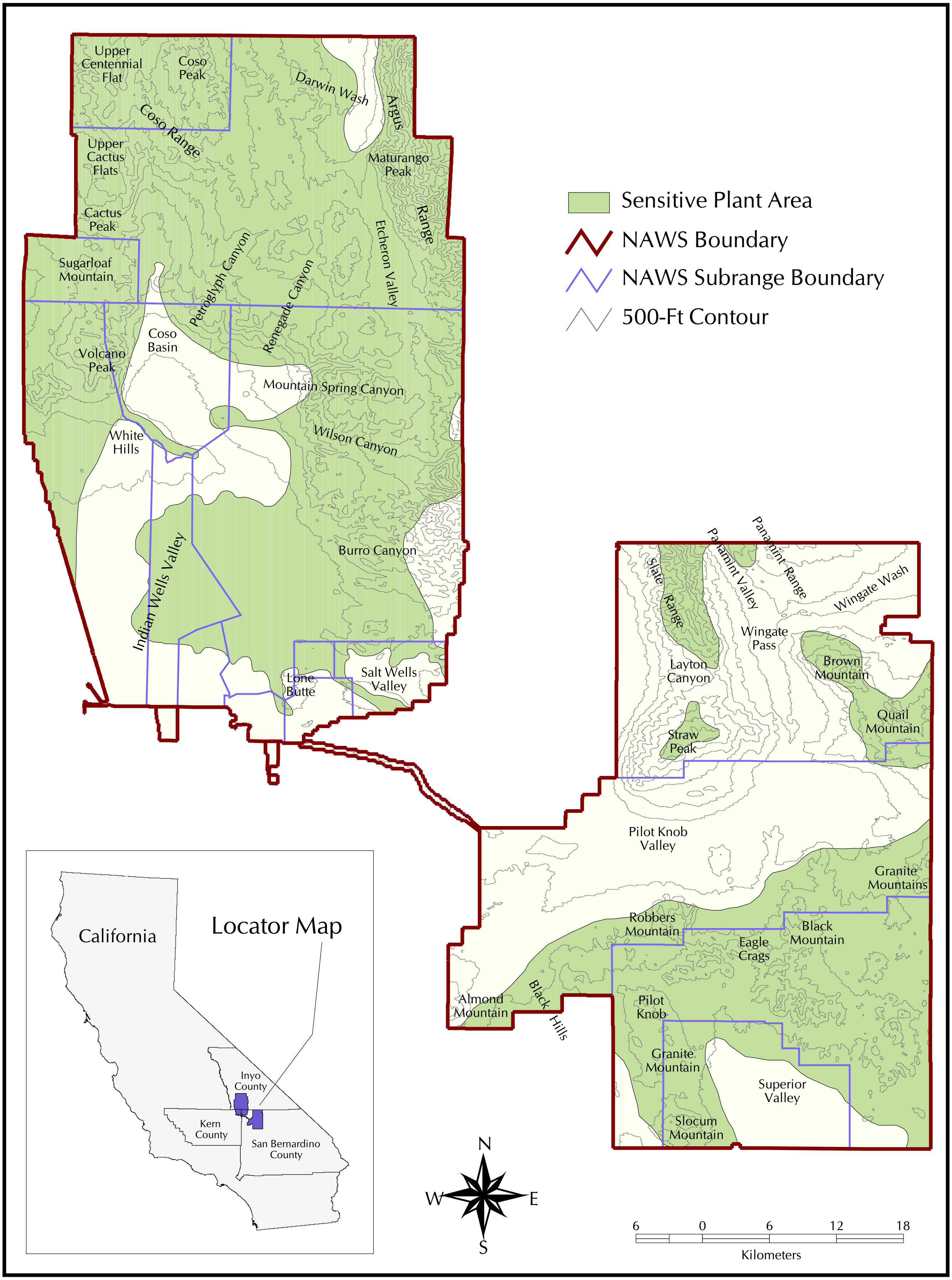

Figure 2.3.1.3 Known Distribution and Potential Range of NAWS/CL Plant Species of Concern

The University of California Riverside has provided numerous new botanical records for NAWS/CL as part of general biological and entomological surveys during 1994-97. NAWS/CL plant records occur at several western herbariums, including the Rancho Santa Ana Botanic Garden and University of California herbariums at Riverside, Los Angeles, and Berkley. Older pre-NAWS/CL records are scattered throughout the country. A small number of recently collected specimens are being kept at NAWS/CL. Appendix A, Section 2.3.1.4a contains a chronological record and abstract of surveys, methods, and results of flora inventory efforts on NAWS/CL. See Section 3.5.1.1 for information on ongoing efforts to improve the quality of the floral inventory of NAWS/CL.

An updated floristic plant list has been created for NAWS/CL (Silverman, 1997). A limited plant list database was created for the 1993 NAWS/CL-SC plant surveys (Kiva Biological Consulting) which was merged with two regional floristic databases (Mark Bagley and Dave Silverman). Records are being searched, reviewed for accuracy, attributed, and rated based on proximity to NAWS/CL. Adding plant lists from past documents at NAWS/CL has not been completed. Richard Zembal's 1979 Coso Geothermal plant list, Mary DeDecker's 1980 flora, Silverman's vegetation map data, Gordon Pratt's plant list from 1996, and the Kiva Biological (Mark Bagley)1993 survey are represented in the database. Appendix A, Section 2.3.1.4b contains location, collector's names, dates of collection or detection, and general information for species of flora found at NAWS/CL. Appendix A Section 2.3.1.4c contains an acronym key to plants of the NAWS/CL region.

2.3.2 Fauna

2.3.2.1 General

NAWS/CL has exceptionally diverse fauna due to a number of factors including the amount of water (natural waters such as seeps and springs as well as the Sewage Treatment Facility Evaporation Ponds and the Lark Seep System), the elevational range of 1,700 to 8,800 feet, and the diversity of vegetation communities. About 35 species of reptiles and amphibians (Appendix B, Section 2.3.2.1a), 322 species of birds (Blue and Moore, 1998 (Appendix B, Section 2.3.2.1b), and 58 species of mammals (Appendix B, Section 2.3.2.1c) have been observed on NAWS/CL.

Four introduced bird species, the chukar, rock dove, European starling, and house sparrow, are present on NAWS/CL. The chukar is a gamebird in mountainous areas on the North and South ranges. Rock doves, European starlings, and house sparrows are common within the housing area. Two other species, the see-see partridge and crested tinamou, were introduced on the North Range by CDFG in the late 1960's. The introduction was not successful, and neither species has been observed since its release. Feral horses and burros are two introduced mammals that have successfully established large populations on the ranges.

Wetlands and riparian areas have the greatest diversity and density of fauna. These areas offer greater availability of food, water, and protective cover from predators and climate. Many of the 403 recorded vertebrates on NAWS/CL are typically associated with wetlands or riparian habitats although these areas comprise only a small percentage of habitat available on the ranges. Riparian zones and their associated wetland areas are crucial habitat components due to their importance of these areas for endemic and endangered species, migratory birds, and overall diversity of flora and fauna. Many of these areas are being significantly impacted by domestic cattle and/or feral horses and burros. Guidelines addressing management of these areas are provided in Section 3.5.

There are five species of fish known from NAWS/CL. These species, the endangered Mojave tui chub (*Gila bicolor mohavensis*), mosquito fish (*Gambusia affinis*), bullhead catfish (*Ictalurus* sp.), goldfish (*Carassius auratus*), and largemouth bass (*Micropterus salmoides*), are introduced non-native species. The Mojave tui chub, mosquito fish, and bullhead catfish are only known to exist in the Lark Seep and G-1 Seep system. Goldfish are found in the Lark Seep and G-1 Seep system, in a number of man-made ponds. Largemouth bass are found in ponds at Area R (Tetra Tech, 1998).

There are numerous sensitive plant and animal associations at NAWS/CL. For example, Joshua trees provide shade and attract animals, especially ungulates, to their bases. Soils tend to be sandy and highly disturbed from animal activity around large Joshua trees. In this manner they influence the composition of other plants in their immediate vicinity. Much organic debris can be found among large Joshua trees as a result of ground and arboreal activity. Nesting raptors and migratory songbirds depend heavily on Joshua Tree Woodlands. The yucca moth has a very unique and critical relationship with Joshua trees. Other relationships, such as the symbiotic relationship some butterfly species have with certain plants and the Tiemann's beetle's association with *Atriplex parryi*, are discussed in sections specific to those species.

Dense shrub growth in washes provide nesting areas to many birds such as flycatchers, LeConte's thrasher, and loggerhead shrikes and many species of migratory birds. This dense growth is especially important to bird populations on the South Range.

2.3.2.2 Threatened and Endangered Species

As diverse as is the fauna of NAWS/CL only nine species are Federally-listed as endangered (five species) or threatened (four species), and 10 species are State-listed as endangered (seven species) or threatened (three species). However, only three species present management issues for NAWS/CL, the Mohave tui chub, desert tortoise, and Inyo California towhee. The remainder includes seven transient species, one vagrant species, and one species with unknown status on NAWS/CL. Species not considered to be present management issues on NAWS/CL are most likely to be found in wetland and riparian areas; thus, they are protected under management of the three resident listed species. Appendix B, Section 2.3.2.2 is a discussion related to threatened and endangered species, including issues such as ESA ramifications to NAWS/CL activities and laws applying to such species of wildlife.

The table below shows the status of listed fauna occurring or suspected to occur on NAWS/CL.

Taxa	Federal Status	State Status	NAWS/CL Habitat	NAWS/CL Occurrence	NAWS/CL Abundance *
Mohave Tui Chub *Gila bicolor mohavensis*	Endangered	Endangered	Wetland	Resident	Common
Desert Tortoise *Gopherus agassizii*	Threatened	Threatened	Desert	Resident	Uncommon
Brown Pelican *Pelecanus occidentalis californicus*	Endangered	Endangered	Wetland	Vagrant	Extremely Rare

Taxa	Federal Status	State Status	NAWS/CL Habitat	NAWS/CL Occurrence	NAWS/CL Abundance *
Bald Eagle *Haliaeetus leucocephalus*	Threatened	Endangered	Throughout	Transient	Extremely Rare
Swainson's Hawk *Buteo swainsoni*	None	Threatened	Throughout	Transient	Extremely Rare
Western Snowy Plover *Charadrius alexandrinus nivosus*	Threatened (Pacific coast population)		Wetland	Unknown	Unknown
Willow Flycatcher *Empidonax trailii*	None	Endangered	Riparian Urban	Transient	Fairly Common
Southwestern Willow Flycatcher *Empidonax trailii extimus*	Endangered	Endangered	Riparian Urban	Transient	Uncommon
Bank Swallow *Riparia riparia*	None	Threatened	Wetland	Transient	Uncommon
Least Bell's Vireo *Vireo bellii pusillus*	Endangered	Endangered	Riparian Urban	Transient	Extremely Rare
Mohave Ground Squirrel *Spermophilus mohavensis*	None	Threatened	Alluvial-filled Valleys	Resident	Uncommon
Inyo California Towhee *Pipilo crissalis eremophilus*	Threatened	Endangered	Riparian	Resident	Uncommon

* Abundance: Common is a few individuals encountered on >90% of days and many individuals encountered on >50% of days. Fairly common is a few individuals encountered on 50-90% of days and many individuals encountered on 10-50% of days. Uncommon is a few individuals encountered on 10-50% of days and many individuals encountered on <10% of days. Rare is a few individuals encountered on <10% of days. Extremely rare is a few individuals encountered on 10 or fewer records at that season.

2.3.2.2.1 Mohave Tui Chub

The Mohave tui chub was federally-listed endangered in 1970 and State-listed endangered in 1971. In 1972, an attempt to preserve the only remaining Mohave tui chub population was made and chub were transplanted from Lake Tuendae to 14 refuge sites. Lake Tuendae is located adjacent to Soda Dry Lake, near Baker California. Only three transplants were successful, the Desert Research Station, Hinkley; California Information Center, Barstow; and Lark Seep System, NAWS/CL.

The California Information Center population consisted of about 60 chub in a 300-gallon pond. This artificial habitat served as a public display and was not considered a viable population. A December 1996 announcement stated that the Desert Research Station underwent new management, and during that time chub ponds were not maintained, allowing that population to expire. In 1986 CDFG established a refuge site at Camp Cady Wildlife Area. Two 0.25-acre ponds were constructed, and groundwater was pumped from the nearby Mojave River drainage channel. A 1994 population census estimated 2,000 chub at that site.

The largest known population of Mohave tui chub is in the Lark Seep/G-1 Seep system on NAWS/CL. The 1997 NAWS/CL Mohave tui chub population was estimated to be 8,104 tui chub. Figure 2.3.2.2.1 shows the location of Mohave tui chub, test wells (for the water mound), measurement stations (for dissolved oxygen, alkalinity, dissolved solids, etc.), weirs, gates, bridges, and other man-made items that could affect the chub on NAWS/CL.

The Lark Seep/G-1 Seep drainage system consists of two seeps and about five miles of inter-connecting channels. Initially 400 chub were introduced into the Lark Seep lagoon (St. Amant and Sasaki, 1971). This introduction was augmented with 75 additional chub in 1976 (Hoover and St. Amant, 1982). As the population grew, chub migrated into the channels. Mark and recapture studies indicate that typically 90 percent of the chub are found in the channels. Slow flowing water within channels is thought to emulate the chub's natural river habitat. Considerable monitoring of the Lark Seep system occurred in 1983 (Feldmeth *et al*., 1984), 1988 (Feldmeth *et al*., 1989), and 1991 (Feldmeth and Bilhorn, 1991). These studies documented important features of the system, including groundwater regime, water quality parameters, biotic characteristics, and chub ecology. Further background and natural history information for Mohave tui chub is in Appendix B, Section 2.3.2.2.1a.

Management of channel vegetation has been a top priority for NAWS/CL. Channel vegetation, mainly cattails and rushes, must be removed annually to keep water flowing. Vegetation is removed with a grade-all earth mover using in-house personnel and equipment. Since the channels were originally constructed to divert water flow from adjacent facilities, funding for vegetation removal has historically been furnished by the Pacific Ranges and Facilities Department. Other funding sources are currently being investigated.

In 1996 a request for re-initiation of Section 7 consultation was submitted to USFWS to update the existing Biological Opinion. During 1997 funding through the USFWS allowed NAWS/CL to enhance Mohave tui chub habitat by widening and deepening 250 feet of Lark Seep south channel. Research has shown that cattails should not grow through 6 to 10 feet of water. The wider channel should also allow more water flow which would require NAWS/CL to clear channels only every second or third year. A Biological Opinion concerning enhancement of chub habitat on NAWS/CL was issued for this project in May 1997 (Appendix B, Section 2.3.2.2.1b). A second Biological Opinion (Appendix B, Section 2.3.2.2.1c) was issued in August 1997 for removal of aquatic vegetation from chub habitat on NAWS/CL. Removal work was accomplished in accordance with Clean Water Act requirements.

May *et al.* (1997) studied the genetic variability among the Mohave tui chub, Owens tui chub (*Gila bicolor snyderi*), and Lahontan tui chubs (*Gila bicolor obesa* and *Gila bicolor pectinifer*) to determine subspecies status. The study also compared genetic structures of Mohave tui chub and Arroyo chub (*Gila orcutti*) to determine if refugia populations are pure. The results of this study support the view that the Mohave tui chub is gentically pure and is a distinct evolutionary lineage that should be regarded as a separate subspecies.

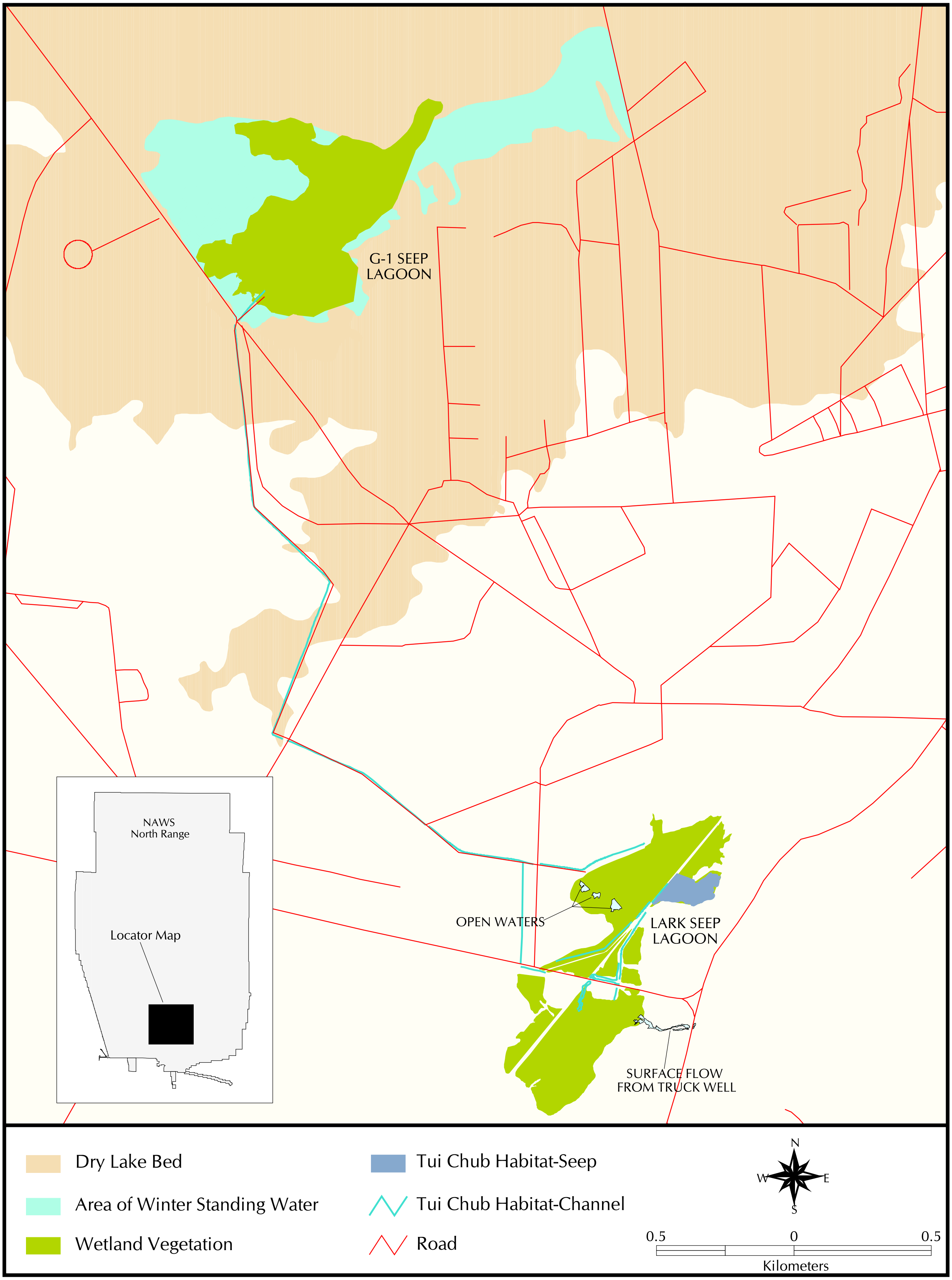

Figure 2.3.2.2.1 Mojave Tui Chub Distribution on NAWS/CL

The *Mohave Tui Chub Recovery Plan* (Taylor and Williams, 1984) contains inventory and monitoring techniques, minimum water levels, and recommended water quality standards for survival of the chub. Another pertinent document affecting this species is the *Technical Approach for a Mohave Tui Chub Protection Plan* (Feldmeth and Bilhorn, 1991). Survey methodologies for the Mohave tui chub and its habitat are discussed in Appendix B, Section 2.3.2.2.1a.

2.3.2.2.2 Desert Tortoise

The Mojave population (north and west of the Colorado River) of the desert tortoise was federally-emergency listed endangered in August, 1989 due to high mortality rates caused by habitat destruction and degradation, upper respiratory tract disease, predation by common ravens (*Corvus corax*), illegal collection as pets, and vandalism. The desert tortoise was State-listed threatened in June, 1989 and federally-listed threatened in April, 1990 (USFWS, 1990). The recovery plan was finalized and critical habitat designated in 1994. NAWS/CL tortoise populations are within the West Mojave Recovery Unit, which has sustained severe and rapid population declines of up to 10 percent or more annually since about 1980 (BLM, 1988). Evidence of upper respiratory tract disease or die-offs have not been documented on NAWS/CL.

Desert tortoise are a long-lived species (more than 60 years) found in Creosote Bush Scrub, Saltbush Scrub, and Joshua Tree Woodland plant communities from about 1,000 to 3,800 feet elevation. At NAWS/CL tortoises are found in all of these habitat types (USFWS, 1995). The highest density tortoise habitat tends to be on gently sloping bajadas in Creosote Bush Scrub with sandy-loam to pebbly soils (USFWS, 1995).

A survey of the North and South ranges was conducted by Kiva Biological Consulting in 1990 and 1991. About 355 square miles (20.7%) of the 1,712 square miles of NAWS/CL is potential desert tortoise habitat (Kiva Biological Consulting, 1991). Figure 2.3.2.2.2 shows desert tortoise distribution and density on NAWS/CL. Only 17.0% (60.5 square miles) of the 355 square miles of potential habitat was estimated to have tortoise densities approaching 20 or more per square mile. On the North Range, 136 square miles of potential habitat were identified, but only two areas totaling seven square miles (5.1%) were estimated to have densities approaching 20 tortoises per square mile, an area three miles east of Airport Lake and another near the town of Inyokern. Of 219 square miles of potential tortoise habitat on the South Range, 30 square miles (13.7%) were estimated to have densities of 21 to 50 tortoises per square mile, the eastern and western ends of Randsburg Wash and the eastern and western sides of Superior Valley. About 23.5 square miles (10.7%) were estimated to have densities approaching 20 tortoises per square mile including an area northwest of Hidden Spring.

Recent mortality rates on NAWS/CL were not unusually high (Kiva Biological Consulting, 1991). Symptoms of upper respiratory tract disease were not found, and although ravens were present, there was no evidence of raven predation on juvenile tortoises. Vandalism and collecting are likely low or non-existent due to restricted access on NAWS/CL. Habitat disturbance and loss is also relatively low since NAWS/CL activities do not typically result in significant new land disturbance.

In 1992 NAWS/CL initiated formal consultation with USFWS to create a programmatic Biological Opinion (BO) (Appendix B, Section 2.3.2.2.2) that would allow NAWS/CL to construct facilities and test sites and to conduct general operations in tortoise habitat without USFWS consultation on a per-project basis (USFWS, 1995). The Biological opinion was issued by the service in 1992; a second Biological opinion was issued in 1995, after reinitiating of formal consultation that was required because of the designation of critical habitat for the species. The BO created a Desert Tortoise Habitat Management Area (DTHMA) on NAWS/CL of about 200,000 acres. The DTHMA is located on the southern end of South Range, centered on Superior Valley. Restrictions to military and other activities in the DTHMA are discussed in Section 3.2.3.1.3.

2.3.2.2.3 Inyo California Towhee

The Inyo California towhee was federally-listed threatened in 1987 because the entire population is confined to a very limited habitat which has been altered and could be further adversely impacted by future land use changes (USFWS, 1987). For similar reasons CDFG State-listed the Inyo California towhee endangered in 1980 (CDFG, 1980). Critical habitat was designated in 1987 (USFWS 1987). A recovery plan which determined management strategies and was completed by the USFWS in April 1998 (USFWS). The Inyo California towhee may be considered for delisting when threats to its habitat have been eliminated and degraded habitat has been restored to its former potential.

Inyo California towhees are essentially non-migratory (Childs, 1968; LaBerteaux, 1989); however, during extreme winter weather they may move altitudinally. Territories are centered around desert riparian vegetation but range into adjacent upland plant communities (LaBerteaux, 1989; 1994). The upland plant community surrounding the riparian habitat may be Mojave Creosote Bush Scrub, Mojave Mixed Woody Scrub, Blackbrush Scrub, or Big Sagebrush Scrub (Holland, 1986) with or without a Joshua tree overstory.

Configuration of habitat is important in selection of territories (Cord and Jehl, 1979). Territories of single pairs of towhees in riparian areas ranged from 3,750 square feet (ft^2) at Indian Joe Spring to 30,000 ft^2 at Ruby Spring. Highest densities of towhee pairs are found in linear habitats with a pair requiring a minimum of 4,000 ft^2 and a minimum of 450 linear feet of riparian habitat in areas where vegetation is linear (Cord and Jehl, 1979). Laabs *et al*. (1992) estimated that a pair of towhees occupy an average 487 feet of linear riparian habitat. Size of territories usually range from 24.7 to 61.8 acres.

Until recently, the total known range of the Inyo California towhee was thought to lie within a 14-mile diameter circle in the southern Argus Mountains, randomly distributed in riparian habitat between 2,680 and 5,630 feet msl, ranging from Indian Joe Canyon in the south to Mountain Springs Canyon and Water Canyon in the north. 1998 surveys have expanded the known range of the towhee (primarily to the north) by about nine miles, but it is still closely associated with open water. Figure 2.3.2.2.3 shows Inyo California towhee distribution on and near NAWS/CL. LaBerteaux (1994) estimates that towhees are in about 32 miles of canyons, 22 miles (68%) of which occur on NAWS/CL. Remaining habitat is located on BLM and State land (Indian Joe Canyon).

Cord and Jehl (1979) conducted a range-wide survey in spring and fall 1978; LaBerteaux (1989) conducted population and behavioral surveys from 1984 to 1986 for a Master of Science thesis; and Laabs *et al*. (1992) conducted a survey in the Great Falls Basin Area of Critical Environmental Concern in spring 1992. Despite these efforts, there remained many nearby potential habitat areas that had not been surveyed. Preliminary results of surveys performed in these areas in 1998 not only expanded the towhee's range but documented a much higher population level and a broader use of vegetative types for nesting than was previously believed. Survey methodologies are discussed in Appendix B, Section 2.3.2.2.3.

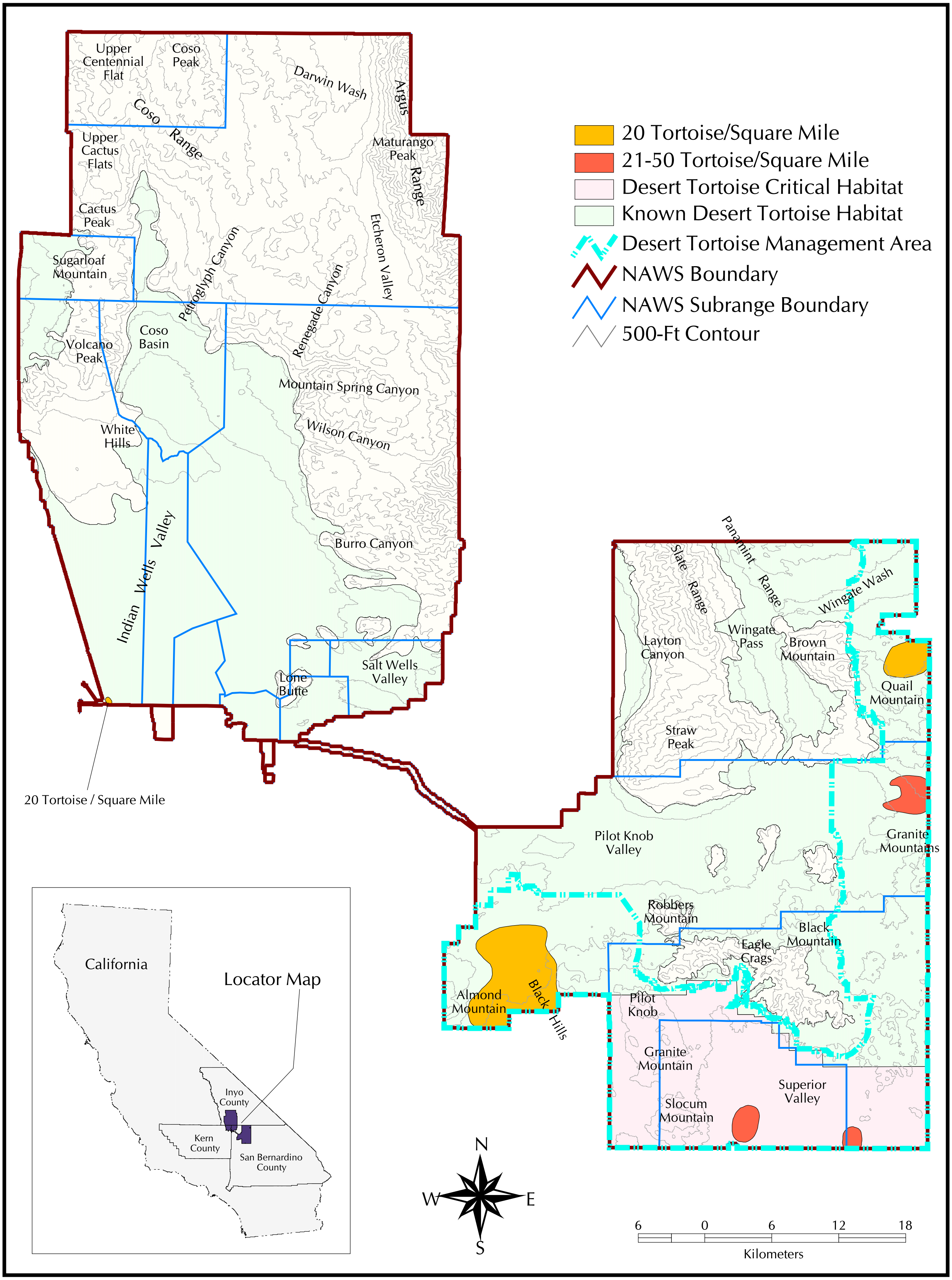

Figure 2.3.2.2.2 Desert Tortoise Distribution and Density on NAWS/CL

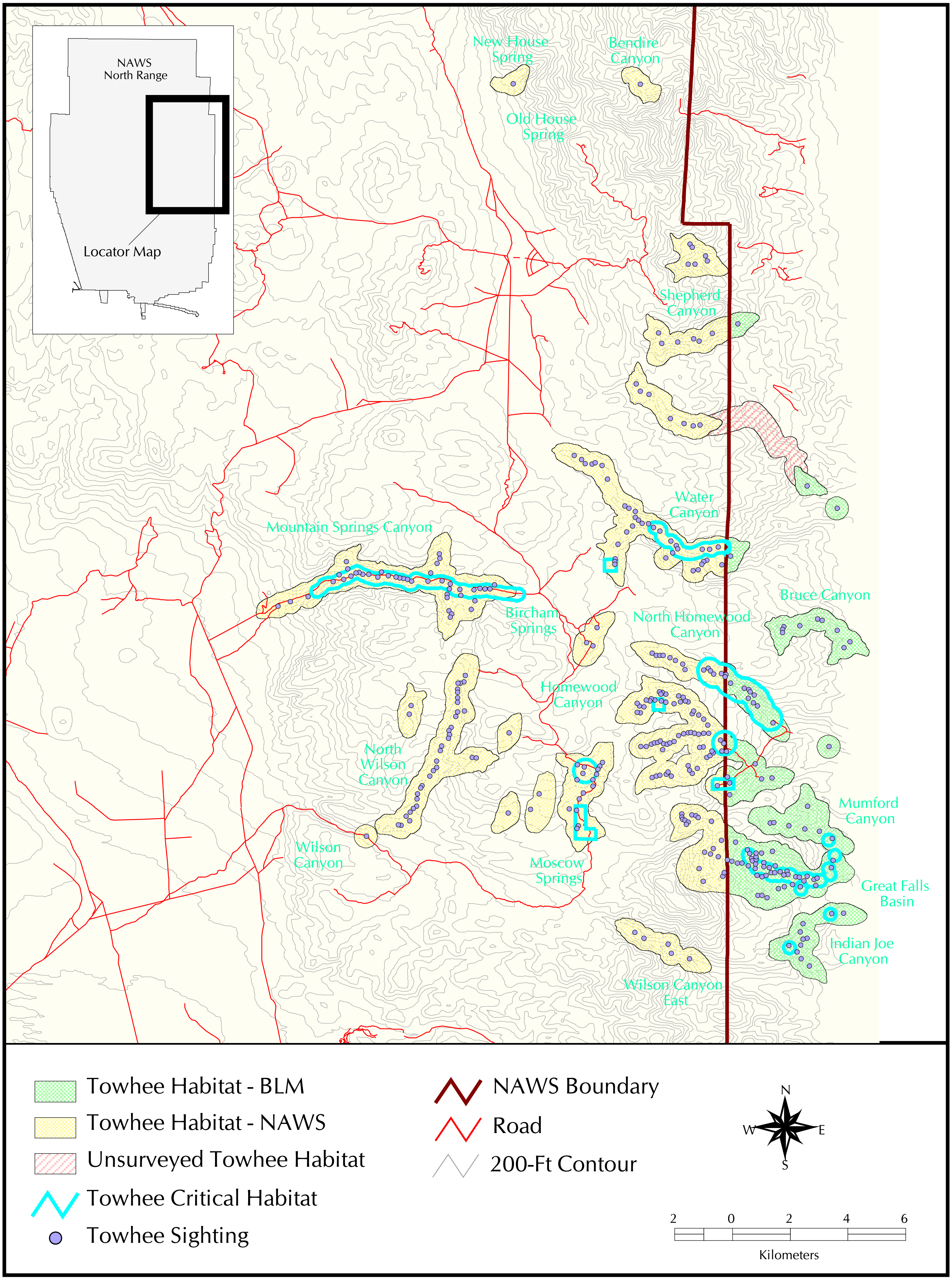

Figure 2.3.2.2.3 Inyo California Towhee Distribution on and near NAWS/CL

Previously, numbers of Inyo California towhees had been estimated between 138 (Cord and Jehl, 1979) and 180 adults (LaBerteaux, 1994). LaBerteaux estimated that 69 (38%) of towhees were on BLM and State land and 111 (62%) were on NAWS/CL. The 1998 surveys revealed a total population of 640 adult towhees with an estimated 317 pairs. Towhees were also found nesting in numerous species of wash and upland shrubs. Previous research indicated that almost all towhee nest sites were confined to willows, cottonwoods, and desert olives. It appears that one of the primary reasons that towhees have expanded their range is due to the extensive and ongoing efforts to remove feral burros from the riparian habitats throughout the Argus Range. It further appears that towhees can utilize marginal habitats. Thus, riparian areas that do not presently support towhees may serve as refugia for unpaired individuals or for pairs that do not have territories in higher quality habitat. These marginal sites may benefit the overall stability and long-term viability of the population.

2.3.2.2.4 Other Listed Species (Non-resident Birds)

Five federally-listed and eight State-listed non-resident birds (nine species total) are migrants with varying degrees of abundance on NAWS/CL (See table in Section 2.3.2.2). On two occasions immature California brown pelicans, federally- and State-listed endangered have been observed at Lark Seep. The bank swallow and willow flycatcher are common migrants, whereas the bald eagle, peregrine falcon, Swainson's hawk, and least Bell's vireo are extremely rare migrants. Western snowy plovers are common during spring at the Sewage Treatment Ponds, but are not considered by the service to be members of the listed coastal population. However, color-banded western snowy plovers from the Pacific Coast population have been observed in the southern San Joaquin Valley and may occur on NAWS/CL. Western snowy plovers may nest at the Sewage Treatment Ponds or at G1 Seep, where juveniles (fledged) but neither nests nor non-flying juveniles have been observed; thus, breeding has not been documented.

Most listed non-resident bird species are associated with wetland (*e.g*., resting in the Sewage Treatment Ponds) or riparian habitats. Although they may utilize habitat on NAWS/CL for only a short period, the habitat is still important as it supplies food and water necessary for migration to breeding or wintering grounds or may provide habitat for young of the year and non-breeders. Wetlands and riparian habitats are extremely rare in deserts, and loss of these critical habitats could seriously impact the ability of migrants to cross desert areas, especially during prolonged drought or bad weather.

The housing area and golf course may also be utilized by the Swainson's hawk, peregrine falcon, willow flycatcher, bank swallow, and least Bell's vireo for foraging and resting. Many homes have large trees for perching and shrubs for foraging and protection for the passerines. However, the housing area cannot be relied upon to provide consistent habitat for transient birds. Many old trees and houses are being systematically removed due to their advanced age and excessively high maintenance costs.

Constraints to activities on NAWS/CL due to listed non-resident bird species are expected to be minimal. All affected species are transients and would typically utilize wetlands associated with the Waste Water Treatment Facility or the Lark Seep System or riparian zones, which provides habitat for a wide variety of NAWS/CL-SC and already has protection because of wetlands and endangered species regulations.

2.3.2.3 Invertebrates

Due to the wide variety of habitats and its location near the northern end of the Mojave Desert and southern end of the Great Basin Desert, NAWS/CL supports a number of potentially rare or endemic species. In addition, many species of invertebrates continue to go undiscovered (entomologists routinely record previously unknown species on NAWS/CL) due to their secretive nature and long periods of inactivity, particularly during dry years.

Sensitive invertebrate species are not listed by the CNDDB. However, 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 species. Taxonomy changes occur on a regular basis, particularly for those species or groups being investigated. As a result, a limited number of invertebrate species are currently considered NAWS/CL-SC.

Nine of the more than 80 species of butterflies found on NAWS/CL are considered NAWS/CL-SC (Dr. Pratt). All nine are found on the North Range, and most are associated with small areas of habitat. According to investigators, three in particular merit special mention: *Plebejulina emigdionis*, *Euphilotes baueri vernalis*, and *Cercyonis sthenele*. Other invertebrate species are considered NAWS/CL-SC on NAWS/CL due to limited distribution, being undescribed, limited habitat, or lack of baseline data.

The giant fairy shrimp (*Branchinecta gigas*) was under review as a species of special concern in 1982 (Eng, 1982). Due to this review and concerns for its habitat throughout California, it has been included as a NAWS/CL-SC. Giant fairy shrimp are found in four locations on NAWS/CL: Mirror Lake, China Lake, north of China Lake on the west side of G-2 Tower Road, and at the intersection of G-1 Tower Road and Range Access Road. Other fairy shrimp (*B. mackini* and *B. lindahli*) as well as tadpole shrimp (*Lepiduras* sp.) and brine shrimp (*Artemia franciscana*) are also known to occur throughout many of the playas on the inner ranges. Figure 2.3.2.3 shows known locations for playa shrimp, Darwin Tiemann's beetle, and NAWS/CL-SC butterfly distribution on-Station. Appendix B, Section 2.3.2.3a contains a list of spider and scorpion species found on NAWS/CL. Specific background information on each invertebrate species known to occur on NAWS/CL is in Appendix B, Section 2.3.2.3b.

2.3.2.4 Reptiles and Amphibians

The western toad (*Bufo boreas*) and Pacific tree-frog (*Pseudoacris regilla*) are BLM-significant species used as indicator species for habitat quality determinations. Western toads are common in appropriate habitat on NAWS/CL; Pacific tree-frogs are found only at Haiwee Spring.

Slender salamanders (*Batrachoseps* sp.) are not known to exist on NAWS/CL. However, they are present in the Panamint, Inyo, and Sierra Nevada surrounding mountain ranges. They have also been recorded in Great Falls Basin in the south Argus Range, K. Berry (pers. comm.).

The chuckwalla (*Sauromalus obesus*) is a CNDDB-sensitive species but not a species that warrants State-level status (Jennings and Hayes, 1994). Although present, the distribution of chuckwalla at NAWS/CL is unknown, but they could be found in all rocky areas of the Argus and Coso mountains from sea level to 6,000 feet and throughout rocky habitats on the South Range.

The Panamint alligator lizard (*Elgaria* [=*Gerrhonotus*] *panamintina*) is a California reptile of special concern (Jennings and Hayes, 1994). Potential Panamint alligator lizard habitat on NAWS/CL is restricted to the Argus and Coso ranges in the northern and northeastern North Range within the vicinity of permanent springs or riparian habitat. Two Panamint alligator lizards have been observed on NAWS/CL.

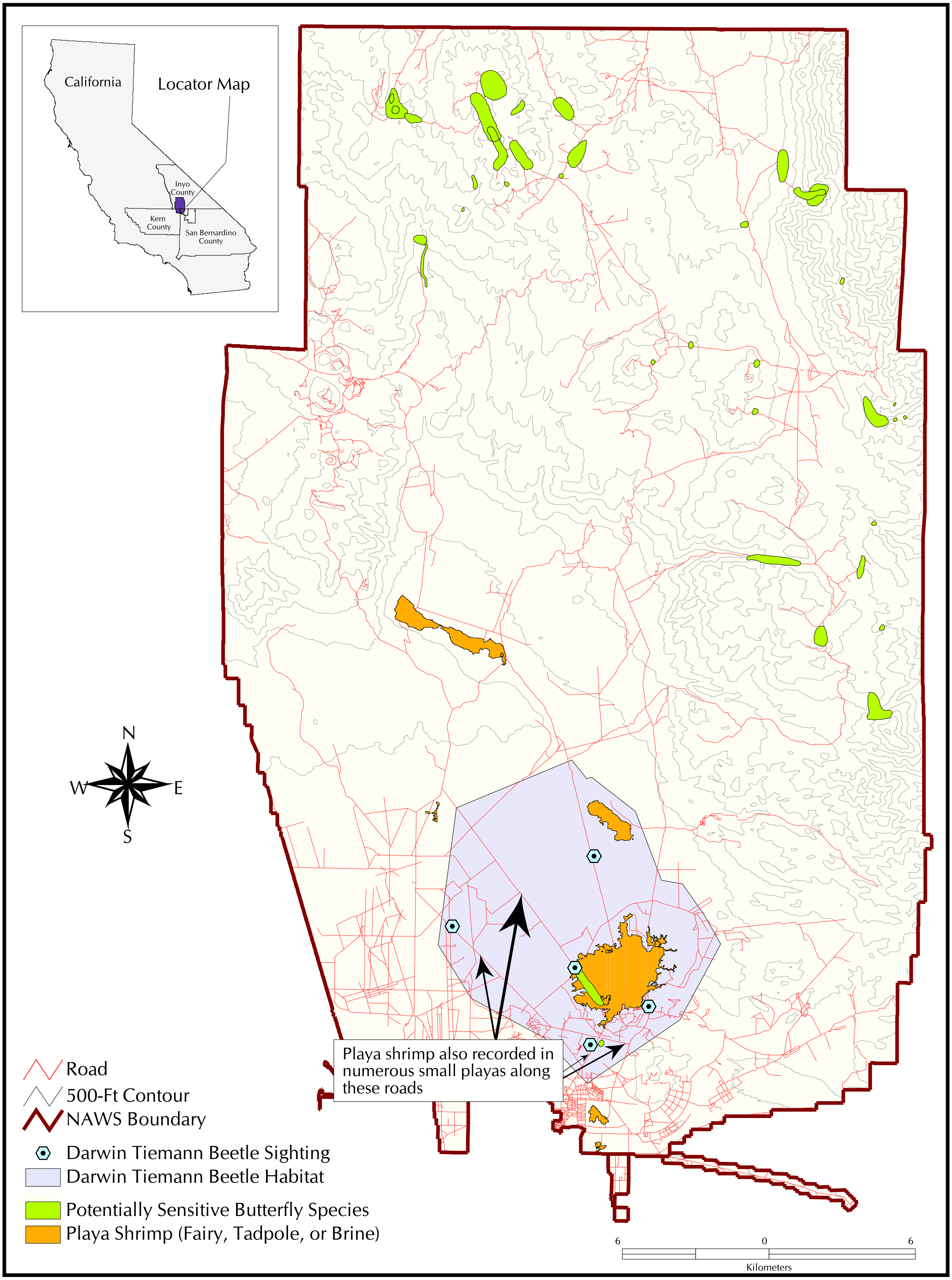

Figure 2.3.2.3 Selected Invertebrate Species of Concern on the North Range of NAWS/CL.

Gilbert's skink (*Eumeces gilberti*) is a BLM-significant species that may be used as an indicator species of habitat quality (BLM, 1980). It is widespread among springs and riparian habitat on NAWS/CL North Range. Specific background information on each species discussed above is in Appendix B, Section 2.3.2.4.

2.3.2.5 Birds

Fifty species of birds are classified as NAWS/CL-SC. These species are listed in Appendix B, Section 2.3.2.5. Due to the large number of bird NAWS/CL-SC, their descriptions and management objectives and recommendations are based upon either the type of bird (raptors or neotropical migrants) or the habitat they occupy. For birds grouped by habitat, broad divisions used include wetlands, riparian, desert, and pinyon forest. One resident federal- and State-listed endangered species (Inyo California towhee), 10 NAWS/CL-SC transients, and many other avian transients are dependent on or utilize riparian habitat. Twenty-four NAWS/CL-SC birds have been observed using ponds at the Sewage Treatment Facility and/or Lark Seep system. The brown pelican and bald eagle are federally-listed, and the remainder are California Species of Special Concern (CNDDB, 1994). Many other species of waterbirds utilize these wetlands as an important stopping point on migration.

Figure 2.2.6a shows wetland areas on the inner ranges and riparian areas on the North Range, and Figure 2.2.6b shows riparian areas on the South Range. A discussion of birds grouped by habitat divisions and their associations with wetland and riparian habitats is in Appendix B, Section 2.3.2.5.

Thirteen raptors and three owls classified as NAWS/CL-SC have been observed on NAWS/CL. The peregrine falcon is State-listed endangered; the bald eagle is federally-listed threatened and State-listed endangered; and the Swainson's hawk is State-listed threatened. All three species are extremely rare migrants. Three raptors and one owl species (Cooper's hawk, golden eagle, prairie falcon, and burrowing owl) are permanent residents known to breed on NAWS/CL (Michael Brandman Associates, Inc., 1989). Further background information on raptors and owls is in Appendix B, Section 2.3.2.5.

Ten neotropical migrant bird species observed on NAWS/CL are NAWS/CL-SC. The southwestern willow flycatcher and least Bell's vireo are federally-listed endangered. Both are migrants on NAWS/CL and would likely be found in riparian, wetland, or urban areas. The other eight species would also be found in these areas. The gray vireo inhabits upland chaparral areas of the Argus and Coso mountains. The willow flycatcher and yellow warbler are common migrants, and the Vaux's swift, bank swallow, purple martin, gray vireo, and summer tanager are uncommon or rare migrants on NAWS/CL. The gray vireo is also an uncommon summer visitor not known to breed on NAWS/CL. Two pairs of vermilion flycatcher are known to have bred in Indian Wells Valley in 1995 and 1996, one pair at the Ridgecrest Cemetery and one at the golf course on NAWS/CL. Neotropical migrants are further discussed in Appendix B, Section 2.3.2.5.

2.3.2.6 Mammals

The following is a brief summary of mammal species of special concern on NAWS/CL. Appendix B, Section 2.3.2.6 contains more detailed background information on each species, and Appendix B, Section 2.3.2.1c lists mammals known to occur on NAWS/CL.

NAWS/CL supports diverse bat fauna, in part due to its relative abundance of sources of water and mines. Eleven species are known from NAWS/CL. The pallid bat (*Antrozous pallidus*), Townsend's big-eared bat (*Corynorhinus townsendii*), spotted bat (*Euderma maculatum*), western mastiff bat (*Eumops perotis*), and

Yuma myotis (*Myotis yumanensis*) are considered NAWS/CL-SC. Recent surveys of abandoned mines have revealed a maternity colony of Townsend's big-eared bats and a roost site for pallid bats in the Sterling Queen mine located south of Wilson Canyon. Detailed discussions of the Townsend's big-eared bat, Western matiff bat, pallid bat, spotted bat, California leaf-nosed bat (*Macrotis californicus*), and pocketed free-tailed bat (*Nyctinomops femorosaccus*) are presented by Brown-Berry Biological Consulting as part of the *Draft West Mojave Coordinated Management Plan*. The California leaf-nosed bat and the pocketed free-tailed bat have not been documented on NAWS/CL. Figure 2.3.2.6a shows distribution of NAWS/CL-SC bats.

The Argus Mountains kangaroo rat (*Dipodomys panamintinus argusensis*) is a BLM-sensitive species having limited distribution. On NAWS/CL it is known from Upper Cactus Flat to northern Indian Wells Valley to Coles Flat and Wild Horse Mesa to Darwin Wash and to Wilson Canyon. Except for populations north of NAWS/CL and on eastern slopes of the Argus Mountains, its entire range is on NAWS/CL. Threats to Argus Mountains kangaroo rats on NAWS/CL are habitat loss and degradation. Constraints to NAWS/CL activities due to the presence of this species are expected to be minimal due to few facilities within their known distribution.

Voles captured on NAWS/CL have not been positively identified but are thought to be California voles (*Microtus californicus*). Four subspecies of California voles are California species of concern and one variety is State- and federally-listed endangered (Amargosa vole (*Microtus californicus scirpensis*)). The Owens Valley vole (*Microtus californicus vallicola*) and Mojave River vole (*Microtus californicus mohavensis*), found north and south of NAWS/CL, are California species of concern. Figure 2.3.2.6a shows distribution of NAWS/CL-SC voles and shrews on NAWS/CL. The genetic relationship of voles found at NAWS/CL to other populations north and south of the Station is unknown, and these voles should be treated as potential candidates for federal listing until its taxonomic status can be determined.

California voles are known from grasslands throughout western and central California, from Mono Lake through Owen's Valley and from Amargosa and Mojave River drainages. On NAWS/CL voles were captured at Lark Seep, Paxton Ranch, and Margaret Ann Spring (Kiva Biological Consulting, 1993). They were captured in riparian habitat at Margaret Ann Spring and in saltgrass at Paxton Ranch and Lark Seep. Threats to the species are degradation or loss of habitat caused by NAWS/CL activities or feral horses, burros, or cattle. Constraints to NAWS/CL activities due to the presence of voles are expected to be minimal due to their restricted distribution.

A single desert shrew (Notiosorex crawfordii) was collected in a pitfull trap north of Coso Village in 1996. This specimen represents a major range extension for this species. It was not previously known from the Mojave Desert.

The ringtail (*Bassiriscus astutus*) is a BLM-sensitive species. Ringtails generally inhabit brushy, rocky slopes between 3,500 and 7,000 feet elevation. They are strictly nocturnal and seem to be active chiefly in the middle of the night. Dens may be in hollow trees, rockpiles, or cliff crevices. Distribution and density on NAWS/CL are unknown, but they are thought to be widely scattered throughout the Argus and Coso mountains in riparian or brushy habitats adjacent to rocky slopes and in rocky areas of Mojavean Pinyon Woodland. There does not appear to be appropriate habitat on the South Range for ringtails. Ringtails have been observed by Leitner (1979) in the Coso Known Geothermal Resources Area and by Westec (1983), Don Moore (pers. comm.), and Kohfield (pers. comm.) in Mountain Springs Canyon. Possible threats to the species are habitat loss or degradation. Constraints to NAWS/CL due to the presence of ringtails are expected to be minimal because the species uses habitat that is minimally used by NAWS/CL.

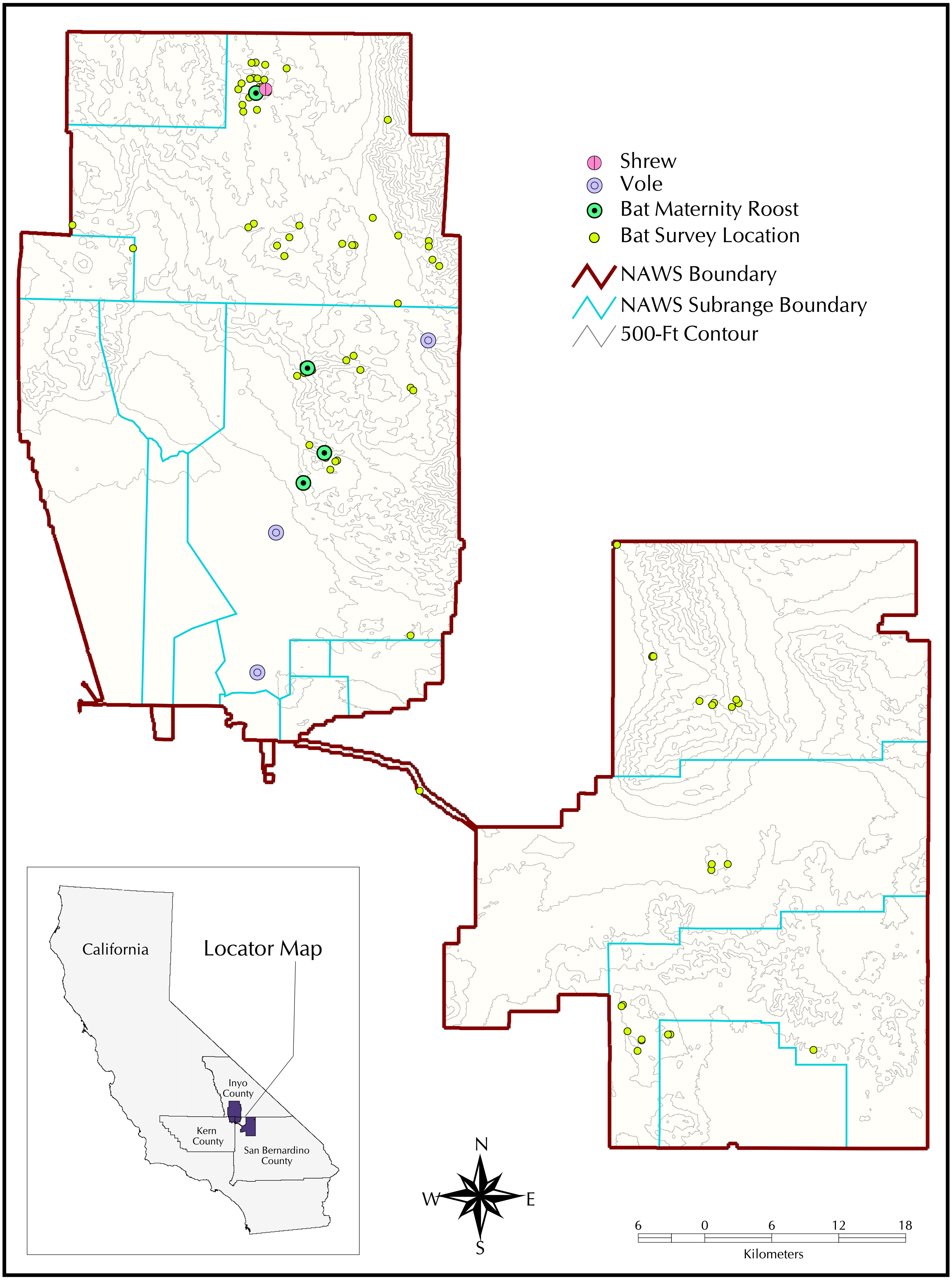

Figure 2.3.2.6a Distribution of Selected Mammal Species of Concern on NAWS/CL

The Mohave ground squirrel (*Spermophilus mohavensis*) is State-listed threatened and CNDDB-listed threatened. Mohave ground squirrels are found from Rose Valley to Antelope Valley and Apple Valley. On NAWS/CL they are found on Brown Mountain in the southern Slate Range, Pilot Knob Valley, and Superior Valley on the South Range, and on the North Range it occurs in the Coso Known Geothermal Resources Area south and east throughout the Indian Wells and Salt Wells valleys. Figure 2.3.2.6b shows the distribution of the Mohave ground squirrel on NAWS/CL.

The American badger (*Taxidea taxus*) is California-protected as a Priority 3 California species of special concern and a BLM-significant species. Badgers inhabit a variety of habitats from sea level to over 8,000 feet elevation from dry deserts to dense forests. Badgers are primarily diurnal and typically dig out prey, usually rodents. Their occurrence varies from uncommon to very common over a widespread range. On NAWS/CL they may be found on all but the steepest slopes of the North and South ranges. Threats to American badgers are habitat loss or degradation. Most NAWS/CL facilities and infrastructure occur on the bajadas and alluvial fans which are habitat for this species. However, protection for the desert tortoise also protects American badgers. Constraints to NAWS/CL activities due to the presence of badgers are expected to be minimal.

The mountain lion (*Felis concolor*) is a NAWS/CL-SC due to its low numbers on NAWS/CL. It is found in a wide variety of habitats in virtually all mountainous areas of California. It feeds primarily on deer but also preys on rodents, skunks, porcupines, and bighorn sheep. Two to three cubs are born in the spring (sometimes at other times of the year) in a den that is typically a cave or crevice in a rockpile. Records of observations on NAWS/CL are from Burro Canyon, Etcheron Valley, Coso Peak, and of tracks at PK Ranch. On NAWS/CL lions are probably throughout the Argus and Coso mountains but are uncommon. In winter mountain lions will venture to lower elevations and may be seen in Creosote Bush Scrub. Possible threats to the species are loss or degradation of habitat or prey base. Constraints to NAWS/CL activities due to the presence of mountain lions are expected to be minimal.

Nelson's bighorn sheep are California-protected, BLM-sensitive, and have a limited distribution in the State. They were once found on NAWS/CL in the Coso and Argus mountains on the North Range and the Eagle Crags on the South Range (Weaver, 1982). In the early 1980s the Navy and CDFG decided to re-introduce bighorn sheep to NAWS/CL. The Eagle Crags on the South Range was the first area targeted for re-introduction. This area had supported a bighorn population in the past and was considered excellent habitat partly due to the presence of numerous springs and burro removal efforts. After eliminating cattle grazing and feral burros from Mojave B ranges, 25 bighorn sheep were released in the Eagle Crags in December 1983 and were augmented with another 15 bighorns in 1987. In 1986, 25 bighorn sheep were released in the eastern Argus Mountains by BLM and CDFG on BLM land. Figure 2.3.2.6b shows bighorn sheep distribution and release sites on NAWS/CL. Limited helicopter surveys of the Eagle Crags resulted in the sightings of 5 adult sheep (4 rams and a ewe). All appeared to be in good condition.

Desert mule deer are observed on a regular basis throughout the Station's North Range, above 4,500 feet. It is estimated that the Station supports between 75-100 mule deer.

2.3.2.7 Grazing

Horses and burros utilize NAWS/CL and contiguous BLM land in the North and South ranges. Cattle graze the northern one-third of NAWS/CL North Range and on BLM land to the north and west. Appendix B, Section 2.3.2.7 discusses issues associated with feral and domestic animal use of NAWS/CL, including administrative considerations, compatibility, compliance, funding and management efforts, and a lack of baseline data. Appendix B, Section 2.3.2.7 also contains more detailed discussions of horse, burro, and cattle history (general and NAWS/CL), animal numbers (presented in tables for each), impacts of each species on NAWS/CL resources, and management efforts on NAWS/CL and the surrounding area. With in passage of the Desert Protection Act in 1994 NAWS/CL became responsible for management of feral horses and burros. The BLM retains management responsibility for the remaining cattle grazing operation.

The distribution of horses on NAWS/CL is limited to the Argus and Coso mountains on the northern third of the North Range and north and west of this area on BLM land (Figure 2.3.2.7a). The 1980 Bureau of Land Management published the California Desert Conservation Area (CDCA) Resource Management Plan. This plan determined that the Centennial Herd Management Area (HMA) could support a horse herd of 168 horses. In 1982, 903 horses were calculated to be in the Coso Range with 151 horses in the Argus Range. Horse numbers apparently peaked at over 1,300 animals in 1982. More than 3,246 horses have been removed from NAWS/CL since 1983 (Table in Appendix B, Section 2.3.2.7). Horse numbers have continually declined from 1,318 animals in 1982 to a low of 208 horses in 1995. The 1997 population is estimated at 225 to 240 horses in the Centennial Herd Management Area, which includes NAWS/CL. BLM continues to indicate that the management area is capable of supporting a total of 168 horses.

Burros were once found in all habitat types on NAWS/CL from low elevations, including areas on and around the airfield, to Pinyon-Juniper habitats of the highest elevations in the Coso and Argus mountains. The range of burros on NAWS/CL is shown at Figure 2.3.2.7b. In 1980 the first reliable population estimate at NAWS/CL indicated that there were 2,225 burros concentrated in six main herds ranging throughout the entire Station. The 1980 CDCA Plan determined that the appropriate number of burros in the two HMA's which overlap Station Lands to be zero burros. In 1981 the Navy estimated 3,500 to 5,700 burros occupied NAWS/CL ranges. NAWS/CL began a burro reduction program in 1980. The table in Appendix B, Section 2.3.2.7 shows the number of burros (over 9,000) removed from NAWS/CL since 1981. Despite removal of over 9,000 burros on the Station and nearby contiguous BLM land, the Navy still conducts annual roundups to control these feral equines. The present burro population is thought to be about 50 on NAWS/CL North Range and about 50 on South Range. On BLM land an additional 150 to 200 burros are thought to exist around the NAWS/CL boundary in the Coso and Argus mountains and in the southern Panamint Mountains bordering the South Range.

NAWS/CL has been grazed by cattle and sheep since the 1860s with reports of up to 10,000 cattle and large numbers of sheep in the area (BLM, 1982). The Lacey-Cactus-McCloud (LCM) grazing allotment is the only remaining allotment on NAWS/CL and nearby BLM-managed land to the north and west. It originally included 233,535 acres on NAWS/CL with another 187,637 acres on BLM-administered land. The table in Appendix B, Section 2.3.2.7 shows the acreage and status of the LCM allotment. The location of the allotment is shown at Figure 2.3.2.7c.

Numbers of cattle grazed in any given year are dependent upon drought and past forage use which affect range conditions. Since 1987 as many as 440 (3,083 animal use months (AUM)) and as few as 107 (748 AUMs) cattle have been turned-out on the LCM allotment (Table in Appendix B, Section 2.3.2.7). The lowest use for a full calendar year (1/1 to 5/31 and 11/1 to 12/31) was 1,210 AUMs (39% of preference) in 1990. The average annual AUM use during 1987 through 1996 was 1,829. For the 1997-1998 season the permittee has indicated that the maximum number of cattle (520 head, 3,655 AUMs) will be turned-out on the allotment.

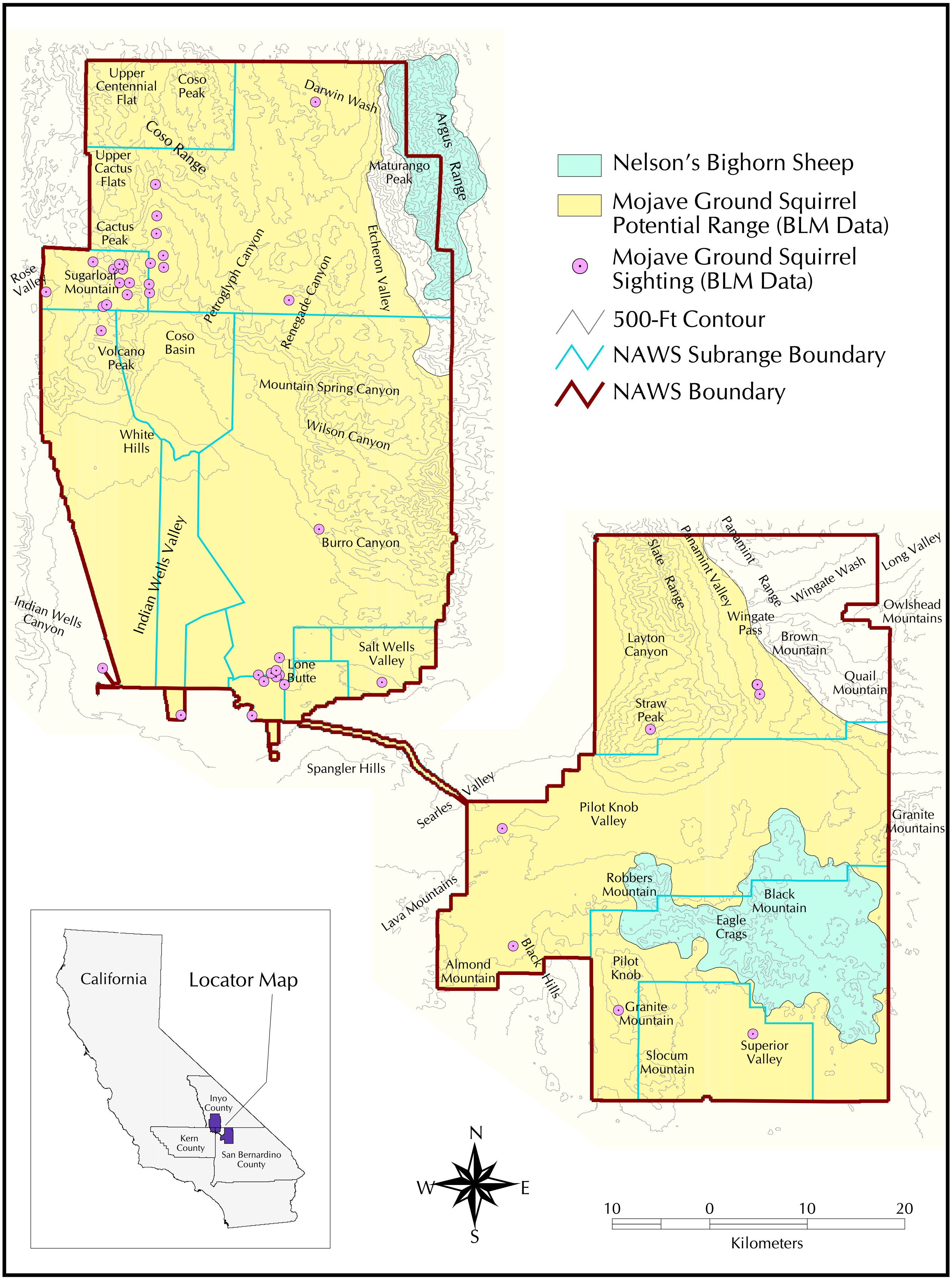

Figure 2.3.2.6b Distribution of Selected Mammal Species of Concern on NAWS/CL

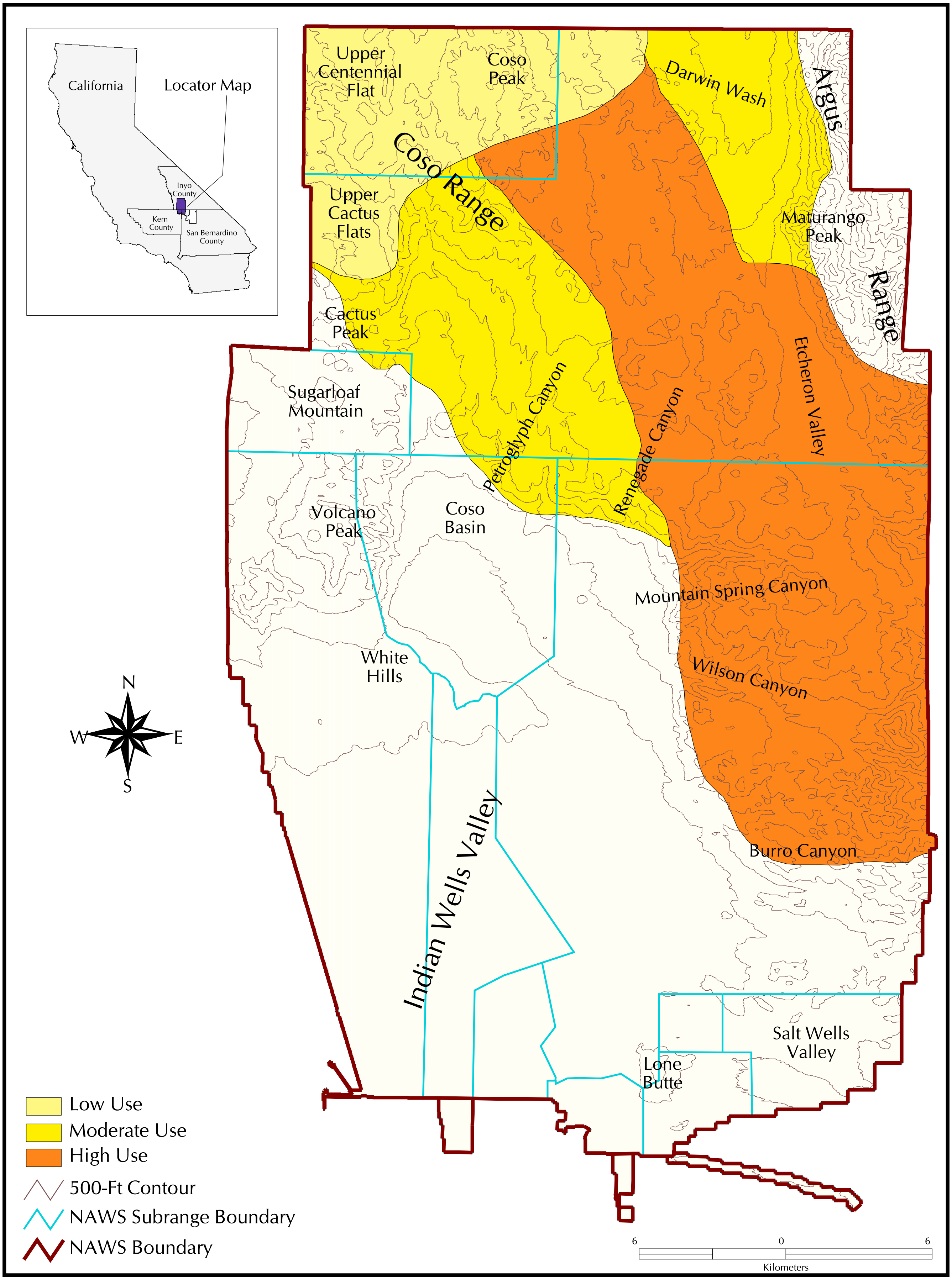

Figure 2.3.2.7a Distribution of Feral Horses on the North Range of NAWS/CL

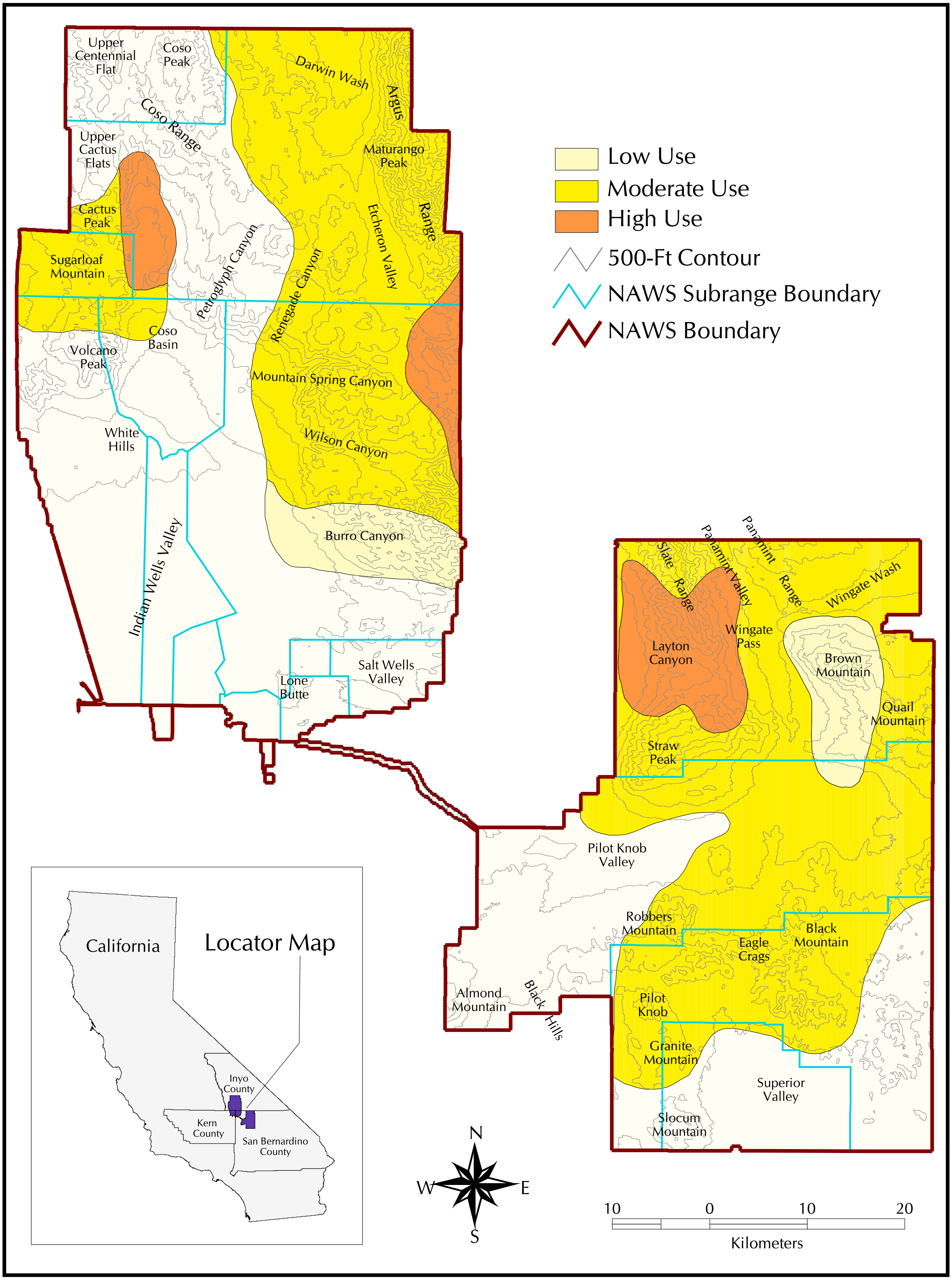

Figure 2.3.2.7b Distribution of Feral Burros on NAWS/CL

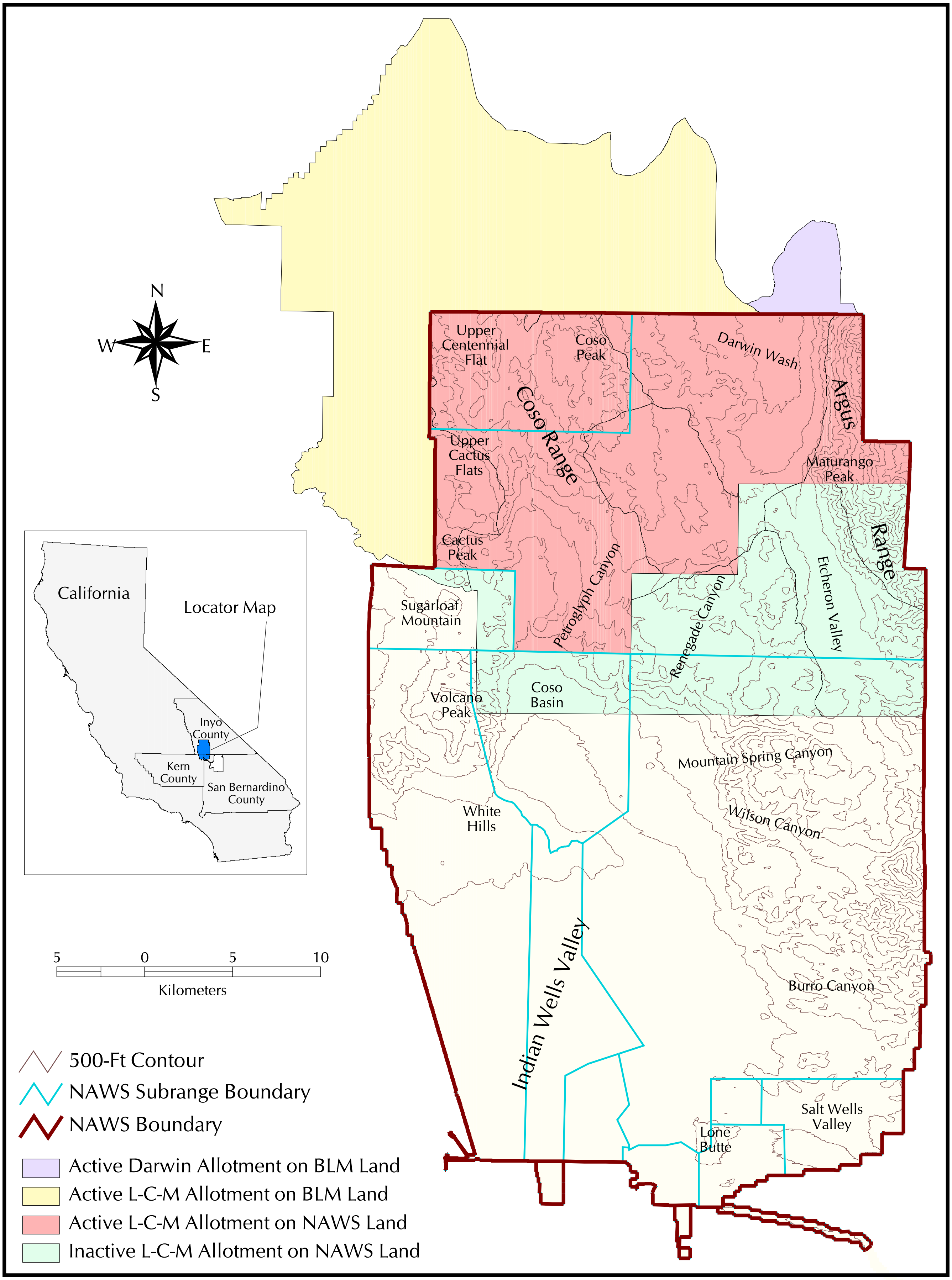

Figure 2.3.2.7c Distribution of Catle On and Adjacent to the North Range of NAWS/CL

2.3.2.8 Pest Species

Plant and animal species are considered pests when they are uncontrolled by natural mechanisms, displace native species, and create an unsafe condition (BASH hazard or increase fire risk) or unhealthful condition (by creating a sanitation problem or health risk).

Some pest species are only associated with urban areas, such as the rock dove *(Columba livia)*, European starling *(Sturnws vulgaris),* and house sparrow *(Passer domesticus).* Others have become established in native habitat. Still other native species have notably expanded their distribution as a result of human presence, most notably the common raven (*Corvus corax*).

Common ravens were native to mountain ranges in and around the Mojave Desert. However, dumps and road kills have enabled ravens to survive summers and winters in the desert. During spring, common ravens can disperse and breed throughout much of the desert. The common raven is a potential pest species because it is known to eat juvenile desert tortoises, a federal- and State-listed species. BLM has attempted to get authority to significantly reduce numbers of common ravens in certain portions of the Mojave Desert. However, Kiva Biological Consulting (1991) found no evidence that common ravens were preying on desert tortoises during their survey on NAWS/CL.

Another potential problem with ravens is their proclivity to nest on power poles. They tend to construct nests on double-arm poles or on transformers, which has the potential for power shorts and power disruption.

Within the housing area and certain facilities, such as airfield hangers, rock doves and European starlings may become a problem and potentially a hazard. These birds roost on rafters and create an unsafe, unsanitary environment. Rodents, particularly deer mice and wood rats become problems when they invade test structures and work spaces. Rodents do considerable damage to structures, wiring, and other objects by chewing and nest building. They are also known to spread disease. Rodents at China Lake have tested positive for the hantavirus titer.

2.4 Cultural Resources

The following discussion is intended to provide a brief overview of cultural resources at China Lake. The text was taken from the *Draft Cultural Resources Management Plan* (Tetra Tech, Inc., 1998). This section provides a general review of prehistoric and historic land use practices at NAWS China Lake. It begins with the prehistoric period, focusing on the results of several important archaeological investigations that have taken place over the last 25 years. Ethnohistoric land use practices are then addressed through an analysis of ethnographic information from the five Native American Indian groups known to have occupied the area at historic contact. Finally, regional developments that occurred in the larger context of the American West expansion and Southern California's history, including the military expansion into the Mojave Desert, are discussed. This overview provides contextual information necessary to evaluate the NRHP eligibility of the diverse range of most types of cultural resources known to exist at NAWS China Lake.

NAWS China Lake contains a wealth of prehistoric archaeological resources. The area is particularly famous for its large obsidian quarries, world-class rock art, and concentrations of terminal Pleistocene and early Holocene artifacts along the ancient shores of China Lake.

The archaeological record at NAWS China Lake is truly outstanding, both with respect to its chronological depth and the variety of materials represented. The Late Pleistocene/early Holocene resources around China Lake Basin, made famous by Emma Lou Davis, remain intriguing to archaeologists to this day as they are among the few known locations in North America with both Late Pleistocene megafauna and early cultural deposits. Future work at this location may prove to be pivotal in establishing if the association is real and synchronous.

NAWS/CL also contains thousands of archaeological sites dating throughout the Holocene, or past 10,500 years. The Coso Obsidian Quarries and the Coso Rock Art Area routinely are prominently featured and incorporated in archaeological overviews of the western United States because of the kind, quantity, quality, and condition of these sites. At various periods in the past, obsidian from the Coso quarries was a toolstone traded and used through southern California and the southwestern Great Basin. The Coso Rock Art Landmark contains one of (if not the) largest, most impressive, and most pristine concentrations of prehistoric art in the United States.

In addition to these three classes of high-profile prehistoric resources, NAWS/CL also has numerous, undisturbed late period open-air sites and rockshelters. The latter occur throughout portions of the South Range Complex as well as the Darwin Wash and uplands portions of the North Range Complex. They are particularly noteworthy because they often contain preserved organic materials, such as plant and animal remains, hides, basketry, and other textiles. The few prehistoric burials that have been discovered at NAWS/CL also tend to have been recovered from the dry rockshelters, further contributing to the sensitivity of such sites.

Several interesting research issues emerge from previous archaeological work in southeastern California, providing the context necessary to evaluate the NRHP eligibility of NAWS/CL prehistoric sites. The research issues are best organized according to five basic categories, including (1) chronology, (2) land use change, (3) production and exchange of obsidian, (4) population replacements and ethnic boundaries, and (5) origin and meaning of rock art. These issues and the needed data sets are pertinent to formal NRHP eligibility determination.

The studies that have been completed at comparatively few of the thousands of archaeological sites at NAWS China Lake have taught us much about prehistoric adaptations in southeastern California and areas beyond. Archaeology is, however, a quite young field of inquiry, and much remains to be learned about hunter-gatherer cultures of the past in the western Great Basin/northern Mojave Desert. It is reasonable to conclude that the sites at NAWS China Lake will continue to be pivotal in advancing our understanding.

Examination of the published ethnographic literature has demonstrated that several tribes used NAWS China Lake for a number of purposes. While some previous anthropologists have tried to delineate tribal boundaries, there is considerable overlapping use, and boundaries are not fixed. The record for ethnographic use of the northern portion of the North Range Complex is much stronger than for the South Range Complex. This is not simply a hiatus in the ethnographic record but reflects the relative availability of water and resources in the two areas. The north portion of the North Range Complex has more water, more abundant and varied flora, and consequently more plant and animal foods.

The Koso Shoshone were resident in the area around Coso Hot Springs and hunted and gathered throughout the Coso and Argus ranges. Other groups were not resident but frequented the northern area to exploit the numerous gathering and hunting resources in the area. Coso Hot Springs was used frequently by Shoshone and Owens Lake Paiute as well as by other Native Americans, and the springs continue to be valued today for their healing powers. Little use of the South Range Complex could be documented. This area is extremely arid, and consequently both floral and faunal resources are far less abundant and diverse than in the northern section. Authorship of the extensive rock art in the area could not be directly determined in the ethnographic literature.

The historical overview demonstrates that NAWS/CL contains a broad variety of historic-era resources and documents major shifts in land use during the past 150 years. The earliest historic resources tend to be affiliated with prospecting and mining, followed shortly thereafter with homesteading and ranching. The Coso Range contains remnants of the earliest mining community at NAWS/CL, Coso Village, first occupied in the 1860s. The earliest military facility established at NAWS/CL was built nearby, sometime between 1861 and 1866, apparently to address conflicts between early settlers, miners, and Native Americans. Freight routes and way-stations followed shortly thereafter, to transport supplies to miners and ranchers and to haul away the ores, minerals, and precious metals to processing facilities and urban and industrial communities. In the 1940s the area shifted to its current military use. For the past 50 years, NAWS China Lake has figured prominently in the RDT&E of modern weaponry, particularly aircraft-fired rockets and guided missiles (see Section 1.3.2).

The CRMP, currently in final draft form, will serve as a critical element of the China Lake Land Use Management Plan. The CRMP will detail the methodology whereby cultural resources will be protected and conserved and how this will be accomplished in direct support of the Stations military mission. The CRMP will detail how the Station will comply with Sections 106 and 110 of the National Historic Preservation Act and provide the basis for a programmatic agreement with the State Historic Preservation Office to facilitate this compliance requirement.

2.5 Waters Resources

There are several types of water sources on NAWS/CL including natural perennial waters, such as springs and seeps which support natural riparian vegetation; natural ephemeral water, such as lake beds (playas), tenajas, and washes; and man-made waters, such as the Wastewater Treatment Facility (WWTF) evaporation ponds and the Lark Seep system. Figure 2.2.6a shows water sources on the North Range, and Figure 2.2.6b shows water sources on the South Range. NAWS/CL has over 120 artificial and natural springs and seeps, three sources of geothermal water, five ponds, more than 20 seasonal playas, more than 25 water troughs, and two wetlands. Groundwater resources are discussed in Section 2.2.6

Each type of water source has specific taxa associated with it. Natural perennial waters are likely to have endemic invertebrates and amphibians dependent upon it and reptile, avian, and mammal species utilizing the associated riparian habitat. Invertebrates (*e.g.*, fairy shrimp) and when wet, avian species (*e.g*., shorebirds, gulls, etc.) are associated with natural ephemeral waters. Some species (*e.g*., Tieman's beetle, vole, etc.) are dependant on vegetation associated with alkaline soils that typically surround a playa. Because the WWTF ponds and the Lark Seep system are artificial systems, there are few native endemic species associated with them, but they do provide habitat to a wide variety of NAWS/CL-SC residents and transients.

Numbers and locations of springs and seeps are discussed in Section 2.2.6 and shown on Figures 2.2.6a and 2.2.6b. Appendix B, Section 2.2.6 contains a spreadsheet of surface water sources for the North and

South ranges. Many NAWS/CL-SC are associated with springs, seeps, and adjacent riparian vegetation as well as potentially unknown and/or undescribed species. For example, Dr. Gordon Pratt found two possibly undescribed species of dune cockroaches (*Aranevaga*) near Birchum Spring (pers. comm.). Aquatic snails have been identified at some springs. Slender salamanders have not been found on NAWS/CL, but due to their retiring habits, they can be easily overlooked and may be present at one or more springs, particularly Mill Spring (Dr. Gordon Pratt, pers. comm.) and upper Haiwee Springs (Giuliani, 1993).

Birds utilize open water but are probably more dependent upon riparian habitat associated with springs. However, riparian vegetation is dependent on a reliable water supply, either surface or subsurface. In addition to riparian obligate species, populations of vertebrates are often greater in adjacent upland areas because of increased food supply and availability of open water. Water systems at many springs are not well understood, and prior to any water diversion, tests should be conducted to identify the source and hydrologic mechanics of the spring. One resident federal- and State-listed species (Inyo California towhee) and 10 NAWS/CL-SC transient species, plus many other avian transients, are dependent on or utilize riparian habitat.

Numbers and locations of playas are discussed in Section 2.2.6 and are shown on Figures 2.2.6a and 2.2.6b. Playas provide habitat for a number of species. Species such as the fairy shrimp have evolved so that their eggs persist during the dry periods. When the playa is inundated with water, eggs hatch and the fairy shrimp become active. In turn, they provide food for birds and other wildlife that are able to take advantage of this intermittent food supply. Most of the larger playas become partially inundated for a period of a few weeks to a few months each year.

Desert washes are intermittently wet. Surface water may not be present, but there may be subsurface flow which results in an increase in vegetation typical of the Mojave Desert Wash Scrub plant community (Holland, 1986). Vegetation in washes is typically more lush with higher diversity and densities of plants and animals (Brown, 1982). This habitat provides greater protection and feeding opportunities for reptiles, mammals, and resident and transient birds.

Twenty-four birds classified as NAWS/CL-SC have been observed using the ponds at the WWTF and/or Lark Seep system (Blue and Moore, 1998; Blue, 1996). Man-made waters on NAWS/CL are shown on Figures 2.2.6a and 2.2.6b. Three species (brown pelican, bald eagle, and American peregrine falcon) are federally-listed, and other NAWS/CL-SC observed at the WWTF and /or Lark Seep system are California Species of Special Concern (CSSC) (CNDDB, 1994). In addition, many other species of water birds utilize these wetlands as important migration stopping points.

Most NAWS/CL-SC would only be found at NAWS/CL during migration or under unusual circumstances. Only the western least bittern (*Ixybrachus axilis hesperus*), northern harrier (*Circus cyaneus*), and western snowy plover (*Charadrius alexandrinus nivosus*) are known to nest near NAWS/CL (Owen's Lake and Harper Lake) and potentially nest at NAWS/CL. The coastal population of the western snowy plover is federally-listed threatened. Coastal birds distinguishable by color bands can range widely and have been observed in the central valley and potentially occur at NAWS/CL. The population of nesting western snowy plover from Owen's and Harper lakes is the unlisted inland population. The inland population is a California Species of Special Concern.

NAWS/CL has no resident wetland birds with federal protection legal requirements. Regardless, wetlands are legally protected, and actions that may affect wetlands are subject to regulations. The Lark Seep system is further afforded protection due to the presence of the Mohave tui chub.

2.6 Outdoor Recreation

2.6.1 Public Access

Department of Defense Directive 4715.3, *Environmental Conservation Program*, May 3, 1996, 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*".

OPNAVINST 5090.1B 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*."

Public use restrictions at NAWS are primarily based on security and safety requirements and the capability of resources to withstand user impacts. Although opportunities for outdoor recreation exist on the ranges, the following factors influence the amount and type of recreational activities:

- The NAWS requirement for physical and information security due to its RDT&E mission. In many areas visitors must either have permanent or interim security clearance or be under continuous escort by Station personnel.
- The physical safety of visitors to NAWS. Much of NAWS has been used for over 50 years for testing of Navy weapons including, bombs, rockets, and other ordnance.
- The cost and extra manpower associated with opening larger areas of the Station for recreational opportunities or increasing the level of activity at locations already open. The cost of providing physical security for visitors outside Mainsite and increased security costs for classified projects would require funding that could only be partially covered by user fees.
- The protection of sensitive biological resources, such as species and unique habitats, and cultural resources, including petroglyphs and historic structures, is not possible with uncontrolled access by large numbers of people considering limited funding and staffing available within the EPO.

NAWS policy for access is to allow access to certain areas for scientific research that benefits the Station. Such access is contingent on non-interference with operations commitments and is subject to cancellation without advanced notice due to operational or weather conditions. NAWS may allow access to other Station areas for recreational purposes on a case by case basis, which normally are associated with Command-sanctioned events sponsored by local agencies and organizations. A new access instruction is being prepared by the Safety and Security Department, but significant changes to the present policy are not anticipated.

2.6.2 Recreation Activities

NAWS personnel and other residents of the Indian Wells Valley enjoy a wide range of recreation activities. Cultural events in Los Angeles, beach activities along the southern California coast, and backpacking, skiing, mountain biking, fishing, and hunting in the nearby Sierra Nevada Mountains are within easy driving distance.

NAWS employees and dependents can enjoy recreational opportunities associated with the housing area, such as a full-service gymnasium, several swimming pools, baseball fields, parks, tennis courts, horse stables and horseback riding on adjacent trails, a bowling alley, bike paths, etc. Other recreational opportunities, such as radio controlled airplane flying, is available on NAWS. These activities are privately sponsored in areas open to the public, such as the stables and Mirror Lake and Satellite Lake playas. The Sierra Desert Gun Club and the Trap and Skeet Club use a facility south of Armitage Airfield.

Section 4.4 describes the management of outdoor recreation at NAWS/CL and discusses compatibility issues.

3.0 RESOURCES MANAGEMENT

Goal 1: *Conserve, protect, and enhance natural ecosystems (natural resources) and biodiversity while guaranteeing continued access to NAWS/CL lands, waters, vegetation, and wildlife resources for the military mission.*

3.1 Introduction

The military mission impacts relatively small land areas, and there is a low requirement to disturb new areas. This facilitates natural resources management on NAWS/CL. The management of sensitive plant and animal populations on NAWS/CL is aided by restricted public access and the ability to implement feral, domestic, and exotic species control.

NAWS/CL does not anticipate significant changes in impacts of the military mission on natural resources in the foreseeable future. The installation has a long-term land use strategy of continuation of current land-affecting military missions within traditional locations at NAWS/CL. New zones of disturbance are not anticipated unless a mission cannot be accomplished within an existing zone of disturbance.

3.2 Endangered and Sensitive Species Management

3.2.1 Endangered Species

Objective and Guidelines for Threatened and Endangered Species in General

Objective: Maintain viable populations of threatened and endangered species on NAWS/CL and maintain compliance with Endangered Species Act requirements.

Guidelines:

- Fully implement requirements of the ESA to ensure that activities in or near threatened or endangered species habitats are accomplished in accordance with the ESA.
- Conduct formal and informal consultations with the USFWS early in the project planning process for all actions, which may affect listed species.
- Comply with requirements of species or site-specific consultations and with terms and conditions, and reasonable and prudent measures of Section 7 Consultation Biological Opinions.
- Develop long-term programmatic agreements with the USFWS to avoid time-consuming consultations which would otherwise need to be conducted on a project-by-project basis.

3.2.1.1 Mohave Tui Chub

The Lark Seep system has become an important component of a variety of complex groundwater issues at NAWS/CL, not only because of the chub but also due to wetland issues associated with resident and transient bird species, Installation Restoration Program constraints, Bird Air-Strike Hazards (BASH), and maintenance requirements for the system and the chub. Evaporation ponds are unlined, and water percolates from them north towards the China Lake playa. A number of buildings and facilities are in the water flow path, and foundations of several are exhibiting signs of stress due to the high water table.

Channels were constructed in the 1950s and 1960s to drain water from the high groundwater mound in the Lark Seep area away from buildings and nearby roadways. The situation is greatly complicated by endangered chubs as they must be ensured an adequate flow of water to maintain the channels and seeps. Thus, any change to the groundwater regime (quantity or quality) has a high potential to affect the seep and the chub.

Annual cattail removal, as discussed in Section 2.3.2.2.1 will continue throughout the Lark Seep/G-1 Seep channel system. Additional habitat enhancement efforts will also be considered in other sections of the channel system along with monitoring of the entire project during 2000-2004. In addition, NAWS/CL will participate in additional genetics studies if initiated by State or federal agencies.

NAWS/CL personnel will remain an active participant of the Mohave Tui Chub Advisory Committee. This committee provides insight and assistance to management for the chub. NAWS/CL personnel will attend other meetings and conferences applicable to management of the chub.

Maintenance of flows away from the high groundwater mound is essential for protection of NAWS/CL buildings, roads, and other structures but must be accomplished in a fashion compatible with maintenance of a viable chub population. Operations at the City of Ridgecrest operated Wastewater Treatment Facility may be affected as any modifications in management of the facility could affect the chub.

Objectives and Guidelines for the Mohave Tui Chub

Objective 1: Maintain a viable population of the Mohave tui chub in the Lark Seep system.

Guidelines:

- Continue the annual cattail/tule removal program.
- Conduct chub population censuses, preferably annually, but not less than every three years, with confirmation of chub presence at regular intervals between major census efforts.
- Develop and maintain data in a NAWS/CL GIS database for resources management.
- Educate station personnel and the general public about the Mohave tui chub and on-going projects involving chubs.
- Develop an emergency plan and be prepared to implement it in the event a catastrophic event threatens the survival of the chub population.
- Develop a plan for habitat improvement leading to a low-maintenance wetlands system (deep and wide), providing a more stable environment for the chub.

Objective 2: Complete long-term habitat monitoring.

Guidelines:

- Regularly monitor water quality of the Lark Seep system within the channels including dissolved oxygen, pH, temperature, toxics, and other parameters.
- Monitor flow rates in Lark Seep channels and water levels in lagoons and wells.

Objective 3: Provide support and take actions favoring Mohave tui chub recovery and/or listing downgrading by the USFWS.

Guidelines:

- Support Mohave tui chub research leading to a better understanding of habitat requirements with the goal of founding new refugia (ideally returning them to their native Mojave River), which would reduce the critical importance of the Lark Seep population.
- Provide for genetic testing and mixing of Mohave tui chub from Lark Seep with those of other refugia to prevent inbreeding and divergence of characteristics and ensure that pure strains of chub are maintained. Mix populations (with Camp Cady and Fort Soda) to prevent inbreeding and genetic isolation of populations at the refugia. Numbers of fish necessary to produce an effective genetic mixing should be calculated. Species-specific stocking techniques should be developed, and differences in water chemistry between refugia should be considered.
- Conduct research to identify factors to ensure successful transplants into other aquatic systems with the goal of recovery and eventual delisting of the species. The Mohave tui chub recovery plan identifies the need for three more refugia of at least 500 fish, with two of the refugia adjacent to their native Mojave River habitat, before reclassifying the species as threatened.

3.2.1.2 Desert Tortoise

Management of the desert tortoise on NAWS/CL is covered under the programmatic Biological Opinion (BO) which created a Desert Tortoise Habitat Management Area (DTHMA) of about 200,000 acres (Figure 2.3.2.2.2) and requires submission of an annual report and briefings for all personnel who operate in areas considered tortoise habitat.

Projects over 50 acres outside and projects over 2.5 acres inside the DTHMA are not exempt under the BO. At a minimum, informal consultation with USFWS must be initiated for each project exceeding these acreage limits. Surveys must be conducted for all projects, regardless of size, within potential desert tortoise habitat. Tortoise surveys are not typically conducted for project which re-utilize well established sites located in tortoise habitats. However, surveys may be conducted any time of year instead of just during spring activity periods.

NAWS/CL has submitted five annual reports to USFWS since the BO was signed (NAWS/CL, 1993; NAWS/CL, 1994; NAWS/CL, 1995; NAWS/CL, 1996; and NAWS/CL, 1997). Only one tortoise was moved as a result of actions covered under the BO although several tortoises have been moved from active roads by both EPO personnel and other workers. The table below shows relationships between projects in tortoise habitat and their effects on NAWS/CL tortoises.

Year	Projects in Tortoise Habitat	Projects Surveyed for Tortoises	Acreage Lost (in DTHMA)	Tortoise Take Killed or Injured Only	Employees Briefed
1993	27	5	7 (2)	1 (0)	1,357
1994	28	7	29.25 (18)	0 (0)	185
1995	28	10	62.3 (2.6)	0 (0)	22
1996	34	8	89.1 (0)	0 (0)	54
1997	4	4	0 (0)	0 (0)	128

Constraints to NAWS/CL activities may be considerable since tortoises are widespread throughout alluvial fans and bajadas in Creosote Bush Scrub and Saltbush Scrub vegetation communities, and many of these areas are heavily used for facilities, infrastructure, and test sites. Desert tortoises are an issue for any construction or testing that occur within this habitat type. However, within the existing BO, survey and mitigation requirements are specified for projects within tortoise habitat, are routinely implemented, and do not typically conflict with mission accomplishment.

Objectives and Guidelines for Desert Tortoise

Objective 1: Maintain a viable population of desert tortoises on NAWS/CL.

Guidelines:

- Maintain habitat quality and integrity. Continue to implement procedures designed to minimize adverse effects of wildland fires.
- Continue surveys to refine knowledge and monitor tortoise distribution, density, and population health at NAWS/CL.
- Conduct surveys, particularly in high density areas, to ensure that mortality rates, upper respiratory tract disease (URTD), and other causes have not increased. Surveys should be conducted during the spring activity period so that some live animals can be investigated for symptoms of URTD. Consider establishment of at least two long-term trend study plots.
- Develop a computer database that would provide data for an annual report, locations of incidental sightings, general locations, and size and results of surveys.
- Implement avoidance and impact minimization measures to reduce conflicts with the desert tortoise and its habitat, when feasible.
- Maintain corridors to adjacent populations (to allow genetic flow) by avoiding habitat fragmenting construction activities or operations whenever possible.

Objective 2: Support recovery plan efforts to establish stable tortoise populations and eventual delisting.

Guidelines:

- Participate with recovery planning and other regional planning initiatives to help establish stable tortoise populations.
- Coordinate management of the NAWS/CL Tortoise Habitat Management Area to ensure compatibility with the Superior-Cronese Management Unit and designated Critical Habitat in Superior Valley.

3.2.1.3 Inyo California Towhee

On NAWS/CL the primary threat to Inyo California towhees is habitat loss and degradation as a result of overuse of riparian and nearby upland areas by feral horses and to a lessor extent by feral burros. Most burros in towhee habitat, including those on off-Station land, were removed through Navy-funded roundups between 1982 and 1992. Since 1992 removal efforts have been jointly funded with the BLM and have been successful at maintaining numbers at relatively low levels. Although towhee habitat is within the Lacey-Cactus-McCloud cattle grazing allotment, cattle grazing is not allowed in or near known towhee habitat areas. Re-establishment of cattle grazing or termination of feral animal control could seriously jeopardize towhees. Most springs and riparian habitats in towhee range are in fair to good condition on NAWS/CL with exception of a few which continue to be overused by feral burros and horses.

The major impacts to towhee habitats occur on BLM lands. Cord and Jehl (1979) and Laabs *et al*. (1992) indicate that a number of springs which either supported towhees or had riparian vegetation that could have supported towhees were degraded by human (pre-Navy mining and grazing activities) and/or burro use. The BLM is unable to fund routine (annual) burro removal in towhee habitat. The Navy will continue limited removal in these areas as funding is made available. In addition, several springs have been severely degraded by human use either by destruction of riparian habitat or alteration of water flow by piping water for offsite use.

Surveys of riparian habitat at known towhee locations should be performed a minimum of every five years, preferably in conjunction with surveys on BLM lands. Remaining potential habitat should be surveyed every 5-10 years.

Constraints to NAWS/CL activities due to the presence of towhees will probably be minimal. Paving Mountain Springs Canyon Road greatly decreased erosion of riparian areas and nearly eliminated the need to routinely maintain the roadway, which typically would wash-out after even minor rainfall events. The potential for towhees to be struck by motor vehicles, which can now travel through the canyon at a much higher rate of speed has not been realized. Towhees are riparian obligates; thus, they are dependent on riparian vegetation which is dependent on surface or subsurface water. Any proposal to divert or modify these water flows would require significant evaluation with respect to potential impacts to the towhee.

Objectives and Guidelines for Inyo California Towhee

Objective 1: Ensure long-term population viability of the Inyo California towhee.

Guidelines:

- Conduct range-wide surveys for towhees to determine the population status. To ensure comparability of data, surveys should cover all known towhee habitats simultaneously. Funding and research design will require coordination with the BLM and the CDFG.
- Develop procedures to permit regular assessment of the status of towhee populations.
- Enact assessment procedures for proposed NAWS/CL activities that could affect riparian habitats within Inyo California towhee range.
- Develop a programmatic Biological Opinion to conduct routine maintenance and other activities within towhee habitat.
- Enhance springs impacted by horses (*e.g*., Birchum, Joshua, and Moscow) by fencing areas with a minimum of 3,500 square feet of riparian habitat. Maintain adjacent upland habitat in good condition for towhee use for foraging and nesting.
- Determine the potential for enhancement of riparian strips or springs and adjacent upland habitats in known, nearby, apparently suitable habitat. Continue construction of domestic and feral animal exclosure fencing.
- Continue reducing horse and burro populations to designated management levels.
- Amend the boundaries of the cattle grazing allotment and the upland gane bird hunting area, to exclude habitat of the Inyo California towhee
- Encourage dissemination of towhee information installation-wide; consider passive education through activities such as placement of signs at the entrance to Mountain Springs Canyon indicating sensitive towhee habitat and the need to minimize vehicle speed in the canyon.
- Continue to encourage redirection of new surface-disturbing activities away from areas within known or potential towhee habitat.
- Remove exotic plant species *(e.g.*, tamarisk) from towhee habitat.

Objective 2: Continue to resolve baseline, biological data gaps and continue habitat enhancement efforts.

Guidelines:

- Continue to fund and support research efforts to determine towhee distribution, habitat requirements, and other population characteristics and establish and implement protocol to monitor population size, population trends, juvenile dispersal, and use of marginal habitats.
- Survey riparian habitat that has not been previously surveyed for towhees.
- Conduct surveys of riparian habitat at known towhee locations a minimum of every five years. Coordinate with BLM to conduct surveys on both agencies' lands in the same year. Concurrent surveys for brown-headed cowbirds should be conducted along with towhee surveys.
- Survey potential habitat (riparian areas not known to be inhabited by towhees) every 5 years. All potential habitat within the known distribution should be conducted during the same period to accurately estimate the number of individuals.

Objective 3: Support recovery plan efforts to establish stable towhee populations or eventual delisting.

Guidelines:

- Continue to participate in the implementation of the recovery plan and other regional planning initiatives to help establish stable towhee populations.
- Coordinate with BLM and the CDFG to manage NAWS/CL towhee habitats in a manner that is compatible with the designated Critical Habitat in adjacent BLM and State lands.

3.2.2 NAWS/CL Sensitive Species

3.2.2.1 Flora

3.2.2.1.1 General

Several sensitive plant taxa are in high use zones; however, most plants in these areas are disturbance-adapted types of plants that live in habitats that reclaim quickly or have numerous other populations at NAWS/CL. Most management and conservation programs for NAWS/CL vegetation are not legally required, as no listed species are known from the station. The nature of the resources and the highly controlled impacts of NAWS/CL's mission should allow NAWS/CL to continue operations with minimal impact to the military mission and still maintain healthy vegetation resources on most of NAWS/CL.

3.2.2.1.2 NAWS/CL-SC Flora

Management of flora on NAWS/CL is accomplished through implementation of habitat conservation measures (Section 3.3), fire management (Section 3.3.1), revegetation activities (Section 3.3.2), exotic plant control (Section 3.3.3), and landscaping practices (Section 4.3). Management of fauna, especially threatened and endangered species (Section 3.2.1), and grazing management (Section 3.5.1) serve as important components of vegetation management on NAWS/CL.

As a whole, the distribution of sensitive plant species at NAWS/CL relative to existing land use patterns is favorable for the management of their populations with ongoing NAWS/CL activities. Management of NAWS/CL-SC plant populations is aided by restricted public access and the ability to implement feral, domestic, and exotic species control. At NAWS/CL, plants near cultural sites, endangered animal species habitat, and wetlands are afforded a high level of protection. Other plant resources may be indirectly managed through efficient land use practices.

Some species warrant more attention than other higher ranking species because populations at NAWS/CL have regional or ecological significance. Given the minimal legal requirements for vegetation management of such a vast and diverse resource, NAWS/CL will continue to give priority to local vegetation issues most in need of attention, as human and fiscal resources permit.

Decisions by the USFWS on plant listings affecting NAWS/CL plant resources are the most important status issues. Frequent communication should be maintained with botanists and biologists of various regional offices to obtain valuable planning information. The disposition of *Astragalus* species under the Endangered Species Act in the NAWS/CL region should be closely watched. Two rare species (shining Milk-vetch and Darwin Milk-vetch) occur at NAWS/CL, and two other extremely rare species (Lane Mountain Milk-vetch and half-ring Milk-vetch) are known from within a few miles of NAWS/CL boundaries. These *Astragalus* have several populations in areas of proposed and existing NAWS/CL activities.

A revision of the CNPS list is expected within the next year. Several new plants which occur at NAWS/CL are being proposed for the list. Two plants listed and known from NAWS/CL (Panamint bird's beak and Booth evening primrose) are proposed to be moved to a higher rank. CDFG also produces, through the CNDDB, a "Special Plants List" with rankings identical to CNPS, including federal, state, and global rankings.

Taxa considered NAWS/CL-SC, but separated from common varieties or subspecies by intergrading morphological differences, should be treated with less priority than unique, well-differentiated species of similar rankings. Global rankings account for taxonomic uniqueness. Consultations with regional biologists, especially those that work for government agencies, provide the best information on future taxonomic and status changes.

Several species at NAWS/CL listed or proposed as sensitive by the CNPS appear to be common enough to be removed from listing, but these common occurrences have not been documented, creating a perceived rarity or endangerment. Species descriptions in the *Draft Environmental Impact Statement for the Comprehensive Land Use Management Plan* (Tetra Tech, Inc., 1998) and in Appendix A of this plan are important steps in recognizing the rarity or commonality of vegetation resources. NAWS/CL should further record and establish known vegetation resources by providing voucher collections to herbariums, sharing GIS vegetation information (including acquiring information about nearby lands), and creating records for sensitive vegetation resources in the CNDDB, Mojave Desert Ecosystem Program.

The most sensitive plant resources at NAWS/CL occur in the Coso Peak area, El Conejo Mine-north Louisiana Butte area, Coso Geothermal-Cinder Peak area, and the Pilot Knob-Robbers Mountain-Slocum Mountain region. It is recommended that these areas receive the highest consideration among general vegetation resources when legal and land use planning conditions permit.

Efficient land use practices with regard to vegetation resources include the following:

- Inventory, document, and verify knowledge of vegetation resources on NAWS/CL.
- Recognize status plants, including those with legal status for other land owners, during land use planning, surface development, and field surveys.
- Minimize impacts to populations of rare, sensitive, culturally important, or scientifically unique plants and to vegetation resource areas with high diversity, economic value, or public interest.
- Maintain habitat quality in areas not utilized by NAWS/CL.
- Minimize negative seasonal effects by scheduling activities with high potential to impact resources from late-summer through early-winter.

General management criteria of status and sensitive plants known to, or suspected to occur on NAWS/CL are presented in Appendix A, Section 3.2.2.1.2.

Lane Mountain Milk-vetch Management

Surveys for the federally listed, endangered Lane Mountain milk-vetch should be conducted whenever seasonally appropriate, usually from March through June in years with above average rainfall. This plant grows up through other shrubs and frequently is difficult to observe. Lane Mountain milk-vetch is most conspicuous during the fruiting stages of May and early June when it acquires a reddish tone before going dormant. Dried pods may be the only available evidence at most times, however they are very diagnostic. NAWS/CL should stay abreast of information about the populations to the south, which may assist in targeting surveys on NAWS/CL.

If found on NAWS/CL, this plant taxon would have strong potential to affect military operations. It is highly endangered, and until comprehensive surveys could be completed, high potential habitat in the Superior Valley area will continue to be surveyed as time and funding permits. Surveys would be required prior to any new surface distributing activity within this species potential range. Appendix A, Section 2..3.1.3d. provides a range map for this species. Unnecessary impacts in the area will continue to be avoided to the maximum extent practicable. Critical desert tortoise habitat at NAWS/CL may provide some protection for potential Lane Mountain milk-vetch habitat.

Half-ring Milk-vetch Management

If half-ring milk-vetch is discovered and is taxonomically unique, it is likely that it will increase rapidly in status, and should be significant threats to this species survival be identified, it will be proposed for ESA listing.

Shining Milk-vetch Management

Although the proposal to list the shining milk-vetch has been withdrawn, this species remains a NAWS/CL sensitive species. If this species is verified at China lake the population would represent the majority of plants known. This species is known to readily form intergrades with other more common milk-vetch varieties and therefore may require genetic testing to validate populations.

Mojave Fish Hook Cactus Management

Mojave fish hook cactus requires management consideration to avoid impacts to NAWS/CL populations. These cacti are ecologically sensitive and grow in very narrow microhabitats with populations that typically consist of a few living individuals, some skeletons, and seeds lying dormant. They have potential conflicts with construction of hilltop facilities and clearings (such as the NATO site). It is important to identify the best populations and sites for these cacti so that activities can be directed to areas where their densities are lower. Richard May (1981) has identified good populations in the Big Petroglyph Canyon-Louisiana Butte area. Numerous other sites have been located since his surveys, including populations of exceptionally large plants in high concentrations. This indicates the potential for further targeted surveys which can be conducted throughout the year.

Grazing and the activities of wild horses and burros could have a highly detrimental effect on these cacti by limiting them to only the most rocky areas. These cacti are capable of extending their populations to the upper bajada zone but require well developed soil crusts, tufted grasses, and subshrubs to survive. These resources are highly altered by feral and exotic ungulates. In addition, disturbance of soils attracts rodents which can have significant impacts to these cacti in some areas (May, 1981).

Natural predation apparently is partly responsible for low population densities of this species. Spiny skeletons or carcasses of *S. polyancistrus* are common in many areas throughout its range. These are the result of small mammal predation and infestation by beetle larvae and subsequent stem rot. More study is needed to determine the population dynamics and impacts of the predation. An important management consideration for this species is to avoid disturbance of intact cactus carcasses. This species and other similar cacti are known for providing niches for seed germination and seedling survival at the base of standing carcasses. Because these cacti have such narrow zones of occurrence, potential conflicts with NAWS/CL activities should have reasonable flexibility to continue without significant disturbance to fish hook cactus populations by exercising minor shifts in activity footprints. Where conflicts cannot be avoided, fishhook cactus should be dug up and moved to a nearby appropriate microhabitat, offered for research, or salvaged. They do not transplant well and usually die within a few years, but they do flower and set seed after transplanting. Thus, they can still function as an asset to nearby populations. Special protected *Sclerocactus* habitat areas, or refuge areas, on NAWS/CL were suggested in a report by R. May (1981, p. 125-129). He mapped recommended sites and discussed their importance. These areas should be recognized by NAWS/CL land use planners as important refugia for this species, free from outside disturbances and collecting pressures found on public lands.

Designated areas for construction of range facilities should be checked before such activity begins, and hopefully, areas with high densities of *Sclerocactus* can be spared. Transplanting these cacti from areas affected by construction is probably not a viable mitigation option. R. May (pers. comm., 1985) has done some successful experiments with transplanting in the wild, but problems remain, such as finding suitable sites for replanting, seasonal timing, and getting skilled personnel to do the job.

Population monitoring and additional field surveys will be most productive if conducted when plants are flowering in May and June and more easily spotted. However, this cactus is so distinctive that field checks of populations may be conducted whenever necessary.

The Mojave fish-hook cactus is very widespread at NAWS/CL, but unpredictably scattered. It is potentially impacted at NAWS/CL, especially from feral ungulates. Not an ecologically robust species, it may be vulnerable to subtle shifts in habitat quality (reduction of shrub and grass cover, soil changes, drought, pathogens, and insect and small mammal herbivory). NAWS/CL populations are core to the species future survival, especially as refugia from horticultural collection pressures.

Darwin Milk-vetch Management

More surveys are recommended to expand the number of sites that the Darwin milk-vetch is known at NAWS/CL. It is highly likely that this plant has much larger populations than are known. This taxa is endemic to Darwin Mesa and appears to be most concentrated in the upper Coso Range. The Darwin Mesa lies in an generally bordered by Hunter Mountain and the upper Coso Range, north of the Station boundary, south onto Station lands to the Moscow Spring area in the Southern Argus Range. Of the NAWS/CL sensitive plants described in the INRMP, only Lane Mountain milk-vetch is more narrowly distributed. Unless Lane Mountain milk-vetch is found within NAWS/CL, Darwin milk-vetch should be considered the most endemic and unique taxa known to NAWS/CL.

This plant illustrates the gap in vegetation knowledge at NAWS/CL. It was originally recorded at NAWS/CL in 1930 from the Coso Mountains. This taxa was not seen at NAWS/CL again until April 1996. It is now known to be locally common along several well-traveled roads. Their occurrences are patchy in distribution but are often dense within a small area. Unfortunately, these plants prefer flats and benches, which are zones favored by cattle, horses, and human uses. Four populations occur in target areas, including the largest known population in the Coso bridge area. Non-explosive bombing is not a threat in comparison to the associated infrastructure and soil disturbances of horses and cattle. Darwin milk-vetch appears to be adversely affected by burns and does not seem to recolonize well without established low shrub cover species. These plants are adversely affected by concentrated grazing of wild horses and cattle. Populations in the Hunter Mountain area have suffered from frequent cattle grazing. Darwin milk-vetch appears to be adapted to a frequent, but milder, level of grazing (such as by deer, rabbits, and rodents). Wild horses appear to ignore the plants in flower but later seek them specifically during the fruiting stages. Two populations observed in 1996 were grazed to such an extent that no fruits on any plants appeared to have matured. In this area both horses and cattle were active and frequent. Similar, but milder, effects were observed in 1997 in the Coso Peak area, presumably from wild horses and native herbivores (since cattle were rotated out in 1997). Darwin milk-vetch occurs with other sensitive plants at NAWS/CL, including Panamint bird's beak, magnificent lupine, pinyon rock cress, Mojave fish hook cactus, and Panamint mariposa lily. Areas with multiple sensitive plant occurrences, including the Darwin milk-vetch, are among the most unique vegetation communities at NAWS/CL.

Charlotte's Phacelia Management

Charlotte's Phacelia is only known from about two dozen localities. Outside of NAWS/CL it is impacted by off-road vehicles and overgrazing (CNPS, 1994). This species may be well protected overall because of its preference for very steep, loose scree slopes. Rugged habitats have probably contributed to a lack of collection and documentation. At NAWS/CL loss of habitat to geothermal development is a management concern. Charlotte's phacelia is a very difficult plant to survey because habitats are so rugged and loose, and it is very hard to detect plants out of season or in dry years. It is important to look for additional populations in the Coso Mountains when high rainfall creates large flowering displays which are easier to spot at a distance. It occurs in cinder areas with Booth evening primrose and Pagoda buckwheat, both potential sensitive species. Charlotte's phacelia is an attractive plant and has public appeal.

Gypsum Linanthus Management

Gypsum linanthus occurs among and adjacent to many NAWS/CL activities. It is likely to be more common than records indicate. It is very small and grows for just a short time during good rain years. There appears to be much suitable habitat at NAWS/CL. Outside of NAWS/CL this plant has a moderately broad distribution. This plant favors aeolian soils and appears to recover rapidly (provided a nearby seed source exists) because of natural reclamation by wind and sand.

It is recommended that NAWS/CL give priority to survey this plant when seasonal conditions warrant, primarily during February and March during good rain years. There is a great potential for increasing known populations at NAWS/CL. There are many potential conflicts currently at NAWS/CL. If this plant gains a federal legal status, it will be important to have other populations recorded for mitigation or habitat conservation. Gypsum linanthus often occurs with shining milk-vetch, a potentially sensitive plant taxa. Sensitive insect species occur in sandy habitats of the gypsum linanthus.

Weasel Phacelia Management

Weasel phacelias are rare and very restricted at NAWS/CL. Three populations are known from the Tuff formations, which are also areas of significant cultural resources and additional habitat for the Mojave fish hook cactus. They are highly glandular, ill-smelling plants; thus grazing is not a threat. This plant is rare throughout most of its range. Further surveys for this plant should be conducted on appropriate geology to determine their extent and numbers. Plants often persist after drying and may be surveyed with reasonable effectiveness out of season. Other than surveys, no special management for this species is required at NAWS/CL.

Pinyon Rock Cress Management

Recent surveys indicate that pinyon rock cress may be widespread over high elevations of the Coso and Argus ranges. It seems to occur as scattered, short-lived plants. *Arabis* species may suffer in areas of intense grazing but usually are missed by herbivores by growing through shrubs, in rock crevices, or, as in the case of the pinyon rock cress, are so small as to avoid notice of large herbivores. Pinyon rock cress appears to be adversely affected by soil degradation associated with wild horses and cattle. Pinyon rock cress extends down to gravelly areas at the peripheries of populations and depends on well developed soil crusts to survive summer dormancy in these areas. These microhabitats suffer from frequent soil disturbances on much of the North Range. NAWS/CL activities at Coso Target area are potential impacts to pinyon rock cress populations.

More surveys are recommended to expand the number of sites that pinyon rock cress is known at NAWS/CL. It is highly likely that this plant has much larger populations than are known. Further control or elimination of domestic and feral grazers is the most important management action for the benefit of pinyon rock cress populations at NAWS/CL.

The taxonomic certainty of *Arabis dispar* may be in question. Pinyon rock cress plants of desert ranges, including NAWS/CL populations, may be separated from the San Bernadino Mountains populations in the future. This may change the sensitivity status for NAWS/CL plants. Pinyon rock cress occurs with other sensitive plants at NAWS/CL, including Panamint bird's beak, magnificent lupine, Darwin milk-vetch, Mojave fish hook cactus, and Panamint mariposa lily.

Coso Mountains Lupine Management

Coso Mountains lupine is one of the most distinctive plants of NAWS/CL lands. Those along the Louisiana Butte road form a spectacular display in May. This lupine has probably expanded its range and numbers at NAWS/CL with the construction of roads. Stinging hairs of the foliage and a preference for loose slopes protect this plant from cattle and horses. Away from regular sources of disturbance, these plants appear to be few and scattered, restricted to talus slopes and washes. Outside of NAWS/CL it is uncommon, appearing primarily after fires. Coso Mountains lupine is part of the magnificent lupine group which was formerly split into varieties but are now being debated whether they should be lumped (as in the Jepson Manual). A rarer variety (var. *magnificus*) occurs in the Wildrose Canyon and Hunter Mountain area and has the potential to occur at NAWS/CL.

Although there appear to be few threats to populations on NAWS/CL, it is recommended that the Coso Mountains lupine be given a special measure of protection/habitat enhancement by performing seasonally favorable road maintenance in areas of known populations. Summer and fall are the best times for disturbing the lupines and their seeds. The choice between grading or cutting a road (especially the Louisiana Butte road) in spring versus fall can have a great effect on the total number of Coso Mountains lupine. Roads maintained more than once a year do not support as many lupines as roads with more infrequent maintenance. Plants can suffer from heavy road traffic but continue to flourish otherwise because of ideal conditions for growth. These plants have fared well under NAWS/CL activities. With timely road maintenance, they will become a more robust vegetation asset.

It is also recommended that additional surveys for this taxa be done to determine the relation of native populations to those of disturbed areas. Future taxonomic determinations may change the status of this taxa. The Coso Mountains lupine occurs near other sensitive plants at NAWS/CL but generally prefers looser soils.

Panamint Bird's Beak Management

Panamint bird's beak is so abundant and conspicuous within its range at NAWS/CL that no further field surveys are recommended. Continuing floristic and biological surveys will easily further document this taxa. It is recommended that NAWS/CL map occurrences, list new records with the CNDDB, and petition CNPS to remove the Coso, Argus, Nelson-Cottonwood, and Panamint populations of this taxa from status lists.

A disjunct population of this plant occurs in the Cushenbury Springs area of the San Bernadino Mountains, the population that forms the basis of the listing. Taxonomic work has been done on this genus in California. It is unlikely that Cushenbury Springs plants will be separated as their own subspecies in the near future. This taxa appears to hold its own against minor disturbances and will colonize roadsides and disturbances around springs. Dense populations occur in areas of heavy horse and cattle disturbances. Individual plants, however, grow much larger in areas of low disturbance with well developed soil crusts. The Panamint bird's beak occurs with other sensitive plants at NAWS/CL, including Darwin milk-vetch, Magnificent lupine, Pinyon rock cress, Mojave fish hook cactus, and Panamint mariposa lily.

Indigo Bush Management

Indigo bush is locally common and sometimes codominant in Desert Wash Scrub throughout its range. For this reason, it has a low rare plant ranking despite its limited habitat type and losses at Fort Irwin. This plant appears to have little conflict with NAWS/CL operations. Because it favors washes prone to flash floods, its habitat is protected from development by unstable geology or is rapidly reclaimed from disturbance after flooding.

Indigo bush appears to occasionally colonize road berms and disturbances. Further surveys for this plant are probably not needed. Additional sites will be easily acquired through general plant surveys. Indigo bush is an indicator for some other rare plants.

Determination of this plant has been an issue at NAWS/CL in the past. Taxonomy of the *P. arborescens*/*P. fremontii* group is confusing. Descriptions for var. *arborescens* over the years, however, have been fairly consistent. It is sympatric with var. *minutifolia* in some areas. When sympatric, the two varieties rarely utilizes the same geologic features and are separable. Where var. *arborescens* is absent, var. *minutifolia* sometimes enters washes. Var. *minutifolia* plants that grow in washes, canyon bottoms, and sand fields often show some characteristics of var. *arborescens*. These plants may have been the source for some questionable reports. Collected specimens can be difficult to separate where geography does not separate the two varieties, especially if material and information are too limited. Determination of this taxa is best done in the field, so that the habitat and population characteristics can be assessed (D. Silverman, 6/96).

Crowned Muilla Management

NAWS/CL will ensure the crowned muilla receives high priority among the rare and sensitive plants known to NAWS/CL lands. Its presence at NAWS/CL is limited to one known site which is developed at Devil's Kitchen of the Coso Known Geothermal Area. Since they are known from the western side of Indian Wells Valley at moderate elevations and prefer flat areas, it is likely that some of their potential habitat at NAWS/CL has also been developed. It has been reported as common in the western Indian Wells Valley (DeDecker, 1980).

Survey effectiveness is very limited outside of the blooming period, which can be a multi-year span. For these reasons, this plant should be given high priority and surveyed when seasonal conditions permit. With future surveys, crowned muilla may prove to be more common at NAWS/CL. Crowned muilla CNPS listing was after most site surveys for the Coso Known Geothermal Area. They have an elusive nature and may be widespread at NAWS/CL including the South Range. Surveys at NAWS/CL that locate this species should closely note the blooming period and local geology. When baseline data are established, future surveys will be much more effective.

DeDecker's Clover Management

Further surveys including collections and determinations should be conducted to determine the extent of DeDecker's clover populations. This species appears to occur in rugged areas and is probably of low management concern on NAWS/CL despite its rarity.

Evening Primrose Management

CNPS (1994) states that cattle grazing is a threat to evening primrose populations off NAWS/CL ranges. On NAWS/CL it could be threatened by cattle grazing, feral horses and burros, and ground-clearing activities. Trampling and grazing by burros would be the greatest threat. Currently, few NAWS/CL activities affect potential habitat. More work needs to be done to verify the El Conejo gate record and survey limestone areas in the northern Argus and Slate ranges before a management plan can be developed for this taxa at NAWS/CL.

Utah Fendlerella Management

Utah fendlerella occurs in a very narrow region of NAWS/CL, on high elevation peaks and ridges of the northern Argus Range. This plant is common outside of California and has a low conservation priority. It is recommended that additional surveys be conducted to verify and map the Utah fendlerella. Though this plant requires little documentation or management concern, it is an indicator species for other rare and sensitive plants of much higher interest at NAWS/CL.

Panamint Live-forever Management

Although Panamint live-forever is unlikely to occur at NAWS/CL, the one record should be investigated and if found correct, the taxonomic identity should be determined. Habitats for this genera of plants tend to be highly sensitive and localized.

The population at Pilot Knob should be verified as ssp. *saxosa* and not the more common ssp. *aloides*. Potential distribution on NAWS/CL would be in appropriate habitat above 3,000 feet msl in the Mojave B and Randsburg Wash ranges and on the eastern side of the Argus Range.

Dudleyas are a taxanomically complex genus with many recently evolved and highly localized taxa. *Dudleyas,* in general, are very similar in appearance and ecology. Existing treatments on *Dudleyas* are unclear with new taxa still being described and new revisions of the genus in progress. Most species come from southern California and Baja, where many taxa are imperiled from habitat loss and horticultural collecting. They prefer specific exposures on rocky slopes and cliffs, growing in crevices on slabs and shady undersides of boulders. They are frequently associated with other crevice-dwelling species, especially ferns, spike moss, and cryptograms. Any *Dudleya* found at NAWS/CL would be disjunct from the nearest known populations of other *Dudleya* taxa and would have good potential to be a unique taxon.

CNPS (1980) states that this showy plant appeals to the commercial and private collector and is, therefore, threatened because of exploitation. The State of California recognized this threat, and it is protected under the California Desert Native Plants Act. In the absence of public access and mining activity on NAWS/CL lands, the main potential threat would be surface disturbances, such as associated with road and facility building.

<u>Clokey Cryptantha Management</u>

This taxa appears to be highly restricted, but somewhat predictable, within the appropriate habitat type at NAWS. All known habitat for this taxon occurs on NAWS land in the South Ranges. It is highly likely that populations occur in the region south of NAWS, including lands proposed for use by Ft. Irwin. Hilltop facilities south of Randsburg Wash and located above 3500' may cause management conflicts. Most of the appropriate habitat at NAWS however, is rugged and remote from the nearest activities. This plant appears to be a desireable forage species prior to fruiting and might be adversely affected by grazing of feral burros. Clokey Cryptantha habitat at NAWS has become densely invaded by exotic annuals, particularly Red Brome (*Bromus madrietensis* ssp. *Rubens*). Because of this, fire and vegetation type conversion may be strong threats to this taxon. The relationship of this species to fire needs further study. NAWS should avoid fire-causing activities in the known habitats until the management practices for this taxon are better understood.

Management of Other NAWS/CL-SC Flora

Management recommendations specific to the following species will be developed during 2000-2004:

- Inyo hulsea,
- naked milk-vetch,
- Panamint mariposa lily,
- Booth evening primrose,
- Darwin rock cress, and
- winged cryptantha.

Objective and Guidelines for NAWS/CL-SC Flora

Objective: Continue to research NAWS/CL-SC flora to provide a better understanding of such species and remain an active participant with other agencies relative to NAWS/CL-SC flora.

Guidelines:

- Maintain contact with regional specialists and regulatory agencies to monitor the listing status of unique or positively identified plant species as well as local varieties and subspecies of plants known or thought to occur on NAWS/CL.
- Continue to participate in the review and listing process of the USFWS for plant species known or thought to occur on NAWS/CL that are being considered for listing under the ESA.
- Stay updated on agency decisions, published material, and meetings that change the listing status of plants.

3.2.2.2 Fauna

3.2.2.2.1 General

The NAWS/CL region is comprised of varied topography and diversified habitats which support a rich diversity of fauna. A primary factor in the distribution of fauna in the desert is the relative scarcity of water. Thus, riparian areas and water sources tend to concentrate wildlife species creating an “oasis effect.” Many species of wildlife are wide-ranging, while others are highly restricted to microhabitats. Due to the variability and uniqueness of desert fauna and habitats, protection and management of these species and habitats are imperative to their future viability.

3.2.2.2.2 Other Listed Species (Non-resident Birds)

NAWS/CL should continue cooperative efforts with the USFWS, the City of Ridgecrest, Lahontan Regional Water Quality Control Board, CDFG, Army Corps of Engineers, and others to produce a workable plan to protect and enhance surface water features. These efforts will benefit listed, non-resident bird species as well as the Mohave tui chub and other listed species. These efforts will also facilitate compliance with wetlands regulations and preclude additional damage to Navy facilities within the Lark Seep system. The Sewage Treatment Facility evaporation ponds should be maintained so that they continue to provide habitat for waterfowl and shorebirds. Cattails, shrubs, and trees on edges of the ponds provide habitat for nesting and transient birds. The partially filled ponds provide habitat for shorebirds by providing shallow water and mudflats.

Objective and Guidelines for Non-resident Birds

Objective: Ensure long-term viability of habitats of State- and federal-listed bird species on NAWS/CL.

Guidelines:

- Maintain habitat quality to ensure adequate foraging and resting areas are maintained.
- Continue to encourage the placement of new surface-disturbing activities away from areas utilized by State- and federal-listed bird species.

- Continue to consult with appropriate regulatory agencies to ensure that proposed activities are completed in compliance with management requirements.
- Continue to enter surface water feature data (riparian area size and location and water quality and quantity data) into the GIS database.

3.2.2.2.3 Invertebrate Species

The management of giant fairy shrimp and butterflies will be accomplished through protection of known and potential habitats and further investigation to resolve species data gaps. Management of other invertebrate species, such as the Argus land snail, Jerusalem cricket, dune cockroach, Darwin Tiemann's beetle, scarab beetle, and weevils, will be accomplished by protecting known and potential habitats and ensuring the continuation of efforts to resolve baseline biological data gaps.

Objective and Guidelines for Giant Fairy Shrimp

Objective: Protect giant fairy shrimp known and potential habitats and continue research on the species.

Guidelines:

- Restrict vehicle use of lake playas to the maximum extent practicable. When possible, direct activities towards playas least frequently flooded by rainfall runoff.
- Eliminate off-road-vehicle use of the Mirror Lake playa and adjacent uplands.
- Avoid the use of small playas, such as along G-1 and G-2 tower roads, to the maximum extent practicable.
- Assess the population status of selected known sites.
- Determine and monitor physical parameters of playas where giant fairy shrimp are present, including total dissolved solids, pH, oxygen, iron, calcium, potassium, manganese, sodium, turbidity, etc. (Fujita, 1978).

Objective and Guidelines for Butterflies

Objective: Determine the distribution of NAWS/CL-SC butterflies and their respective host species.

Guidelines:

- Continue to support investigations of butterfly species and identification and distribution of host plant species.
- Conduct investigations in concert with botanical surveys. Surveys should be conducted during years when plant species are in good condition and should be conducted over multiple years to avoid problems with some species exhibiting an extended superdiapause pupal stage.

3.2.2.2.4 Reptiles and Amphibians

In general, management of reptiles and amphibians is accomplished by implementation of the objectives and guidelines listed above. Management specific to western toads is not necessary as they are a common species on NAWS/CL. Pacific tree-frog management consists of protection of Haiwee Spring from development or other degradation as this is the single location on NAWS/CL with a record of the species.

The distribution of the chuckwalla on NAWS/CL is unknown, but they have been observed on three mountains, Wilson Canyon, and other areas in the southern Argus Mountain range. General protection of their preferred habitat (rocky areas of the Argus and Coso mountains) to the most practicable extent is adequate for management.

Panamint alligator lizards are closely associated with permanent springs and riparian habitat. Protection of these habitats serves as adequate management of this species. Since Gilbert's skink is used only as an indicator species by BLM, no management prescriptions are recommended for the species.

Objective and Guidelines for Reptiles and Amphibians in General

Objective: Protect known and potential habitats and continue research to fill biological data gaps.

Guidelines:

- Determine the distribution of chuckwalla, Panamint alligator lizard, and Gilbert's skink on NAWS/CL.
- Conduct investigations in concert with other surveys.
- Support investigations of reptiles and amphibians to identify species presence and distribution.

Objective and Guidelines for Slender Salamander

Objective: Determine if slender salamanders are present; if so, determine their taxonomy and delineate special procedures to protect this highly specialized and habitat-restricted species.

Guidelines:

- Continue surveys during appropriate times of the year, using specialists.
- Protect potential habitat areas to ensure that this species, if present, is protected.
- Continue to remove domestic and feral animals from potential slender salamander habitat.

3.2.2.2.5 Birds

Two ventures, Partners in Flight (PIF) and the Riparian Habitat Joint Venture (RHJV), were created to protect songbird populations and conserve habitat to stop their decline. PIF is a national program initiated by the USFWS for conservation of songbird populations. The RHJV was created to conserve, increase, and improve riparian habitat throughout California. Although the focus of RHJV is to increase bird populations, the protection of habitat will also increase density and diversity of all species associated with riparian habitat. NAWS/CL will become more involved in PIF and the RHJV during 2000-2004. These ventures are further discussed in Appendix B, Section 3.2.2.2.5.

Bird/Animal Aircraft Strike Hazard (BASH) plans are required by the Department of Defense for military installations where there is a potential for a conflict between military activity and wildlife. BASH plans contain installation-specific guidelines to minimize collisions between aircraft and birds, such as ducks, geese, and raptors.

NAWS developed and implemented a BASH plan in September 2002. The plan complies with DoD and Navy directives, and is implemented through a NAWS Instruction (NAWSINST 3750.2). The program is designed to reduce the potential for collision between aircraft and birds and other animals. The BASH Plan established a Bird Hazard Working Group to monitor and implement the BASH program.

Objectives and Guidelines for Birds

Objective 1: Provide protection and enhancement of habitats used by waterfowl and other water-dependent bird species.

Guidelines:

- Ensure that use, protection, and enhancement of naturally occurring and man-made water sources does not adversely affect other wildlife.
- Ensure that birds are not unnecessarily attracted to areas, which may create hazards with respect to collisions with aircraft.

Objective 2: Provide protection and enhancement of habitats used by raptors.

Guidelines:

- Identify power lines and poles that have been known to electrocute raptors and correct design deficiencies.
- Ensure that construction of new power distribution systems preclude raptor and owl electrocution.
- Whenever possible, redirect construction and military operations away from cliffs and burrowing owl colonies during the breeding season.
- Conduct additional surveys to determine the status of accipiter and small cavity-nesting owl species on the installation.
- Conduct a breeding survey to determine numbers and locations of burrowing owls.
- Consider the construction and placement of nest boxes for a variety of species, particularly the American kestrel, and the creation of artificial nest burrows for burrowing owls.

Objective 3: Identify and protect areas important to water-dependent and upland bird species.

Guidelines:

- Continue to support the documentation of avian use of China Lake, especially sightings of species with special status and rare sightings. Develop an associated database.
- Continue to be involved in Partners in Flight.

Objective 4: Reduce bird/animal aircraft strike hazards (BASH).

Guidelines:

- Continue to implement the BASH program in accordance with NAWSINST 3750.3.
- Continue to collect bird/animal aircraft incident data and continue efforts to coordinate daily/seasonal bird/animal movement data via the Bird Hazard Working Group.
- Ensure that a NAWS/CL China Lake staff biologist attends classes on bird/animal hazards to aircraft operation.
- Maintain records of BASH incidents, including time of day, date, species involved, and location.

3.2.2.2.6 Mammals

Management of mammals, such as the Mohave ground squirrel, Argus Mountains kangaroo rat, ringtail, American badger, mountain lion, voles, and shrews, consists primarily of maintaining current population levels by protection of potential habitat and conducting surveys to determine species distribution and abundance. In the case of voles, management includes determining the taxonomy of the species present on NAWS/CL. Nelson's bighorn sheep management is somewhat more intensive in that sheep habitat should be maintained such that herds can increase and stabilize. Bighorns should be monitored every three to five years, probably using helicopter surveys. Access should be provided to qualified personnel to conduct surveys or studies of not only bighorns but other species as well.

Objective and Guidelines for Mammals in General

Objective: Maintain viable populations of mammal species on NAWS/CL.

Guidelines:

- Protect habitats to the greatest extent practicable.
- Document the occurrence and monitor known species.

Protection of roosting and foraging sites, water sources, and food supply are keys to management of healthy bat populations (Brown-Berry, 1996). Management of these resources, along with more extensive communication with EPMD prior to use of mines for testing, should enhance bat protection on NAWS/CL. Mines that are bat roost sites should not be used for NAWS/CL activities. In addition, the placement of gates and signage and maintaining open water will enhance bat colonies on NAWS/CL.

Objective and Guidelines for Bats

Objective: Maintain colonies of NAWS/CL-SC bats.

Guidelines:

- Monitor maternity and hibernation colonies to determine bat numbers and population trends.
- Place specially designed bat gates at Redwing Mine, lower Star of the West Mine, and the Josephine Mine. Gates should be placed during winter after inspection of the mine to determine that individuals are inactive. Colonies should be entered only every other year to reduce disturbance to bats.
- Open and gate the lower adit to the Argus Sterling Mine to increase air flow to improve the

hibernation site, which may then support a maternity colony.

- Maintain open water areas to ensure availability to bats.
- Place signs at important mine entrances stating that EPO must be contacted to determine compatibility prior to use of mines.

3.3 Habitat Conservation

Habitat conservation on NAWS/CL can be accomplished by implementing the objectives and guidelines discussed below. Management associated with NAWS/CL-SC flora and fauna, grazing management, and other management practices associated with vegetation, such as fire management and exotic plant control, will further provide for habitat conservation on NAWS/CL.

Objectives and Guidelines for Habitat Conservation

Objective 1: Continue programs to minimize impacts and protect known and potential endangered and sensitive species habitats to the maximum extent practicable.

Guidelines:

- Continue to work closely with the Public Works Department, Range users, and other operators to assist with project development and implementation to ensure incorporation of natural resource management considerations. Initiate involvement with project proponents at the earliest possible stage in the planning process. Continue efforts to encourage reuse of existing zones of disturbance to the maximum extent practicable.
- Continue to encourage redirection of new surface-disturbing activities away from areas that are known potential quality habitats or habitats of potentially significant species. Direct protection efforts towards avoidance of impacts to known high value habitat areas. Ensure development will either avoid or mitigate impacts to these areas to the greatest extent possible.

Objective 2: Develop an accurate and precise database for sensitive, unique, or protected habitats, particularly those associated with NAWS/CL-SC.

Guidelines:

- Use GPS technology to delineate precise locations of all NAWS/CL-SC.
- Develop GIS databases with spatial data related to detailed supporting data, text, and other documentation.
- Continue to use GPS and GIS to locate, map, and record locations of plant and animal species and associations that more accurately delineate boundaries of high value habitat, such as (but not limited to) wetlands, endangered species habitats, unique plant assemblages or plant-animal associations, and areas of scientific interest.
- Develop databases for riparian areas due to their overall importance and vulnerability.

3.3.1 Wildland Fires

Fires are one of the most serious threats caused by NAWS/CL activities to vegetation resources and the habitat of listed and NAWS sensitive species. Most wildfires at NAWS/CL are associated with testing or training operations (starting by use of explosive weapons), by people with access to Range areas inadvertently starting fires, by lightning, or by other means.

There are several factors that have contributed to the creation of fire prone areas on NAWS/CL (Brook, 1998). First, the original ecosystems of the region had physical components that did not attract or sustain fires. In general, Mojave Desert vegetation is not adapted to repetitive fires. The mature Joshua trees, which are characteristic of NAWS/CL, are indicators of low fire frequency. Joshua Tree Woodland is highly susceptible to fire, requiring hundreds of years to recover. Second, exotic plants are a serious threat to some areas of NAWS/CL and may have strong infestations as a result of overgrazing and fire. Exotics, such as cheatgrass (*Bromus tectorum*), splitgrass (*Scismus* spp.), and in some instances native species, such as fiddleneck (*Amsinckia tessellata*), are widespread and have become a major factor affecting the regional ecosystems. These species more readily carry fires, thus, effectively converting areas to fire-based communities. Third, intensive grazing and surface disturbance from feral and domestic ungulates have created widespread, disturbed plant communities that favor exotic plants. Infestations of exotics, particularly exotic grasses is most pronounced on lava mesas. The exotics are enhanced by the breaking and continued disturbance of organic and clay soil crusts. The crusts normally help the soil resist penetration by seeds of exotic weeds. Fourth, most volcanic areas at NAWS/CL are among the most fire-prone terrain in the region. These areas have very shallow soils with a high clay content and therefore support short-rooted, exotic species such as introduced grasses. Fifth, previous fires have altered certain areas of NAWS/CL, preparing those areas for repeat fires by removing fire-resistant vegetation.

NAWS/CL has adopted a "Let-Burn" policy which allows wildfires to burn unless personnel, structures, or test sites are jeopardized. This policy is supported for the following reasons:

- fiscal considerations to maintain firefighting capabilities,
- security and logistical issues that prevent regular use of cooperating agency firefighting resources,
- a general lack of equipment and training,
- risks associated with military mission activities including unexploded ordnance, and
- potential archeological and environmental damage from remote firefighting activities.

The let-burn policy has been adequate in the past as fires have been generally small and have burned themselves out in a short time. However, due to alterations of NAWS/CL lands from native ecosystems to a more fire-prone environment, adoption of a "No Burn" policy is now appropriate. Implementation of a no burn policy entails working with outside agencies to control off-station fires with the potential to impact NAWS/CL and continuing to support and increasing the local firefighting ability to respond to fires in remote or rugged areas of NAWS/CL. Furthermore, the following fire prevention guidelines and practices should be adopted to the maximum extent practicable:

- avoid explosives testing in fire prone areas and during fire prone and/or high fuel conditions;
- schedule explosives testing during favorable seasons;
- consider use of ordnance that does not generate flame and avoid use of explosive spotting charges;
- use large targets to allow misses to remain within cleared areas;
- have on-site fire crews available during fire prone testing and provide fire fighters, test personnel, and appropriate contractors with fire fighting training and equipment;
- use naturally occurring land features, existing roads, and constructed firebreaks when necessary

to contain wildfires; and

- maintain roads, flight tracks, targets, and other previously cleared areas in a cleared condition.

Objective and Guidelines for Fire Management

Objective: Minimize impacts to intact plant habitats and sensitive plant and animal taxa from wildfires.

Guidelines:

- Continue to work closely with range users to assist with project development and implementation to ensure incorporation of natural resources management considerations.
- Prevent fires from spreading outside of test/target areas to the point where suppression becomes unfeasible. Avoid using fire-prone areas for risky testing that has potential for producing uncontrollable fires when possible.

3.3.2 Revegetation

There is much conflicting information regarding the revegetation of disturbed desert sites. Opinions range from natural revegetation to an aggressive reseeding and watering regime. A variety of studies have been conducted to determine the amount of time required for climax vegetation to become re-established. It has been estimated that it would take 850 years in the Great Basin Desert. The NAWS/CL policy of using already disturbed areas for new military missions minimizes the need for revegetation.

In general, most regional revegetation efforts have had poor results. Low rainfall, typical of the NAWS/CL region, is a strong mitigating factor in preserving soil stability. Most areas of NAWS/CL have native shrubs which are weedy and successional to climax vegetation. These species are normally represented in low numbers in a climax vegetation community but are able to rapidly recolonize an area and grow with elevated vigor and abundance in disturbed areas where loose soils, lack of competition, compaction, and pooling and runoff are favorable. Cost, exotic species introduction, delay of climax vegetation recovery, and desert climate are strong factors to be considered before planning revegetation.

NAWS/CL should prohibit the use of exotics or non-local native plant ecotypes in road construction and revegetation plans with the possible exception of an experimental introduction of threatened and endangered plant taxa from lands surrounding NAWS/CL. If reseeding is used, seeds should be gathered from nearby native successional species.

Seeding with soil manipulation and setting the clay crust by watering will greatly improve germination and survival rates. Setting the soil crust will also reduce the effects of seed eating animals. Gravel, rocks, and boulders should be used to stabilize zones adjacent to infrastructure rather than counting on vegetation to hold a slope.

Surface reclamation is more important in recovering climax vegetation than seeding or transplants. Revegetation on sloping terrain benefits from landscaping which makes the topology of a site consistent with the overall slope. Some erosion is desirable to bring surface geomorphology into a stabilized condition. Natural revegetation often does not become active until the first erosional rain. These high rainfall events (usually > 0.5") leach and scarify seeds and lock them into alluvial bars. These features, the shallow initial drainage paths over an alluvial grade, attract new growth of crytograms, algae, and soil microbes. Creating bars and holes or other methods for catching seeds, while good for quick results, delay reclamation of geologically stable climax condition vegetation.

It is best to work inward from the outer edges of a disturbed area when attempting to recover a shrubby succession or climax condition vegetation. Initial soil preparation, reseeding, and other revegetation measures should be focused on areas most likely to recover. Usually these are peripheral areas where soils become stabilized early and have a higher seed base, animal dispersion, moisture retention, soil microbes, and pollination. The investment in revegetating peripheral zones will be less affected if the site is to be reused. Natural drainages and rock outcrops running through disturbed areas can be used like islands as they often provide the extra hydrological resource that new plants need.

Seasonal timing of revegetation is very important depending on the seed types used, elevation, local habitat characteristics, and revegetation strategy. Fall is the best time to disturb west Mojave Desert soils and results in the most rapid vegetation recovery. Most plants are dormant; natural surface reclamation with winter rains usually follows within one or two months; seed bank loss is minimized; and leaching, cold stratification and scarification of seeds can be complete before spring. In general, low elevation soils can be disturbed in late summer (through September) without inhibiting plant activity. Some plants, especially perennials such as cactus, riparian trees, and creosote bush, germinate best in summer even though assistance from natural rains is unlikely.

Transplanting is a useful mitigation measure for a narrow range of situations when the season, funding, species, and relocation site are appropriate. Even if transplants die within one or two years, they can still be ecologically beneficial They may flower and set seed, provide pollen and genetic crosses for nearby populations, are usually weaker and more susceptible to insects and pathogens drawing these pressures away from healthy plants, can provide refuge and forage for animals, and provide nursery zones for seedlings to germinate and become established. Areas with young Joshua trees; medium and small cacti; bunch grasses; shallow rooted shrubs such as sagebrush, cooper goldenbush, burrobush, krameria, etc.; and most riparian plants provide good opportunities for transplanting. Transplanting should be performed for displaced populations of Mojave fish hook cactus as they are a sensitive species and they have strong ecological value as transplants.

Transplants are handicapped and rarely function in the same habitat position as those naturally derived from seed and adapted specifically to withstand elements in open locations. Rhizomal plants have the best chance of forming natural growth patterns after transplanting. The strategy for relocation should be to place plants where they are most likely to survive for the following few years. These locations are generally more mesic and less exposed than the plant’s typical ecological position. North sides of large rocks and boulders are good niches, and large shrubs can also reduce exposure for transplants. Cactus can tolerate more exposed transplant locations. Transplants or cultivated starters used for revegetation should be located at the edges of a disturbance and next to established vegetation to minimize exposure factors.

NAWS/CL should study past activities and their effects on vegetation composition. Mapping the different succession communities for various geologic and elevation land types can assist in predicting sensitivity, recovery rates, and long term effects of various activities on vegetation and local ecology. The results could assist management determinations for revegetation.

Objective and Guidelines for Revegetation

Objective: Compile information on revegetation of desert environments to determine success and applicability to NAWS/CL and perform revegetation projects as necessary.

Guidelines:

- Where necessary, re-establish native plant communities in areas of disturbance.
- Minimize impacts to habitats surrounding project sites to reduce dust and the potential for establishment of invasive exotics.
- Account for appropriate seasonal factors for revegetation.
- Transplant native species, as appropriate, during revegetation projects.
- Allow plant research, collections, and salvage for scientific, conservation, education, revegetation/landscaping, and other worthy purposes, especially from areas where vegetation is already impacted.

3.3.3 Exotic Plant Control

Navy policy, as described in Chapter 22 of OPNAVINST 5090.lB, states that Navy commands shall act responsibly in the public interest to restore, improve, preserve, and properly utilize natural resources on Navy-administered land. The Noxious Plant Control Act and the Federal Noxious Weed Act provides for the control and eradication of noxious (pest) plants and weeds on land under the control of the federal government. Pesticide use in natural resources management programs must comply with applicable requirements of Chapter 13 of OPNAVINST 5090.lB. Such programs must also allow for the conservation of federal- and State-listed plants and promote their delisting by maintaining or enhancing the ecosystem they depend upon. The Pest Management Coordinator is responsible for all actions involving control of plant and animal pest species on NAWS/CL.

Many species of exotics have become established in the Mojave Desert. The origins of virtually all (possibly all) can be attributed to human activities. Exotic plant species of current or potential management concern include:

- cheatgrass or downy chess *(Bromus tectorum),*
- foxtail chess (*Bromus madritensis* ssp. *rubens*),
- fiddleneck *(Amsinckia tessellata),*
- filaree *(Erodium cicutarium),*
- tamarisk *(Tamarix ramosissima),*
- tumbleweed (*Salsola* spp.),
- annual ragweed *(Ambrosia acanthicarpa),*
- mustard (*Brassica* spp.),
- tumble mustard (*Sysimbrium* spp.),
- splitgrass (*Schismus* spp.),
- tumbleweed *(Amaranthus albus), and*
- bermuda grass *(Cynodon dactylon).*

Exotic plants and animals at NAWS/CL can create disclimax plant associations. Not only do exotics colonize disturbed habitats, but they also create new disturbances on nearby climax ecosystems. The effects are usually widespread across many plant communities.

Sheep, cattle, horses, and burros have created widespread disclimax plant communities favoring adventive plants of looser soils and reducing perennial grasses and other palatable species at NAWS/CL. These effects increase density and reduce the size of common annuals by breaking the organic crusts which help the soil retain moisture. These effects are present at NAWS/CL in nearly all flat and rolling terrain of the Coso-Argus ranges plateau and the western portions of NAWS/CL ranges where past grazing by sheep has significantly altered the creosote bush scrub plant community. Recent feral animal control methods have greatly improved the health of climax vegetation.

In some areas of NAWS/CL exotic plants, such as filaree, fiddleneck, cheatgrass, and splitgrass, may have already replaced most native annuals with weedy disclimax associations. Effects on some areas of NAWS/CL are visually distinct, such as at Wild Horse Mesa, the northern rim of Airport Lake, and the northeastern bajada of Robbers Mountain. These are well established plant associations that may be resistant to change until a major climatic shift occurs. In many areas these plant associations have been enforced by activities of sheep, cattle, and horses.

Anthropogenic features and activities create disclimax plant associations. Roadsides are the most well developed disclimax plant association at NAWS/CL. Roadsides provide excellent conditions for disturbed plant types by removing climax cover species during grading, parking, and infrastructure development. Drainage, runoff, carbon dioxide, and soil insulation associated with roadsides attracts adventive plants. In areas of NAWS/CL where roadside associations of native shrubs occur, they are similar to those of adjacent wash communities. At higher elevations roadsides tend to be narrower; the adjacent substrate is rocky or more stable; and the available moisture for shrub recovery is greater. Along these roadsides, native plants, including trees and shrubs, are a more frequent component of the disturbed vegetation and form higher density, taller formations than from surrounding climax plant communities.

Roads are assets to inventory and monitoring of natural resources and can also serve as firebreaks. Vehicle access to some areas of NAWS/CL would be lost if roads and trails were not maintained, become impassable, are reclaimed by vegetation, or become excluded from land use planning decisions. While some roads can be lost over time, roads which are unique access routes, especially in remote areas, should be mapped, designated for travel, and maintained.

There are numerous range features at NAWS/CL where access exists by cross-country routes ("two track" dirt roads) rather than by graded roads. This is especially true of targets, mobile sites, and areas accessed for ordnance recovery purposes. These non-graded routes are a preferable alternative for vegetation conservation where use is infrequent but necessary. One aspect of these access routes, which is detrimental to vegetation, occurs when routes are ambiguous or entry points are unmarked. Additional access paths are created each time a vehicle negotiates the route, especially after an extended period of inactivity has hidden the previous tracks. If the destination is a fixed location, such as targets or mobile instruments, additional impacts can be avoided if one route is chosen and designated. It is recommended that NAWS/CL utilize access markers where possible on such corridors. Ordnance recovery and other operations accessing random locations have less flexibility and environmental need for marking routes.

Road development and maintenance can have a dramatic effect on nearby vegetation. Where exotic plants are invasive, road construction and grading can produce intensified weedy growth. In general, roads modify bordering vegetation to form more moist ecosystems with composition similar to natural vegetation patterns in washes. There is little that can be done to reasonably mitigate these effects. In most areas of NAWS/CL, bordering vegetation areas along roads should be managed as disturbance zones. These areas have great value to biological diversity inventory because they are a richer array of organisms and often have greatly extended phenology and activity for plants and animals.

Seasonal timing of road construction, maintenance, and grading should be considered, especially in areas that have sensitive vegetation or biologic resources. For example, the Coso mountains lupine is a sensitive plant which thrives along roadsides and should be avoided by road development or maintenance from December through June. Other sensitive plants that have specialized occurrences with roads on NAWS/CL include Panamint bird's beak, shining milk-vetch, gypsum linanthus, Charlotte's phacelia, and Booth evening primrose.

Off-road travel corridors have been a planning and mitigation measure for some projects at NAWS/CL, and this process should be further applied to other areas of similar impact. NAWS/CL should map and designate all routes of repetitious travel and access to off-road range features. NAWS/CL should also plan for access to both active and inactive range features. Buffer zones on major roads for infrastructure expansion, maintenance, parking, and mobile sites should be established and managed.

Anthropogenic disturbances create similar types of niches for native weedy species as do natural impacts. Anthropogenic disturbances usually include more exotic plants because human access routes and development are vectors for distribution. Natural disturbances to vegetation communities are usually stabilized and reclaimed to climax condition more rapidly than anthropogenic or exotic species impacts. Native, disturbance-adapted plants have evolved to fill these niches. Another factor in rapid vegetation recovery after natural disturbances is health of the surrounding ecosystems. Bordering areas provide the seed bank, pollinators, spores for micorrhiza, and other symbiotic species. Some native species characteristic of disturbed plant communities are so faithful to disturbed habitats that they are only seen after occasional severe disturbances like flood, fire, debris flow, or human-related activities. Many native desert plants require high disturbance events to germinate and become established but thereafter, need protection and lack of disturbance to survive and reproduce.

Disturbed plant associations vary with plant communities and elevation. The nature of disturbance also has a strong effect on subsequent plant composition.

Runoff, pooling, or drainage are factors attracting exotic plants to anthropogenic disturbances. Drainages and other forms of land development can create disturbed climax associations by providing a consistent source of flooding and extra moisture. Saltgrass has become the dominant cover in areas which receive seepage from the sewer ponds. This area was probably saltbush and alkaline basin scrub with little or no saltgrass before the installation of the sewer ponds. Downstream of these effects is the most distinctive disclimax plant community at NAWS/CL, Lark Seep, an alkaline marsh with emergent tules, cattails, rushes, and a few submergent plants. Lark Seep also was formerly saltbush and alkaline basin scrub.

Areas near playas that become elevated by soil (human deposited, alluvial, or aeolian) are colonized by parry saltbush. Saltgrass appears to be an indicator of changing hydrology in the China Lake basin. It is replacing Saltbush Scrub and Alkaline Sink Scrub in the Lark Seep region. Summer cypress, rushes, and tamarisk are other disclimax indicators in the Lark Seep area. Disturbances at lower elevations of Creosote Bush Scrub are often followed with allscale shrub covers. These disclimax communities are frequent in the China Lake and Ridgecrest area. Disturbed higher areas of Creosote Bush Scrub are often replaced with cheesebush. Tumbleweeds are the annual plant cover of the Drop Zone and other target areas. Annual ragweed is frequent along roadsides in sandy areas.

Fiddleneck, cheatgrass, and foxtail chess are abundant and widespread exotic species throughout NAWS/CL. They occur in nearly all plant communities and can become dominant covers without significant disturbances. Areas of lava flows are covered by dense growths of *Bromus* spp. The abundance of *Bromus* grasses in lava flow areas allows fires to spread rapidly. Such exotic grass-induced fires have dramatically altered high desert vegetation in northwestern Arizona, Nevada, and Utah. Wild Horse Mesa at NAWS/CL has been altered in a similar manner. Fiddleneck has the widest elevation range of NAWS/CL weedy species. It dominates a large marshy area north of Airport Lake and is frequent at other low-alkalinity pools and dry lakes.

Tamarisk has the ability to enter semi-alkaline or freshwater riparian systems and aggressively replace trees and shrubs. These trees are mostly limited to alkaline areas where they use resources that have little effect on the surrounding plants of NAWS/CL. In Salt Wells Valley tamarisk have replaced some shrubs in the wash communities.

Some tamarisk may actually help protect buildings against water damage in the Sewer Ponds, Lark Seep, and other similar basin areas. These should be lowest priority for removal, and chub habitat (where not conflicting with structural needs), seasonal pools, and springs should be the highest priority areas for tamarisk removal.

Tamarisk removal should be done at NAWS/CL where they have the ability to become aggressively established, replace native vegetation, or claim water resources to the expense of general riparian ecosystem health. Two areas in particular are CLPL and Salt Wells.

Objectives and Guidelines for Exotic Plant Control

Objective 1: Remove high priority exotic species, such as tamarisk, and monitor and evaluate the necessity for removal of other species.
Guideline:

- Determine the best methods for removal, control, and timing of removal and locations requiring removal of NAWS/CL pest plant species and ensure compliance with applicable regulations governing removal.

Objective 2: Manage roads and access routes to minimize the spread of exotic species, establishment of nondesignated roads, and protect sensitive species.

Guidelines:

- Designate and maintain roads and access routes.
- Develop and distribute a map of all approved NAWS/CL travel routes.

Objective 3: Manage feral and domestic ungulates to reduce the establishment and spread of exotics.

Guidelines:

- Continue wild horse and burro roundups.
- Continue efforts to manage domestic livestock in an appropriate manner.

3.4 Water Resources

Management of water resources at NAWS/CL involves the identification, monitoring, permitting, use, maintenance, protection, and enhancement of surface waters and groundwater. An overview of surface and groundwater resources is provided in Section 2.2.6.

Surface water management on NAWS/CL includes the following:

- Conduct baseline geophysical, geological, and hydrological surveys at each natural spring on NAWS/CL.
- Provide additional fencing at Birchum Spring and other springs within known and potential range of the Inyo California towhee to protect runoff and allow habitat to become re-established in areas formerly occupied by riparian vegetation. Ensure that a water source remains available outside of the riparian habitat.
- Document avian use of wetlands, especially breeding species and sightings of NAWS/CL-SC, and develop a database for observations.
- Conduct flora and fauna surveys at natural perennial and ephemeral water sources on NAWS/CL. Priorities would be to conduct surveys in areas of playas most likely to have fairy shrimp, unique vegetation, or other unique features. Survey priorities for perennial water sources would be at springs, in particular those with potential to support the Panamint alligator lizard, slender salamanders, unique vegetation, or unique invertebrates.
- Enter GPS data into the GIS and map vegetation at natural springs.
- Fence water sources and riparian vegetation with bighorn sheep fencing such that deer and bighorn sheep have access to water sources but feral burros, horses, and cattle do not. Provide water sources outside fenced areas for feral animals as necessary.

Objectives and Guidelines for Water Resources

Objective 1: Achieve full compliance with requirements of the Clean Water Act, specifically provisions involving Waters of the United States.

Guidelines:

- Thoroughly evaluate requirements of the Clean Water Act as they pertain to surface water at NAWS/CL.
- Review military and nonmilitary uses at NAWS/CL and determine which uses may impact Waters of the United States.
- Consult with the Army Corps of Engineers and the Lahonton Regional Water Quality Control Board to ensure appropriateness and adequacy of compliance.

- Evaluate the requirement to submit a permit application, under Sections 401 and 404, to the U.S. Army Corps of Engineers and Lahonton Water Quality Control Board.
- Develop management guidelines based on the determination of which uses may impact Waters of the United States and amend the Integrated Natural Resources Management Plan as appropriate.

Objective 2: Continue to inventory, protect, and enhance springs, seeps, other water sources, and associated adjacent habitats.

Guidelines:

- Continue the long-term program to characterize springs, seeps, and other water sources.
- Monitor water source conditions and identify adverse impacts.
- Design and implement a management program to assess, protect, and enhance all station water sources.
- Provide physical protection to high value habitats through the construction of exclosure fencing, particularly around water sources, taking particular care to ensure that water remains available to designated species outside exclosures.

***Objective* 3:** Continue to manage groundwater resources in accordance with the goals of the Indian Wells Valley Cooperative Groundwater Management Plan to ensure the conservation and long-term availability of high-quality groundwater resources.

Guidelines:

- Continue to limit additional large-scale pumping in already adversely affected areas.
- Distribute new groundwater production to minimize adverse impacts.
- Develop and implement a water conservation and education program.
- Continue to advocate use of treated water; reclaimed water; and recycled, gray and lower quality water.
- Explore other water management programs such as transfers, banking, imports, and replenishment.
- Continue the cooperative groundwater data acquisition and distribution program.
- Develop a cooperative management framework.

3.5 Grazing and Pest Control

3.5.1 Grazing

Elimination or proper control of feral and domestic herbivores would likely produce a greater conservation benefit to NAWS/CL natural resources than all future land use planning and environmental measures combined (assuming similar NAWS/CL missions in the future). The greatest impact to NAWS/CL vegetation is caused by cattle, feral horses, and burros. Burros, the subject of extensive control, continue to exert a widespread impact at lower elevation springs and their peripheries but are generally less destructive to vegetation than horses and cattle. The ecological alteration caused by these three grazers exceeds impacts of NAWS/CL military activities.

Implementation of the objectives and guidelines are the necessary management actions for these species. In the case of cattle, analysis of cattle grazing options and methodology appropriateness will be accomplished through the preparation of the Comprehensive Land Use Management Plan and Station-wide EIS. Issues involving management of these species on NAWS/CL are more fully described in Appendix B, Section 2.3.2.7.

Providing water in remote locations and developing rest/rotation grazing procedures to more equitably distribute cattle to facilitate recovery of forage areas are complex projects. Construction of catch boxes, water distribution pipelines, water storage tanks, float-regulated drinking troughs, and associated fencing and gates will require a significant amount of new construction and land disturbance. Likewise, developing a rest/rotation system would require extensive fencing which is in conflict with the NAWS/CL wild and free roaming horse herd. These activities would probably require more extensive biological and cultural resource inventories and preparation of more detailed NEPA documentation. Impact assessment will have to address not only the development of water distribution systems but also general cattle grazing operations.

Effective management of feral and domestic animals can only be accomplished through a coordinated management approach involving Navy and BLM land managers. Horse, burro, and cattle management discussions are generally consolidated because they are biologically, economically, and politically linked. Cattle grazing is currently authorized under a two-year interim permit (1998-2000). During this time grazing will be evaluated to determine what adjustments may be required to improve the compliance status and efficiency of the program.

Objective and Guidelines for Grazing in General

Objective: Manage feral and domestic herbivores within the capacity of NAWS/CL's resources.

Guidelines:

- Continue to remove wild horses and feral burros to designated management levels.
- Eliminate impacts associated with horse, burro, and cattle grazing to sensitive habitat areas.
- Eliminate causes of impacts to, enhance, and protect high value habitats.
- Provide physical protection to high value habitats through construction of exclosure fencing, particularly around and adjacent to water sources.
- Continue to evaluate effects of grazing by horses, burros, and cattle.

Objectives and Guidelines for Horses

Objective 1: In accordance with the 1980 California Desert Conservation Area Resource Management Plan, maintain a herd size of 168 horses so that the need to remove large numbers of animals can be avoided and environmental damage minimized.

Guidelines:

- Continue annual roundups.
- Annually assess herd size, herd condition, and distribution of sub-herds.
- Continue to work closely with the BLM during roundups and throughout the year.

Objective 2: Ensure good herd health, genetic diversity, and good individual horse appearance and conformation and re-establish a more natural herd age-class structure.

Guidelines:

- Allow older horses to live out their lives and naturally decrease in numbers over time.
- Only remove adoptable horses (primarily young animals) for placement through the BLM Wild Horse and Burro Adoption Program.
- Selectively remove young animals so that adequate numbers of high quality individuals are retained.
- Trained observers, such as the BLM wrangler crew, will be consulted to maximize appropriateness of the selection/retention process.

Objective 3: Initiate a program to facilitate recovery of forage areas and water sites, minimize adverse environmental impacts, and protect high value areas, such as water sources and riparian areas.

Guidelines:

- Assess impacts and develop a prioritized plan to provide protection for key habitat areas.
- Maintain horse numbers at levels consistent with land stewardship.
- Eliminate impacts to water sources and riparian areas (and their associated biological and cultural resources) through construction and maintenance of exclosure fencing.

Objective 4: Develop a horse herd management plan in concert with BLM to resolve issues such as protection of springs and riparian zones, conflicts with cattle grazing, construction of security and cattle drift fences, safety and security concerns, and funding constraints.

Guidelines:

- Utilize available documentation for horse management, such as the BLM report, *Management Option for Coso Range and Argus Range Wild Horse Herd*.
- Incorporate, as appropriate, methodologies detailed in the BLM preliminary report *Improving the Adaptability of Wild Horses through Management*.
- Develop a cooperative horse herd management plan in concert with the BLM.

Objectives and Guidelines for Burros

Objective 1: Continue to conduct roundups and adoption of burros until the designated management goal of zero burros is attained.

Guidelines:

- Continue to conduct annual roundups.
- Whenever possible, utilize BLM wrangler crews and the BLM Wild Horse and Burro Adoption Program. Coordinate removal efforts with the Ridgecrest Resource Area Office of the BLM regarding burro gathering methods.

- Continue to encourage and support the BLM with the conduct of roundups on lands adjacent to NAWS/CL.
- Conduct roundups in concert with Death Valley National Park and Fort Irwin to minimize infiltration from these areas.

Objective 2: Continue to protect water sources and riparian areas.

Guidelines:

- Continue to construct exclosure fencing around springs, seeps, and riparian areas. Ensure that water remains available to native wildlife and burros until the entire area serviced by the water source is free of burros.
- Preclude access to water by feral animals once an area has been cleared to eliminate re-establishment of burros in specific areas.
- Construct exclosure fencing which requires minimal maintenance over the long-term. If water is to be provided outside exclosures, passive water flow, as opposed to piping, is preferred.

Objectives and Guidelines for Cattle

Objective 1: Develop a short-term grazing management program that identifies and corrects identified current grazing management program deficiencies.

Guidelines:

- Continue coordination of efforts between NAWS/CL, BLM, and the permittee to identify and protect high value habitats most impacted by uncontrolled use by large herbivores in a systematic and prioritized manner.
- Continue to support and identify means to fund and accomplish on-the-ground habitat protection and enhancement efforts, particularly in riparian and wetland areas.
- Identify and implement measures designed to meet the long-term goal of returning the entire allotment area to a range condition of "good".
- Ensure continued compliance with applicable rules and regulations including the Safe Drinking Water Act, the Clean Water Act, the Endangered Species Act, and the National Historic Preservation Act.

Objective 2: Continue efforts designed to assess impacts, constraints, mitigation, and appropriateness of cattle grazing operations on NAWS/CL.

Guidelines:

- Continue to support efforts by the BLM to develop a revised Allotment Management Plan (AMP) to serve as a basis for describing implementation of a proposed grazing management program on NAWS/CL.
- Actively support BLM efforts to assess impacts of implementation of a proposed AMP through the preparation of appropriate NEPA documentation.
- Evaluate the feasibility of implementing a long-term grazing management program through the CLUMP/EIS process, incorporating results of past and ongoing evaluation efforts.

- Implement a long-term grazing program only after development of an MOU/MOA acceptable to NAWS/CL, BLM, and the permittee which clearly details and assigns responsibility for implementation of required program elements detailed in the revised AMP and supporting NEPA documentation.

3.5.2 Pest Control

Management of pest species will be in the form of implementation of practices designed to reduce the number of rock doves and European starlings in and around airfield hangers and other facilities. The need for control of other pest species will be monitored, and guidelines for control will be developed if necessary.

Objective and Guideline for Pest Control

Objective: Create a clean and safe environment within airfield hangers by keeping the number of rock doves and European starlings to a minimum.

Guideline:

- Remove rock doves and European starlings from airfield hangers.

3.6 Resources Inventory and Data Management

3.6.1 Introduction

The inventory and recordation of biological field data, and development of a computerized retrieval system for this data is an ongoing effort at NAWS/CL. The size of the facility, variety of habitats, and limited availability of staff and funding makes the completion of a Station-wide, comprehensive inventory a particularly difficult but essential task.

The discovery of unanticipated, endemic, potentially rare, or new species of plants and animals is a regular occurrence when specialists conduct surveys of the Range areas. This is particularly true when studies are conducted in seldom visited or remote areas or microhabitats. Most of these discoveries involve the smaller, and harder to observe or identify species that require specialized skills to locate and identify.

Knowledge of the distribution of these potentially rare species facilitates mission accomplishment by allowing project planners to assess potential impacts to these resources early-on in the planning process. This is particularly important for those species which may, or are currently being, considered for listing under the provisions of the Endangered Species Act. It is also equally important to provide this information, in a usable format, to adjacent land managers since management of sensitive species can best be accomplished when all forms of potential impacts are considered for a species throughout its entire range. Ecosystem-wide management of sensitive resources requires mutual cooperation of regional land managers, regulators and scientific groups and facilitates regional planning efforts towards common goals.

3.6.2 Data Gaps and Research Needs

Most NAWS/CL activities have relatively restricted zones of surface disturbance. The most critical potential vegetation impact at NAWS/CL would be the loss of an unidentified population of a threatened or endangered species. It is necessary to identify sites which may be surface impacted so that seasonally-dependent biological surveys can be conducted before future management options become limited.

Recent surveys at NAWS/CL have been limited but very successful in discovering new rare occurrences. Foe example, 25% of NAWS/CL plant species have been recorded since 1993. This indicates there is good potential for more sensitive biological occurrences being recorded at NAWS/CL. Ten of the 22 sensitive plants known from NAWS/CL were unknown until 1993. Many potentially occurring taxa will be difficult to effectively target in field surveys and should be searched for as opportunity permits during other biological field investigations. Plant community mapping and general floristic surveys are favorable for the discovery of new rare plant populations. Identifying and describing the diversity of habitats at NAWS/CL is an important first step in establishing a consistent baseline for the management of resources and will help target potentially occurring species.

Gaps in resource knowledge and supporting documentation are inevitable for a region so broad and diverse. Environmental project funding often must be directed to a local area or toward a narrow scope of priority projects. Despite numerous surveys, the history of NAWS/CL studies is still incomplete. Much of NAWS/CL is remote and rugged, which makes assessment slow, complex, and expensive. Due to past public access restrictions, some amateur discoveries that have helped increase the vegetation resource knowledge on nearby lands were not available to NAWS/CL.

Conditions for ephemeral plant species are unfavorable most of the time. Bulb-forming perennials and annuals constitute a significant share of the known and potentially occurring NAWS/CL-SC plants. They are the most difficult vegetation elements to characterize because years may pass before these resources can receive valid assessments. Searches for these plant forms should take priority whenever seasonal conditions permit.

Summer annuals are rare at NAWS/CL. Conditions for widespread growth are rare, occurring once every 10-20 years. NAWS/CL should use these opportunities to observe this little-known section of the regional flora to further document and inventory vegetation resources. Many plant occurrences can be documented by simple driving and short walking surveys.

Filling gaps in general vegetation resource knowledge is desirable, particularly for rapid resource assessment, improving management options, and setting priorities for land use decisions. Documentation, organization, summaries, and electronic references help provide status assessments of specific resources in a timely manner. Such information is essential to efficient study planning. Because so many areas of NAWS/CL remain unsurveyed, it is important to avoid duplication of data collection.

Surveys of riparian areas are most likely to discover unique resources. Springs, seeps, and canyon bottoms have dynamic vegetation patterns that can change rapidly with climatic swings. Many herbaceous plants at springs, along with associated animal resources, appear to be cyclic, both seasonally and in multi-year trends. In addition, vegetation patterns are useful for determining the hydrology of surface and subsurface water resources.

Efforts to document sensitive resources will have little conservation value if future selection of project sites on NAWS/CL do not consider realistic alternative sites or consider environmental data early in the planning process. Environmental data at NAWS/CL should be used to facilitate avoidance of sensitive resources and to aid permitting.

NAWS/CL should encourage research on taxonomic issues. Shining milk-vetch status is a potentially important plant taxonomic issue at NAWS/CL. Several others, recognized as NAWS/CL-SC plants, may be taxonomically invalid or mis-determined. Verification of taxonomically questionable plant and animal species is important and should be done as a high priority.

Assessment and documentation of non-vascular plants, especially those which are ecologically important, such as micorrhiza, algae, lichens, decomposing fungus, etc., are necessary as these NAWS/CL plant resources may be the most adversely affected biological component of NAWS/CL ecosystems as a result of soil disturbances from the cattle, burros, horses, and to a lesser extent by mission related activities. This area of knowledge is difficult to obtain and is a major resource knowledge gap for most landowning agencies. Attracting research specialists in these fields is the only practical source for accurate knowledge and assessment of non-vascular vegetation.

Among the most important gaps to fill in NAWS/CL biological information is the preparation and continued maintenance of geographically correct map images of known sensitive species records, their population boundaries, rough estimates of numbers, and corresponding document records with regional data sources.

Some field data on biological data at NAWS/CL may be useful for management purposes as either electronic mapping (such as GIS) data, text documentation, or database information. Data entry and integration of data with software packages is necessary to make these data available. Production of an electronic and printed identification guide to sensitive and unique taxa in the NAWS/CL region would help resource assessment studies for nonspecialists and other field personnel. Material from such a guide could also be used as electronic resources for education of other NAWS/CL personnel and contractors involved with environmental management issues.

Verification or modification of NAWS/CL vegetation patterns maps to account for remote areas which were not field surveyed during initial map creation should be accomplished. NAWS/CL vegetation units should be converted from the layer of mutually exclusive polygons to individual layers that overlap. This is important because much of NAWS/CL vegetation is transitional, and vegetation patterns are better analyzed as overlapping layers. Future vegetation mapping should include a system of releves (field lists - ongoing data collection), past mapping images, GPS data, and aerial photos.

NAWS/CL has several areas where plant communities and flora and fauna are complex, especially transitional areas and canyons. The large-scale (1:100,000) NAWS/CL plant communities map can not adequately characterize these habitats. Widely distributed, small-scale, more detailed samples of these areas will help characterize resource shifts and associated patterns. These samples can be used to predict plant and animal occurrences for areas too complex or too rugged to survey using topographic and geologic overlays. Obtaining or creating associated environmental and physiognomic GIS layers will help to create habitat prediction models and estimates of the extent of potential resources.

Information on collections from NAWS/CL that have been converted to specimen vouchers is lacking, even though extensive records exist. Often these collections are not considered important when first made. They are subsequently deposited to herbariums or museums, sometimes traded, or simply remain in the collection. Often specimen records are never seen again until a researcher reviews a particular plant or animal group. As taxonomy and conservation priorities change, these records are forgotten in resource assessment decisions.

Most large herbariums are beginning the process of bringing collections online in databases available on the Internet. Several California herbariums with NAWS/CL plant records are participating in the SMASCH database program for electronic reference of collections. The University of California Riverside is using a Filemaker Pro database. NAWS/CL personnel should be aware as these institutions complete their inventories. NAWS/CL can use database queries to recover lost information about past plant collections on the station, some of which will undoubtedly affect resource management decisions. With the current body of botanical references, regional herbariums, and other available information systems, much progress in vegetation resource information can be accomplished with a modest investment in baseline field investigations.

Outside researchers and specialists routinely record and provide NAWS/CL with unique plant and animal observations, plant collections, and data collections. Free exchange of such data gives EPO and NAWS/CL planners an early opportunity to evaluate these data.

Objectives and Guidelines for Inventory

Objective 1: Inventory plant taxa according to the priorities listed below (priorities are relative to seasonal factors).

Guidelines:

- Intensive surveys for very rare or endangered taxa (listed plants and those that may become listed), which may occur on NAWS/CL and which are proposed for listing, particularly in areas of future development.
- Searches for potentially occurring rare or endangered riparian species.
- Further inventory and mapping of existing NAWS/CL-SC.
- Investigations of rare taxa with incomplete verification of NAWS/CL occurrences.
- Surveys for other potentially occurring very rare or endangered taxa.
- Surveys for other, less endangered or rare plants that potentially occur at NAWS/CL.

Objective 2: Continue to resolve baseline biological data gaps.

Guidelines:

- Continue to fund and support on-going and new research. Encourage the use of regional specialists to facilitate recognition and discovery of previously unrecorded species or species locations.
- Determine the taxonomic status of selected NAWS/CL-SC.
- Direct specific attention toward locating and identifying rare, endemic, undescribed, and potentially new species.
- Verify questionable plant occurrences.
- Maintain databases for all species regarding taxonomic and legal status, rangewide and

NAWS/CL distribution, inventory techniques, and time frames.

- Continue to update and enter new data into GIS databases. Record location data using GPS equipment.
- Conduct surveys during appropriate seasons or where locally conducive conditions exist. Take advantage of seasonal windows of opportunity within which species are most likely to be encountered or observed and when local conditions are optimal.
- Establish a database of regional professionals.
- Give the highest survey priority to seasonal taxa with the narrowest windows of observability.
- Conduct regular surveys and documentation of springs, seeps, and wetlands.
- Give high survey priority to areas, such as those in and around water sources and riparian zones, which are most severely degraded and are most likely to continue to support known, suspected, or previously unrecorded NAWS/CL-SC.
- Actively seek and support outside researchers, institutions, and programs to facilitate resource data gathering efforts in addition to maintaining good rapport with the scientific community.
- Review and document the NAWS/CL herbarium and send specimens to regional herbariums housing other NAWS/CL plant specimens.
- Complete the herbarium collection to include all plants occurring on NAWS/CL and enter data into an on-line database.

3.6.3 Data Management

The collection of natural resources data is a virtually useless venture without the capability to store, retrieve, and analyze these data. In many cases, data are collected and stored without being used. NAWS/CL is committed to providing efficient, cost-effective systems for data storage and analysis.

The geographic information system (GIS) is administered within the Land Use Planning Office. It is available to all programs within EPO including natural resources. GIS data manipulation, analysis, and development are currently being performed under contract with BTG, Inc., Delta Research Division. The GIS is an ArcInfo® system using software version 7.1.2 for Unix workstations. ArcView® version 3.0.A for PCS and 3.0.B for a Unix platform are also being used. Other GIS equipment includes an HP 750C E size plotter, a Sun Sparc® 20 Unix workstation, a Sun microsystem storage array with 12.5 gigabytes (gb) storage capacity, an additional storage array with 4 gb capacity, and a digitizing tablet.

Most recent data development includes conversion of GPS data to ArcInfo® for zones of disturbance and cultural resources data layers, such as surveys, sites, and relational databases. Most recent applications of the GIS include archeological data analysis of constraints and proximity for natural resources and application of the Comprehensive Land Use Management Plan to issues such as flight paths and hazard footprints. The natural resources program will probably produce many new databases and make more use of the analytical capabilities of the NAWS/CL GIS to provide natural resources management options during 2000-2004.

The oldest aerial photographs of NAWS were taken in 1943. In 1989 black and white, 10-meter resolution aerial photographs of the entire station were taken. The latest aerial photographs, taken in 1997, covered the entire station and are ortho-rectified, black and white and color, and are at 2-meter resolution. The 1997 aerial photographs have been digitized into GIS format.

Computer technology provides a means of using aerial photographs and/or aerial videos for a wide range of natural resources-related tasks. Current aerial photographs are probably adequate for NAWS/CL's needs during most of the 2000-2004 period. No additional aerial photos are anticipated during 2000-2004 with the possible exception of site-specific photos as necessary.

Objective and Guidelines for Data Management

Objective: Continue to develop and maintain NAWS/CL's data management capabilities.

Guidelines:

- Support, through general floristic surveys and additional mapping efforts, the development of maps and supporting data that clearly identify plant communities and habitat diversity as an initial step in establishing a consistent baseline of vegetative resources to help locate and target potential management issues.
- Identify areas most likely to receive surface impacts which may also be areas most likely to support known and suspected NAWS/CL-SC and other sensitive resources and develop impact avoidance or minimization procedures.
- Continue to fund and otherwise support on-going and new research, encouraging the use of specialists to facilitate recognition and discovery of previously unrecorded species or species occurring in previously unrecorded locations.
- Direct specific attention towards locating and identifying rare, endemic, undescribed, and potentially new species.
- Maintain a database of invertebrate species including taxonomic status, range-wide and NAWS/CL distribution, inventory techniques, and appropriate survey time frames.
- Continue to update the GIS database.
- Develop databases for invertebrate species. Little is known about this group at NAWS/CL and it is the most likely to produce new or previously unrecorded species.

3.7 Cultural Resources

This program is described in detail in the draft *Cultural Resources Management Plan* (Tetra Tech, Inc. and Far Western Anthropological Research Group, 1998).

4.0 PLANNING FOR COMPATIBLE USE OF NATURAL RESOURCES

Goal 2: *Manage China Lake lands in a manner that accommodates ongoing and evolving military mission support requirements and conserves and protects land-based environmental resources in accordance with compliance requirements and stewardship principles.*

4.1 Military Mission and Environmental Compatibility

NAWS/CL lands have been used for 50 years to support Navy Air Weapons development, testing, and training missions. A large portion of these lands (about 92%) are withdrawn from the public domain by Congress for use by the Navy to conduct its RDT&E and training missions. In 1994 Congress reauthorized the withdrawal of these lands through the passage of the California Desert Protection Act (CDPA). The CDPA required that a management plan be prepared for those lands in accordance with guidelines contained in the Federal Land Management and Policy Act (1976).

A Comprehensive Land Use Management Plan (CLUMP) is being developed in partnership with the BLM to address requirements and to facilitate mission support through the integration of military operations and environmental planning. The draft CLUMP will present the Navy's proposed approach to management of its lands for the withdrawal period and will undergo public review through the NEPA process.

The CLUMP will develop guidelines and procedures for the management of NAWS/CL lands for the next 20 years (withdrawal authorization period) or for the period of the next reauthorization legislation. The CLUMP will be the implementing vehicle for land management activities, including this INRMP. The draft CLUMP is being developed concurrently with this INRMP and other keystone management plans. Other planning initiatives in development at NAWS/CL include the draft Cultural Resources Management Plan (Tetra Tech, Inc. and Far Western Anthropological Research Group, 1998), the draft Range Management Plan (SRS Technologies, 1996), and an update to the Station's Air Installation Compatible Use Zone report for airfield and range flight operations.

Objective and Guidelines for Compatibility

Objective: Ensure no net loss in military mission support capabilities while pursuing environmental conservation and protection needs.

Guidelines:

- Dedicate NAWS/CL lands to the support of the military mission.
- Facilitate ongoing and evolving mission support activities by integrating land use and environmental planning.
  a. Minimize land use compatibility constraints for on-site projects by implementing policies, guidelines, and procedures described in the final CLUMP.
  b. Minimize off-site land use compatibility through continuing active participation in local and regional land use and environmental resources management plans and initiatives.
  c. Standardize procedures for guiding ongoing mission support projects by using existing

agreements and programmatic consultations.

   d. Pursue new agreements and programmatic consultations to augment standard operating procedures for guiding new projects.

- Protect the integrity of important environmental resources while accommodating needed mission support activities by developing policies and procedures.
   a. Utilize existing land use footprints or previously disturbed areas to the fullest extent practical for new and ongoing mission support projects.
   b. Tier off the Final Environmental Impact Statement (FEIS) and undergo the review and approval process as defined in the final CLUMP for new and ongoing projects that have the potential to impact areas beyond the footprints established in the CLUMP,
- Continue to update knowledge of resource patterns (type, sensitivity, distribution) and transfer information to the GIS decision support system.
   a. Map and characterize disturbed land use patterns created by existing and previously utilized mission support activities, including RDT&E.
   b. Map and characterize baseline non-military land uses for existing activities.

4.2 Commercial Forestry and Agriculture

OPNAVINST 5090.1B (Chapter 22) requires the Navy to identify areas that may be suitable and available for agricultural outleasing or commercial forestry. More specifically, 10 U.S.C. 2665/2667 of the Military Construction Authorization Act, provides for the use of Department of Defense lands under a lease to an agency, organization, or person for the purpose of agricultural outleasing or the production of and sale of forest products that have commercial value.

At NAWS/CL there are no forest lands suitable for timber production. Because of the lack of marketable timber stands, aridity of the desert region, and lack of low cost irrigation, the development of timber resources on NAWS/CL is unlikely.

The only potentially harvestable trees on NAWS/CL are pinyon pine which could be harvested for nuts, wood, or Christmas trees. The pinyon pine is a slow-growing species that takes many years to reach maturity. Any reduction in the size of pinyon stands would have long-term effects. Given the relatively small area that could be harvested, it is not a sustainable program. In the late 1800s and early 1900s pinyon pines were harvested to provide fuel for charcoal kilns.

Areas that might be suitable for agriculture, such as relatively flat areas which are easily accessible, are located in NAWS/CL inner ranges and are heavily utilized for testing or as a buffer for test facilities. Due to the uncertain nature of testing programs and the potential for test item malfunctions, access cannot be assured on a daily basis to manage agricultural enterprises. In addition, safe and unimpeded access to potential sites and readily available water in adequate quantity are problematic.

Commercially viable agricultural endeavors in the Indian Wells Valley are limited to alfalfa, fruit (peaches and apricots), and nut (pistachios and pecans) tree farming, mostly in the Inyokern area. There have been no inquiries as to the availability of NAWS/CL lands for such uses. For reasons discussed above, there is not an agricultural outlease program.
Two programs which may be compatible with ongoing range operations involve beekeeping and pinyon nut harvesting. These operations would be small scale, located in discrete areas, allowed on a strictly non-interference basis, and would involve minimal involvement and oversight by safety, security, and

environmental personnel. NAWS/CL will investigate the feasibility of small-scale agricultural outleases during 2000-2004.

Objective and Guideline for Commercial Forestry and Agriculture

Objective: Protect and manage NAWS/CL forest areas.

Guideline:

- Investigate developing a forest management plan for the pinyon pine forests of NAWS/CL.

4.3 Landscaping and Grounds Maintenance

Regular maintenance of semi-developed and developed grounds is accomplished according to guidelines offered in the 1986 *Naval Weapons Center Grounds Maintenance Standards*, Public Works Publication 2637-L-001. These maintenance guidelines are a compendium of suitable material from the 1981 publication, *Maintenance Standards for Improved Grounds - Southwestern Desert Region*. General and specific guidelines are provided for irrigation, turf management, fertilizers, pruning, tree stump and sucker removal, inert groundcovers, mulches, and general grounds maintenance. In addition, NAWS/CL supports the policies regarding the use of native species in accordance with the Presidential memo on the subject (Office of the President, 1994).

NAWS/CL's arid desert location and limited ground water resources makes water usage a major concern. NAWS/CL addresses this issue by emphasizing a water conservation program. Xeriscaping, an important aspect of the water conservation program, is based on the use of native or drought-resistant plants and efficient irrigation practices that require less water. Xeriscaping can be both functional and aesthetic. Traditional high water-use landscaping has been replaced with xeriscaping at many high traffic areas since 1986. Xeriscaping should continue to be used to the greatest extent possible.

Principals of xeriscaping include the following:

- using drought tolerant species of plants that require a minimum of maintenance;
- using gravel as a ground cover to preclude weed growth and enhance water retention;
- using plastic or rubber-based products to prevent the growth of undesirables, such as bermuda grass;
- using species that accomplish a goal, such as providing shade to buildings for thermal relief or using ground cover to prevent blowing dust and soil erosion;
- watering using automatically controlled cycles during low evaporation periods;
- using drip irrigation whenever possible; and
- replacing large expanses of lawn with xeriscaping.

New technology should be implemented to reduce water usage whenever possible. For example, timers and drip irrigation can enable landscape watering during the most efficient time of day. Deteriorated and out-of-date irrigation systems should be upgraded and retrofitted with efficient, low-water use components.

Pruning schedules are established to occur prior to trees leafing or budding. Pruning should take place during mid- to late winter to avoid impacting nesting birds.

NAWS/CL should reduce the use of any plants known to be pests. The intact native ecosystems at NAWS/CL, particularly riparian areas, would be easier to manage for long-term stability if the use of native plants for landscaping at facility sites and Mainsite was encouraged. The use of native plants, especially successional species, should be considered as a landscaping choice and potential replacements to exotics. Native plants need as much water as exotics to become established, but once established most native plants can thrive in landscaped habitats without direct watering. Native plants provide extra resources for native pollinators and birds thus helping to buffer the edge effect on neighboring intact ecosystems. Land developments and road maintenance provide many opportunities for plant salvage as ecologically appropriate and low cost landscaping resources. Cactus, Joshua trees, and bunch grasses are generally the easiest and most desirable choices for transplanting. Some young shrubs can also be successfully transplanted with minimal effort. In general, the shrubs at NAWS/CL which appear to be most common are usually the easiest to grow.

Native plants which might be suitable landscaping or revegetation alternatives include small trees, such as pinyon pine, one-seeded juniper, Joshua tree, desert olive, screwbean, honey mesquite, and serviceberry and elderberry for well-drained areas. These trees are typically shorter and slower growing than those commonly planted at NAWS/CL, but have lower watering needs. Mesquite and elderberry can also thrive in wet areas and are fast growing.

Trees ideal for wet areas or near ponds include cottonwood, red willow, coyote willow, and arroyo willow. Cottonwood, mesquite, and red willow are easy to propagate by cuttings and have the best alkalinity tolerance of native trees at NAWS/CL. Tall shrubs, such as seepwillow, creosote bush, big sagebrush, bitterbrush, fourwing saltbush, plateau gooseberry, scalebroom, rabbitbrush, and peachthorn, can be useful for landscaping. For alkaline areas the rabbitbrush ecotypes native to dune areas of the China Lake basin, fourwing saltbush, and seepwillow may be useful.

Operational costs, such as heating, cooling, and lighting, can be reduced with strategic placing of vegetation. Particularly important in the desert environment is shade provided by vegetation on south- and west-facing sides of buildings. Vegetation on these sides also provides a wind break against prevailing southwesterly winds.

While vegetation can screen unsightly structures such as fences, security measures may be somewhat compromised by limited visibility. *The China Lake Base Exterior Architecture Plan* (DON, 1989) provides detailed design guidelines to give a consistent and coherent theme for NAWS/CL buildings. Major topics in the plan are Objectives, Design Process, Guidelines, Maintenance, and Screening Walls.

Revegetation or landscaping plans that utilize medium height or low shrubs have many options for native plants. Species such as *Artemisia* spp., *Senecio flaccidus*, *Ericameria* spp., burrobush, goldenhead, cheesebush, brittlebush, and saltbushes are easy to propagate and reasonably fast growers. Saltbushes, goldenbush, gray molly, desert alyssum, and intricate aster are well adapted to alkaline areas. Parry saltbush is a well adapted alkaline species and thrives in disturbed areas, often where no other shrubs will grow. This plant is host to a rare endemic beetle and should be encouraged in the low lying alkaline zones of NAWS/CL.

Low growing perennials and herbaceous and grass-like plants are among the best colonizers of disturbed areas and will thrive in revegetated and landscaped sites. Easily grown perennial grasses include dropseed, alkali sacaton, deergrass, galleta grass, ricegrass, saltgrass, and mistgrass. These species can be easily transplanted from clumps or rhizomes. Other plants that could be used are milk-vetch, four o'clock, *Lotus* spp., bush woolly star, stillingia, Indian paintbrush, and penstemons.

Riparian plants are the easiest native plants to grow. Most are available as cuttings or rhizomes with many appearing naturally in ditches and drainages. Most NAWS/CL landscaping is watered sufficiently to support many desert riparian species.

Annuals are difficult to grow in landscaped areas and require seasonal maintenance. However, NAWS/CL has a great abundance of native annual plants. One year displays can be produced with extra seeding, leaching, and soil preparation. The use of native annuals may be more appropriate for revegetation purposes.

Objective and Guidelines for Landscaping

Objective: Consider environmental factors in landscape planning.

Guidelines:

- Implement new technology to reduce water usage whenever possible.
- Utilize xeriscaping to the maximum extent possible.
- Create aesthetic, functional, xeriscaped, and shaded areas that people can use for relaxation, exercise, etc.
- Use native species to the greatest extent possible.

4.4 Outdoor Recreation

Outdoor recreation activities and public access policies are described in Section 2.6. Implementation of recreational programs requires careful assessment of potential effects with respect to air, noise, and water pollution; health and safety; security; and interference with military activities. Certain outdoor recreation opportunities at NAWS are, at their present level of activity, compatible with each other and NAWS missions. For example, petroglyph tours are allowed only when no testing is planned on the North Range and are conducted by trained tour guides who coordinate tours with the Safety and Security Department, Public Affairs Office, and EPO. Tour participants are briefed on procedures and proper behavior regarding resources (petroglyphs are particularly susceptible to damage by vandalism and inadvertent defacement) and the sensitive nature of missions at China Lake (photography is permitted only within Little Petroglyph Canyon). The below table lists activities that are compatible and incompatible with existing land use and safety, security, and environmental requirements.

Currently Authorized Activity and Area	Compatibility	Level of Environmental Impact
Camping		
Birchum Springs	Compatible**	Minimal
Petroglyph Tours		
Little Petroglyph Canyon	Compatible	Minimal
Other petroglyph areas	Compatible*	Minimal
Horseback Riding		
On ranges	Incompatible	Minimal
Corrals and vicinity	Compatible	Minimal
Picnicking		
Birchum Springs	Compatible	Minimal
Little Petroglyph Canyon	Compatible, during tours	Minimal
Off-road Vehicles		
Off-roads	Incompatible	Heavy
Historic trails	Incompatible	Heavy
Mirror Lake	Incompatible	Heavy
Radio Control (cars and airplanes)	Compatible**	Minimal
Land Sailing (Mirror Lake)	Incompatible	Moderate
Target Practice (archery, pistol, rifle, skeet)	Compatible**	Minimal
Biological*		
Birdwatching - waterfowl	Compatible	Minimal
Geological		
Coso Known Geothermal Resources Area tour	Compatible	Minimal
Rockhounding	Incompatible	Moderate
Hunting (chuckar and falconry)	Incompatible	Moderate

* Typically research related.
** Compatible at established sites.

Chukar hunts were held in the past after consultation with the CDFG and after determining adequate population levels of game. Funding, hunt control personnel, and environmental considerations were taken into account prior to a decision on allowing hunting. Numbers of hunters and areas opened to hunting were designed to maximize safety of hunters, to maintain proper security, and to afford protection to sensitive natural and cultural resources. Hunting has not been allowed since 1988.

Objective and Guidelines for Outdoor Recreation

Objective: Continue to evaluate opportunities for recreation on NAWS.

Guidelines:

- Periodically review appropriateness of instituting new recreation activities.
- Eliminate off-road vehicle use on NAWS land and land sailing and other recreational activities on dry lake playas.
- Maintain recreational opportunities on NAWS which do not impact operations, such as petroglyph tours, birdwatching on the wastewater treatment ponds, and other recreation not conducted on the ranges.

5.0 PLANNING AND ADMINISTRATION

Goal 3: *Provide for the organizational capacity, support, and communication linkages necessary for the successful implementation and administration of the INRMP and NAWS/CL's natural resources.*

5.1 Basewide Land Use and Environmental Planning

The INRMP establishes the baseline setting and condition of natural resources on NAWS-CL. From this baseline condition, the Plan identifies resources management needs, the proposed management focus, and prioritizes the management Objectives and Guidelines needed to ensure the long-term conservation and enhancement of the identified resource values.

A key element of the natural resources management program is the early identification of projects and programs that may affect sensitive resources. Close coordination with project planners and early identification of potential conflicts with natural resource management issues provides both the project planners and resource managers with the opportunity to jointly design and implement project plans in a manner that minimizes or eliminates adverse impacts. The primary means by which this is accomplished at NAWS-CL is through the environmental review process. This process has been designed to meet the requirements of the National Environmental Policy Act (NEPA) and has proven to be an effective tool to minimize impacts and support the military mission. The NEPA process is discussed in Section 5.1 below.

With the passage of the Sikes Act Improvement Act of 1997, INRMP's must be coordinated with the U. S. Fish and Wildlife Service and the State Department of Fish and Game. Integration with these agencies is essential since most resource values present on the Station are also significant management concerns on adjoining State and federal land. It is acknowledged that management of resources of mutual concern to NAWS and other agencies is often best accomplished by region-wide, mutually supporting management efforts. Cooperative resource planning efforts are discussed in Section 5.2 below.

5.1.1 National Environmental Policy Act Implementation

The National Environmental Policy Act (NEPA) was created to disclose environmental concerns with human activities and resolve them to the best degree possible. Implementing NEPA instructions (OPNAVINST 5090.1B, Chapter 2, *Procedures for Implementing the National Environmental Policy Act*) require mitigation of damage to the environment. NEPA was not legislated to stop actions. Rather, it was crafted to identify environmental problems, providing an opportunity to resolve them using planning at early stages of project development.

5.1.2 Responsibilities and Implementation

5.1.2.1 Responsibility

The Director of Environmental Programs, EPO, has primary responsibility for NEPA implementation at NAWS/CL. Responsibilities of the Director (NAWC-WDINST 5090.1) include:

- ensuring each action proposal is reviewed in a timely manner;
- completing and forwarding documentation for Categorical Exclusions (CE) and continuing action determinations to the action proponent and Office of Council;
- coordinating consultation and document preparation with the proponent for actions requiring an

Environmental Assessment (EA) or Environmental Impact Statement (EIS),
- assisting action proponents in development of an EA or EIS;
- routing environmental documentation through the Office of General Council as early as possible in the planning process;
- when appropriate, including the Public Affairs Office as early as possible in the planning process;
- serving as a member of the Environmental Review Board;
- forwarding EA and EIS documents to OPNAV via the chain of command;
- serving as a single point of contact with regulatory agencies while engaged in the NEPA process; and
- coordinating revisions and updates of the NAWC-WDINST 5090.1 Instruction.

5.1.2.2 NEPA Documentation

The most common NEPA document prepared for projects which impact natural resources is a CE. This simple documentation generally works well for routine projects. The Navy has 45 primarily facilities-oriented, separate, and distinct CEs listed in OPNAVINST 5090.1B. These include actions such as studies, data, and information gathering (bird counts, forest inventories, etc.); repair and maintenance of facilities and equipment; pre-lease exploration activities for oil, gas, or geothermal reserves; etc. that have been determined to have no significant, singular, or cumulative adverse environmental effects under normal circumstances.

Environmental Assessments are required when conditions for a CE are not met. This may happen when a new military mission is planned, when the action involves a wide geographic area, or when wetlands or other sensitive plant communities may be involved. The EA is used either to document a Finding of No Significant Impact (FONSI) or as the basis for requiring an EIS. Navy policy stipulates that the Head of the Systems Command must approve an EA and, if appropriate, issue a FONSI. EAs require a 30-day waiting period for public comment.

If an FONSI is not appropriate, the following options are available:

- Modify the action to remove significant impacts.
- Mitigate significant adverse impacts.
- Drop the action.
- Publish a Notice of Intent to prepare an Environmental Impact Statement.

Environmental Impact Statements must be prepared for actions that have been determined to have a substantial potential for significant effect on environmental quality and/or would result in significant environmental controversy. Navy policy states that the EIS must be approved by and a record of decision (ROD) issued by the Secretary of the Navy.

5.1.3 Mitigation

Mitigation is an option within the NEPA and OPNAVINST 5090.1B when a proposed action affects the environment. Mitigation is an excellent way to either consider less damaging options or provide means to off-set damage to the environment. Below are five general mitigation tactics:

Avoidance: Avoid adverse impacts on natural resources by not performing activities that would result in such impact. Confine construction to areas where no significant impact would occur to natural resources.

Limitation of action: Reduce the extent of an impact by limiting the degree or magnitude of the action. Minimize impacts of construction projects by arranging timing, location, and magnitude of actions so that they have the least impact on natural resources.

Restoration of the environment: Restore the environment to its previous condition or better. This could involve reseeding and/or replanting an area with native plants after it has been damaged by construction projects.

Preservation and maintenance operations: Design the action to reduce adverse environmental effects. This could involve actions such as monitoring and controlling pollution, contamination, disturbance, or erosion caused by construction projects that would impact natural resources.

Replacement: Replace the resource or environment that will be impacted by construction projects. Replacement can occur in-kind or otherwise, on-site, or at another location. This could involve creation of the same type or better quality habitat for a particular impacted fish or wildlife species or creation of habitat for another species.

Mitigation that is identified in a FONSI is a Class 1 "must fund" for environmental purposes. This provides a mechanism to fund mitigation included in NEPA documents. NAWS/CL may use this feature in 2000-2004.

5.1.4 NEPA and Natural Resources Management

The Environmental Project Office uses NEPA to ensure its activities (as described in this INRMP) are properly planned, coordinated, and documented. It also uses NEPA to identify problems associated with other organizations' projects which affect NAWS/CL's natural resources when it has the opportunity to review such projects.

Siting range-related projects is perhaps the most basic decision which requires input from EPO personnel. If this phase is done within the cooperative spirit of NEPA, most other environmental problems are generally resolved with relative ease. Decisions such as specific siting or mission planning should be cooperatively discussed prior to preparing NEPA draft documents.

An important offshoot of proper NEPA implementation is that projects are often enhanced by the effort. Siting is one of the most common examples of project enhancement. When natural resources managers understand mission/project requirements in terms of land features and requirements, they often not only offer more potential site options to mission or project planners but also offer alternatives to avoid future environmental conflicts.

5.1.5 NEPA and This INRMP

NAWS/CL has no NEPA documentation for the natural resources program as a whole. Effects of implementation of this INRMP are being documented through an EIS being prepared for the China Lake Comprehensive Land Use Management Plan which includes implementation of this INRMP. This INRMP can be referenced in descriptions of affected environment to reduce verbiage in other NEPA documents.

Objective and Guidelines for NEPA Implementation

Objective: Implement NEPA on NAWS/CL.

Guidelines:

- Use NEPA to identify projects and activities on NAWS/CL which might impact natural resources and work with project planners to resolve issues early in the planning process.
- Use NEPA to ensure this INRMP is documented according to the spirit and letter of NEPA.

5.2 Cooperative Resource Planning

5.2.1 Introduction

Species and project specific resource management efforts that are primarily restricted to NAWS-CL lands were discussed in Chapters 2 and 3. These efforts included day-to-day management efforts, site surveys, monitoring, data collection efforts, species and issue specific Section 7 consultations with the U.S. Fish and Wildlife Service, and joint on-Station programs with the BLM.

In addition to these NAWS specific management efforts the Station is also actively involved in a number of regional planning and natural resources management efforts. These efforts include development and implementation of endangered species Recovery Plans, the West Mojave Coordinated Management Plan, the North and East Mojave Planning Effort, and the Mojave Desert Ecosystem Program. Each of these regional planning efforts are discussed below.

Participation in these regional planning efforts by the EPO is facilitated through close coordination with the Land Use Planning Office (LUPO). The LUPO was established as the principal NAWS/CL point of contact for all on/off station land use issues and is responsible for assuring compatible land use development and minimization of mission-related constraints. LUPO responsibilities include the following:

- Serves as the chair for NAWCWPNS, China Lake, Land Use and Airspace Steering Committee working group;
- serves as the NAWCWPNS point of contact for all China lake encroachment issues (except airspace;
- serves as the lead for updating the NAWCWPNS, China Lake Land Use Master Plan;
- serves as the coordinator for the LEGACY Resources Management Program; and
- serves as the coordinator for the Western Mojave Coordinated Management Plan and Mojave Desert Ecosystem Program projects.

5.2.2 Endangered Species Recovery Planning Efforts

Desert Tortoise Recovery Plan. The desert tortoise *(Gopherus agassizii)* was listed as a threatened species in April 1990. The recovery plan outlining actions needed to recover and protect the species was finalized in 1994. The U.S. Fish and Wildlife Service (USFWS) designated critical habitat for the desert tortoise in 1994. A Desert Tortoise Habitat Management Area was established on NAWS/CL in 1992 and was reaffirmed in 1995 through the Section 7 Consultation process.

Inyo California Towhee Recovery Plan. On August 3, 1987 the U.S. Fish and Wildlife Service (USFWS) designated critical habitat for the Inyo California towhee *(Piplio crissalis eremophilus)* under Section 3(5)(a) of the Endangered Species Act. A Recovery Plan outlining actions believed to be required to recover and protect the Inyo California towhee was finalized by the USFWS in April 1998.

Mohave Tui Chub Recovery Plan. The Mohave tui chub *(Gila bicolor mohavensis)* was listed as a endangered species in 1970. A recovery plan (Taylor and Williams, 1984) containing inventory and monitoring techniques, minimum water levels, and recommended water quality standards was adopted in 1984 and the *Technical Approach for a Mohave Tui Chub Protection Plan*, which supplements it was drafted in 1991.

5.2.3 Other Regional Planning Efforts

California Desert Conservation Area Plan. Section 601 of FLPMA required the Bureau of Land Management (BLM) to develop a plan for long-term protection and administration of public lands in the California desert. FLPMA requires this plan, called the California Desert Conservation Area Plan, to take into account multiple use management and sustained yield principles in providing for resource use and development, including maintenance of environmental quality, rights-of-way, and mineral development. The California Desert Conservation Area Plan was finalized in 1980 and establishes general guidance for management of all BLM-administered lands in the California desert (U.S. Bureau of Land Management, 1997).

West Mojave Coordinated Management Plan.

The West Mojave Coordinated Management Plan is a comprehensive, interagency planning effort for the conservation of biological resources in the West Mojave region. In 1992 agencies within the West Mojave planning area established a multi-agency partnership for preparing this plan. The plan is a cooperative effort involving many different agencies:

- five military installations (NAWS China Lake, Edwards Air Force Base (AFB), Fort Irwin National Training Center (NTC), Marine Corps Logistics Base in Yermo, and Marine Corps Air Ground Combat Center (MCAGCC) Twentynine Palms);
- four federal managers (BLM, National Aeronautics and Space Administration at Goldstone, USGS Biological Resources Division, and Boron Prison);
- six State of California agencies (Department of Transportation, Energy Commission, California Department of Fish and Game, Department of Parks and Recreation, State Lands Commission, and the University of California Reserve System);
- one special district (Indian Wells Valley Water District);
- four counties (Inyo, Kern, Los Angeles, and San Bernardino); and
- 11 incorporated towns and cities (Adelanto, Apple Valley, Barstow, California City, Hesperia, Lancaster, Palmdale, Ridgecrest, Twentynine Palms, Victorville, and Yucca Valley).

The West Mojave Coordinated Management Plan[1] will provide a consistent and streamlined regional program for compliance with the California and federal endangered species acts. The product of the West

[1] Memorandum: Steering Committee Meeting; Proposed Task Group Process, to Steering Committee from Bill Haigh, Project Manager, August 14, 1998.

Mojave Plan will be programmatic incidental take permits and biological opinions, as appropriate, issued to participating cities, counties, and state and federal agencies (participating agencies) by the CDFG and the USFWS. Incidental take permits and biological opinions will set forth a program for mitigating and minimizing impacts to species listed as endangered, threatened, or rare under the California Endangered Species Act and the federal Endangered Species Act. Each incidental take permit or biological opinion will identify choices of mitigation measures which can be implemented by project proponents seeking discretionary permits from the participating agencies and/or mitigation fees. Plants and animals for which such measures and/or fees are required are said to be covered by the West Mojave Plan; that is, the CDFG and USFWS are providing coverage for that plant or animal. As a condition of receiving and maintaining a valid incidental take permit or biological opinion, each participating agency will contractually obligate itself to funding and implementing the West Mojave Plan by executing an implementing agreement with the CDFG and USFWS.

The West Mojave Plan is also developing measures to mitigate impacts to unlisted plants and animals. These can be adopted by participating agencies through the mechanism of pre-listing agreements. An agency which executes a pre-listing agreement with CDFG or USFWS is assured that in the event the species is later listed, no additional measures (barring unforeseen circumstances) will need to be adopted. From the time the pre-listing agreement is executed, the species involved receives coverage from CDFG and/or USFWS.

Northern and Eastern Mojave Planning Effort.

The Northern and Eastern Mojave Planning Effort will provide a regional perspective for the management of federal lands and will update agency-specific management plans to reflect changes made by the California Desert Protection Act of 1994. The Northern and Eastern Mojave interagency planning team consists of representatives from the National Park Service, BLM, and USFWS. Cooperating agencies include the Bureau of Indian Affairs; Fort Irwin NTC; NAWS China Lake; U.S. Army Corps of Engineers; U.S. Environmental Protection Agency; California Department of Fish and Game; California State Parks; California Department of Transportation; State Lands Commission; California State Historic Preservation Office; Nevada State Historic Preservation Office; San Bernardino, Inyo, and Mono counties in California; Clark, Nye, and Esmeralda counties in Nevada; and the Timbisha/Shoshone, Mojave, and Chemehuevi Native American Tribal Councils.
The Northern and Eastern Mojave (NEMO) planning area encompasses 7.9 million acres of public land, two million acres of BLM land adjacent to and between 5.9 million acres of National Park Service (NPS) land that includes the Death Valley National Park and Mojave National Preserve. The BLM and NPS are preparing separate management plans for the three management units to clarify each agency's alternatives and management objectives for each unit and reduce the size of the documents (BLM, 1998).

BLM's final planning document will result in an amendment to the California Desert Conservation Area Plan. The NPS is preparing a general management plan for the Mojave National Preserve and an environmental impact statement that will amend the amended general management plan for Death Valley National Park (BLM, 1998).

The seven major objectives involving BLM-managed public lands (BLM, 1998) are:

- protection and recovery of threatened and endangered species,
- management of lands affected by the California Desert Protection Act,
- cross-jurisdictional coordination with the NPS on issues of mutual concern,
- implementation of public lands health standards and guidelines,

- evaluation of zoning to protect sensitive resources identified during data analysis,
- evaluation of zoning to facilitate development adjacent to communities, and
- evaluation of new and existing Areas of Critical Environmental Concern.

Mojave Desert Ecosystem Program. The Mojave Desert Ecosystem Program (MDEP) is a multi-agency cooperative effort designed to assist Department of Defense, Department of Interior, and other participating agencies and organizations to accomplish their respective missions by providing a comprehensive data management framework to support informed land use and resource management decision making. The goal of the MDEP is to design and implement a database that is accessible through the world wide web to facilitate the collection, storage, transfer, and analysis of information regarding environmental resources, land uses, and issues related to maintaining biological diversity and ecosystem sustainability throughout the Mojave Desert ecoregion. Participants in the Mojave Desert Ecosystem Program include:

- Department of Defense: NAWS China Lake, Fort Irwin NTC, Edwards AFB, Nellis AFB, MCAGCC Twentynine Palms, and Marine Corps Logistics Base at Barstow; and
- Department of Interior: BLM, National Park Service, USFWS; USGS Biological Resources Division; U.S. Geological Survey; U.S. Bureau of Mines (U.S. Geological Survey, 1997).

5.3 Project Funding

Below are general discussions about different sources of funding to implement this INRMP. Many projects described in this INRMP are budgeted using the Environmental Program Requirements (EPR) Report. Below are sources of funds within the EPR system that are or may be used by NAWS/CL:

5.3.1 Forestry Funds

Forestry funds are generated from sale of forest products throughout the Department of Defense. Forestry funds are centrally controlled by the Department of the Navy. Funds must be spent for forest management, but installations are not required to generate forestry funds to apply for them. Thus, NAWS/CL is eligible for these funds.

The account is called the Forest Reserve Account. Funds must be used only for items directly related to management of the forest ecosystem. NAWS/CL is requesting funds to develop a forest ecosystem management plan.

5.3.2 Sikes Act Funds

Sikes Act funds are collected via sales of licenses to hunt or fish. They are authorized by the Sikes Act and may be used only for fish and wildlife management on the installation where they are collected. They have no year-end expenditure deadlines (unobligated funds carry over on 1 October). NAWS/CL has no Sikes Act funds except for $2,000 remaining from previous permit sales. No Sikes Act funds are anticipated during 2000-2004, unless security and safety conditions change to allow hunting on the installation, which is not anticipated.

5.3.3 Operations and Maintenance (Navy) Funds

Operations and Maintenance (Navy) (O&MN) funds are used for environmental projects including natural resources. Compliance with laws is the key to obtaining this funding. Funds are distributed from Naval Air Systems Command using the EPR process in the budget cycle/POM process. The Sikes Act requires implementation of the INRMP; thus projects are high priority for O&MN funding.

Operations and Maintenance (Navy) Projects*

Project	FY 00	FY 01	FY 02	FY 03	FY 04	Totals
Cattail Removal/Chub Habitat	$5	$10	$5	$10	$5	$35
Monitoring Chubs	$10	$10	$10	$10	$10	$50
Chub Habitat Enhancement	$40	$40	$40	$40	$40	$200
Towhee Dispersal/Habitat Utilization Study	$10	$10	$10	$75	$10	$115
Tortoise Post Fire Event (and other) Surveys	$10	$5	$5	$	$	$20
Waters/Wetlands Habitat Protection and Enhancement	$100	$100	$100	$50	$50	$400
Waters/Wetlands Monitoring	$10	$10	$10	$10	$10	$50
Waters/Wetlands Characterization and Mapping Surveys	$15	$10	$10	$10	$10	$55
Horse and Burro Roundup	$200	$100	$80	$60	$60	$500
Horse and Burro Density, Health, and Distribution Assessments	$20	$10	$10	$10	$10	$60
Locate and Map Two Species of *Astragalus*/Other Listed Species	$20	$15	$15	$15	$10	$75
Locate and Identify NAWS/CL-SC Flora	$20	$20	$20	$20	$20	$100
Baseline Wildlife Surveys	$20	$20	$20	$20	$20	$100
Determine Taxonomy of Voles and Other Questionable Wildlife	$15	$10	$10	$5	$5	$45
Bat Gates and Other Protective Measures	$20	$20	$10	$10	$10	$70
GIS Mapping of NAWS/CL-SC	$20	$10	$10	$5	$5	$50

Project	FY 00	FY 01	FY 02	FY 03	FY 04	Totals
Flora and Plant Communities						
GIS Mapping of NAWS/CL-SC Wildlife	$20	$10	$10	$5	$5	$50
Resources Inventory - Census/Survey	$50	$40	$30	$20	$20	$160
Resources Inventory - Database Management	$40	$20	$20	$20	$20	$120
Totals	$645	$470	$425	$395	$320	$2,255

* Funding in thousand of dollars.

The total O&MN Fund budget for this INRMP is estimated at $2,255,000 for 2000-2004. Budget estimates will be adjusted as needed each year.

Objective and Guidelines for Funding

Objective: Adequately fund natural resources planning initiatives.

Guidelines:

- Provide documentation to secure appropriate levels of in-house (overhead) funding to support natural resource management programs.
- Develop prioritized lists of proposed management efforts to facilitate accomplishment of programs required for compliance with legal mandates and best support the military mission.
- Develop long-range plans and supporting documentation to secure off-site funding.
- Continue to request funding from other agencies for programs of mutual benefit.
- Continue to support scientific, academic, and volunteer efforts to initiate or supplement natural resource management programs.

5.4 INRMP Implementation

This plan is only as good as NAWS/CL's capability to implement it. This INRMP was prepared with a goal of 100% implementation. Described below is the organization and personnel needed to implement programs described within this INRMP.

5.4.1 Organization

The Environmental Project Office (EPO) at NAWS/CL can implement most of this INRMP and fulfill goals and objectives established in Chapter 1. Other organizations identified in Chapter 1 are also capable of implementing their portions of this INRMP with no organizational changes, although they may elect to make changes during 2000-2004 for improved operations efficiency.

5.4.2 Personnel

"The management and conservation of natural and cultural resources under DoD control, including planning, implementation, and enforcement functions, are inherently governmental functions that shall not be contracted"

5.4.2.1 Staffing

The following staffing within EPO is required to implement this INRMP at NAWS/CL:

Environmental Project Office

Supervisory Environmental Protection Specialist
Fish and Wildlife Biologist (vacant)
Environmental Protection Specialist (NEPA)
Geologist
Botanist (vacant)

Objective and Guidelines for Staffing

Objective: Continue to adequately staff natural resource management programs.

Guidelines:

- Maintain in-house expertise.
- Provide the means for adequate staffing for those projects and programs not supportable by in-house staff.

5.4.2.2 Personnel Training

NAWS/CL plans to continue support for at least one person to participate in regional natural resources planning initiatives and recovery planning for listed species occurring on NAWS/CL. NAWS/CL plans to send at least one person to each of the following annual workshops or professional conferences:

National Military Fish and Wildlife Association annual workshop;
North American Natural Resources Conference;
Partners in Flight national, regional, and state meetings (generally in conjunction with other listed meetings); and
Desert Fishes Council annual meeting.

NAWS/CL will encourage and support at least one persons participation in efforts, such as the West Mohave and North and East Mohave planning initiatives as well as coordinating committees, particularly those dealing with endangered species issues or other species of concern, such as the Mohave tui chub, desert tortoise, and the Mohave ground squirrel. Other conferences/workshops will be evaluated for their usefulness, and decisions will be made based on appropriateness to ongoing projects and funding availability. Projects which are especially useful are GPS, GIS, and endangered species training.

The Wildlife Society and National Military Fish and Wildlife Association are among the professional societies applicable to meeting the needs of NAWS/CL's natural resources managers. Membership in these societies is encouraged. They have some of the best scientific publications in their professions, and literature review is a necessary commitment to maintain standards. Attending meetings of these societies provides excellent opportunities to communicate with fellow professionals as well as maintain professional standards.

Objective and Guidelines for Personnel Training

Objective: Continue to improve the success of natural resources management activities through professional development and information exchange.

Guidelines:

- Maintain staff knowledge of management strategies at the current state of the art through training and participation in or hosting workshops, research presentations, and other activities of regional, interstate, and international professional natural resources research and conservation programs.
- Share information with natural resources experts to ensure maximum benefits of adaptive management and research efforts.

5.4.3 External Assistance

The rapid development of natural resources management, combined with Navy personnel limits, have resulted in the need for outside assistance with natural resources programs on NAWS/CL. The station has used its partnerships in a variety of ways, but particularly for wildlife and vegetation research. The growth of environmental compliance requirements has increased many of these needs and added considerably to the need for partners in other areas, including on-the-ground personnel support.

5.4.3.1 Support Mechanisms

5.4.3.1.1 Volunteers

Volunteers are a valuable source of personnel assistance at NAWS/CL. Volunteers tend to "come and go", and the potential to lose valuable information exists. The best example of a volunteer project on NAWS/CL is the Kerncrest Chapter of the Audubon Society's continuing efforts to document avian use of the Wastewater Treatment Facility. Volunteers will continue to be an opportunistic source of assistance in 2000-2004.

5.4.3.1.2 Other Agencies

NAWS/CL recognizes the importance of cooperating with federal and State agencies in addition to private organizations. Chapter 1 identifies other agencies and organizations with whom NAWS/CL has cooperatively worked in recent years. These organizations, particularly this INRMP's signatory partners (USFWS and CDFG), BLM, NPS, Army Corps of Engineers (ACOE), and SWDIV will continue to assist with implementation of various aspects of this INRMP during the next five years.

5.4.3.1.3 University Assistance

Universities are an excellent source of research assistance. NAWS/CL has used several universities in recent years to help with specialized needs, such as the University of California, Riverside (invertebrate surveys) and the University of Nevada, Reno (mountain quail research). These are the most likely sources of assistance with implementation of this INRMP during 2000-2004.

5.4.3.1.4 Contractor Support

NAWS/CL may use outside contractors for support in an ever-growing list of project areas. Contractors give the station access to a wide variety of specialties and fields. Contractors are involved in projects such as NEPA documentation, vegetation surveys, spring and water source surveys and evaluations, species surveys (invertebrates, vertebrates, bats, and slender salamanders), management plans, and similar activities.

5.4.3.2 Planned External Support

The table below outlines needed external support projects in three priorities. In 2000-2004 many of these projects will be determined by funding availability.

2000-2004 Natural Resources External Support Project Needs

Project	Priority*	Agency	Completion	Comments
Chub, tortoise, towhee management support	1	USFWS and Contractor	Indefinite	Planned
Tortoise population trend analysis	2	Contractor	1999	Planned one-year study
Vegetation surveys	1	Contractor	Various Projects	Planned; various studies
Invertebrate/butterfly survey	2	UC Riverside	Indefinite	Ongoing
Herpetological survey	2	Contractor	1999-00	Planned
Mountain quail study	2	U Nevada, Reno	Indefinite	Ongoing
Bat survey (follow up)	2	Contractor	1999-00	Planned
Burro/horse removal	1	BLM	Indefinite	Ongoing
Grazing administration	1	BLM	Indefinite	Ongoing
Grazing study	1	Contractor	1999-00	Planned
GIS support	1	Contractor	Indefinite	Planned
Cultural resources surveys**	2	Contractor	Indefinite	As needed

* 1 Needed as soon as possible for immediate management application.
2 Useful for improving management to a significant degree over a long period.
** As needed for natural resources management.

Objective and Guidelines for External Assistance

Objective: Use external assistance as needed.

Guidelines:

- Provide and support research and other studies to support NAWS/CL natural resources management.
- Provide personnel to manage certain aspects of the NAWS/CL natural resources program.
- Provide logistics and administrative support for various NAWS/CL natural resources programs.

5.4.4 Summary of INRMP Objectives

Below are the specific objectives within this INRMP (sections identified within Chapters 3-5) in the order discussed. This list serves as a broad checklist to measure implementation of this INRMP. Most below objectives have multiple guidelines for specific implementation. These guidelines (within each section) can be used as a specific checklist for INRMP implementation.

Threatened and Endangered Species in General (3.2.1)
Objective: Maintain viable populations of threatened and endangered species on NAWS/CL and maintain compliance with Endangered Species Act requirements.

Mohave Tui Chub (3.2.1.1)
Objective 1: Maintain a viable population of the Mohave tui chub in the Lark Seep system.
Objective 2: Complete long-term habitat monitoring.
Objective 3: Provide support and take actions favoring Mohave tui chub recovery and/or listing downgrading by the USFWS.

Desert Tortoise (3.2.1.2)
Objective 1: Maintain a viable population of desert tortoises on NAWS/CL.
Objective 2: Support recovery plan efforts to establish stable tortoise populations and eventual delisting.

Inyo California Towhee (3.2.1.3)
Objective 1: Ensure long-term population viability of the Inyo California towhee.
Objective 2: Continue to resolve baseline, biological data gaps and continue habitat enhancement.
Objective 3: Support recovery plan efforts to establish stable towhee populations or eventual delisting.

NAWS/CL-SC Flora (3.2.2.1.2)
Objective: Continue to research NAWS/CL-SC flora to provide a better understanding of such species and remain an active participant with other agencies relative to NAWS/CL-SC flora.

Non-resident Birds (3.2.2.2.2)
Objective: Ensure long-term viability of State- and federal-listed bird species and their habitats.

Giant Fairy Shrimp (3.2.2.2.3)
Objective: Protect giant fairy shrimp known and potential habitats and continue research on the species.

Butterflies (3.2.2.2.3)
Objective: Determine the distribution of NAWS/CL-SC butterflies and their respective host species.

Reptiles and Amphibians in General (3.2.2.2.4)
Objective: Protect known and potential habitats and continue research to fill biological data gaps.

Slender Salamander (3.2.2.2.4)
Objective: Determine if slender salamanders are present; if so, determine their taxonomy and delineate special procedures to protect this highly specialized and habitat-restricted species.

Birds (3.2.2.2.5)
Objective 1: Provide protection and enhancement of habitats used by waterfowl and other water-dependent bird species.
Objective 2: Provide protection and enhancement of habitats used by raptors.
Objective 3: Identify and protect areas important to water-dependent and upland bird species.
Objective 4: Reduce bird/animal aircraft strike hazards (BASH).
Mammals in General (3.2.2.2.6)
Objective: Maintain viable populations of mammal species on NAWS/CL.

Bats (3.2.2.2.6)
Objective: Maintain colonies of NAWS/CL-SC bats.

Habitat Conservation (3.3)
Objective 1: Continue programs to minimize unnecessary impacts and protect known and potential habitats to the maximum extent practicable.
Objective 2: Develop an accurate and precise database for sensitive, interesting, or protected habitats, particularly those associated with NAWS/CL-SC.

Wildland Fires (3.3.1)
Objective: Minimize impacts to intact plant habitats and sensitive plant taxa from wildfires.

Revegetation (3.3.2)
Objective: Compile information on revegetation of desert environments to determine success and applicability to NAWS/CL and perform revegetation projects as necessary.

Exotic Plant Control (3.3.3)
Objective 1: Remove high priority exotic species, such as tamarisk, and monitor and evaluate the necessity for removal of other species.
Objective 2: Manage roads and access routes to minimize the spread of exotic species, establishment of nondesignated roads, and protect sensitive species.

Water Resources (3.4)
Objective 1: Achieve full compliance with requirements of the Clean Water Act.
Objective 2: Continue to inventory, protect, and enhance springs, seeps, other water sources, and associated adjacent habitats.

Grazing and Pest Control (3.5)
Objective: Manage feral and domestic herbivores within the capacity of NAWS/CL's resources.

Horses (3.5.1)
Objective 1: Maintain a herd size of 168 horses so that the need to remove large numbers of animals can be avoided and environmental damage minimized.
Objective 2: Ensure good herd health, genetic diversity, and good individual horse appearance and conformation and re-establish a more natural herd age-class structure.
Objective 3: Initiate a program to facilitate recovery of forage areas and water sites, minimize adverse environmental impacts, and protect high value areas, such as water sources and riparian areas.
Objective 4: Develop a horse herd management plan in concert with BLM to resolve issues such as protection of springs and riparian zones, conflicts with cattle grazing, construction of security and cattle drift fences, safety and security concerns, and funding constraints.

Burros (3.5.1)
Objective 1: Continue to conduct roundups and adoption of burros until the designated management goal of zero burros is attained.
Objective 2: Continue to protect water sources and riparian areas.

Cattle (3.5.1)
Objective 1: Develop a short-term grazing management program that identifies and corrects identified current grazing management program deficiencies.
Objective 2: Continue efforts designed to access impacts, constraints, mitigation, and appropriateness of cattle grazing operations on NAWS/CL.

Pest Control (3.5.2)
Objective: Create a clean and safe environment within airfield hangers by keeping the number of rock doves and European starlings to a minimum.

Inventory of Flora (3.6.2)
Objective 1: Inventory plant taxa according to the priorities listed below (priorities are relative to seasonal factors).
Objective 2: Continue to resolve baseline biological data gaps.

Inventory of Fauna (3.6.2)
Objective: Continue to resolve baseline, biological data gaps.

Data Management (3.6.3)
Objective: Continue to develop and maintain NAWS/CL's data management capabilities.

Military Mission and Environmental Compatibility (4.1)
Objective: Ensure no net loss in military mission support capabilities while pursuing environmental conservation and protection needs.

Commercial Forestry and Agriculture (4.2)
Objective: Protect and manage NAWS/CL forest areas.

Landscaping and Grounds Maintenance (4.3)
Objective: Consider environmental factors in landscape planning.

Outdoor Recreation (4.4)
Objective: Continue to evaluate opportunities for recreation on NAWS.

NEPA Implementation (5.1.5)
Objective: Implement NEPA on NAWS/CL.

Funding (5.3)
Objective: Adequately fund natural resources planning initiatives.

Staffing (5.4.2.1)
Objective: Continue to adequately staff natural resource management programs.
Personnel Training (5.4.2.2)
Objective: Continue to improve the success of natural resources management activities through professional development and information exchange.

External Assistance (5.4.3)
Objective: Use external assistance as needed.

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APPENDIX A: Vegetation at Naval Air Weapons Station China Lake

References to sections within this Appendix are related to sections of the Integrated Natural Resources Management Plan for Naval Air Weapons Station China Lake, California.

Table of Contents

SECTION 2.3.1.1 Floristic Influences

Floristic regions are characterized by less common, regionally restricted plants and are indicative of recent trends in plant evolution and climate changes. Understanding their extent and their indicators help field botanists and biologists identify potential areas for unusual, endemic, or sensitive species. Unlike plant communities, they are often visually indistinct and usually encompass many plant community types. The two major floristic influences at NAWS are the Great Basin and Desert Floristic provinces. Also, the California Floristic Province is a major province to the west of NAWS which has affected the flora of the Coso Mountains.

Great Basin Floristic Province

The southern boundary of the Great Basin Province is well defined at NAWS by lower elevation distributions of big sagebrush *(Artemisia tridentata),* bitterbrush (*Purshia tridentata* var. *glandulosa),* sticky-leafed rabbitbrush *(Chrysothamnus viscidiflorus),* and Mormon tea *(Ephedra viridis).* This boundary occurs at elevations of 4,500-5,500 feet mean sea level (msl), from northwestern Coso Range east of Haiwee Reservoir, southeast to Louisiana Butte, upper Mountain Springs Canyon, and ending near Moscow Spring and Argus Peak. From this southern boundary the characteristic Great Basin species of NAWS extend for hundreds of miles to the north and northeast, including Washington, Wyoming, and Colorado. Many common Great Basin species also appear in the Sierra Nevada Mountains to the west and occupy a narrow strip in the peninsular range as far south as the San Pedro Martir Range in Baja California. However, in the California desert region, the Coso-Argus ranges are probably the southwestern boundary of the Great Basin Province.

Desert Floristic Province

Most of NAWS land, often characterized by sparse perennial vegetation and numerous annual species in years of increased rainfall, is typical of the Desert Floristic Province, which extends for hundreds of miles east and south. Long durations of freezing temperatures are a strong limiting factor for many Desert floristic species. This area is well defined by the distribution of creosote bush *(Larrea tridentata).* Other species associated with creosote bush vary with local regions and desert subdivisions. Burrobush *(Ambrosia dumosa)* is perhaps the most characteristic species associated with creosote bush in the Mojave region. Associations of creosote bush and burrobush dominate wide areas of valleys between mountain ranges of the Mojave Desert.

With increases in elevation, surface moisture, or alkalinity, numerous other scrub species appear, most of which have broad ranges throughout the desert Southwest. Some wide-ranging shrubs known from NAWS include cheesebush (*Hymenoclea salsola*), thornbush (*Lycium andersonii*), ratany (*Krameria erecta*), bladder sage *(Salazaria mexicana),* and allscale saltbush *(Atriplex polycarpa).* Playas and alkaline basins are particularly typical of the Mojave Desert. These basins are ringed by various minor plant communities relating to hydro-alluvial gradients, with saltbush *(Atriplex* sp) usually being the dominant cover.

Minor Floristic Regions and Subregions

In addition to the major floristic regions, NAWS vegetation is further influenced by local floristic subregions. Nearby floristic areas or subregions west of NAWS (Hickman, 1993) include the West Mojave, Southern Sierra Nevada, Eastern Sierra Nevada, Inyo-White Mountains, East

Mojave/Death Valley, and Central Mojave subregions, which are desert-transitional versions of the California Floristic Province. These subregions are characterized by diverse annual and herbaceous plant species. These subregions are described below.

West Mojave Subregion

The West Mojave Subregion is extreme among California's floristic areas in the ratio of abundant annuals to sparse perennials. At NAWS this area has a moderate influence in the West Superior Valley to the Black Hills area of the South Range. Plants at NAWS that characterize this floristic area include desert candle (*Caulanthus inflatus*), alkali goldfields (*Lasthenia california*), leafy-stemmed coreopsis (*Coreopsis calliopseda*), angle-stemmed buckwheat (*Eriogonum angulosum*), chickpea lupine (*Lupinus microcarpus*), spineplant (*Chorizanthe watsonii*), and Mojave buckwheat (*Eriogonum mohavense*).

Southern Sierra Nevada Subregion

The Southern Sierra Nevada Subregion includes desert transition areas from Mojave to Little Lake. It has a number of rare and unique species. Influences to NAWS flora are found in the Inyokern area and the western Coso Mountains. Several characteristic species extend their eastern range at NAWS, including Charlotte's phacelia (*Phacelia nashiana*), Modoc gilia (*Gilia modocensis*), Coulter jewelflower (*Caulanthus coulteri*), bush mallow (*Malcothamnus fremontii*), bush penstemon (*Keckiella breviflora*), and xantus spineplant (*Chorizanthe xanti*).

Eastern Sierra Nevada Subregion

The Eastern Sierra Nevada Subregion is contiguous with the Southern Sierra Nevada Subregion and is characterized by granitic-adapted species of conifer woodlands and Great Basin scrub. Influences at NAWS occur in the northern Coso Mountains with species such as magnificent lupine (*Lupinus magnificus* var. *glarecola*), crowned muilla (*Muilla coronata*), DeDecker's clover (*Trifolium macilentum* var.*dedeckerae*), mono penstemon (*Penstemon monoensis*), and horkelliella (*Horkelliella congdonis*).

Inyo-White Mountains Subregion

Nearby floristic areas or subregions to the north of NAWS are mostly subsets of the Great Basin Floristic Province. Flora at the north boundaries of NAWS are influenced by the Inyo-White Mountains Subregion. This Subregion contributes unique plant taxa to the northern Coso Mountains, and, to a lesser extent, the northern Argus Range. Characteristic species known to occur at NAWS include Prince's plume (*Stanley elata*), Owens Valley penstemon (*Penstemon patens*), showy penstemon (*P. speciosus*), Inyo rock cress (*Arabis inyoensis*), chocolate drops (*Caulanthus pilosus*), Kennedy buckwheat (*Eriogonum kennedyi* ssp. *purpusii*), bush penstemon (*Keckiella rothrockii*), Darwin milk-vetch (*Astragalus atratus* var. *mensanus*), Case locoweed (*Astragalus casei*), Indian parsley (*Cymopterus aboriginum*), and Inyo hulsea (*Hulsea vestita ssp. inyoensis*).

East Mojave/Death Valley Subregion

The Death Valley Floristic Subregion (not recognized by the Jepson Manual) is a subset of the East Mojave Subregion. Lower elevations can further be considered a subset of the Desert Floristic Province, while higher elevations are often characteristic of the Great Basin Province, especially the limestone ranges. The Panamint Mountains have several species that are rare in California but widespread in Nevada and Utah. The Death Valley Floristic Subregion is best characterized by numerous unique and highly adapted, low-growing, perennial species, many endemic to carbonate formations.

Along with more widespread species associated with the East Mojave Subregion, these two floristic influences have a distinct, but limited, effect on northeastern regions of NAWS, especially in the eastern Argus Range, northern Slate Range, and southern Panamint Valley, usually where limestone is present. Plants at NAWS that characterize these floristic areas include Utah fendlerella (*Fendlerella utahensis*), evening primrose (*Oenothera caespitosa ssp. crinita*), pagoda buckwheat (*Eriogonum rixfordii*), tall perityle (*Perityle megalocephala*), Panamint parsley (*Cymopterus panamintensis*), weasel phacelia (*Phacelia mustelina*), reticulated goldeneye (*Viguiera reticulata*), littleleaf mahogany (*Cercocarpus intricatus*), cliff rose (*Purshia mexicana*), and Death Valley sand mat (*Chamaesyce parishii*). Most potential rare plant species at NAWS would be associated with this region, most of which is limited to boundary areas.

Central Mojave Subregion

A weakly defined Central Mojave Subregion is near Barstow, to the southeast. Though less unique overall, it has some localized, highly endangered species. Indigo bush (*Psorothamnus arborescens* var. *arborescens*) is a taxa frequent in the South Range of NAWS that is endemic to this subregion. Lane Mountain locoweed (*Astragalus jaegerianus*) is a very rare and endangered species of this Subregion which occurs close to NAWS.

SECTION 2.3.1.2a Plant Community Formations, Series, and Associations

Formation refers to the structure and canopy of vegetation (Woodland, Scrubland, Wetland, etc.). Vegetation formations at NAWS range from dry and riparian woodlands to barren salt flats and alkaline wetlands. Scrub formations occupy the greatest percentage of NAWS. Woodland formations occupy the second greatest percentage, resulting from significant areas of pinyon pine woodland in northern Coso and Argus ranges. There are many areas at NAWS with varying geology that are devoid of woody plants. Vegetation formations in these areas are seasonal in appearance and mostly restricted to a vegetation cover of annuals or herbaceous perennials.

Series are named and classified after a prominent species that dominates the upper canopy cover. NAWS has several characteristic vegetation series including creosote bush, sagebrush, pinyon pine, blackbrush, and saltbushes (allscale, shadscale, desert holly, Parry saltbush, and spinescale). This is the level at which most common plant communities are named along with the formation type; for example Creosote Bush Scrub, Sagebrush Scrub, and Pinyon Pine Woodland.

Associations are named and classified after localized associations of one or more cover species. Associations often vary with changes in topography and geology and are usually the smallest subsets in plant classification systems. There are numerous associations within NAWS vegetation series commonly including Creosotebush-Burrobush, Sagebrush-Mormon Tea-Bitterbrush, Pinyon-Sagebrush, and Allscale/Bush seepweed. The Creosote Bush-Burrobush Association is the most widespread at NAWS and occupies more acreage than most series types at NAWS. Single species covers are also considered associations when they are subsets of a more prominent plant community. Common single species associations at NAWS include iodine bush, Indigo bush, cheesebush, and Mormon tea.

Several systems for classification of plant communities suitable to NAWS vegetation have been published. Though general classes are similar to NAWS vegetation, most descriptions for units are uncharacteristic of shrub and herbaceous cover compositions common to NAWS and do not include some locally important plant formations. The largest visually distinct units of vegetation at NAWS appear to be most similar to the system created by Holland (1986). The California Natural Diversity Database (CNDDB) uses this classification for plant community records, global lists, and state plant community sensitivity rankings for recognized California types.

SECTION 2.3.1.2b NAWS Plant Community System

Plant Community	Defining Species	Associated Species
Pinyon Woodland	Pinyon pine, *Pinus monophylla*	*Artemisia tridentata, Ephedra viridis, Purshia tridentata, Tetradymia canescens, Ribes velutinum, Chrysothamnus viscidiflorus*
Great Basin Mixed Scrub	Bitterbrush, *Purshia tridentata* var. *glandulosa*	*Artemisia tridentata, Ephedra viridis, Chrysothamnus viscidiflorus, C. nauseosus, Yucca brevifolia*
Sagebrush Scrub	Big Sagebrush, *Artemisia tridentata*	*Ephedra viridis, Purshia tridentata, Chrysothamnus viscidiflorus, Salvia dorrii*
Blackbrush Scrub	Blackbrush, *Coleogyne ramosissima*	*Yucca brevifolia, Ephedra viridid, Chrysothamnus teretifolius, Ericameria linearfolia*
Joshua Tree Woodland	Joshua tree, *Yucca brevifolia*	*Coleogyne ramosissima, Artemisia tridentata,* and many common shrubs
Desert Transition Scrub	Showy goldenbush, *Ericameria linearfolia*	*Tetradymia axillaris, Penstemon incertus, Ephedra* ssp., *Coleogyne ramosissima, Yucca brevifolia, Lupinus excubitus*
Mojave Mixed Scrub	Bladder sage, *Salazaria mexicana*	*Yucca brevifolia, Eriogonum fasiculatum, Coleogyne ramosissima, Lycium cooperi, L. andersonii, Chrysothamnus teretifloius, Ephedra nevadensis, Psorothamnus arborescens, Hymenoclea salsola, Ericameria cooperi, Achnatherum speciosum*
Hop-sage Scrub	Spiny Hop-sage, *Grayia spinosa*	*Atriplex canescens, Menodora spinescens, Ericameria cooperi, Atriplex confertifolia, Lycium andersonii, Coleogyne ramosissima, Hymenoclea salsola*
Shadscale Scrub	Shadscale, *Atriplex confertifolia*	*Atriplex spinescens, Grayia spinosa, Lycium andersonii, Lepidium fremontii, Stanleya* ssp.
Mojave Wash Scrub	Cheesebush, *Hymenoclea salsola*	*Senna armata, Lepidospartum squamatum, Chrysothamnus paniculatus, Atriplex polycarpa, Lycium cooperi, L. andersonii*
Mojave Sand Field	Clonal Creosote bush rings, *Larrea tridentata*	*Astragalus lentiginosus, Oenothera deltoides, Eriastrum densifolium, Stillingia paucidentata, Nicolletia* spp.
Creosote Bush Scrub	Creosote bush, *Larrea tridentata*	*Ambrosia dumosa, Acamptopappus sphaerocephalus, Lycium andersonii, Hymenoclea salsola, Senna armata, Atriplex* spp.
Desert Holly	Desert holly, *Atriplex hymenolytra*	*Larrea tridentata, Atriplex* spp., *Ambrosia dumosa*
Saltbush Scrub	Allscale, *Atriplex polycarpa*	*Atriplex spinescens, A. confertifolia*
Alkaline Sink Scrub	Bush seepweed, *Suaeda moquinii*	*Allenrolfea occidentalis, Atriplex parryi, A. Confertifolia, Tetradymia glabrata, Kochia californica, Lepidium fremontii, Machaeranthera carnosa*
Seasonal Pools and	Stinkweed,	*Amsinkia tessellata, Sisymbrium* spp., *Chamomilla*

Plant Community	Defining Species	Associated Species
Playas	*Cleomella obtusifolia*	*occidentalis, Atriplex phyllostegia, Ceomella* ssp.
Riparian	Arroyo willow, *Salix lasiolepis*	*Salix exigua, L. laevigata, Forestiera pubescens, Baccharis serilloides, Juncus* ssp., *Rosa woodsii, Mimulus* ssp., *Solidaga* ssp., *Leymus triticoides, Phragmites australis, Scirpus* ssp., *Eleocharis* ssp., *Polypogon monspeliensis, Artemisia dracunculus, A. ludoviciana, Typha* ssp., *Districhlis spicata*
Disturbed Plant Associations	Tumbleweed, *Salsola* spp.	*Tamarix ramosissima, Atriplex* ssp., *Chrysothamnus nauseosus, Eriogonum* spp., *Lupinus* spp., *Astragalus* spp., *Hymenoclea salosa, Bromus* ssp., *Brassica* ssp., *Sisymbrium* spp., *Schismus, Amsinkia, Erodium cicutarium, Kochia scoparia, Ambrosia acanthicarpa, Distichlis spicata*

Rankings for CNDDB Terrestrial Plant Communities Similar to Those Known on NAWS

NAWS Plant Community Type	Holland, 1986. (Or other) Terrestrial Natural Communities	Holland CNDDB Rank
Pinyon Woodland	72122 Great Basin Pinyon Woodland - 304: Sinpinyon	G3 S3.2
Great Basin Mixed Scrub	35100 Great Basin Mixed Scrub - 107: Bitterbrush	G4 S4
Sagebrush Scrub	35210 Big Sagebrush - 100: Bigsagebrush	G4 S4
Blackbrush Scrub	34300 Blackbrush Scrub - 108: Blabrush	G3 S3.2
Joshua Tree Woodland	73000 Joshua Tree Woodland - 168: Jostree	G4 S3.2
Desert Transition Scrub	Transition Desert Category (Beatley, 1976)	G3 S3.2*
Mojave Mixed Scrub	34210 Mojave Mixed Woody Scrub - 168: Jostree	G3 S3.2
Hop-sage Scrub	Hop-sage Series (Sawyer and keeler-Wolf, 1995)	G4 S3.2*
Shadscale Scrub	36140 Shadscale Scrub - 199: Shadscale	G4 S3.2
Mojave Wash Scrub	63700 Mojave Desert Wash Scrub - 193: Scalebroom	G3 S2.1
Mojave Sand Field	22300 Stabilized and Partially Stabilized Desert Sand Fields	?
Creosote Bush Scrub	34100 Mojave Creosote Bush Scrub - 145: Crebuswhibur	G4 S4
Desert Holly	Desert-holly Series (Sawyer and Keeler-Wolf, 1995)	G3 S3.2*

NAWS Plant Community Type	Holland, 1986. (Or other) Terrestrial Natural Communities	Holland CNDDB Rank
Saltbush Scrub	36110 Desert Saltbush Scrub - 173: Mixsaltbush	G3 S3.2
Alkaline SinkScrub	36120 Desert Sink Scrub - 118: Busseepweed	G3 S2.1
Seaseonal Pools and Playas	46000 Alkali playa Communities	G3 S2.1

* CNDDB rank for nearest Holland type.

Global Rank: The global rank is a reflection of the overall condition of an element throughout its global range.

Gl = Less than 6 viable element occurrences or less than 1,000 individuals or less than 2, 000 acres.

G2 = 6-20 element occurrences or 1,000 -3,000 individuals or 2, 000 - 10,000 acres.

G3 = 21-100 element occurrences or 3,000-10,000 individuals or 10, 000 - 50,000 acres

G4 = Apparently secure; this rank is lower than G3 but factors exist to cause some concern; i.e., there is some threat, or somewhat narrow habitat.

G5 = Population or stand demonstrably secure to ineradicable due to being commonly found in the world.

CNDDB rank for nearest Holland type.

State Rank: The state rank is assigned much like the global rank, except state ranks in California often also contain a threat designation attached to the "S" rank.

S1 = Less than 6 element occurrences or less than 1,000 individuals or less than 2,000 acres.

- Sl.l = Very threatened
- Sl.2 = No current threats known
- Sl.3 = Very threatened

S2 =6-20 element occurrences or 1,000 -3,000 individuals or 2,000 - 10,000 acres.

- S2.1 = Very threatened
- S2.2 = No current threats known
- S2.3 = Very threatened

S3 = 21-100 Element occurrences or 3,000-10,000 individuals or 10,000 - 50,000 acres.

- S3.1 = Very threatened
- S3.2 = No current threats known
- S3.3 = Very threatened

S4 = Apparently secure within California; this rank is clearly lower than S3 but factors exist to cause some concern; i.e. there is some threat, or somewhat narrow habitat. No threat rank.

S5=- Demonstrably secure to ineradicable in California. No threat rank.

Examples for NAWS (1996), Holland (1986), and Munz (1974) and other classifications as noted.

SECTION 2.3.1.2c Distribution and Percentages of NAWS Occupied by Each Plant Community

Plant Community	% North Range	% South Range	% Total
Pinyon Woodland	7	0	3.5
Great Basin Mixed Scrub	8	0	4
Sagebrush Scrub	3	0	1.5
Blackbrush Scrub	8	4	6
Joshua Tree Woodland	8	2	5
Desert Transition Scrub	8	1	4.5
Mojave Mixed Scrub	20	40	30
Hop-sage Scrub	3	1	2
Shadscale Scrub	2	0	1
Mojave Wash Scrub	1	5	3
Mojave Sand Field	5	1.5	3.25
Creosote Bush Scrub	10	33	21.5
Desert Holly	1	3	2
Saltbush Scrub	5	5	5
Alkaline Sink Scrub	4	2	3
Seasonal Pools and Playas	3	1	2
Riparian	1	.5	.75
Barren Geology	2	1	1

SECTION 2.3.1.2d Plant Community Descriptions

Pinyon Woodland

Community Definition

Pinyon Woodland at NAWS is defined where pinyon pine (*Pinus monophylla*)grows in moderate to dense stands, usually above 6,500 feet msl on north slopes, drainages, and peaks of the Coso and Argus ranges. Argus Peak is unique at NAWS, having an extensive stand of pinyon pine below 6,000 feet msl on north slopes. Above 7,500 feet msl pinyon pine at NAWS is usually dense and dominant regardless of geology or aspect. Big sagebrush, Mormon tea, and bitterbrush are the most frequent associates in Pinyon Woodland. Other tall shrubs or trees, including one-seeded juniper (*Juniperus osteosperma*), Joshua tree (*Yucca brevifolia*), serviceberry (*Amelanchier utahensis*), buckbrush (*Ceanothus greggii* ssp. *vestitus*), plateau gooseberry (*Ribes velutinum*), and horsebrush (*Tetradymia canescens*), are frequently associated with Pinyon Woodland.

Minor Perennial Species

Where pines are dense, subshrubs, perennial herbs and grasses tend to be sparse. Understory diversity increases rapidly with small openings in the pine canopy, especially in rocky areas. These may include sticky-leaved rabbitbrush, Nevada goldeneye (*Heliomeris multiflora*), purple sage (*Salvia dorii*), campion (*Silene verecunda*), pennyroyal (*Monardella linoides*), hawksbeard (*Crepis occidentalis*), prickly phlox (*Leptodactylon pungens*), various parsley species (*Lomatium* sp.), perennial lupines (*Lupinus magnificus* and *L. argenteus*), buckwheat species (*Eriogonum microthecum, E. wrightii, E. panamintense*, and *E. umbellatum*), and one-sided bluegrass (*Poa secunda*). In Pinyon Woodland of the northern Argus Range, freckled milk-vetch (*Astragalus lentiginosus* var. *fremontii*) is very abundant on dry slopes, ridges, and disturbed areas.

Annual Species

Annual plant species in NAWS Pinyon Woodland can be representative of many other plant communities. Mojavean annuals are the most frequent types. Characteristic species that prefer Pinyon Woodland include miner's lettuce (*Claytonia parviflora*), Douglas pincushion (*Chaenactis douglasii*), fine oxytheca (*Oxytheca dendroidea*), flower baskets (*Mentzelia congesta*), dwarf phacelia (*Phacelia curvipes*), whisker brush (*Linanthus ciliatus*), least snapdragon (*Antirrhinum kingii*), and goosefoot (*Chenopodium fremontii*). With exception of miner's lettuce, these annuals are uncommon when compared to Mojavean species found in Pinyon Woodland. Cheatgrass (*Bromus tectorum*) is an introduced weed that dominates much of the annual cover in Pinyon Woodland and other plant communities.

Transition Sequence

In more open areas of Pinyon Woodland, the understory is very typical of the Great Basin Mixed Scrub plant community. Pinyon Woodland at NAWS is usually surrounded by or intermixed with Great Basin Mixed Scrub. On Argus Peak, Mojave Mixed Scrub occurs in close proximity to Pinyon Woodland. In many areas of the Southwest, pinyon pine is adjacent to or intermixed with juniper-dominated plant communities. On NAWS however, juniper is uncommon and restricted to sparse, scattered stands in the northern Coso Range. Pinyon pine do not occur on South Range.

Unique Associations

Unique plant associations within Pinyon Woodland at NAWS include the Snowberry (*Symphoricarpos longiflorus*)-Solomons Seal (*Smilisca stellata*)-Horkeliella Association at Mill Spring and the Singleleaf Ash (*Fraxinus anomala*)-Mock Orange (*Philadelphus microphyllus*) Association in upper Bendire Canyon. Juniper areas within Pinyon Woodland may be relictual stands. Rare plants may be associated with these areas.

Rare or Species of Concern

Several rare or NAWS species of concern (NAWS-SC) plants occur in Pinyon Woodland, including magnificent lupine, Panamint bird's beak (*Cordylanthus eremicus* ssp. *eremicus*), Darwin milk-vetch, Utah fendlerella, pinyon rock cress, Inyo hulsea, and DeDecker's clover.

GIS Map Layer

This plant community is depicted where dominant in the May 1997 revision of the NAWS GIS Arcinfo vegetation communities layer. Sparse stands of pinyon pine in the northern Coso Mountains are classified with Great Basin Mixed Scrub.

Great Basin Mixed Scrub

Community Definition

Great Basin Mixed Scrub at NAWS is defined where bitterbrush is a codominant cover or a common associate with big sagebrush and Mormon tea, usually occurring on upper slopes and rocky areas from 5,000 to 8,000 feet msl. At lower elevations Great Basin Mixed Scrub also occurs as a narrow band where the base of rocky hills provide adequate moisture for bitterbrush. This band usually is bounded by Blackbrush Scrub above and Sagebrush Scrub below. Other characteristic shrubs of Great Basin Mixed Scrub include purple sage, Joshua tree, sticky-leaved rabbitbrush, rubber-leaved rabbitbrush (*Chrysothamnus nauseosus*), and four-winged saltbush (*Atriplex canescens*). Where aspects or soils permit, other shrub species characteristic of higher elevations in the Mojave Desert or the Sierra Nevada foothills are intermixed in Great Basin Mixed Scrub.

Minor Perennial Species

Subshrubs and herbaceous perennials are diverse within Great Basin Mixed Scrub. Common species include several buckwheat species (*Eriogonum wrightii, E. umbellatum, E. kennedyi, E. panamintense*, and *E. nudum*), pinyon brickellia (*Brickellia oblongifolia* var. *linifolia*), bedstraw (*Galium multiflorum*), various penstemons (*Penstemon speciosus, P. rostriflorus, P. palmeri,* and *P. incertus*), locoweeds (*Astragalus purshii, A. casei,* and *A. lentiginosus* var. *fremontii*), phlox (*Phlox stansburyi*), lotus (*Lotus procumbens*), fleabane (*Erigeron breweri* ssp. *covillei*), sandwort (*Arenaria macradenia*), Nevada goldeneye, giant four o'clock (*Mirablis multiflora*), Indian paintbrush (*Castilleja angustifolia*), mallow (*Sphaeralcea ambigua*), larkspur (*Delphinium parishii*), rock cress (*Arabis pulchra*), parsleys (*Lomatium* spp.), and hawksbeard.

At NAWS terrestrial grasses are most diverse in Great Basin Mixed Scrub. Prior to introduction of feral and domestic ungulates, grasses may have been a significant part of the vegetation cover in this plant community. Presently, grasses are mostly restricted to rockier areas and riparian zones. Some characteristic grasses include wild rye (*Leymus cinereus* and *L. triticoides*), James galetta grass (*Pleuraphis jamesii*), squirreltail (*Elymus elymoides*), needlegrasses (*Achnatherum* spp), and one-sided bluegrass (*Poa secunda*).

Annual Species

Mojavean species contribute the major share of the annual cover. Some species more characteristic of Great Basin Mixed Scrub include annual phlox (*Phlox gracilis*), tidy tips (*Labia glandulosa*), granite collinsia (*Collinsia callosa*), lupines (*Lupinus brevicaulis* and *L. flavoculatus*), Bailey buckwheat (*Eriogonum baileyi*), and Panamint bird's beak.

Transition Sequence

Lower boundaries of Great Basin Mixed Scrub transition into Sagebrush Scrub, Blackbrush Scrub, Joshua Tree Woodland, and high elevation compositions of Mojave Mixed Scrub. Where elevations extend above Great Basin Mixed Scrub, Pinyon Woodland is dominant. Great Basin Mixed Scrub at NAWS contains many shrubs characteristic of the Mojave Desert because of the transitional nature of the Mojave and Great Basin biomes on North Range. For NAWS plant classification purposes, areas where the cover is not dominated by shrubs characteristic of common plant community types are assigned to and described under Desert Transition Scrub (NAWS type). Most shrubs characteristic of Great Basin Mixed Scrub do not occur on NAWS South Range. One exception is Mormon tea, which occurs as scattered individuals in favorable microhabitats of the Pilot Knob-Eagle Crags region.

Unique Associations

One of the visually unique plant associations within Great Basin Mixed Scrub at NAWS is the Kennedy Buckwheat Association. Kennedy buckwheat is a very low growing, matted perennial that often forms monocultures in openings, barren ground, and past disturbance sites.

Rare or Species of Concern

Plant species of concern that occur in NAWS Great Basin Mixed Scrub include magnificent lupine, Panamint bird's beak, Darwin milk-vetch, pinyon rock cress, and fish hook cactus (*Sclerocactus polyancistrus*). Most of these taxa have regionally significant populations within Great Basin Mixed Scrub at NAWS.

GIS Map Layer

This plant community is depicted where dominant in the May 1997 revision of the NAWS GIS Arcinfo vegetation communities layer. Small pockets of Great Basin Mixed Scrub are included under other plant communities, especially Pinyon Woodland, Sagebrush Scrub, Joshua Tree Woodland, and Blackbrush Scrub. Remote areas from 5,000 feet to 7,500 feet msl were mapped Great Basin Mixed Scrub by default, especially where boundary communities are known.

Sagebrush Scrub

Community Definition

Sagebrush Scrub at NAWS is defined where big sagebrush is dominant or codominant with less conspicuous or smaller shrubs. This plant community usually occurs between 4,500 to 6,500 feet msl at NAWS. In sandy valleys, flats, and basins of corresponding elevation, big sagebrush often forms shrub monocultures. Such formations are widespread in Etcheron Valley and Coles Flat. Sagebrush Scrub often occurs as a sandy subset of Great Basin Mixed Scrub. In these areas it is often associated with Joshua trees. Where Joshua trees are dense, these areas are defined under the Joshua Tree Woodland plant community. Sagebrush Scrub is also the dominant plant community on high elevation basalt lava flows where it is frequently associated with Mormon tea. In these areas other shrubs infrequently occur. Purple sage and snakeweed (*Gutierrezia microcephala*) are sometimes common on basalt mesas in Sagebrush Scrub. Such mesas can be found in the central Argus Range, east of Birchum Springs, surrounding Water Canyon, and west of Junction Ranch.

Annual and Minor Perennial Species

Small perennials and annuals in the sandy subset of Sagebrush Scrub are typical of Great Basin Mixed Scrub though the sandy nature of the soil usually restricts abundance and diversity. Mojavean species may be more frequent in Sagebrush Scrub than Great Basin Mixed Scrub because looser soils favor species with earlier flowering periods. Grasses are greatly reduced in sandy Sagebrush Scrub, generally occurring among shrubs.

The basalt subset of Sagebrush Scrub differs greatly in respect to annuals and herbaceous perennials, especially on tops and upper slopes, due to numerous boulder microhabitats and clays, which preserve snowmelt and rainfall. Diversity for these forms is high and can include species characteristic of the California Floristic Province, such as chickpea lupine, wild onion (*Allium lacunosum*), fiddleneck (*Amsinkia menziesii* var. *intermedia*), and chicory (*Rafinesquia californica*). Bright orange mariposa lilies (*Calachortus kennedyii*) are conspicuous and abundant in years of moderate to high rainfall. Cheatgrass is very dense in basalt Sagebrush Scrub. High aerial views of these mesas can appear straw colored from the high density of dried cheatgrass, despite shrubs, lava rock, and soil color. Numerous microhabitats of these mesas have great potential for flora not known at NAWS.

Transition Sequence

The upper end of sandy Sagebrush Scrub often breaks sharply into Blackbrush Scrub at the base of foothills or, more typically, transitions into Great Basin Mixed Scrub. Sagebrush Scrub frequently intermixes with Great Basin Mixed Scrub, Joshua Tree Woodland, or Transition Desert Scrub. At lower elevations Sagebrush Scrub is replaced by Desert Transition Scrub or Mojave Mixed Scrub. Washes and disturbances in Big Sagebrush Scrub will often be replaced with snakeweed, rubber-leaved rabbitbrush, and four-winged saltbush. Low forms of big sagebrush can occur on ridges and windswept openings among pinyon pine. Purple sage is often associated with these formations. Black sagebrush replaces big sagebrush in limestone regions of the northeastern Argus Range, areas not typical of Sagebrush Scrub. Instead they represent a transition between Great Basin Mixed Scrub and Mojave Mixed Scrub. Sagebrush Scrub does not occur on NAWS South Range.

Unique Associations

One of the unique plant associations at the lower end of Sagebrush Scrub at NAWS are infrequent stands of desert peach (*Prunus andersonii*) in the upper Centennial Flat area. These shrubs produce spectacular flowering displays and form clonal patches.

Rare or Species of Concern

Plant species of concern that occur in NAWS Sagebrush Scrub include fish hook cactus, magnificent lupine, and Panamint bird's beak. Darwin milk-vetch and pinyon rock cress are found in the basalt subset of Sagebrush Scrub. These high elevation basalt flows have good potential for other species of concern.

GIS Map Layer

This plant community is depicted where dominant in the May 1997 revision of the NAWS GIS Arcinfo vegetation communities layer. Sagebrush Scrub was mapped by default for basalt flows of appropriate elevation. A few areas (of appropriate elevation) where no other dominant shrub was known or predicted were mapped Sagebrush Scrub. Future field work may find these areas more transitional in nature.

Blackbrush Scrub

Community Definition

Blackbrush Scrub at NAWS is defined where blackbrush (*Coleogyne ramosissima*) is dominant, often forming pure monocultures with distinct population edges. This occurs at NAWS on both North and South ranges at elevations ranging from 3,500 to 6,500 feet msl. Extensive stands of Blackbrush Scrub occur in the central Argus Range near Moscow Spring, north of Birchum Springs, north and east of Junction Ranch, and east of Coles Spring on North Range. On South Range Blackbrush Scrub is very dense and conspicuous on north slopes of Slocum Mountain and extends northward to the Pilot Knob area.

Blackbrush Scrub is often geologically restricted and appears to prefer granitic and limestone formations. Aspect and geomorphology strongly affect boundaries of Blackbrush Scrub, though specific requirements vary between areas. Generally, stable rocky soils on north aspect slopes are favored at lower elevations. At higher elevations rocky hilltops with poor ground moisture are favored. Though blackbrush occasionally occurs on basalt and other extrusive formations, it appears to sharply decline at boundaries of these formations, often giving way to Sagebrush Scrub. Mojavean shrubs are mostly associated with Blackbrush Scrub when it does not occur as a near-monoculture. Joshua trees are frequently associated with Blackbrush Scrub. Great Basin Mixed Scrub, Desert Transition Scrub, Joshua Tree Woodland, and Mojave Mixed Scrub often contain a large percentage of blackbrush cover. These compositions are separated with difficulty from blackbrush-dominated formations defined as Blackbrush Scrub.

Annual and Minor Perennial Species

Where blackbrush occurs as a monoculture, especially on low rocky hills, associated plant diversity tends to be sparse. These often are the most dense shrub cover to be found at NAWS outside of canyon bottoms. Annuals and herbaceous perennials often increase as the intermix of other shrubs increases. Where Blackbrush Scrub intermixes with other shrubs, herbaceous perennials, grasses, and annuals will usually be characteristic of other nearby plant communities. More work needs to be done to identify characteristic associated plants. Mariposa lily appears to frequent among blackbrush, often scrambling up through canopies.

Transition Sequence

Great Basin Mixed Scrub and less frequently Joshua Tree Woodland replace Blackbrush Scrub at higher elevations. At higher elevations lower boundaries of Blackbrush Scrub formations often break sharply into Sagebrush Scrub or Joshua Tree Woodland at the base of hills where geomorphology becomes alluvial. At lower elevations Blackbrush Scrub frequently transitions into Mojave Mixed Scrub, Shadscale Scrub, or Joshua Tree Woodland.

Unique Associations

Rare or unique plant associations probably do not occur in Blackbrush Scrub because blackbrush tends to be highly dominant and specific in composition.

Rare or Species of Concern

Plant species of concern that occur in NAWS Great Basin Mixed Scrub include Panamint bird's beak, Darwin milk-vetch, pinyon rock cress, and fish hook cactus. Most of these taxa have regionally significant populations within Blackbrush Scrub at NAWS, especially fish hook cactus. Rare mariposa lily taxa could occur at NAWS in Blackbrush Scrub.

GIS Map Layer

This plant community is depicted where dominant in the May 1997 revision of the NAWS GIS Arcinfo vegetation communities layer. Where blackbrush occurs as broad stands, the vegetation communities layer is fairly accurate. It is masked by other conflicting polygon edges in some areas. The patchy nature of Blackbrush Scrub formations may not be represented well for many remote regions of NAWS.

Joshua Tree Woodland

Community Definition

Joshua Tree Woodland is one of the least definitive of plant communities described at NAWS. Some plant classification systems do not recognize plant communities based on Joshua trees. Joshua trees are not normally associated with any consistent group of cover species, and even where dense, they are rarely the dominant cover type. In the NAWS area Joshua trees can occur with Saltbush Scrub (Rose Valley and Superior Valley), Creosote Bush Scrub (northeastern and western Coso Mountains), Mojave Mixed Scrub (Grass Valley), Shadscale Scrub (Centennial Flat and Cactus Flat), Blackbrush Scrub (north of Birchum Springs and PK Ranch), Sagebrush Scrub (Etcheron Valley and Coles Flat), Great Basin Mixed Scrub (entire Coso and Argus ranges), and Pinyon Woodland (on fringes of some pinyon pine areas). Joshua trees at NAWS may be most frequent in Desert Transition Scrub (throughout North Range).

Despite classification ambiguities, Joshua trees are ecologically and culturally significant. In many ways they are the most prominent and characteristic of NAWS flora In addition, there are some plant classification systems that recognize Joshua tree communities. For these reasons, prominent stands of Joshua trees are recognized at NAWS as separate plant communities. Joshua Tree Woodland at NAWS is defined where Joshua trees grow in dense formations, as taller, multi-branched individuals. Joshua trees appear to be most concentrated at NAWS from 4,000 to 7,000 feet msl, usually with an understory of Sagebrush Scrub, Desert Transition Scrub, Mojave Mixed Scrub, or Blackbrush Scrub. These areas are often hanging alluvial valleys, washes, bowls, typically upstream of major drainages, canyons, or basins. Significant stands of Joshua trees can be found in North Range at upper Renegade Wash, southwestern Etcheron Valley, upper Mountain Springs Canyon, Lower Centennial Flat, and northeastern Cactus Flat. On South ranges Joshua trees are widespread but mostly sparse and small. Areas northwest of Pilot Knob and around PK Ranch have dense stands associated with a complex shrub cover.

Annual and Minor Perennial Species

Minor perennial and annual species in Joshua Tree Woodland are typical of all surrounding plant communities, especially Mojave Mixed Scrub.

Transition Sequence

Transition sequences for Joshua Tree Woodland are variable and specific to minor regional differences. There is no consistent pattern at NAWS, although high elevation occurrences tend to be more predictable than other elevations

Unique Associations

Areas of clonal Joshua trees and abnormal Joshua tree growth (spikes) might be considered unique botanical occurrences. Work needs to be done to determine the age of clones and the cause of spikes.

Rare or Species of Concern

Plant species of concern that occur in NAWS Joshua Tree Woodland include Panamint bird's beak, Darwin milk-vetch, pinyon rock cress, Indigo bush, crowned muilla, and fish hook cactus.

GIS Map Layer

This plant community is depicted where prominent in the May 1997 revision of the NAWS GIS Arcinfo vegetation communities layer. Joshua Tree Woodland polygons include numerous other plant community types.

Desert Transition Scrub

Community Definition

This plant community has not been treated very often in plant classification systems. On NAWS lands however, there are significantly large areas of shrub formations characteristic of the transition between Great Basin and Mojave deserts. These extensive ecotonal zones often can be found where canyons meet uplands, especially on North ranges. Desert Transition Scrub formations at NAWS commonly occur between 4,000 and 6,500 feet msl. Usually, transition zones do not posses unique shrub cover. At NAWS however, there are a few shrubs characteristic of the Mojave-Great Basin transition. Their presence and composition with other shrubs defines Desert Transition Scrub at NAWS.

Linear-leaved goldenbush (*Ericameria linearfolia*) is the most characteristic shrub of Desert Transition Scrub. Cotton-thorn (*Tetradymia axillaris* var. *longispina*) and bush penstemons (*Penstemon incertus* and *P. excubitus*) are also characteristic of Desert Transition Scrub. Blackbrush is one of the most frequently associated species and is very characteristic of transition between Great Basin and Mojave deserts. Where dominant, blackbrush is depicted as Blackbrush Scrub. Mojavean shrubs are more frequently associated with Desert Transition Scrub than Great Basin types, including Joshua tree, Nevada joint-fir (*Ephedra nevadensis*), golden cholla (*Opuntia echinocarpa*), green rabbitbrush, California buckwheat (*Eriogonum fasiculatum*), bladder sage (*Salazaria mexicana*), peachthorn (*Lycium cooperi*), and snakeweed. Great Basin Shrubs that are characteristic and frequent in Desert Transition Scrub includes bitterbrush, big sagebrush, Mormon tea, and sticky-leaved rabbitbrush.

Limestone areas in the northern Argus Range of appropriate elevation for Great Basin Mixed Scrub are transitional towards carbonate-adapted compositions of Mojave Mixed Scrub (See Carbonate Zone -Mojave Mixed Scrub). These areas probably best fit under Desert Transition Scrub. In these areas Great Basin species such as big sagebrush and bitterbrush are replaced by black sagebrush (*Artemisia nova*) and cliffrose (*Purshia mexicana*). Their associates tend to be Mojavean shrubs.

Annual and Minor Perennial Species

Smaller perennials and annuals are mostly typical of Mixed Mojave Scrub. In general there are no characteristic annuals or herbaceous perennials for Desert Transition Scrub. Certain annuals characteristic of higher Mojave desert elevations are particularly common in the Desert Transition Scrub areas of NAWS. Among these are gilia (*Gilia brecciarum* ssp. *neglecta* and *G. ochroleuca*), pincushion (*Chaenactis xantiana* and *C. stevioides*), golden linanthus (*Linanthus aureus*), blazing star (*Mentzelia veatchiana*), woolly sunflower (*Eriophyllum ambiguum* and *E. pringlei*), and desert calico (*Loeseliastrum mathewsii*).

Transition Sequence

Like Joshua Tree Woodland, Desert Transition Scrub is complex in its relation to nearby plant communities. In general Mojave Mixed Scrub and less frequently, Blackbrush Scrub, replace Desert Transition Scrub at lower elevations. At higher elevations Desert Transition Scrub is interwoven with Great Basin Mixed Scrub, Blackbrush Scrub, Sagebrush Scrub, and Joshua Tree Woodland. Desert Transition Scrub is often limited to northern or southern aspects where a particular elevation favors other plant communities. Loose, steep, south-facing slopes permit Desert Transition Scrub to occur as high as 7,500 feet msl in the northern Argus Range. Desert Transition Scrub may fit some formations at the highest elevations of the South ranges, particularly in the Pilot Knob area.

Unique Associations

Thickleaf sage (*Salvia pachyphylla*) is rare at NAWS, occurring in canyon bottoms of northwestern Coso Range in areas of Desert Transition Scrub. Dolomite outcrops in northern Argus Range have very unique plant associations composed of sparse, low-growing, cliff dwelling shrubs like little-leaf mahogany (*Cercocarpus intricatus*), Nevada forsellesia, dwarfed shrubs of blackbrush, Heerman buckwheat, and butterfly bush (*Buddleja utahensis*).

Rare or Species of Concern

Plant species of concern that occur in NAWS Desert Transition Scrub include the Panamint bird's beak, fish hook cactus, crowned muilla, and perhaps Charlotte's phacelia. Fish hook cactus have significant populations within Desert Transition Scrub.

GIS Map Layer

This plant community is not depicted in the NAWS GIS Arcinfo vegetation communities layer.

Mojave Mixed Scrub

Community Definition

Mojave Mixed Scrub is defined by boundary transition zones rather than by a specific shrub cover. For NAWS vegetation classification purposes, lower boundaries of Mojave Mixed Scrub are defined where upper zones of Creosote Bush Scrub transition into shrub compositions that are no longer clearly dominated by creosote bush or burrobush, usually on well-drained upper bajada slopes above 2,500 feet msl and typified by an increase in shrub diversity. The upper end of Mojave Mixed Scrub usually ends at 4,500 to 5,500 feet msl where there is a mix of Mojavean shrubs with the lowest elevation forms of Great Basin plant communities. No plants characteristic of the Great Basin will be commonly found within the NAWS definition of Mojave Mixed Scrub. In general, most Mojave Mixed Scrub areas at NAWS are associated with rocky slopes. Mojave Mixed Scrub is the most widespread of NAWS plant communities and is found wherever the appropriate elevations are present.

No plant classification system for the Mojave desert has yet produced a detailed system for the formations and series that occur above the typical Creosote Bush-Burrobush Association (Creosote Bush Scrub). Mojave Mixed Scrub is an aggregate of minor shrub series which become prominent and diminish with minor topological and geological changes. Some prominent sections of this ecotonal plant community have been further classified. These are utilized for NAWS vegetation classification where their defining species are clearly dominant. They include Desert Transition Scrub, Joshua Tree Woodland, Shadscale Scrub, Hop-sage Scrub, Mojave Wash Scrub, and Mojave Sand Field. These plant communities are often inseparable from Mojave Mixed Scrub in areas where their characteristic species are not dominant.

Besides classified community types, there are numerous localized series dominated by other shrubs including Anderson thornbush (*Lycium andersonii*), cheesebush, Cooper goldenbush (*Ericameria cooperi*), green rabbitbrush, horsebrush (*Tetradymia stenolepis*), chaff bush (*Amphipappus fremontii*), Indigo bush (*Psorothamnus arborescens* var. *minutifolia*), spiny menodora (*Menodora spinescens*), California buckwheat, and bladder sage. Creosote bush is often a dominant cover type within some definitions of Mojave Mixed Scrub. Other shrub types frequently occur in Mojave Mixed Scrub that tend to be associates rather than dominants, including goldenhead (*Acamptopappus sphaerocephalus*), Nevada joint-fir, ratany (*Krameria erecta*), Mojave aster (*Xylorhiza tortifolia*), desert alyssum (*Lepidium fremontii*), turpentine bush (*Thamnosma montana*), snakeweed, winterfat (*Krascheninnikovia lanata*), wire lettuce (*Stephanomeria pauciflora*), golden cholla, and brittlebush (*Encelia actonii*).

The most common form of Mojave Mixed Scrub at NAWS is usually associated with north-or east-facing rocky slopes including a codominant composition of creosote bush, Cooper goldenbush, Indigo bush, green rabbitbrush, cheesebush, bladder sage, Anderson thornbush, hop-sage (*Grayia spinosa*), California buckwheat, Mojave aster, Nevada joint-fir, wire lettuce, and brittlebush.

Minor Perennial Species

The most typical herbaceous perennials of Mojave Mixed Scrub at NAWS usually include inflated buckwheat (*Eriogonum inflatum*), Indian paintbrush, four o'clock (*Mirablis bigelovii* var. *retorsa*), apricot mallow, larkspur, Mohave parsley (*Lomatium mohavense*), blue dicks (*Dichelostemma pulchellum*), rattlesnake weed (*Chamaesyce albomarginata*), and Layne locoweed (*Astragalus layneae*). Perennial grasses include purple three-awn (*Aristida purpurea*), needlegrass, squirreltail, and one-sided bluegrass.

Annual Species

Of all NAWS plant communities Mojave Mixed Scrub has the most abundant and diverse assemblage of annual plants. Most are only active during years of adequate rainfall. As many as 20 different species can be found in a square foot of soil surface. Numerous species are typical of Mojave Mixed Scrub and common species at NAWS. Among these are tackstem (*Calycoseris* spp), pincushion (*Chaenactis fremontii, C. stevioides*, and *C. xantiana*), coreopsis (*Coreopsis bigelovii*), woolly sunflower (*Eriophyllum ambiguum, E. pringelii*, and *E. wallacei*), malacothrix (*Malacothrix coulteri* and *M. glabrata*), chicory (*Rafinesquia neomexicana*), silver stars (*Uropappus lindleyi*), cryptanthas (*Cryptanthas pterocarya, C. circumcissa, C. nevadensis, C. dumetorum*, and *C. utahensis*), popcorn flower (*Plagiobothrys arizonicus*), caulanthus (*Caulanthus cooperi, Guillenia lasiophylla*), peppergrass (*Lepidium lasiocarpum*), fringepod (*Thysanocarpus curvipes*), streptanthella (*Streptanthella longirostris*), lotus (*Lotus humistratus* and *L. tomentellus*), lupines (*Lupinus microcarpus* and *L. concinnus*), annual locoweeds (*Astragalus didymocarpus* and *A. acutirostris*), phacelia (*Phacelia distans, P. tanacetifolia*, and *P. fremontii*), fiesta flower (*Pholistima membranaceum*), blazing star (*Mentzelia veatchiana, M. affinis*, and *M. albicaulis*), chia (*Salvia columbariae*), evening primrose (*Camissonia boothii* ssp *desertorum* and *C. campestris*), little gold-poppy (*Escholtzia minutiflora*), woolly star (*Eriastrum eremicum* and *E. diffusum*), gilia (*Gilia brecciarum, G. ochroleuca*, and numerous others (8 spp)), linanthus (*Linanthus aureus, L. dichotomus*, and *L. parryae*), desert calico, annual buckwheats (*Eriogonum baileyi, E. deflexum, E. maculatum, E. nidularium, E. pusillum*, and *E. trichopes*), saucer plant (*Oxytheca perfoliata*), and monkey flower (*Mimulus bigelovii*).

Exotic annual weeds are well established in Mojave Mixed Scrub at NAWS. These include filaree (*Erodium cicutarium*), foxtail (*Bromus madritensis* ssp *rubens*), cheatgrass, fiddleneck (*Amsinkia tessellata*), and a variety of annual mustards (*Descurainia sophia, Brassica nigra, B. tournfourtii, Sysymbrium irio, S. altissimum*, and *S. orientale*). Regions of basalt geology are most infested, especially with cheatgrass.

Unique Zones of Mojave Mixed Scrub

To some extent, geologically influenced compositions of Mojave Mixed Scrub can be separated. Some frequently seen compositions at NAWS include plants of rocky slopes and cliffs, aeolian deposits, carbonate formations, cinder and talus, upper bajada alluvium, canyon bottoms, and outlying washes. Mojave Sand Field (aeolian deposits) and Mojave Wash Scrub (outlying washes) are two community types which are treated separately and have been similarly classified by Holland (1986). Both communities are highly transitional to Creosote Bush Scrub.

Upper Bajada Zone

Upper bajada alluvial zones usually have the tallest and most diverse scrub formations of Mixed Mojave Scrub. They tend to be at the higher elevations of Mixed Mojave Scrub. Characteristic shrubs of this zone include turpentine bush, Cooper goldenbush, horsebrush (*Tetradymia stenolepis*), peachthorn, spiny menodora, winterfat, cheesebush, bladder sage, and Anderson thornbush. Joshua trees, blackbrush, and hop-sage are frequent in this zone and where common, define their own plant communities. In the Grass Valley and Slocum Mountain region of South ranges, needlegrass is a codominant cover species in this zone. This zone of Mixed Mojave Scrub has the highest diversity of annual species at NAWS. An annual fescue grass species (*Vulpia microstachys*) is very characteristic of this zone.

Rocky Slopes and Cliffs Zone

Rocky zones and cliffs, especially north-facing slopes, are characterized by goldenbush (*Ericameria cuneata*), green rabbitbrush, bedstraw (*Galium stellatum* and *G. matthewsii*), pungent brickellia (*Brickellia arguta*), California buckwheat, bush cryptantha (*Cryptantha racemosa*), wire lettuce, desert alyssum, bladder sage, desert aster, needlegrass (*Achnatherum speciosum*), rock lotus (*Lotus rigidus*), rock cress, thistle (*Cirsium mohavense*), and ferns (*Cheilanthes* and *Pityrogramma*). Annuals in north-facing rocky zones are few due to limited soil space. Roundleaf phacelia (*Phacelia rotundifolia*), eucryptas (*Eucrypta* spp), miner's lettuce, and pterostegia (*Pterostegia drymarioides*) are very characteristic of this habitat.

Warmer zones of steep rocky areas in Mixed Mojave Scrub, especially west and south aspects, will also include creosote bush, burrobush, chaffbush, cactus (*Echinocactus polycephalus, E. engelmannii,* and *Opuntia basilaris*), brittlebush (*Encelia farinosa*), reticulated goldeneye, sweetbush (*Bebbia juncea*), and pygmy cedar (*Peucephyllum schottii*). These areas are transitional towards the Creosote Bush Scrub plant community. Annual plants in this zone are more typical of the Creosote Bush Scrub. Due to the slope aspects and cool air drainage, this zone often includes species typical of the Colorado desert.

Carbonate Zone

Carbonate geology within Mixed Mojave Scrub (see Floristic Influences) can have very unique and characteristic species. Usually these are associated with limestone outcrops, but carbonate adapted Mixed Mojave Scrub vegetation can also be found on dolomite, metamorphics, fault zones, travertine, caliche deposits, and ancient saline lakebeds and shorelines. Shadscale (*Atriplex confertifolia*) and creosote bush are the most characteristic shrubs in this zone. Blackbrush and hop-sage are also common. Unlike other geologic settings in Mixed Mojave Scrub, these four shrubs on carbonate slopes are rarely dominant enough to separate into their own plant communities. Other characteristic shrubs include desert alyssum, winterfat, spiny menodora, Heerman buckwheat (*Eriogonum heermannii*), Death Valley ephedra (*Ephedra funerea*), Anderson thornbush, Mojave aster, turpentine bush, reticulated goldeneye, brittlebush, Prince's plume (*Stanleya pinnata*), and snakeweed. Cactus are often locally abundant on south and west-facing carbonate slopes. Most of the these shrubs also occur in a variety of geologic settings, besides cabonate formations. More closely associated with the carbonate zones of Mixed Mojave Scrub are species such as bud-sage (*Artemisia spinescens*), red kochia (*Kochia americana*), Nevada forsellesia (*Forsellesia nevadensis*), bush penstemon (*Penstemon fruticiformis*), and butterflybush (*Buddleja utahensis*). While these species are highly characteristic of carbonate zones, they are rarely common enough to contribute significantly to the shrub cover. Higher elevations in the carbonate zones of Mixed Mojave Scrub also include black sagebrush, cliffrose, little-leaf mohagany (*Cercocarpus intricatus*), and desert snowberry (*Symphroricarpos longiflorus*) (see Desert Transition Scrub).

Herbaceous perennials are probably the most highly adapted formation in carbonate zones of Mixed Mojave Scrub. Characteristic species at NAWS include tall perityle (*Perityle megalocephala*), golden forget-me-not (*Cryptantha confertiflora*), evening primroses (*Camissonia walkeri* and *Oenothera caespitosa* ssp *crinita*), Inyo blazing star (*Mentzelia inyoensis*), various locoweeds (*Astragalus mohavensis, A. newberryi*, and *A. panamintensis*), sandwort (*Arenaria kingii*), and cliff phacelia (*Phacelia perityloides*). Annual species are mostly typical of other zones in Mojave Mixed Scrub. Not much is known about annual species of NAWS limestone areas.

Cinder and Talus Zone

Cinder and talus zones within Mojave Mixed Scrub have very distinctive, highly adapted plant compositions. Much of the steep terrain at NAWS is typical of this geology, and plant community. Cinder formations in the Coso Range are the most unique of these zones. Geomorphology and chemical rock type are strong determining factors in specific localized plant compositions. Most cinder and talus zones have very limited shrub cover, usually clinging to most stable portions of slopes. Usually shrubs that occur on cinder and talus are typical of the surrounding area. One shrub which appears to be adapted to a variety of cinder and talus slopes at NAWS is the shining sandpaper plant (*Petalonyx nitidus*). Bladder sage, bush lupine, groundsel (*Senecio flaccidus*), and pygmy cedar are also frequent on loose slopes, though less adapted to cinder soils than sandpaper plant. Plants characteristic of wash zones are often able to colonize lower slopes of talus and cinder slopes where extra moisture is likely present. Many unique plants are also found on cinder and talus at elevations above Mojave Mixed Scrub at NAWS, including several rare or species of concern.

Herbaceous perennials and annuals are plant formations most characteristic of cinder and talus zones within Mojave Mixed Scrub. Most small plants adapted to loose slopes have deep tap roots. Shallow rooted plants, such as grasses, are usually sparse on cinder and talus slopes. Soils are poorly developed. Herbaceous perennials characteristic of these slopes include buckwheats (*Eriogonum nudum, E. saxatile, E. inflatum*), four o'clock (*Mirablis bigelovii*), Panamint parsley (*Cymopterus panamintensis*), prickly poppy (*Argemone munita*), and thistles (*Cirsium mohavense* and *C. neomexicanum*). When active, annual plants are the dominant cover on pure talus and cinder slopes. The composition is usually limited to a few dominant types which flourish in the absence of competition. More gentle slopes with more developed soils have buckwheats (*Eriogonum deflexum, E. maculatum, E. nidularium*, and *E. rixfordii*), coreopsis (*Coreopsis bigelovii*), turtle plant (*Psathyrotes* spp), phacelias (*Phacelias cryptantha, P. nashiana*, and *P. pedicellata*), satin blazing star (*Mentzelia involucrata*), vernal fiddleneck

(*Amsinkia vernicosa*), sented cryptantha (*Cryptantha utahensis*), evening primroses (*Camissonia boothii* ssp, *C. claviformis*, and *C. brevipes*), wooly stars, rock gilia (*Gilia scopulorum*), and chia. There is great potential for undocumented species on cinder and talus slopes at NAWS. This type of terrain is difficult to access. Past work in these areas has been minimal, yet very productive in locating noteworthy plant occurrences.

Canyon Bottom and Wash Zone

Canyon bottoms in Mixed Mojave Scrub often have the highest perennial plant diversity of all NAWS ecosystems due to the blending of slope aspects and geomorphology types, the presence of riparian zones and seasonally moist washes, protection from exposure, and cool air drainage. Many plants characteristic of higher elevation plant communities establish their lowest occurrences in wash and riparian areas of canyon bottoms. Slope bottoms lose their characteristic shrub compositions as they drop into washes. Large shrubs dominate washes, while subshrubs and small perennials cling to the banks, rock outcrops, and nearby slopes. Riparian zones contribute tall formations to canyon bottoms in Mojave Mixed Scrub, usually in upper portions of canyons. These zones are treated under Riparian plant community descriptions.

Shrubs characteristic of canyon bottoms include four-winged saltbush, rubber rabbitbrush, bush lupine, bladder sage, cheesebush, seepwillow (*Baccharis sergilloides*), scalebroom (*Lepidospartum squamatum*), allscale, brickellias (*B. microphylla, B. multiflora*), peachthorn, snakeweeds (*Gutierrezia microcephala* and *G. sarothrae*), western bush penstemon, brittlebush (*Encelia actonii*), sweetbush, and groundsel. Subshrubs and herbaceous perennials of canyon bottoms include nude buckwheat, Wright buckwheat (*Eriogonum wrightii*), rock lotus, melic grass (*Melica imperfecta* and *M. frutescens*), prickly poppy, purple three-awn, desert milkweed (*Asclepias erosa*), rattlesnake weed, rock nettle (*Eucnide urens*), ground-cherry (*Physalis crassifolia*), desert tobacco (*Nicotiana obtusifolia*), bushy bedstraw (*Galium mathewsii*), prince's plume, and thistles (*Cirsium* spp). Annual cover is normally limited by rock outcrops and loose gravels. The most characteristic annuals of canyon bottoms are associated with washes and adjacent alluvial terraces, including monkey flower (*Mimulus bigelovii*), purple mat (*Nama demissum*), wooly sunflower (*Eriophyllum wallacei*), goosefoot (*Chenopodium fremontii*), purple roote crypatantha (*Crypatantha micrantha*), annual buckwheats (*Eriogonum reniforme, E. pusillum*, and *E. palmerianum*), and thread plant (*Nemacladus* spp).

Canyon bottoms are mostly typical of drainage zones that occur throughout Mojave Mixed Scrub on North ranges and the Slate Range of South ranges; however, most other areas in South ranges have more open drainages and washes at elevations where Mojave Mixed Scrub occurs. These wash zones usually have a lower diversity of perennial species. In general the shrub cover is less unique and often intermixed with alluvial terraces, floodplains, and bajada landforms. Shrubs characteristic of open wash zones of Mixed Mojave Scrub include Indigo bush (*Psorothamnus arborescens* var *arborescens*), cheesebush, peachthorn, Anderson thornbush, hop-sage, desert senna (*Senna armata*), desert almond (*Prunus fasiculata*), bladderpod (*Isomeris arborea*), bladder sage, allscale, four-winged saltbush, and Nevada joint-fir. Fewer herbaceous perennials are associated with these zones. Some characteristic types include dyssodia (*Adenophyllum cooperi*), rattlesnake weed, stillingia (*Stillingia paucidentata*), hole-in-the-sand plant (*Nicolletia occidentalis*), and desert milkweed. Annuals in open wash zones can be very abundant and diverse in years of ample rainfall. They are typical of other alluvial zones of Mojave Mixed Scrub.

Transition Sequence

Upper ends of Mojave Mixed Scrub usually grade into Desert Transition Scrub, Blackbrush Scrub, or Joshua Tree Woodland. On south facing loose slopes, the transition may be directly into Sagebrush Scrub or Great Basin Mixed Scrub. The lower end of Mojave Mixed Scrub usually transitions into Creosote Bush Scrub. Where the lower transition zone is alluvial geomorphology, the boundary between Mojave Mixed Scrub and Creosote Bush Scrub is gradual and difficult to define. The base of rocky slopes is often a sharp boundary definition for the lower end of Mojave Mixed Scrub.

Mojave Sand Field and Mojave Wash Scrub are intermediate communities between Mojave Mixed Scrub and Creosote Bush Scrub. Mojave Wash Scrub can be considered a subset of Mojave Mixed Scrub which extends down drainages into broad areas of Creosote Bush Scrub. Drainages provide the extra moisture that allows species characteristic of Mojave Mixed Scrub to survive at lower elevations. Differences between the two are often minimal (see Mojave Wash Scrub). Transition sequences in the carbonate zones of Mixed Mojave Scrub are very ambiguous and gradual at upper and lower ends. In general the whole region of Mojave Mixed Scrub is shifted to a higher elevation in areas of limestone and dolomite.

Unique Associations

Associations unique to the typical compositions of Mojave Mixed Scrub occur at NAWS, nearly all associated with geologic features. Some areas in previously defined zones within Mojave Mixed Scrub have unique plant associations. Cinder Hills in the southwestern Coso Mountains have an association that is dominated by uncommon annuals like Charlotte's phacelia, disjunct populations of Booth primrose (*Camissonia boothii* ssp. *boothii*), pagoda buckwheat (*Eriogonum rixfordii*), and the minor perennials, cinder buckwheat (*E. nudum* ssp. *westonii*) and shining sandpaper plant (*Petalonyx nitidus*). Near cinder areas are near-monocultures of the common variety of Indigo bush (*Psorothamnus arborescens* var. *minutifolia*). Washes in upper bajadas of the Eagle Crags-Pilot Knob area have concentrations of the rare variety of Indigo bush (*Psorothamnus arborescens* var. *arborescens*).

Rare or Species of Concern

Plant species of concern that occur in NAWS Mojave Mixed Scrub include Charlotte's phacelia, weasel phacelia (*Phacelia mustelina*), Indigo bush (*Psorothamnus arborescens* var. *arborescens*), fish hook cactus, Booth primrose, and crowned muilla. Lane Mountain locoweed is a highly endangered species that occurs within four miles of South ranges in habitat very typical of the upper bajada zone of Mojave Mixed Scrub. Live-forever (*Dudleya saxosa* ssp *saxosa*) is another potential NAWS-SC that could occur in Mojave Mixed Scrub or Desert Transition Scrub. Sensitive species new to NAWS are most likely to be found in areas of Mojave Mixed Scrub because of the extent and variability of this plant community at NAWS.

GIS Map Layer

This plant community is depicted where dominant in the May 1997 revision of the NAWS GIS Arcinfo vegetation communities layer.

Shadscale Scrub

Community Definition

Shadscale Scrub at NAWS is defined where shadscale is dominant and homogeneously distributed. In some areas Shadscale Scrub will be defined where it is codominant with spinescale (*Atriplex spinifera*). Shadscale Scrub at NAWS usually occurs over broad bajada slopes and basins between 3,500 and 5,000 feet msl. Areas at NAWS which typify Shadscale Scrub include the lower Cactus Flats region, small basins within the Coso Geothermal Area, Darwin Wash, and Lower Centennial Flat. From Lower Centennial Flat, Shadscale Scrub dominates alluvial stretches north of NAWS throughout Darwin Mesa and Lee Flat. Some frequently associated species besides spinescale include Anderson thornbush, cheesebush, hop-sage, bud-sage, desert alyssum, and Nevada joint-fir. Less frequently associated shrubs include winterfat, allscale, spiny menodora, four-winged saltbush, snakeweed, burrobush, and horsebrush (*Tetradymia glabrata*).

Other shrub formations occur at NAWS where shadscale is common, but these are not defined as Shadscale Scrub plant communities. These formations include carbonate geology in Mojave Mixed Scrub and Creosote Bush Scrub, Saltbush Scrub where other saltbush (*Atriplex* sp) are dominant, and sandy transition areas within Alkaline Basin Scrub. Shadscale Scrub is a well recognized plant community and one of the dominant series throughout the lower Great Basin Desert. In California it blends with other plant communities and is described by different classification systems with a variety of associates, especially chenopod shrubs. At NAWS it tends to be more associated with Mixed Mojave Scrub plant types.

Annual and Minor Perennial Species

Descriptions for minor associated plant species of Shadscale Scrub are not well known for NAWS. Likely, many species common to Mojave Mixed Scrub also occur in Shadscale Scrub, but with less diversity. Herbaceous perennials appear to be infrequent. *Stanleya elata* is a tall, conspicuous perennial herb throughout the Shadscale Scrub of Darwin Mesa, occurring commonly at NAWS in the lower Centennial Flat area. Certain annual species, such as lupines, wooly star, Booth primrose, and cheatgrass, occur in great abundance in Shadscale Scrub during productive rain years.

Transition Sequence

Shadscale Scrub occupies similar elevations as Mojave Mixed Scrub, Hop-sage Scrub, and the Spinescale Series formations of Saltbush Scrub. Where slopes become steeper, both lower and higher, Shadscale Scrub transitions to Mojave Mixed Scrub or Hop-sage Scrub. Where basins form, water tables rise, and salt saturation is higher, Shadscale Scrub transitions at the lower end to Saltbush Scrub. Mojave Mixed Scrub, Hop-sage Scrub, Blackbrush Scrub, and Joshua Tree Woodland are communities which occur above Shadscale Scrub.

Unique Associations

Creosote bush is sometimes present at upper ends of shadscale alluvial basins, clinging to the base of hills and outcrops as a narrow band. North of NAWS these often represent the upper limits of creosote bush and the last vestiges of Mojave vegetation as Great Basin plants take over.

Rare or Species of Concern

Plant species of concern that occur in NAWS Shadscale Scrub include Charlotte's phacelia, fish hook cactus, Booth primrose, and crowned muilla. These are usually associated with outcrops and unique geology that have localized shrub compositions within broad areas of Shadscale.

GIS Map Layer

This plant community is depicted where dominant in the May 1997 revision of the NAWS GIS Arcinfo vegetation communities layer. Some polygons of Saltbush Scrub, Mojave Mixed Scrub, and Hop-sage Scrub are contained in Shadscale Scrub or contain small patches of Shadscale Scrub.

Hop-sage Scrub

Community Definition

Hop-sage Scrub at NAWS is defined where hop-sage is the dominant cover shrub. These cover series usually occur between 3,000 and 5,000 feet msl. As with Shadscale Scrub, this community is defined in other regions with associates more typical of alkaline basins, but at NAWS it is most frequently associated with Mojave Mixed Scrub. Areas at NAWS where Hop-sage Scrub occurs include Darwin Wash, Cactus Flats, Coso Geothermal Area, and the upper Slate Range. In these areas it sometimes occurs as nearly monotypic stands (as in the Darwin Wash area). It is most frequently associated with spiny menodora, Cooper goldenbush, Anderson thornbush, shadscale, cheesebush, blackbrush, creosote bush, bud-sage, spinescale, winterfat, and burrobush. It is also frequent and sometimes dominant in the carbonate geology of NAWS. Hop-sage occurs as a minor associate over much of NAWS lands.

Annual and Minor Perennial Species

Data are not available. NAWS will continue to collect these data.

Transition Sequence

Data are not available. NAWS will continue to collect these data.

Unique Associations

A broad expanse of hop-sage occurs in the Darwin Wash area where it forms monotypic stands and also dominates transition zones into Creosote Bush Scrub, Shadscale Scrub, and Mixed Mojave Scrub.

Rare or Species of Concern

Plant species of concern that occur in NAWS Hop-sage Scrub include fish hook cactus, Booth primrose, and crowned muilla. Like Shadscale Scrub, these are usually associated with outcrops in the proximity of hop-sage-dominated scrub formations.

GIS Map Layer

This plant community is depicted in the May 1997 revision of the NAWS GIS Arcinfo vegetation communities layer.

Mojave Wash Scrub

Community Definition

Mohave Wash Scrub at NAWS is defined in areas typically surrounded by Creosote Bush Scrub where washes provide extra ephemeral moisture and create distinct shrub associations. Shrub associations are usually very specific with fewer, taller species that extend up and down washes for long stretches. These wash communities occur at the lowest elevations at NAWS and intergrade with Mojave Mixed Scrub at elevations of 3,000 to 4,000 feet msl (see canyon bottom and wash zones of Mixed Mojave Scrub). Dominant shrubs vary depending on hydrologic and geologic factors.

Higher elevations of Mohave Wash Scrub can be dominated by gum-leaved brickellia (*Brickellia multiflora, B. microphylla*), scalebroom, four-winged saltbush, rubber rabbitbrush, peachthorn, Indigo bush, bladdersage, allscale, and cheesebush. Lower elevations are often dominated by desert senna or cheesebush. Cheesebush is probably the most characteristic shrub of low elevation washes at NAWS. The lowest elevation washes at NAWS are often very distinct from surrounding Creosote Bush Scrub. These areas are subject to strong flash floods. Blackband rabbitbrush (*Chrysothamnus paniculatus*), pygmy cedar, and allscale are primary shrubs for these zones. Associated shrubs usually include those found in Creosote Bush Scrub and sometimes those typical of Mojave Mixed Scrub which are able to survive at lower elevations because of wash hydrology. Some washes have little or no effect on overall plant composition, while geographically similar washes will have distinct scrub associations easily seen at a distance. In general all washes change the composition of plant communities, even if only annual species. Washes and drainages affect most plant communities at nearly any elevation, but in general the most distinct plant communities of washes at NAWS are found in lower elevation areas with Creosote Bush Scrub and Mojave Mixed Scrub.

Annual and Minor Perennial Species

Data are not available. NAWS will continue to collect these data.

Transition Sequence

Data are not available. NAWS will continue to collect these data.

Unique Associations

Data are not available. NAWS will continue to collect these data.

Rare or Species of Concern

Indigo bush (*Psorothamnus arborescens* var. *arborescens*) occurs in the higher elevation Mojave Wash Scrub zones of the Black Hills, Pilot Knob, Superior Valley, and Eagle Crags areas of South ranges, which have significant populations for this taxa.

GIS Map Layer

This plant community is partially depicted in the May 1997 revision of the NAWS GIS Arcinfo vegetation communities layer. These areas are mapped inconsistently and are difficult to represent at the current scale of the draft map.

Creosote Bush Scrub

Community Definition

Creosote Bush Scrub is defined at NAWS where creosote bush is the dominant or codominant cover, usually with burrobush or white bursage (*Ambrosia dumosa*). At NAWS Creosote Bush Scrub occurs from the lowest, well-drained, non-alkaline areas (1,400 feet msl) up to 3,500 feet msl. Above 3,500 feet creosote bush still grows but is usually associated with a diverse shrub mixture that is more characteristic of Mojave Mixed Scrub, Shadscale Scrub, Joshua Tree Woodland, or Blackbrush Scrub. The Creosote Bush-Burrobush Series is the most widespread shrub association at NAWS. Other shrubs frequently encountered in Creosote Bush Scrub include allscale, shadscale, Indigo bush, goldenhead, cheesebush, desert senna, and Anderson thornbush.

Annual and Minor Perennial Species

Data are not available. NAWS will continue to collect these data.

Transition Sequence

Data are not available. NAWS will continue to collect these data.

Unique Associations

Areas with creosote clones or rings are considered unique associations. Desert pavements are frequently associated with Creosote Bush Scrub. These have sensitive pebble and cryptogram mosaics which normally exclude most annual species. Areas of clays sometimes support dense exclusive growths of little trumpet buckwheat (*Eriogonum trichopes* var. *hooveri*), most frequently associated with Creosote Bush Scrub, but occurring as high as 7,000 feet msl.

Rare or Species of Concern

Gypsum linanthus (*Linanthus arenicola*) is known from sandy areas in Creosote Bush Scrub at NAWS. Mojave fish hook cactus probably occurs in some rocky areas of Creosote Bush Scrub.

GIS Map Layer

This plant community is depicted in the May 1997 revision of the NAWS GIS Arcinfo vegetation communities layer. Lower limits of Creosote Bush Scrub were delineated with good accuracy from aerial photos.

Mojave Sand Field

Community Definition

Mojave Sand Field at NAWS is defined for areas where sand deposits, usually aeolian, are thick enough to influence areas normally dominated by Mojave Mixed Woody Scrub, Creosote Bush Scrub, or Saltbush Scrub. Influences of sand fields or stabilized dunes usually reduce or exclude large shrubs with exception of creosote bush, which often thrive and grow larger as a result of increased sandy soils. Creosote clones or "rings" occur most often in these areas. Where sands are fine and loose, very distinctive herbaceous plant compositions and annual plants occur. Extensive sand fields and dunes occur at NAWS in the southern Argus Range, east of the China Lake basin. Elevations of these formations range from 2,200 to 3,800 feet msl.

Perennials characteristic of Mojave Sand Field include sandpaper plant (*Petalonyx thurberi* ssp *thurberi*), locoweed (*Astragalus lentiginosus* var. *variablis*), Indian rice grass (*Achnatherum hymenoides*), stillingia (*Stillingia spinosa* and *S. paucidentata*), wooly star (*Eriastrum densifolium*), zigadenus (*Zigadenus brevibracteus*), hole-in-the-sand plant, prickly poppy, evening primrose (*Oenothera* spp.), and buckwheat (*Eriogonum plumatella*). Annuals are rich and robust growing on dunes and sand fields. Some of the most characteristic include desert dandelion (*Malacothrix glabrata*), coreopsis (*Coreopsis bigelovii*), sand-verbena (*Abronia pogonantha* and *A. villosa*), brown-eyed primrose (*Camissonia claviformis*), keysia (*Glyptopleura marginata*), sticky yellow-throats (*Phacelia bicolor*), *Dicoria canescens*, annual mitra (*Stephanomeria exigua*), various Gilia species, split grass (*Schismus arabicus* and *S. barbatus*), and chicory.

There are some plants that are exclusive to aeolian deposits and others that are characteristic of both aeolian deposits and other types of sand deposits, such as sandy washes, sandy slopes, or bajadas with meandering flash flood paths. This is especially true with granitic alluvium.

Annual and Minor Perennial Species

Data are not available. NAWS will continue to collect these data.

Transition Sequence

Data are not available. NAWS will continue to collect these data.

Unique Associations

Areas of Creosote Bush clones or rings represent one of the most valuable plant associations at NAWS.

Rare or Species of Concern

Gypsum linanthus is very characteristic of Mojave Sand Field. Milk-vetches (*Astragalus lentiginosus*), closely related to the federally-proposed Eureka dunes milk-vetch, reach their most extreme forms in Mojave Sand Field. This plant community has good potential for other sensitive species of plants and animals.

GIS Map Layer

This plant community is depicted in the May 1997 revision of the NAWS GIS Arcinfo vegetation communities layer.

Desert Holly Scrub

Community Definition

Desert holly (*Atriplex hymenolytra*) is patchy but locally dominant cover in widespread areas of NAWS, usually occurring below 3,000 feet msl. It is defined wherever Desert Holly Scrub is evenly distributed, dominant or codominant with creosote bush or other saltbush. Distinctive examples of Desert Holly Scrub at NAWS are found in the White Hills, Salt Wells Valley, Randsburg Wash road south of Searles Lake, Wingate Pass, and numerous areas on southern bajadas and foothills of Straw Peak. Where desert holly is uncommon, it is usually associated with Creosote Bush Scrub or Saltbush Scrub (especially shadscale).

Annual and Minor Perennial Species

Data are not available. NAWS will continue to collect these data.

Transition Sequence

Data are not available. NAWS will continue to collect these data.

Unique Associations

Desert pavements are frequently associated with Desert Holly Scrub. These have sensitive pebble and cryptogram mosaics which normally exclude most annual species.

Rare or Species of Concern

Data are not available. NAWS will continue to collect these data.

GIS Map Layer

This plant community is depicted in the May 1997 revision of the NAWS GIS Arcinfo vegetation communities layer. Many zones of Desert Holly are represented within this layer.

Saltbush Scrub

Community Definition

Saltbush Scrub for NAWS is defined for areas where allscale or spinescale is clearly the dominant cover shrub, often to the exclusion of all other shrub species. At NAWS these areas are below 5,000 feet msl and occur primarily in Airport and China Lake basins, Coso Geothermal Area, Salt Wells Valley, Wingate Wash, Pilot Knob Valley, and Superior Valley. Allscale is the most widespread and abundant saltbush at NAWS. It often forms exclusive stands near riparian areas, below the Creosote Bush Scrub zone or at the edge of playas. Spinescale generally grows in drier, less alkaline areas. It will intermix with both the Allscale and Shadscale series.

Spinescale is widespread in Superior Valley and the southwestern Coso Mountains. Other shrub types contribute a minor portion of the cover in Saltbush Scrub. They are typical of adjacent plant communities, usually Alkaline Sink Scrub, Mojave Sand Field, or Creosote Bush Scrub.

Other saltbush species are the most frequently associated shrubs. Shadscale forms the most variable saltbush communities at NAWS. More terrestrial associations are partially treated under Shadscale Scrub or Mixed Mojave Scrub, but it also occurs as a definite halophyte near playas and sinks, often closely associated with allscale or spinescale. Desert holly is scattered in areas of Saltbush Scrub at low elevation that are rocky and well drained. It is locally dominant in patchy areas throughout NAWS (see Desert Holly plant community description). These locations are normally too rocky and dry for other *Atriplex* species. Desert holly is more typically associated with Creosote Bush Scrub than Saltbush Scrub. Four-winged saltbush appears in Saltbush Scrub in areas of disturbance, near seeps, or in washes. It is rarely a well-distributed cover, usually occurring as sparse individuals or as thickets with other tall shrubs. At higher elevations four-winged saltbush is a more frequent associate in Saltbush Scrub. Torrey saltbush (*Atriplex lentiformis* ssp. *torreyi*) and Parry saltbush (*Atriplex parryi*) also occur in Saltbush Scrub but are most typically associated with Alkaline Sink Scrub.

Annual and Minor Perennial Species

Data are not available. NAWS will continue to collect these data.

Transition Sequence

Data are not available. NAWS will continue to collect these data.

Unique Associations

Data are not available. NAWS will continue to collect these data.

Rare or Species of Concern

Gypsum linanthus occurs in sandy areas of Saltbush Scrub at NAWS.

GIS Map Layer

This plant community is depicted in the May 1997 revision of the NAWS GIS Arcinfo vegetation communities layer. Some zones of Saltbush Scrub are intermixed with Alkaline Sink Scrub.

Alkaline Sink Scrub

Community Definition

Alkaline Sink Scrub at NAWS occurs where salt-tolerant plants grow as locally patchy covers, usually between more alkaline areas of playas and higher zones, usually with Saltbush Scrub. Some plants are also characteristic of maritime plant communities. Seasonally high water tables determine the shrub cover where plants are not growing on raised areas or sand fields. Visually distinct subsets occur in Alkaline Sink Scrub at NAWS. Some are probably best treated as separate plant communities. Among them are shrub series dominated by iodine bush, Parry saltbush, or bush seepweed. Areas with seeps and high water tables favor saltgrass covers. The most diverse subset of Alkaline Sink Scrub occurs in the sand fields of China Lake Basin. These have shrubs of higher zones intermixed with typical alkaline sink vegetation.

Characteristic species of Alkaline Sink Scrub, include bush seepweed (*Suaeda moquinii*), red molly (*Kochia californica*), Parry saltbush, iodine bush (*Allenrolfea occidentalis*), intricate aster (*Machaeranthera carnosa*), rubber rabbitbrush, allscale, shadscale, and desert alyssum (*Lepidium fremontii*). Other perennials in Alkaline Sink Scrub include four-winged saltbush, tamarisk, Indigo bush (*Psorothamnus arborescens* var. *arborescens*), Torrey saltbush, horsebrush, goldenbush (*Isocoma acradenia*), Prince's plume (*Stanleya pinnata*), and saltgrass.

Annual and Minor Perennial Species

Data are not available. NAWS will continue to collect these data.

Transition Sequence

Data are not available. NAWS will continue to collect these data.

Unique Associations

Aeolian fields and dunes have rich shrub compositions and provide numerous niches for wildlife. Some endemic invertebrates are associated with these formations, which share many similarities to Mojave Sand Field.

Rare or Species of Concern

Gypsum linanthus is very characteristic of aeolian alkaline plant communities. Milk-vetches (*Astragalus lentiginosus*) closely related to the federally-proposed Eureka dunes milk-vetch grow as similar ecotypes, in need of further investigation. Orycetes (*Orycetes nevadensis*) occur on similar alkaline sand fields at Owens Lake.

GIS Map Layer

This plant community is depicted in the May 1997 revision of the NAWS GIS Arcinfo vegetation communities layer. This is an area that will be mapped into finer plant associations in future versions.

Vernal Playa

Community Definition

Vernal Playa is defined for areas ranging from vernal pools to flooded alkaline basins. These are normally barren with clays and alkalis but become flooded on occasion to produce dense to patchy growths of annuals and weedy species. These areas are characterized by geology consistent with clay deposition, standing water, and for most of the time, a lack of vegetation. In the desert only the highest rainfall in combination with the right season will reveal specialized annuals or biennials which are characteristically associated with lake, pool, or playa shore edge. NAWS has numerous dry lakes, playas, and clay depressions, ranging from small clay depressions and pools in the basalt flows up to 7,500 feet msl in the northern Coso Range to alkaline and semi-alkaline playas in China Lake Basin, Salt Wells, and southern Panamint Valley (1,400-2,400 feet msl).

Weeds or exotic species are the most characteristic plants of these areas. In years of abundant rainfall, annuals such as fiddleneck, tumble mustards (*Brassica* and *Sisymbrium* spp), chamomille (*Chamomilla occidentalis*), storks bill, annual *Atriplex* species, and stinkweed (*Cleomella* spp.) can form dense areas of cover on perimeters of depressions, pools, and playas. Common annual species typical of surrounding plant communities usually occur in nearby pebble and aeolian fringes of playa and pool edges. Tamarisk is an exotic perennial tree associated with playa depressions in the China Lake Basin. Saltgrass, bush seepweed, allscale, and occasionally iodine bush are other perennials associated with similar areas. Allscale is the most characteristic shrub of Vernal Playa on NAWS lands. No endemic plants have been documented at NAWS that are specifically associated with seasonal pools of water; however, these areas at NAWS have not been surveyed well in the best years of ephemeral plant production.

In the North ranges Carricut Lake and upper Junction Wash have the most seasonally consistent areas of Vernal Playa due to the greater rainfall and low-alkaline sandy clays. Weeds, such as mustard (*Brassica tourfourtei*), Russian thistle, and poverty weed (*Iva axillaris*), are usually present here in all but the driest years. Vinegar weed (*Lessingia lemmoni*) and coyote tobacco (*Nicotiana attenuata*) are native annuals that concentrate in the Carricut Lake area. Another prominent example of Vernal Playa vegetation at NAWS can be seen at the northern end of Airport Lake, which supports a broad field of fiddleneck.

Annual and Minor Perennial Species

Data are not available. NAWS will continue to collect these data.

Transition Sequence

Data are not available. NAWS will continue to collect these data.

Unique Associations

No unique associations have been identified for Vernal Playa.

Rare or Species of Concern

Gypsum linanthus occurs in the alkaline sand fields near playas. Nearby playas in the region support sensitive species like spiny chorizanthe (*Chorizanthe spinosa* - Cuddeback Lake), Parish phacelia (*Phacelia parishii* - Coyote Lake), and orycetes (*Orycetes nevadensis* - Owens Lake).

GIS Map Layer

This plant community is depicted in the May 1997 revision of the NAWS GIS Arcinfo vegetation communities layer. Most polygons were delineated by the National Wetlands Inventory wetlands survey in 1993 except for Carricut Lake and North Towers playa. Salt Wells Valley has areas of this type which are not included in the GIS layer.

Riparian

Community Definition

Riparian is defined at NAWS where there are plants that need a permanent source of water or a substantial ephemeral flow. Typically these areas are found at springs and seeps, highly restricted, well defined zones characterized by aquatic herbs, grasses, tall shrubs, and trees in active growth stages throughout summer. Dominant cover species vary greatly among riparian plant associations at NAWS. Most riparian plant types can become exclusive cover in favorable microhabitats. A typical riparian zone at NAWS consists of various vegetation patches, each dominated by a single species. More classified vegetation types exist for riparian plants and communities because each species can potentially be a dominant cover series. In regions where wetlands and climate create broader riparian zones, these community types have the same importance as terrestrial plant communities. In desert regions however, riparian zones are very narrow and restricted. For NAWS purposes, various cover series of riparian plants have been lumped under one riparian community type. Different general formations of riparian vegetation occur at NAWS. These are characterized by the hydrology and range from mesic montane microhabitats to highly alkaline low elevation seeps and wetlands. Plants that are terrestrial at higher elevations are often restricted to riparian areas at lower elevations. These should be treated as indicative cover types for lower elevation riparian zones.

Annual and Minor Perennial Species

Data are not available. NAWS will continue to collect these data.

Transition Sequence

Data are not available. NAWS will continue to collect these data.

Unique Associations

Data are not available. NAWS will continue to collect these data.

Rare or Species of Concern

Areas of surface waters and seeps are legally protected as sensitive areas. No individual sensitive plant species are known from NAWS riparian areas. Panamint bird's beak is often associated with nearby areas of minor seeps at high elevations. Knotted rush (*Juncus nodosus*), Parish alkali grass (*Puccinellia parishii*), mariposa lily (*Calachortus striatus*), buttercup (*Ranunculus hydrocharioides*), and tarplant (*Hemizonia* spp) are rare plants that occur in other riparian zones in the region.

GIS Map Layer

Riparian communities are not included in the general vegetation map because they do not fit well at the 1:100,000 scale.

Disclimax

Community Definition

Disclimax is not a natural plant community but a group of disturbed habitats characterized by invasive or exotic species. They have very distinct ecological components and often have sensitive plant species associated with them. Because they are often associated with human activity zones, their outlines tend to be geometric and conspicuous. Disclimax plant communities are widespread and numerous at NAWS. They are most frequently caused by human activities but can be identically created by feral ungulates, fires, rapid erosion, or flash floods. Each climax plant community, in combination with the geologic setting, is replaced after impact by a specific composition of disturbance-favoring plants. Some are cover series dominated by woody shrubs, but the majority are dominated by herbaceous, mostly annual plants. Exotic plants influence nearly all disturbed areas, the amount depending on local geology and timing of rain. Exotic plants create ecological pressures on surrounding plant communities when they populate vigorously enough to dominate a cover series of vegetation. Annual exotic plants can displace native seed banks.

Some native species characteristic of Disclimax plant communities are so faithful to disturbed habitats that they are only seen after occasional severe disturbances like floods, fire, debris flow, or human-related activities. Some native species require high disturbance events to germinate and establish but thereafter, need protection and lack of disturbance to survive and reproduce. Many taxa at NAWS are most frequent in areas of human disturbances, especially roadsides.

Riparian, Vernal Playa, and Mojave Wash Scrub are plant communities which receive natural flood disturbances. They are sometimes similar to Disclimax plant communities and share many of the same species.

Areas near playas that become raised with soil (human, alluvial, or aeolian) are colonized by Parry saltbush. Saltgrass appears to be an indicator of changing hydrology in the China Lake Basin, replacing Saltbush Scrub and Alkaline Sink Scrub in the Lark Seep region. Summer cypress, rushes, and tamarisk are other Disclimax indicators in the Lark Seep area. Disturbances at lower elevations of Creosote Bush Scrub are often followed with allscale shrub covers. These Disclimax communities are frequent in the China Lake area and Ridgecrest. Higher areas of Creosote Bush Scrub, when disturbed, are often replaced with cheesebush. Tumbleweeds (*Salsola kali*) are the annual plant cover of the Drop Zone and other target areas. Annual ragweed (*Ambrosia acanthicarpa*) is frequent along roadsides in sandy areas.

Fiddleneck, cheatgrass (*Bromus tectorum*), and foxtail chess (*B. madritensis* ssp *rubens*) are abundant and widespread exotic species throughout NAWS. They occur in nearly all plant communities and can become dominant covers without significant disturbances. Areas of lava flows are covered by dense growths of *Bromus* species. The abundance of *Bromus* grasses in these areas allows fires to extend rapidly. Such fires induced by exotic grasses have dramatically altered high desert vegetation in northwestern Arizona, Nevada, and Utah. Wild Horse Mesa at NAWS has been altered in a similar manner.

Fiddleneck has the widest elevation range of NAWS weedy species. It dominates a large marshy area north of Airport Lake.

Bush wooly star along with freckled milk-vetch, stillingia, sandpaper plant, dicorea, and annual ragweed are disturbance replacements in Mojave Sand Field areas, particularly over the K2 Track. In Great Basin plant communities, rabbitbrush, snakeweed, and four-winged saltbush are indicators of previously disturbed sites. Buckwheats are initial annual covers in many plant communities after severe disturbances.

Annual and Minor Perennial Species

Data are not available. NAWS will continue to collect these data.

Transition Sequence

Data are not available. NAWS will continue to collect these data.

Unique Associations

Kennedy buckwheat forms low distinctive covers over rocky, open disturbed areas of Great Basin Mixed Scrub.

Rare or Species of Concern

Sensitive species associated with disclimax communities include *astlenmic, lupmagg, linare, camboob, coreree, phanas, hulvesi*, and others, such as *oxywat, lupmagm*, and *petthugil*.

GIS Map Layer

Urban exotic is listed for the China Lake complex. Disclimax is not represented in the GIS layer.

SECTION 2.3.1.2e Analogous Plant Communities

This Appendix is a summary of NAWS plant community types and their analogous types as listed in published classification systems. The following table shows terrestrial plant communities known on NAWS. Analogous types in **bold** have descriptions that are most characteristic of NAWS vegetation..

NAWS Community Type	(Holland, 1986) Terrestrial Natural Communities[2]; CNDDB Rank[1]	(Brown et al., 1982) Biotic Communities[2]	(Munz and Keck, 1968) . A California Flora and Supplement[2]	(Sawyer and Keeler-Wolf, 1995) California Vegetation (other references)[2]
Pinyon Woodland	72210 Mojavean Pinyon Woodland - 304: Sinpinyon; G4 S4 **72122 Great Basin Pinyon Woodland - 304: Sinpinyon; G3 S3.2**	122.4 Great Basin Conifer Woodland - 122.41 Pinyon-Juniper series	Pinyon Juniper Woodland	Singleleaf Pinyon Series
Great Basin Mixed Scrub	**35100 Great Basin Mixed Scrub - 107: Bitterbrush; G4 S4** 35210 Big Sagebrush - 107: Bitterbrush; G4 S4 35300 Sagebrush Steppe - 107: Bitterbrush; G2 S2.1	122.4 Great Basin Montane Scrub - 122.41 Bitterbrush Series	Sagebrush Scrub	Bitterbrush Series
Sagebrush Scrub	35100 Great Basin Mixed Scrub - 100: Bigsagebrush; G4 S4 **35210 Big Sagebrush - 100: Bigsagebrush; G4 S4** 35300 Sagebrush Steppe - 100: Bigsagebrush; G2 S2.1	122.4 Great Basin Montane Scrub - 122.41 Bitterbrush Series	Sagebrush Scrub	Big Sagebrush Series
Blackbrush	34300 Blackbrush Scrub - 108: Blackbrush; G3 S3.2		Shadscale Scrub	
Joshua Tree Woodland	**73000 Joshua Tree Woodland - 168: Jostree; G4 S3.2** 34210 Mojave Mixed Woody Scrub - 168: Jostree; G3 S3.2 34220 Mojave Mixed Steppe - 168: Jostree; G3 S2.2	154.1 Mohave Desertscrub - 153.15 Joshuatree Series	Joshua Tree Woodland	Joshua tree Series
Desert Transition Scrub	73000 Joshua Tree Woodland - 168: Jostree; G4 S3.2 34210 Mojave Mixed Woody Scrub - 168: Jostree; G3 S3.2 34220 Mojave Mixed Steppe - 168: Jostree; G3 S2.2	152.1 Great Basin Desertscrub - 152.16 Mixed Scrub Series	Joshua Tree Woodland	Black bush Series Big sagebrush Series Joshua tree Series **Transition Desert Category (Beatley, 1976)[2]**

NAWS Community Type	(Holland, 1986) Terrestrial Natural Communities[2]; CNDDB Rank[1]	(Brown et al., 1982) Biotic Communities[2]	(Munz and Keck, 1968) . A California Flora and Supplement[2]	(Sawyer and Keeler-Wolf, 1995) California Vegetation (other references)[2]
Mojave Mixed Scrub	73000 Joshua Tree Woodland - 168: Jostree; G4 S3.2 **34210 Mojave Mixed Woody Scrub - 168: Jostree; G3 S3.2** 34220 Mojave Mixed Steppe - 168: Jostree; G3 S2.2	153.1 Great Basin Desertscrub - 152.16 Mixed Scrub Series 153.1 Mojave Desertscrub - 153.11 Creosotebush Series 153.1 Mojave Desertscrub - 153.14 Bladdersage Series 153.1 Mojave Desertscrub - 153.15 Joshuatree Series	Joshua Tree Woodland	Black Bush Series Joshua Tree Series Hop-sage Series Desert Needlegrass Series Brittlebush Series
Hop-sage Scrub	36100 Desert Chenopod Scrub - 199: Shadscale 36140 Shadscale Scrub - 199: Shadscale; G4 S3.2	152.1 Great Basin Desertscrub - 152.12 Shadscale Series 152.1 Great Basin Desertscrub - 152.15 Winterfat Series	Shadescale Scrub	**Hop-sage Series**
Shadescale Scrub	36100 Desert Chenopod Scrub - 199: Shadscale **36140 Shadscale Scrub - 199: Shadscale; G4 S3.2**	152.1 Great Basin Desertscrub - 152.12 Shadscale Series	Shadescale Scrub	Shadscale Series

NAWS Community Type	(Holland, 1986) Terrestrial Natural Communities[2]; CNDDB Rank[1]	(Brown et al., 1982) Biotic Communities[2]	(Munz and Keck, 1968) . A California Flora and Supplement[2]	(Sawyer and Keeler-Wolf, 1995) California Vegetation (other references)[2]
Mojave Wash Scrub	34210 Mojave Mixed Woody Scrub - 34240 Mojave Wash Scrub - 36110 Desert Saltbush Scrub - 98: Allscale 36110 Desert Saltbush Scrub - 153: Fousaltbush 63000 Riparian Scrub - 193: Scalebroom **63700 Mojave Desert Wash Scrub - 193: Scalebroom; G3 S2.1**	153.1 Mojave Desertscrub - 153.11 Creosotebush Series 153.1 Mojave Desertscrub - 153.14 Bladdersage Series	Creosote Bush Scrub	Allscale Series Larrea Series Scalebroom Series
Mojave Sand Field	22100 Active Desert Dunes - 51: Dessanver 22200 Stabilized and Partially Stabilized Dunes - 51: Dessanver **22300 Stabilized and Partially Stabilized Desert Sand Fields; ?** 34100 Mojave Creosote Bush Scrub	152.1 Mojave Desertscrub - 152.12 Hymenoclea Series	Creostae Bush Scrub	Desert Sand-verbena Series
Creosote Bush Scrub	34000 Mojavean Desert Scrubs **34100 Mojave Creosote Bush Scrub - 145: Crebuswhibur; G4 S4** 34100 Mojave Creosote Bush Scrub - 144: Crebush 34100 Mojave Creosote Bush Scrub - 207: Whibursage	152.1 Mojave Desertscrub - 152.11 Larrea Series	Creosote Bush Scrub	Creosote Bush Series Creosote Bush - White Bursage Series White Bursage Series
Desert Holly Scrub	36000 Chenopod Shrubs - 149: Desholly 36100 Desert Chenopod Scrub - 149: Desholly 36110 Desert Saltbush Scrub - 149: Desholly; G3 S3.2*	152.1 Great Basin Desertscrub - 152.12 Shadscale Series	Saltbush Scrub	**Desert-holly Series**

NAWS Community Type	(Holland, 1986) Terrestrial Natural Communities[2]; CNDDB Rank[1]	(Brown et al., 1982) Biotic Communities[2]	(Munz and Keck, 1968) . A California Flora and Supplement[2]	(Sawyer and Keeler-Wolf, 1995) California Vegetation (other references)[2]
Saltbush Scrub	36000 Chenopod Shrubs - 98: Allscale 36000 Chenopod Shrubs - 173: Mixsaltbush 36000 Chenopod Shrubs - 201: Spinescale 36100 Desert Chenopod Scrub - 98: Allscale 36100 Desert Chenopod Scrub - 173: Mixsaltbush 36100 Desert Chenopod Scrub - 201: Spinescale 36110 Desert Saltbush Scrub - 98: Allscale; G3 S3.2 **36110 Desert Saltbush Scrub - 173: Mixsaltbush; G3 S 3.2** 36110 Desert Saltbush Scrub - 201: Spinescale	152.1 Great Basin Desertscrub - 152.17 Saltbush Series 153.1 Mojave Desertscrub - 153.17 Saltbush Series	Saltbush Scrub	Shadscale Series Allscale Series Spinescale Series Mixed Saltbush Series
Alkaline Sink Scrub	36000 Chenopod Shrubs 36100 Desert Chenopod Scrub - 118: Busseepweed 36100 Desert Chenopod Scrub - 166: Iodbush 36100 Desert Chenopod Scrub - 173: Mixsaltbush **36120 Desert Sink Scrub - 118: Busseepweed; G3 S2.1** 36120 Desert Sink Scrub - 166: Iodbush 36120 Desert Sink Scrub - 173: Mixsaltbush	152.1 Great Basin Desertscrub - 152.12 Shadscale Series 152.1 Great Basin Desertscrub - 152.17 Saltbush Series 153.1 Mojave Desertscrub - 153.17 Saltbush Series 253.4 Mojavean Interior Strand - 253.42 Mixed Scrub Series	Alkali Sink	Suaeda Series Saltgrass Series Iodine Bush Series

NAWS Community Type	(Holland, 1986) Terrestrial Natural Communities[2]; CNDDB Rank[1]	(Brown et al., 1982) Biotic Communities[2]	(Munz and Keck, 1968) . A California Flora and Supplement[2]	(Sawyer and Keeler-Wolf, 1995) California Vegetation (other references)[2]
Vernal Playa	36120 Desert Sink Scrub 44400 Vernal Pools **46000 Alkali Playa Communities; G3 S2.1** 52500 Vernal Marsh	152.1 Great Basin Desertscrub - 152.12 Shadscale Series	Alkali Sink	Suaeda Series Saltgrass Series Iodine bush Series
Riparian	45310 Alkali Meadows; G3 S2.1 **45320 Alkali Seep; G3 S2.1** **45400 Freshwater Seep - 82: Sedge; G4 S4** 45400 Freshwater Seep - 86: Spikerush 52420 Transmontane Freshwater Marsh; G3 S2.2 52300 Alkali Marsh - 35: Bulrush 52300 Alkali Marsh - 37: Bulcattail 52300 Alkali Marsh - 43: Cattail 52320 Transmontane Alkali Marsh - 35: Bulrush; G3 S2.1 52320 Transmontane Alkali Marsh - 37: Bulcattail; G3 S2.1 52320 Transmontane Alkali Marsh - 43: Cattail; G3 S2.1 52420 Transmontane Freshwater Marsh; G3 S2.2 52500 Vernal Marsh; G2 S2.1 61320 Southern Arroyo Willow Riparian Forest - 219: Arrwilow 61320 Southern Cottonwood-Willow Riparian Forest - 279: Mixwillow; G3 S3 **61700 Mojave Riparian Forest; G1 S1.1** 62000 Riparian Woodlands - 219: Arrwillow	222.2 Plains and Great Basin Riparian Deciduous Forest - 222.21 Cottonwood-Willow Series 222.4 Sierran-Cascade Riparian Scrub - 222.41 Cottonwood-Willow Series 223.2 Interior Southwestern Riparian Deciduous Forest and Woodland 223.21 Cottonwood-Willow Series 223.3 Californian Riparian Deciduous Forest and Woodland		

NAWS Community Type	(Holland, 1986) Terrestrial Natural Communities[2]; CNDDB Rank[1]	(Brown et al., 1982) Biotic Communities[2]	(Munz and Keck, 1968) . A California Flora and Supplement[2]	(Sawyer and Keeler-Wolf, 1995) California Vegetation (other references)[2]
Riparian (continued)	**63300 Southern Riparian Scrub - 279: Mixwillow** 63320 Southern Willow Scrub - 180: Narwillow; G3 S2.1 63700 Mojave Desert Wash Scrub 63810 Tamarisk Scrub	223.31 Cottonwood-Willow Series 233.2 Interior Southwestern Swamp and Riparian Scrub - 233.21 Mixed Narrowleaf Series 233.3 Interior Southwestern Swamp and Riparian Scrub - 23 Disclimax Saltcedar Series 233.3 California Deciduous Swamp and Riparian Scrub - 233.31 Mixed Narrowleaf Series 242.5 Great Basin Interior Marshland - 242.51 Rush Series 242.5 Great Basin Interior Marshland - 242.52 Saltgrass Series 243.4 Mohavian Interior Marshland - 243.41 Rush Series 243.4 Mohavian Interior Marshland - 243.42 Saltgrass Series		

NAWS Community Type	(Holland, 1986) Terrestrial Natural Communities[2]; CNDDB Rank[1]	(Brown et al., 1982) Biotic Communities[2]	(Munz and Keck, 1968) . A California Flora and Supplement[2]	(Sawyer and Keeler-Wolf, 1995) California Vegetation (other references)[2]
Riparian (continued)		243.6 California Interior Marshland - 243.61 Cattail Series 253.4 Mohavian Interior Strand - 253.42 Mixed Scrub Series		
Disclimax	63810 Tamarisk Scrub			Cheatgrass Series

[1] CNDDB - California Natural Diversity DataBase rank.

Global Rank: The global rank is a reflection of the overall condition of an element throughout its global range.

Gl = Less than 6 viable element occurrences or less than 1,000 individuals or less than 2, 000 acres.
G2 = 6-20 element occurrences or 1,000 -3,000 individuals or 2, 000 - 10,000 acres.
G3 = 21-100 element occurrences or 3,000-10,000 individuals or 10, 000 - 50,000 acres
G4 = Apparently secure; this rank is lower than G3 but factors exist to cause some concern; i.e., there is some threat, or somewhat narrow habitat.
G5 = Population or stand demonstrably secure to ineradicable due to being commonly found in the world.

State Rank: The state rank is assigned much like the global rank, except state ranks in California often also contain a threat designation attached to the "S" rank.

S1 = Less than 6 element occurrences or less than 1,000 individuals or less than 2,000 acres.
Sl.l = Very threatened
Sl.2 = No current threats known
Sl.3 = Very threatened
S2 =6-20 element occurrences or 1,000 -3,000 individuals or 2,000 - 10,000 acres.
S2.1 = Very threatened
S2.2 = No current threats known
S2.3 = Very threatened
S3 = 21-100 Element occurrences or 3,000-10,000 individuals or 10,000 - 50,000 acres.
S3.1 = Very threatened
S3.2 = No current threats known
S3.3 = Very threatened
S4 = Apparently secure within California; this rank is clearly lower than S3 but factors exist to cause some concern; i.e. there is some threat, or somewhat narrow habitat. No threat rank.
S5=- Demonstrably secure to ineradicable in California. No threat rank.

[2] References are listed below:

Beatley, J.C. 1976. *Vascular Plants of the Nevada Test Site and Central Southern Nevada: Ecologic and Geographic Distributions.* Energy Research and Development Administration, Technical Information Center. Available from National Technical Information Service, Springfield, VA. 385 pp.

Brown, D.E., C.L. Lowe, and Pase. 1982. *Biotic Communities of the American Southwest - United States and Mexico.* Boyce-Thompson Southwestern Arboretum, vol. 1-4, 342 pp.

Holland, R.F. 1986. *Preliminary Descriptions of the Terrestrial Natural Communities of California.* California Department of Fish and Game, Sacramento, CA. 156 pp.

Munz, P.A., and D.D. Keck. 1968. *A California Flora and Supplement.* University of California Press, Berkeley, California.

Sawyer, J.O., and T. Keeler-Wolf. 1995. *A Manual of California Vegetation.* California Native Plant Society.

* CNDDB rank for nearest Holland type.

SECTION 2.3.1.3a Categories of NAWS Species of Concern Plants

NAWS Category 1 - Status Plants

These Potential Status Plants Are Known From Within Five Miles Of NAWS

NAWS Rank	Common Name	Scientific Name
1a-1	Lane Mountain milk-vetch	*Astragalus jaegerianus*
1a-2	Half-ring milk-vetch	*Astragalus mojavensis* var. *hemigyrus*

This Potential Status Plant Has Been Reported On NAWS But Needs Further Taxonomic Determinations

NAWS Rank	Common Name	Scientific Name
1b-1	Shining milk-vetch	*Astragalus lentiginosus* var. *micans*

NAWS Category 2 - Sensitive Plants

NAWS Well Known And Documented Sensitive Plant Taxa

NAWS Rank	Common Name	Scientific Name
2a-1	Mohave fish hook cactus	*Sclerocactus polyancistrus*
2a-2	Darwin milk-vetch	*Astragalus atrastus* var. *mensanus*
2a-3	Charlotte's phacelia	Phacelia nashiana
2a-4	Gypsum linanthus	*Linanthus arenicola*
2a-5	Weasel phacelia	Phacelia mustelina
2a-6	Pinyon rock cress	*Arabis dispar*
2a-7	Magnificent lupine	*Lupinus magnificus* var. *glarecola*
2a-8	Panamint bird's beak	*Cordylanthus eremicus* ssp. *eremicus*
2a-9	Indigo bush	*Psorothamnus arborescens* var. *arborescens*

Sensitive Plant Taxa With Probable Records On NAWS But Need Further Verification, Determination, Or Localities

NAWS Rank	Common Name	Scientific Name
2b-1	Crowned muilla	Muilla coronata
2b-2	DeDecker's clover	*Trifolium macilentum* var. *dedeckerae*
2b-3	Inyo hulsea	*Hulsea vestita* spp. *inyoensis*
2b-4	Naked milk-vetch	*Astragalus serenoi* var. *shockleyi*
2b-5	Panamint mariposa lily	*Calochortus panamintensis*
2b-6	Booth evening primrose	*Camissonia boothii* ssp. *boothii*
2b-7	Evening primrose	*Oenothera caespitosa* ssp. *crinita*
2b-8	Utah fendlerella	*Fendlerella utahensis*

Sensitive Plant Taxa With Suspect Records On NAWS

NAWS Rank	Common Name	Scientific Name
2c-1	Panamint live-forever	*Dudleya saxosa* ssp. *saxosa*
2c-2	Darwin rock cress	*Arabis pulchra* var. *munciensis*
2c-3	Winged crytantha	*Cryptantha holoptera*
2c-4	Mt Pinos larkspur	*Delphinium parryi* ssp. *purpureum*
2c-5	Clark Mountain Heerman buckwheat	*Eriogonum heermannii* var. *floccosum*

Potentially Sensitive Taxa Known On NAWS That Are Being Reviewed For Listing By CNPS

NAWS Rank	Common Name	Scientific Name
2d-1	Shockley columbine	*Aquilegia shockleyi*
2d-2	Dainty rock-cress	*Sibara rosulata*
2d-3	Wing-fruited primrose	Camissonia pterosperma
2d-4	Tall perityle	*Perityle magalocephala* var. *oligophylla*
2d-5	Pagoda buckwheat	Eriogonum rixfordii
2d-6	Mojave buckwheat	Eriogonum mohavense
2d-7	Indian parsley	Cymopterus aboriginum
2d-8	Panamint parsley	*Cymopterus panamintensis* var. *panamintensis*

2d-9	Gum-leaved brickellia	Brickellia multiflora
2d-10	Keysia	Glyptopleura marginata (including G. setulosa)
2d-11	Ives phacelia	*Phacelia ivesiana* (including *P. pediculoides*)

Potential Sensitive Plant Taxa On NAWS

NAWS Rank	Common Name	Scientific Name
2e-1	Pygmy poppy	Canbya candida
2e-2	Pinyon Mesa buckwheat	Eriogonum panamintense (or other taxa?)
2e-3	Common lomatium	Lomatium utriculatum (other spp?, new taxon?)

NAWS Category 3 - Unique Plant Localities
Localities With The Richest Vegetation, Highest Number Of Sensitive And Unique Plants

NAWS Rank	Localities
3a-1	El Conejo area (from guzzler 3, Whiskey Tower to Louisiana Butte north to Big Petroglyph Canyon)
3a-2	Coso Peak Lava Flow (from Coso Peak south to Silver Peak and Pinyon Bridge)
3a-3	Coso Known Geothermal Resource Area (from Cinder Peak north to Cactus Flats)
3a-4	Pilot Knob region (from Slocum Mountain north to Pilot Knob and Seep Spring north to the Robber's Mountain area)
3a-5	Birchum Mesa area (from southwest Birchum Mesa northeast to Water Canyon and the mesa to the north)
3a-6	East China Lake sand fields (extensive sand formations from CT Main Magazine areas through K2, Burro and Deadman canyons, and VABM 3004 "Baby Mountain")
3a-7	North Argus Range (from East Parkinson Peak and Bendire Canyon north to Maturango Peak and carbonate formations to the north including Argus Sterling Mine)
3a-8	Wilson and Mountain Springs area canyon bottoms (riparian systems and associated north-facing slopes including Moscow Spring Canyon)

Localities With The Richest Vegetation, Highest Number Of Sensitive And Unique Plants (cont.)

NAWS Rank	Localities
3a-9	Darwin Plateau (from Coso Village to lower Centennial Flat east to China Garden, Indian Garden, and Crystal Wash)
3a-10	Haiwee Spring area
3a-11	Pink Hill Spring area
3a-12	Red Hill Mine area
3a-13	Guzzler Number 14 area

Unique Plant Taxa That Should Be Included In Land Use Planning

NAWS Rank	Plant Taxa
3b-1	Plants that are essential hosts to sensitive or status animals including: riparian trees for Inyo California towhee; cottonwood (*Populus fremontii*), arroyo willow (*Salix lasiolepis*), red willow (*S. laevigata*), yellow willow (*S. lutea*), narrow-leaf willow (*S. exigua*), desert olive (*Forestiera pubescens*), mesquite (*Populis glandulosa*), and seepwillow (*Braccharis salicifolia*) for other birds; parry saltbush (*Atriplex parryi*) in the China Lake Basin for Darwin Tiemann's beetle; four-wing saltbush (*A. Canescens*) at El Conejo Gate for *Pholisora alpherus* and other butterflies; buckwheats).
3b-2	Creosote clonal rings (the largest/oldest).
3b-3	Trees of limited distribution such as maple (*Acer glabrum*), elderberry (*Sambucus mexicana*), serviceberry (*Amelanchier utahensis*), and singleleaf ash (*Fraxinus anolmola*).
3b-4	Joshua tree spikes and other exceptional tree formations.
3b-5	Plants of noteworthy occurrence, range extension, etc., such as *Fragonia laevis, Salvia pachyphylla, Keckiella* spp., *Cercocarpus, Malcothamnus fremontii, Horkeliella congdonis, Mammilaria tetrancistra*, and *Viola purpurea*.
3b-6	Mockorange (*Philadelphus microphyllus*) in upper Bendire Canyon.
3b-7	Orchids (*Epipactis gigantea*) at Margaret Ann and similar springs.
3b-8	Solomon's seal (*Smilisca stellata*) at Mill Spring.
3b-9	Snowberry (*Symphoricarpos longiflorus*) at Mill Spring and Coso Bridge.
3b-10	Plants previously recognized as sensitive since withdrawn from lists, but still are uncommon or of interest such as *Pholisma*.

Plant Habitats That Should Be Included In Land Use Planning

NAWS Rank	Plant Habitat
3c-1	Riparian areas and surrounding habitat, such as canyon slopes near Mill, Moscow, Wilson, and Margaret Ann springs.
3c-2	Areas of dense Joshua Tree Woodland, such as upper Mountain Springs Canyon and southwest of China Garden Spring.
3c-3	Dense perennial grass associations, such as in Grass Valley, galleta grass near Goldstone, Poa stands, deergrass, parish needle grass, and James galleta grass.
3c-4	Higher elevation dry lakes, pools, and lacustrine basins, such as Carricut Lake, El Conejo Gate, and lava flow pools.
3c-5	Juniper areas, such as southwest of Coso Peak and Mariposa Mine.
3c-6	Concentrations of cactus, such as west of Argus Sterling Mine.
3c-7	Higher elevation lava flow mesas, such as Birchum Mesa, the Coso Peak area, and low sage formations with Mariposa lilies.
3c-8	Desert pavements.
3c-9	Sand fields and dunes.

3c-10	Dolomite/marble formations.
3c-11	Cinder formations.
3c-12	Felsic outcrops, dikes and ridges
3c-13	High elevation caliche formations

NAWS Rank: 1a - Potential status plants known to occur within five miles of NAWS.
1b - Potential status plant reported from NAWs but further taxonomic determinations are needed.
2a - Sensitive plant taxa that are well known and documented on NAWS.
2b - Sensitive plant taxa with probable records on NAWS, but need further investigation.
2c - Plant taxa having suspect records on NAWS and are probably reporting errors or nomenclature changes.
2d - Potentially sensitive plant taxa known on NAWS that are being reviewed for listing by CNPS.
2e - Potential sensitive plant taxa on NAWS.
3a - Unique plant localitieson NAWS.
3b - Unique plant taxa that should be included in land use planning.
3c - Habitats that should be included in land use planning.

General Mitigating Factors for Plant Conservation at NAWS

The rugged and remote terrain of NAWS ranges is the primary natural mitigating factor in preserving the quality of native vegetation. In areas of NAWS that are being used, the primary factor for plant conservation is the relatively limited (for a military range) and low frequency of surface impacts associated with many operations. Most impacts and development are in the China Lake basin where natural reclamation is a mitigating factor due to widespread aeolian activity and playa flooding.

The climate of the NAWS region is generally unfavorable to the ability of vegetation to resist anthropogenic and grazing effects. Temperature extremes, aridity, wind, and exposure severely affect plant growth and reproduction in the west Mojave Desert. Secondary effects occur when soil-binding plants are removed, including topsoil abrasion, establishment of weed species, and replacement with sand field. The geographic shape of disturbed areas reflects wind and surface flooding effects, especially at lower elevations. Because of the climate, seasonal timing of surface impacting activities at NAWS is the most important mitigating factor for vegetation resources conservation.

Other factors influencing plant conservation are cultural resources, wetlands, and faunal habitat issues. Management of sensitive plant populations is aided by restricted public access and the ability to implement feral, domestic, and exotic species control.

Most NAWS-SC plant taxa, which have received reasonable survey work, appear to have healthy populations and good habitat quality. As a whole, the distribution of sensitive plant species at NAWS, relative to land use patterns, is favorable for management of populations with ongoing NAWS activities, if operational patterns remain similar to the past.

Criteria for NAWS Plant Importance and Value

Only some plant taxa and their habitats can be avoided at NAWS. Prioritizing taxa and habitats is necessary to ensure that the most important or highest value vegetation resources are given greatest consideration during environmental and land planning processes.

Legal status is the main criteria that most federal landholding agencies use to determine which plants to manage (*i.e.* which plants through actions or avoidance are given the highest consideration in planning and operations). The ESA is the most protective legal status that could affect a plant taxon occurring at NAWS. No ESA-listed plants are known from NAWS. However, one plant taxa being proposed, may potentially occur at NAWS. Plants listed under the ESA are listed only for purposes of taxonomic endangerment.

Several other levels of listing for taxonomic endangerment of plants, populations, and habitats relative to NAWS include the California state environmental laws, California Native Plant Society listings, TNC and CNDDB databases, and regional desert plans. There is little or no legal applicability of these listings to NAWS, but they serve as a tool for environmental management. These lists are the foundation for prioritizing non-status plants at NAWS.

Other legal and conservation issues value plant habitats, including ESA-listed animal critical habitat, wetlands, and cultural sites. In the future, certain individual plant taxons, which are hosts to dependent ESA-listed animals, may receive specific protection. There are plant taxa at NAWS which are host to rare insects (one proposed-threatened). Some plant habitats have state status rankings. These are described and ranked in the CNDDB, but have limited applicability to the specific plant associations found at NAWS.

Criteria for Considering an Individual Non-status Plant

Rare or valued plant resources at NAWS without legal status should be considered through general land use practices and voluntary protective actions. If NAWS chooses to include non-status species during environmental assessment and planning decisions, other factors should be considered when attempting to prioritize vegetation resources.

Generally, individual plants are not considered during environmental management. Some unique plant formations, especially ancient individuals, get protected at the federal level through agency or policy decisions. The 1980 BLM CDCA plan includes protection of unique stands (see Phase One: NWC creosote clones survey, Michael Brandman Associates, Inc., 1989). At NAWS creosote bush clones may be the highest status ranking individual plants present.

Non-status plants, such as trees, cacti, and unique large shrubs, are often voluntarily avoided during development because of their prominence, shade provision, limited known regional occurrence, or aesthetic appeal. Many minor roads of NAWS have avoided pines and Joshua trees especially where they occur in large forms. Large Joshua trees (particularly spikes), creosote bush clones, and cactus are among the most valued plants at NAWS and are limited plant resources. Large individuals of Mojave fishhook cactus are one of the most regionally important individual plants on NAWS without federal status.

Criteria for Considering a Non-status Plant Taxon

The following criteria should be considered when including and prioritizing non-status plants in environmental planning:

- Is there a need to consider the taxon affected by NAWS activities or affected by activities outside of NAWS?
- Has the taxon been overlooked or improperly assessed by status listings? Much of California's plant conservation emphasis is focused on interior and coastal areas and areas surrounding larger cities. Desert plant issues are not always reflected in listings and lobbying.
- Is the taxon currently or potentially affected by activities on NAWS?
- Is the taxon unique to the region or are populations at NAWS the most important?
- Is the taxon a distinct, unique species (of higher interest to biodiversity; or less genetically distinct from other similar forms; or in a species complex or lesser taxonomic level, a ssp. or var.)?
- Does the taxon share habitat with other rare or sensitive plants, animals, or wetlands, or is the taxon an essential host to rare or sensitive faunal resources?
- Does the taxon provide forage or shelter for game or sensitive faunal resources?
- Is the taxon already protected by natural mitigating factors, such as location or terrain, or does it occur in an area with other legal status?
- Does the taxon have cultural significance (Native American uses or indicators for cultural sites)?
- Does the taxon have commercial value?
- Does the taxon have high public interest or appeal (landscaping/revegetation uses, unique form, scenic value, historic, etc.)?
- Is the taxon scientifically or ecologically unique (range extension-disjunct, ancient or unusual forms, etc.)?

Criteria for Considering Non-status Plant Habitats

Generally, many of the same assessment factors used for individual plant taxon can be applied to prioritizing conservation of plant habitats and communities. Diversity is generally the most important feature of plant habitat conservation. Areas of multiple sensitive plant taxa occurrences often coincide with high diversity zones.

Other factors in conservation priority decisions for non-status plant habitats in environmental planning include:

- Is the plant habitat unique to the region? Highly restricted plant habitats are also important because they provide a unique resource for a small land area. This applies mostly to riparian areas or unique geological associations, such as cinder or dolomite zones.
- Is the plant habitat unaffected by NAWS activities or outside threats; is it already protected by natural mitigating factors, such as location or terrain; or does it occur in an area with other legal status, such as wetlands, cultural sites, ESA-listed animal habitat, etc.?
- Is the plant habitat vulnerable or currently affected by activities at NAWS or in an area where trespass or adjacent activities cause degradation to NAWS resources?

SECTION 2.3.1.3b Ecological Sensitivity Rankings for NAWS/CL-SC Plants

Plant Taxa	Occurrence	Threats	Endemism	Distribution	Surface Impact Sensitivity[1]	Fire Sensitivity[2]	Grazing Sensitivity[3]
Lane Mountain Milk-vetch*	Unconfirmed	Moderate	Core populations, locally disturbed*	Highly restricted*	High	Moderate	High
Darwin Milk-vetch	Uncommon	Active	Core populations, locally disturbed	Patchy	Moderate	Moderate	High
Panamint Live-forever*	Rare	Moderate	Important populations, regionally disturbed	Highly restricted	High	Moderate	High
Crowned Muilla	Rare	Active	Minor populations, widely disturbed	Highly restricted	High	Low	Low
Mohave Fish Hook Cactus	Uncommon	Active	Important populations, regionally disturbed	Widely disturbed	High	High	High
DeDecker's Clover*	Rare*	None	Important populations, regionally disturbed*	Highly restricted*	High	High	Moderate
Charlotte's Phacelia	Rare	Moderate	Minor populations, widely disturbed	Highly restricted	Moderate	Low	Low
Weasel Phacelia	Rare	None	Minor populations, widely disturbed	Highly restricted	High	Low	Low
Inyo Hulsea*	Rare*	None	Minor populations, widely disturbed*	Highly restricted*	Low	Moderate	Low
Pinyon Rock Cress	Uncommon	Moderate	Important populations, regionally disturbed	Patchy	High	High	High
Magnificent Lupine	Uncommon	Moderate	Important populations, regionally disturbed	Patchy	Moderate	Low	Low
Panamint Mariposa Lily*	Rare	None	Important populations, regionally disturbed*	Patchy*	Moderate	Low	Moderate
Shining Milk-vetch*	Common*	Moderate	Important populations, regionally disturbed*	Widely disturbed*	Low	Low	Low

Plant Taxa	Occurrence	Threats	Endemism	Distribution	Surface Impact Sensitivity[1]	Fire Sensitivity[2]	Grazing Sensitivity[3]
Gypsum Linanthus	Common	Moderate	Important populations, regionally disturbed	Widely disturbed	Low	Low	Low
Evening Primrose*	Rare*	None	Minor populations, widely disturbed*	Highly restricted*	High	Moderate	Low
Utah Fendlerella	Rare	None	Minor populations, widely disturbed	Highly restricted	High	High	Low
Indigo Bush	Common	None	Important populations, regionally disturbed	Patchy	Moderate	High	Low
Panamint Bird's Beak	Common	None	Important populations, regionally disturbed	Widely disturbed	Low	Low	Low
Booth Evening Primrose*	Common*	None	Minor populations, widely disturbed*	Patchy*	Moderate	Low	Low

* Taxa that require further investigation, are suspect, or from old records.

[1] **Surface Impact Sensitivity** = Taxa's sensitivity to surface impacts and common disturbances.
High = Highly sensitive to surface disturbances, scrapes, broken soil crusts, loosened rock cover, compaction, etc. Plant taxa of this sensitivity will very likely be locally extirpated from these impacts.
Moderate = Moderately sensitive to surface disturbances. Plant taxa of this sensitivity will partially recover from a low frequency of surface impacts but are still adversely affected by major habitat alterations or a high frequency surface impacts.
Low = Low sensitivity to surface disturbances. Plant taxa of this sensitivity will often thrive and increase populations in areas of surface disturbances. These plants can recover if habitat morphology is mostly unaltered or unaffected by frequent surface disturbances, such as bombing, roads, off-road driving, grazing, etc.

[2] **Fire sensitivity** = Taxa's sensitivity to patchy, cool burning fires typical of deserts.
High = Highly sensitive to fires. These mostly include woody shrubs which do not resprout after fires. Also includes plants adversely affected by post-burn ecological changes.
Moderate = Moderately sensitive to fires. Includes plants which can survive or repopulate after light or rapid fires.
Low = Low sensitivity to fires. These plants can avoid fires as annuals or geophytes or require fires or other scarification to prepare the seeds and soil for germination.

[3] **Grazing sensitivity** = Taxa's sensitivity to grazing habits of domestic and feral herbivores.
High = Highly sensitive to grazing. These plants are palatable to ungulates and other herbivores or are adversely affected by soil disturbances associated with grazing.
Moderate = Moderately sensitive to grazing. These plants are only grazed lightly or seasonally or moderately affected by grazing-associated disturbances.
Low = Low sensitivity to grazing. These plants are highly unpalatable or grow in inaccessible areas or thrive with grazing-associated disturbances.

SECTION 2.3.1.3c Ecological Aspects of NAWS Species of Concern Plants Known or Suspected to Occur on NAWS

Plant Taxa	Elevation (msl)	Plant Community Associations	Geology	Known Populations**
Pinyon Rock Cress *Arabis dispar*	4,000 to 8,000 feet	Pinyon Woodland, Great Basin Mixed Scrub, Sagebrush Scrub, Joshua Tree Woodland, Blackbrush Scrub	Rocky or stony slopes, outcrops, and benches; granite and basalt	6 sites, sparse at all sites, 50 + plants (similar habitat = ca. 1,000 plants)
Darwin Milk-vetch *Astragalus atratus* var. *Mensanus*	6,000 to 7,700 feet	Pinyon Woodland, Great Basin Mixed Scrub, Sagebrush Scrub, Joshua Tree Woodland, Blackbrush Scrub	Benches, flats with cobbles and clay; granite and basalt	8 sites, (similar habitat = ca. 4,000 plants)
Lane Mountain Milk-vetch *Astaragalus jaegerianus*	3,000 to 3,500 feet	Joshua Tree Woodland, Blackbrush Scrub, Mojave Mixed Scrub, Hop-sage Scrub	Shallow ridges and upper bajada, granite	3 sites SE of NAWS
Shining Milk-vetch *Astragalus lentiginosus* var. *micans**	2,000 to 3,500 feet	Mojave Sand Field, Creosote Bush Scrub, Saltbush Scrub, Hop-sage Scrub	Sandy areas, stabilized dunes, roadsides	Common in China Lake basin and Salt Wells Valley, (similar habitat = ca. 250,000 plants)
Panamint Mariposa Lily *Calachortus panamintensis**	6,500 to 8,100 feet	Pinyon Woodland, Great Basin Mixed Scrub, Sagebrush Scrub	Basalt flats, rolling terrain	2 sites in the Coso Peak area, 20 plants, (similar habitat = ca. 1,000 plants)
Booth Evening Primrose *Camissonia boothii* ssp. *boothii*	2,500 to 4,500 feet	Sagebrush Scrub, Desert Transition Scrub, Mojave Mixed Scrub, Hop-sage Scrub, Shadscale Scrub, Creosote Bush Scrub	Steep cinder slopes; pumice, obsidian, rhyolite	6 sites in the Coso Peak area, ca. 20,000 plants, (similar habitat = ca. 100,000 plants)
Panamint Bird's Beak *Cordylanthus eremicus* ssp. *eremicus*	5,000 to 8,000 feet	Pinyon Woodland, Great Basin Mixed Scrub, Sagebrush Scrub, Joshua Tree Woodland, Blackbrush Scrub, Desert Transition Scrub	Basalt flows, granitic slopes, rolling terrain, all soil types	30 + sites in upper elevations of North ranges, 100,000 plants, (similar habitat = ca. One million plants)
Panamint Live-forever *Dudleya saxosa* ssp. *saxosa**	3,000 to 5,000 feet	Joshua Tree Woodland, Blackbrush Scrub, Mojave Mixed Scrub	Rocky outcrops or crevices among boulders	One site reported on 1980 (BLM) at Pilot Knob
Utah Fendlerella *Fendlerella utahensis*	7,500 to 8,800 feet	Pinyon Woodland, Great Basin Mixed Scrub, Desert Transition Scrub	Upper slopes and ridges of limestone ranges	One site reported from Maturango Peak
Inyo Hulsea *Hulsea vestita* ssp. *inyoensis**	4,500 to 7,000 feet	Pinyon Woodland, Great Basin Mixed Scrub, Sagebrush Scrub, Desert Transition Scrub	Steep scree and talus slopes	One report (1891) from canyon south of Crystal Springs
Gypsum Linanthus *Linanthus arenicola*	1,600 to 3,500 feet	Mojave Mixed Scrub, Mojave Sand Field, Creosote Bush Scrub, Saltbush Scrub, Alkaline Sink Scrub	Alkaline and aeolian areas at low elevations	8 sites in China Lake basin and Pilot Knob Valley
Magnificent Lupine *Lupinus magnificus* var. *Glarecola*	5,500 to 8,000 feet	Pinyon Woodland, Great Basin Mixed Scrub, Sagebrush Scrub, Joshua Tree Woodland, Blackbrush Scrub	Scree slopes, washes, sandy areas, and disturbed sites; usually granitic	15 + sites from Louisiana Butte to Upper Centennial Flat, 2,000 plants
Crowned Muilla *Muilla coronata*	2,500 to 4,500 feet	Joshua Tree Woodland, Blackbrush Scrub, Desert Transition Scrub, Mojave Mixed Scrub, Hop-sage Scrub, Shadscale Scrub, Creosote Bush Scrub	Stony and clay flats, heavy soils	One site reported from Devil's Kitchen

Plant Taxa	Elevation (msl)	Plant Community Associations	Geology	Known Populations**
Evening Primrose *Oenothera caespitosa* ssp. *crinita**	4,000 to 6,500 feet	Great Basin Mixed Scrub, Joshua Tree Woodland, Blackbrush Scrub, Desert Transition Scrub	Rocky bajada, canyons; usually limestone	One site at El Conejo gate, (# of plants unknown)
Weasel Phacelia *phacelia nashiana*	2,500 to 4,500 feet	Joshua Tree Woodland, Mojave Mixed Scrub, Hop-sage Scrub, Shadscale Scrub, Creosote Bush Scrub	Steep scree slopes, cinder, granite, metamorphic	4 sites at Volcano and Cinder peaks, (# of plants unknown)
Indigo bush *Psosrothamnus arborescens* var. *arborescens*	2,500 to 4,500 feet	Joshua Tree Woodland, Blackbrush Scrub, Mojave Mixed Scrub, Hop-sage Scrub	Washes and upper bajada	10 + populations, ca. 5,000 plants
Mohave Fish Hook Cactus *Sclerocactus polyancistrus*	3,000 to 6,500 feet	Great Basin Mixed Scrub, Sagebrush Scrub, Joshua Tree Woodland, Blackbrush Scrub, Desert Transition Scrub, Mojave Mixed Scrub, Hop-sage Scrub, Shadscale Scrub, Creosote Bush Scrub	Rocky hilltops, many formations	20 + populations, ca. 1,000 plants, North and South ranges
DeDecker's Clover *Trifolium macilentum* var. *dedeckerae*	7,000 to 8,000 feet	Pinyon Woodland	Talus, metamorphic granite	One population NE of Coso Peak, 100 plants

msl -mean sea level

* - Requires further investigation, are suspect, or from old records

**ca. - Calculated

SECTION 2.3.1.3d NAWS/CL Sensitive Plant Species Maps

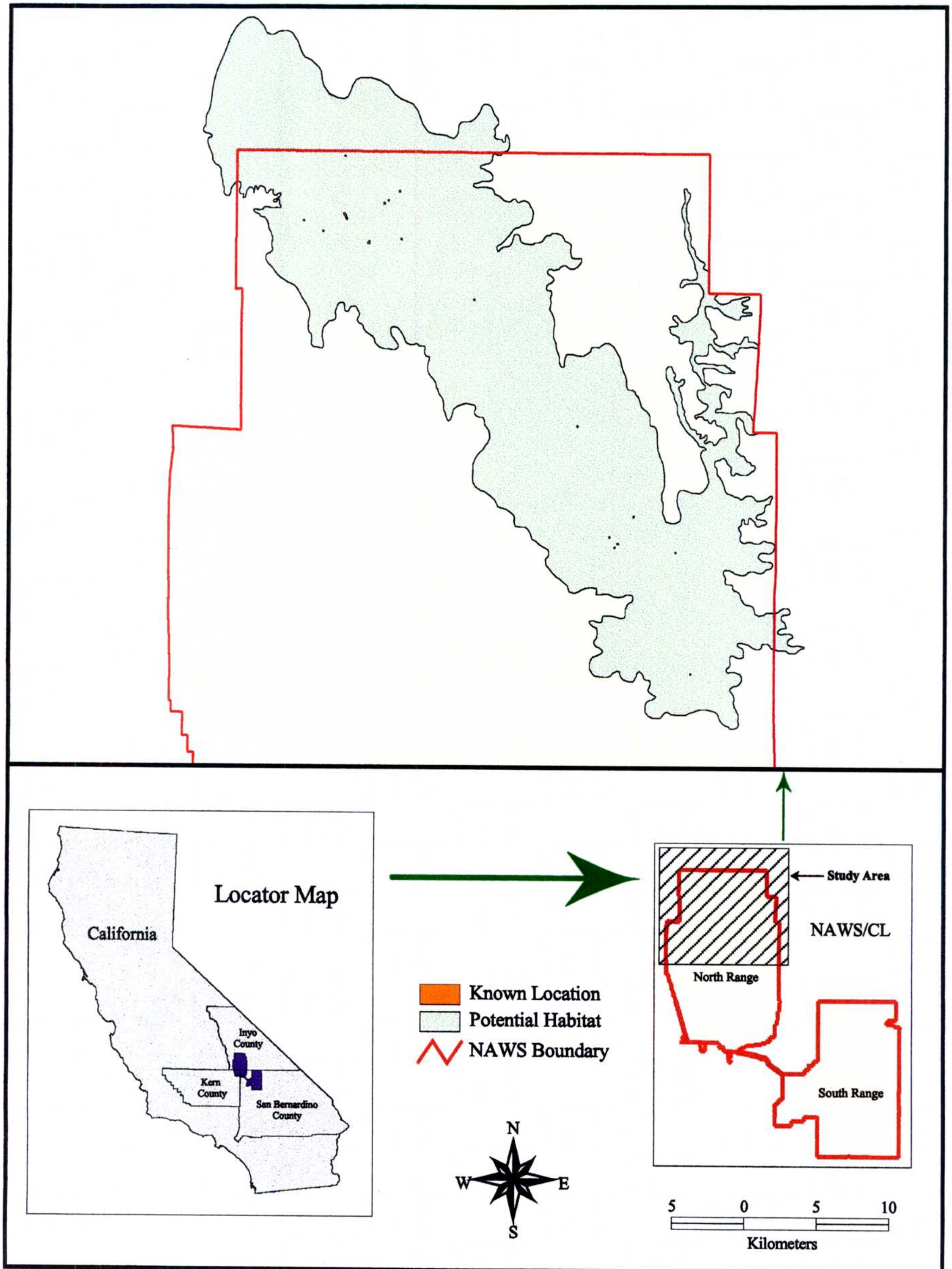

Figure 1 Known Locations and Potential Distribution of *Arabis dispar* (Pinyon Rock Cress) on NAWS/CL

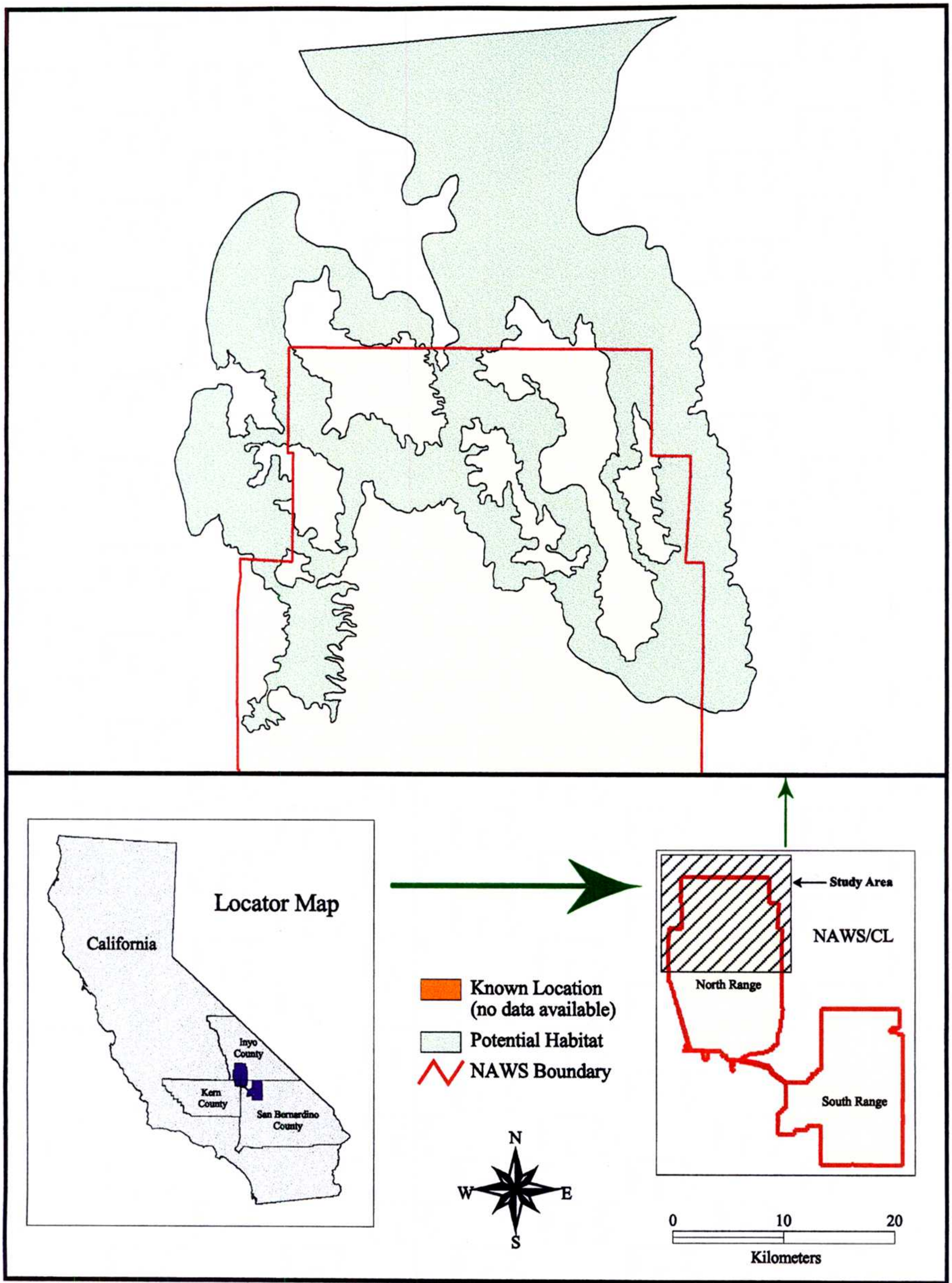

Figure 2 Known Locations and Potential Distribution of *Arabis pulchra var. munciensis* (Darwin Rock Cress) on NAWS/CL

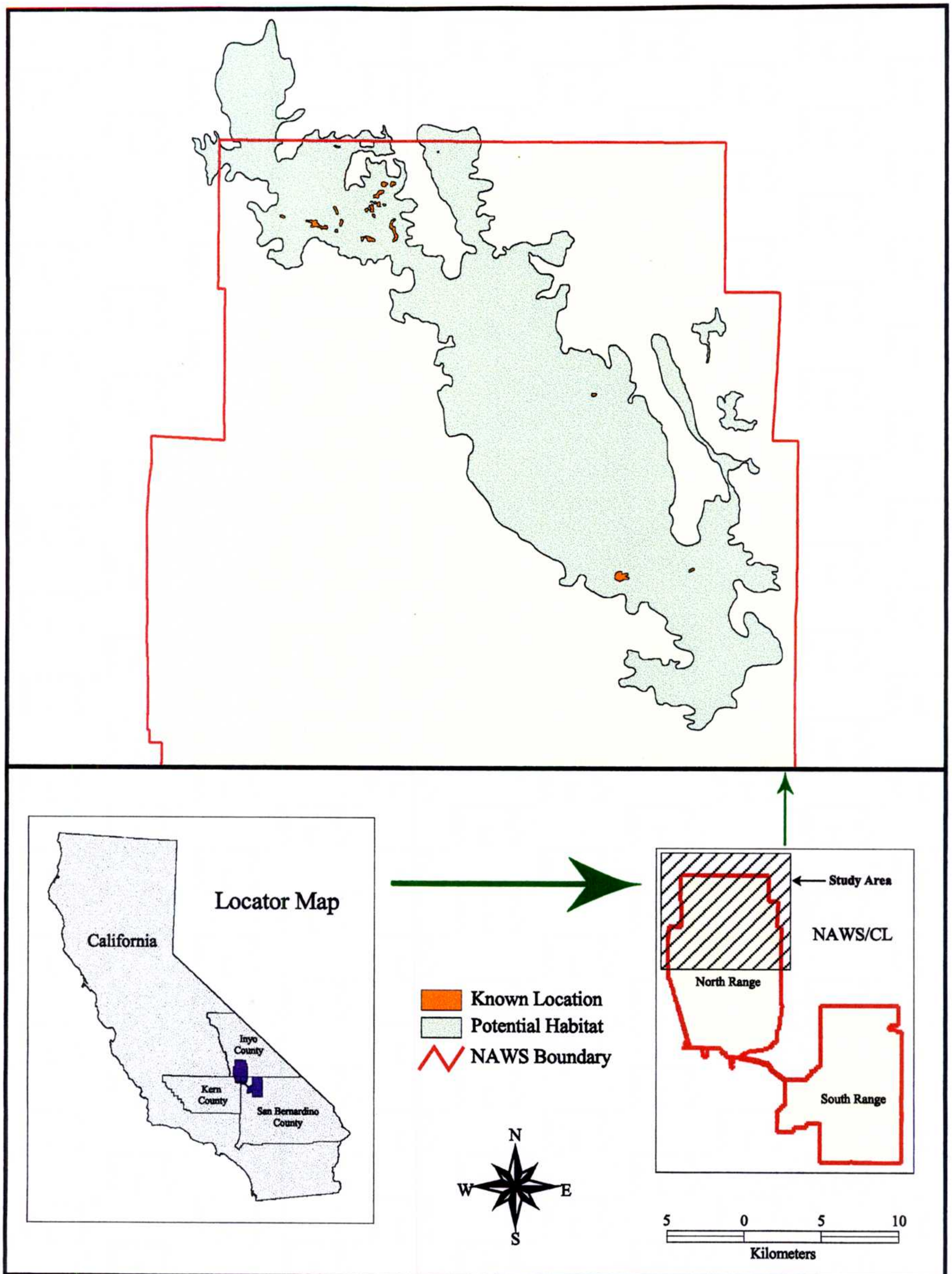

Figure 3 Known Locations and Potential Distribution of *Astragalus atratus var. mensanus* (Darwin Mesa Milk-vetch) on NAWS/CL

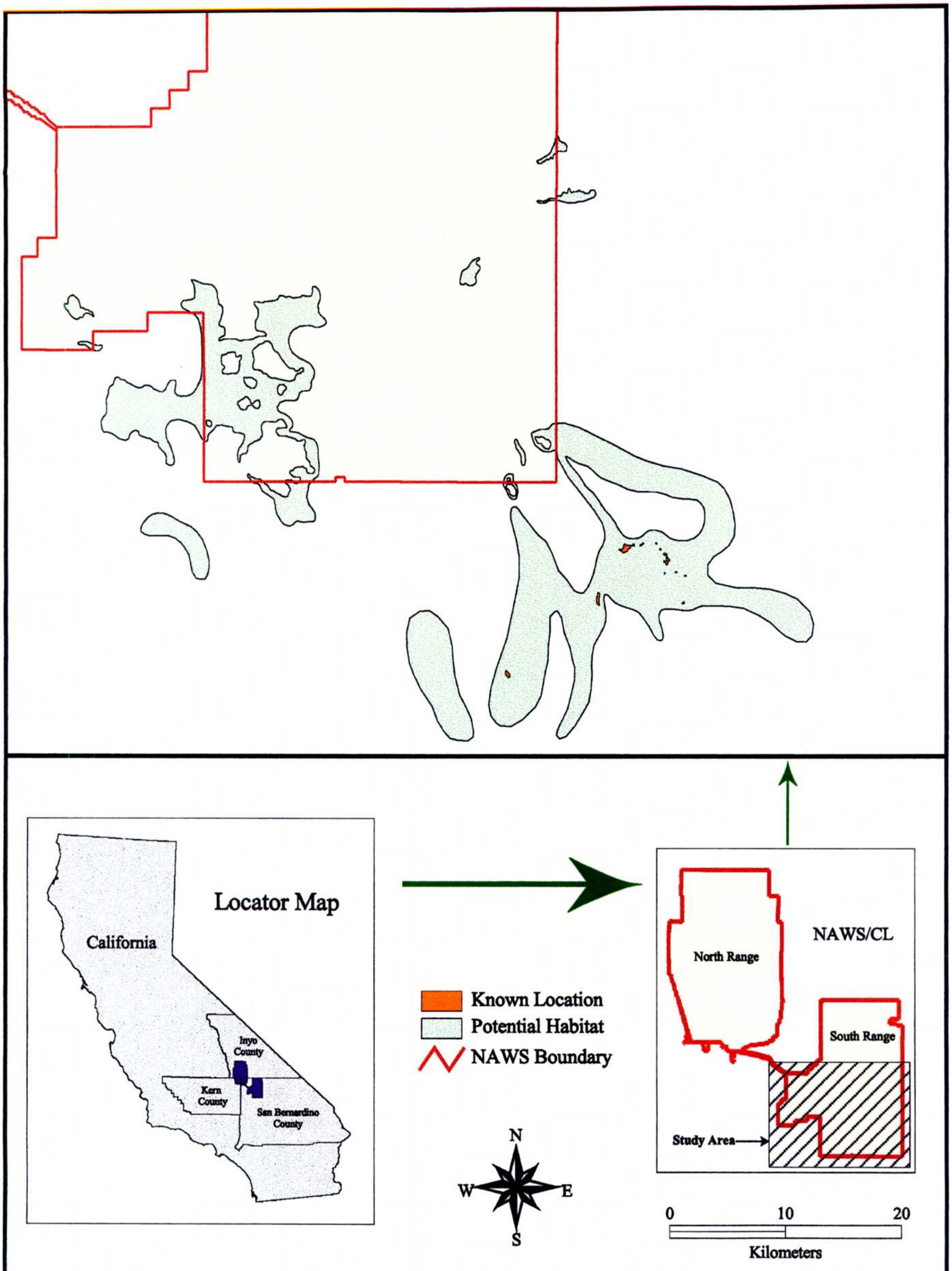

Figure 4 Known Locations and Potential Distribution of *Astragalus jaegerianus* (Lane Mountain Milk-vetch) on NAWS/CL

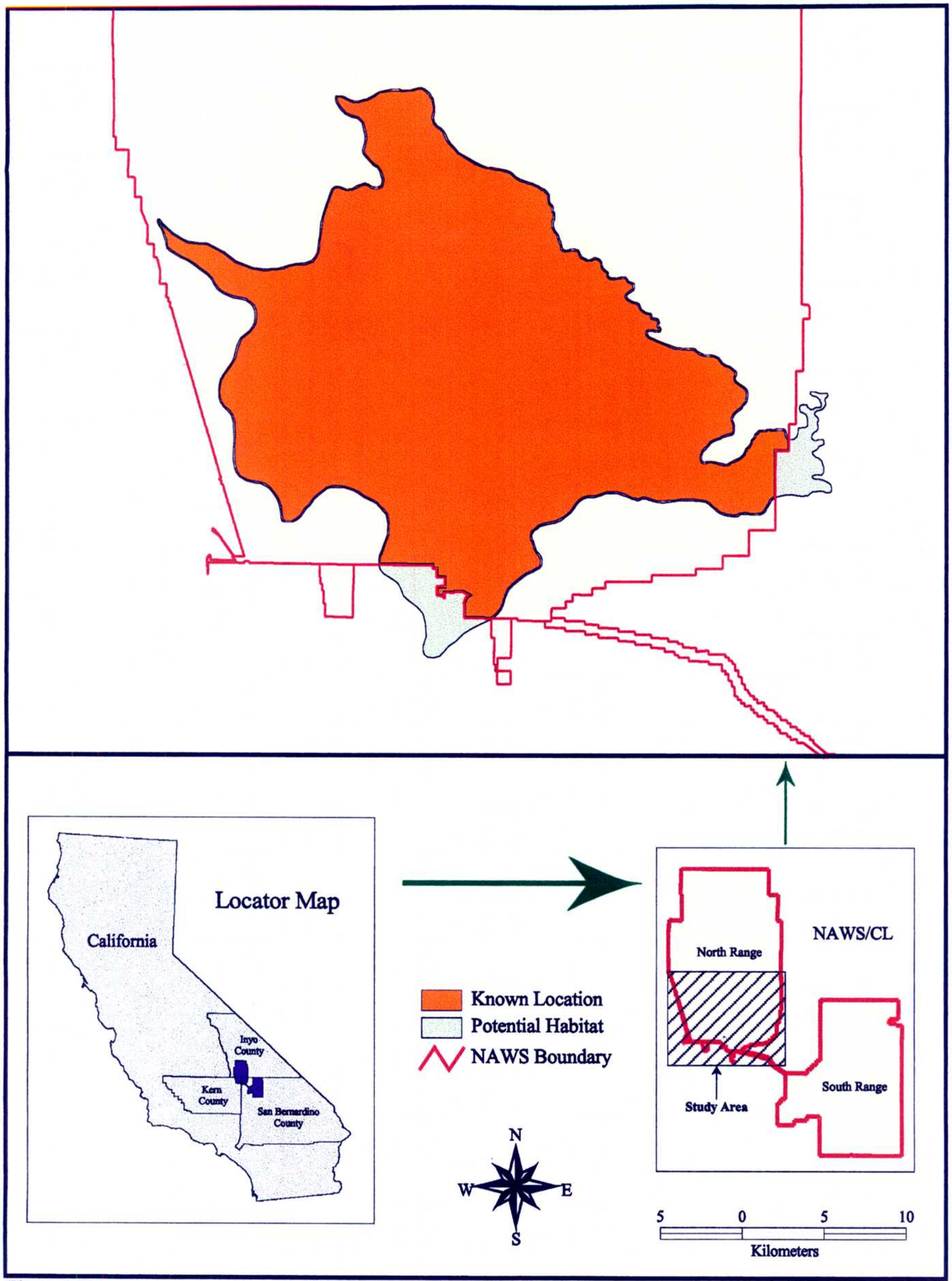

Figure 5 Known Locations and Potential Distribution of *Astragalus lentiginosus var. micans/variabilis* (Shining Milk-vetch) on NAWS/CL

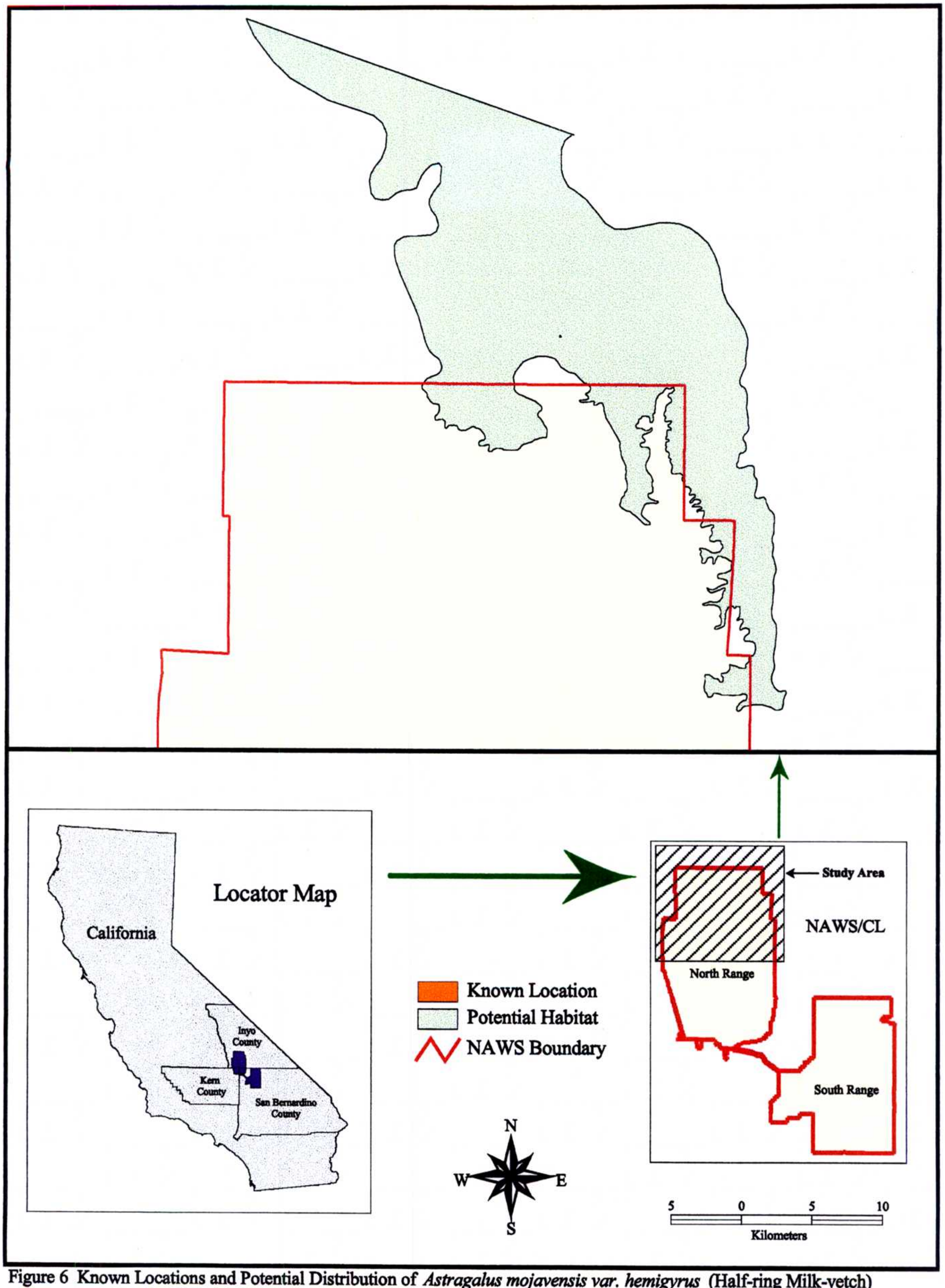

Figure 6 Known Locations and Potential Distribution of *Astragalus mojavensis var. hemigyrus* (Half-ring Milk-vetch) on NAWS/CL

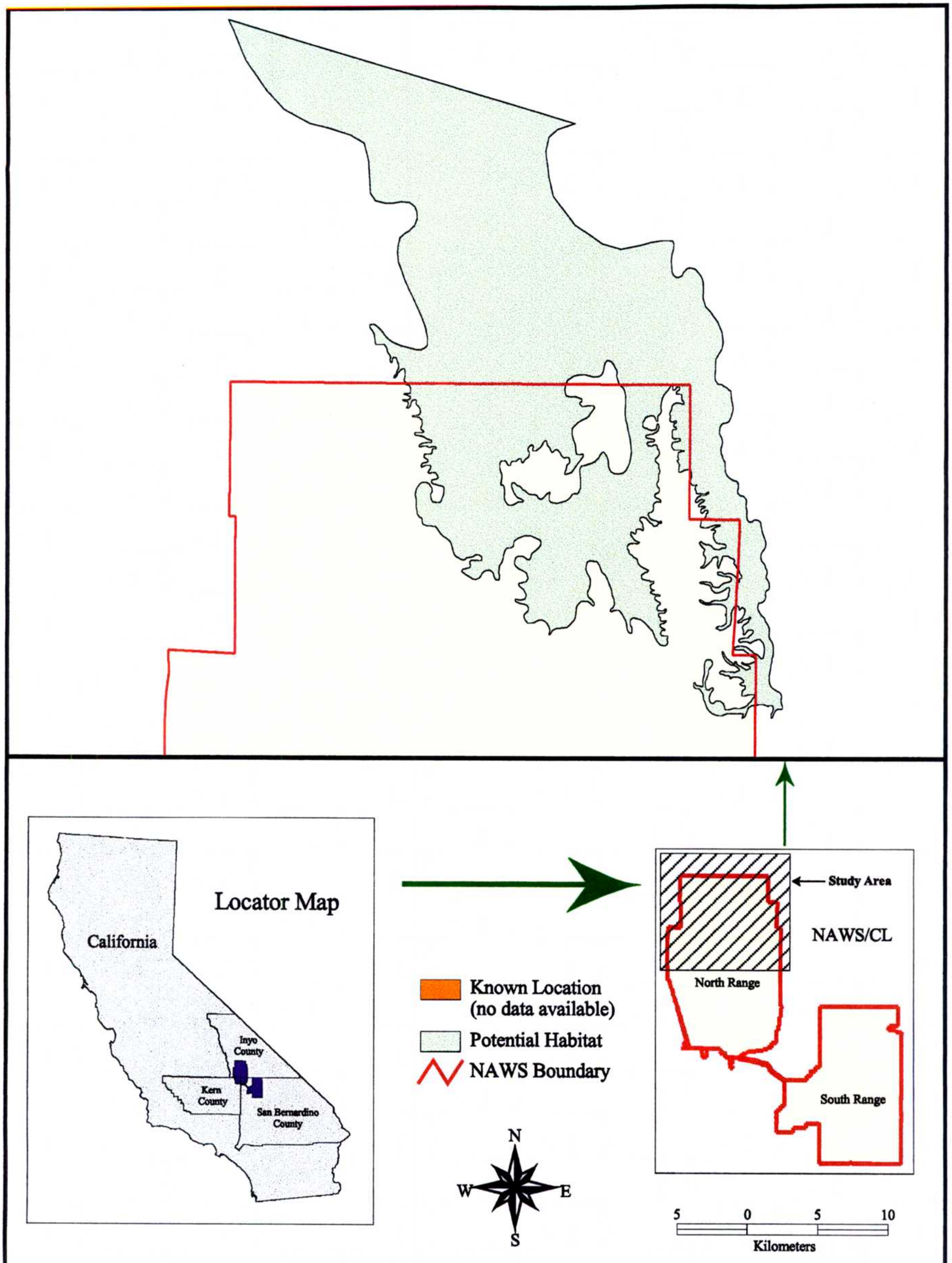

Figure 7 Known Locations and Potential Distribution of *Astragalus serenoi va. shockleyi* (Naked Milk-vetch) on NAWS/CL

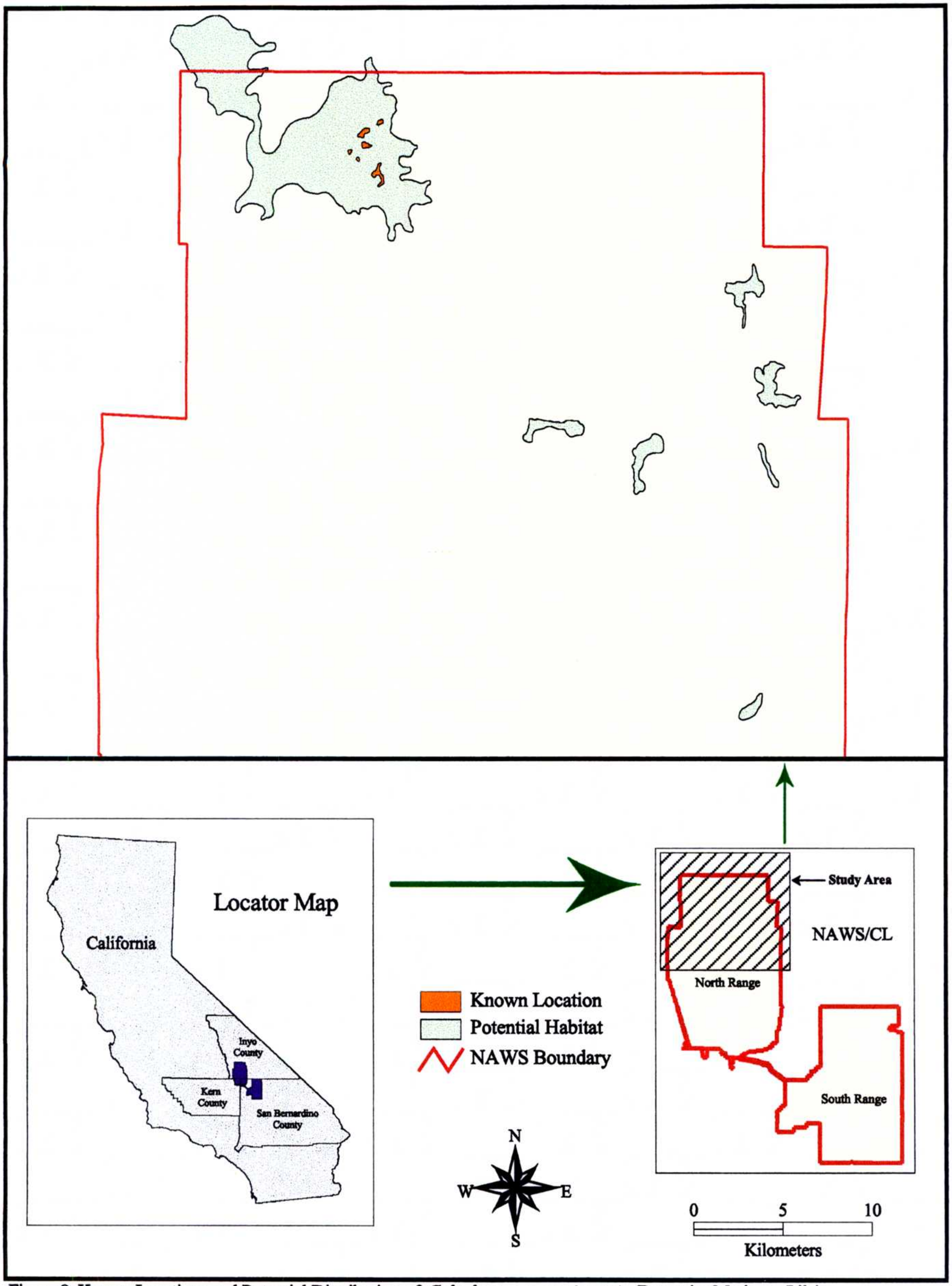

Figure 8 Known Locations and Potential Distribution of *Calochortus panamintensis* (Panamint Mariposa Lily) on NAWS/CL

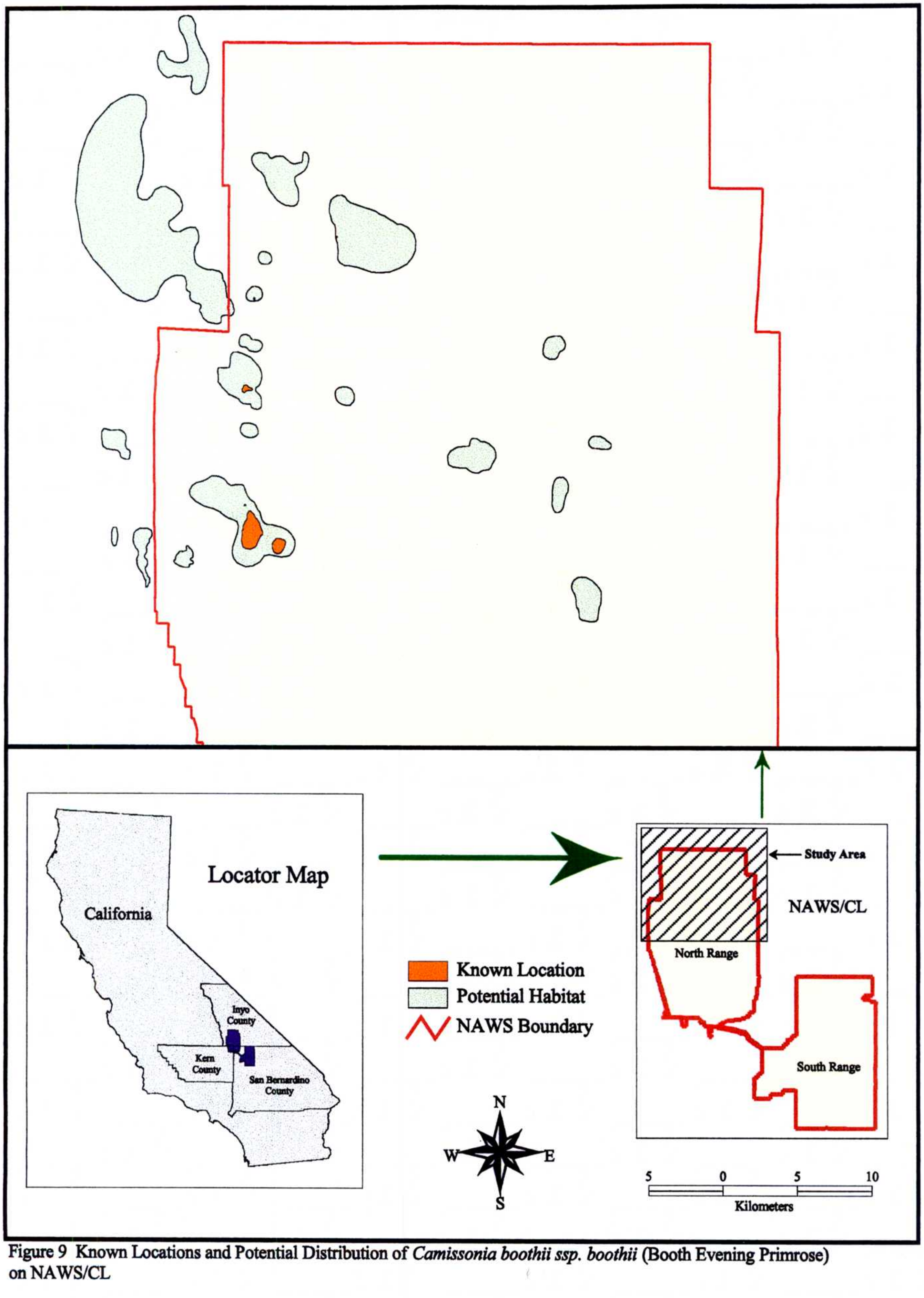

Figure 9 Known Locations and Potential Distribution of *Camissonia boothii ssp. boothii* (Booth Evening Primrose) on NAWS/CL

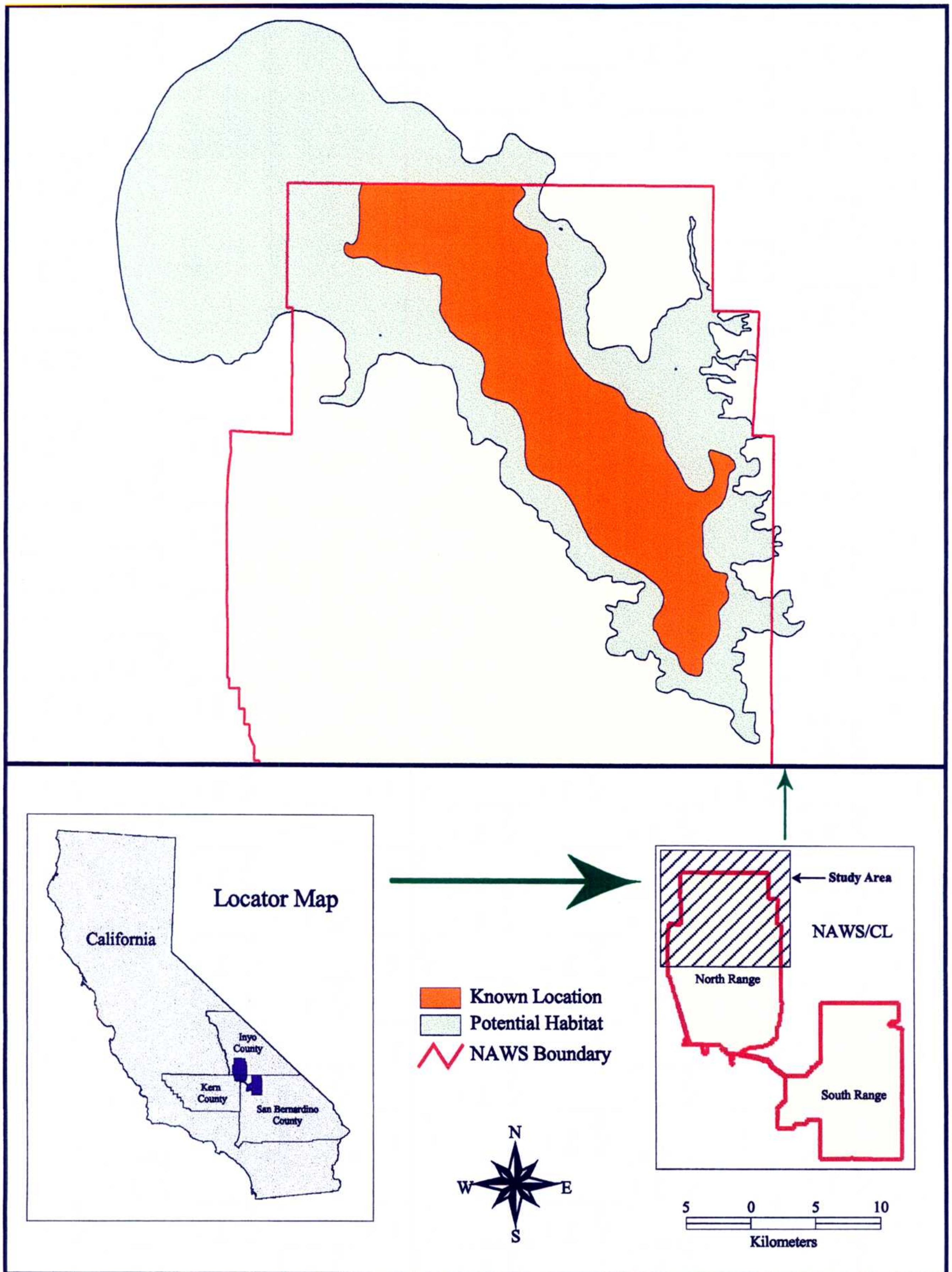

Figure 10 Known Locations and Potential Distribution of *Cordylanthus eremicus ssp. eremicus* (Panamint Bird's Beak) on NAWS/CL

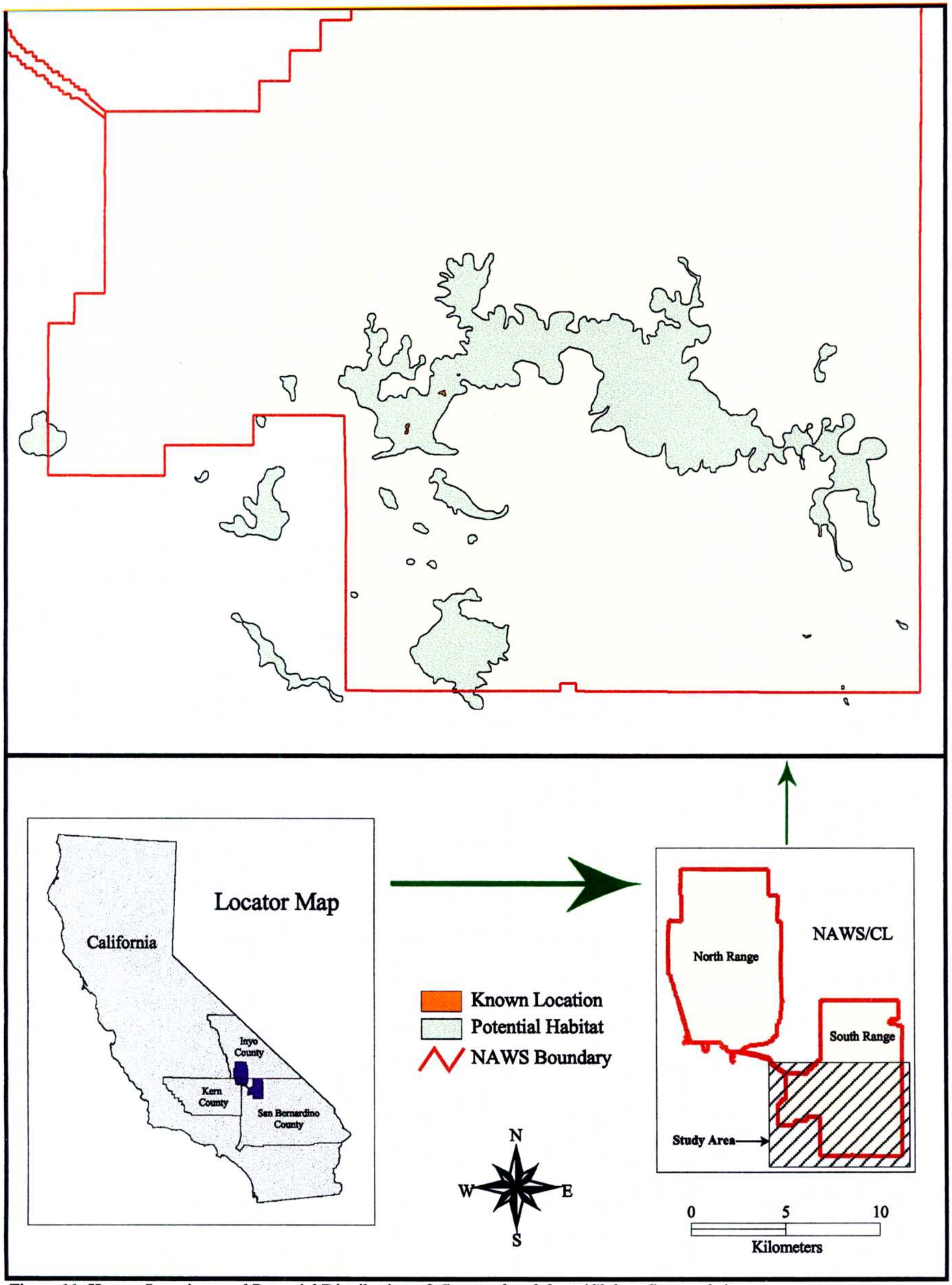

Figure 11 Known Locations and Potential Distribution of *Cryptantha clokeyi* (Clokey Cryptantha) on NAWS/CL

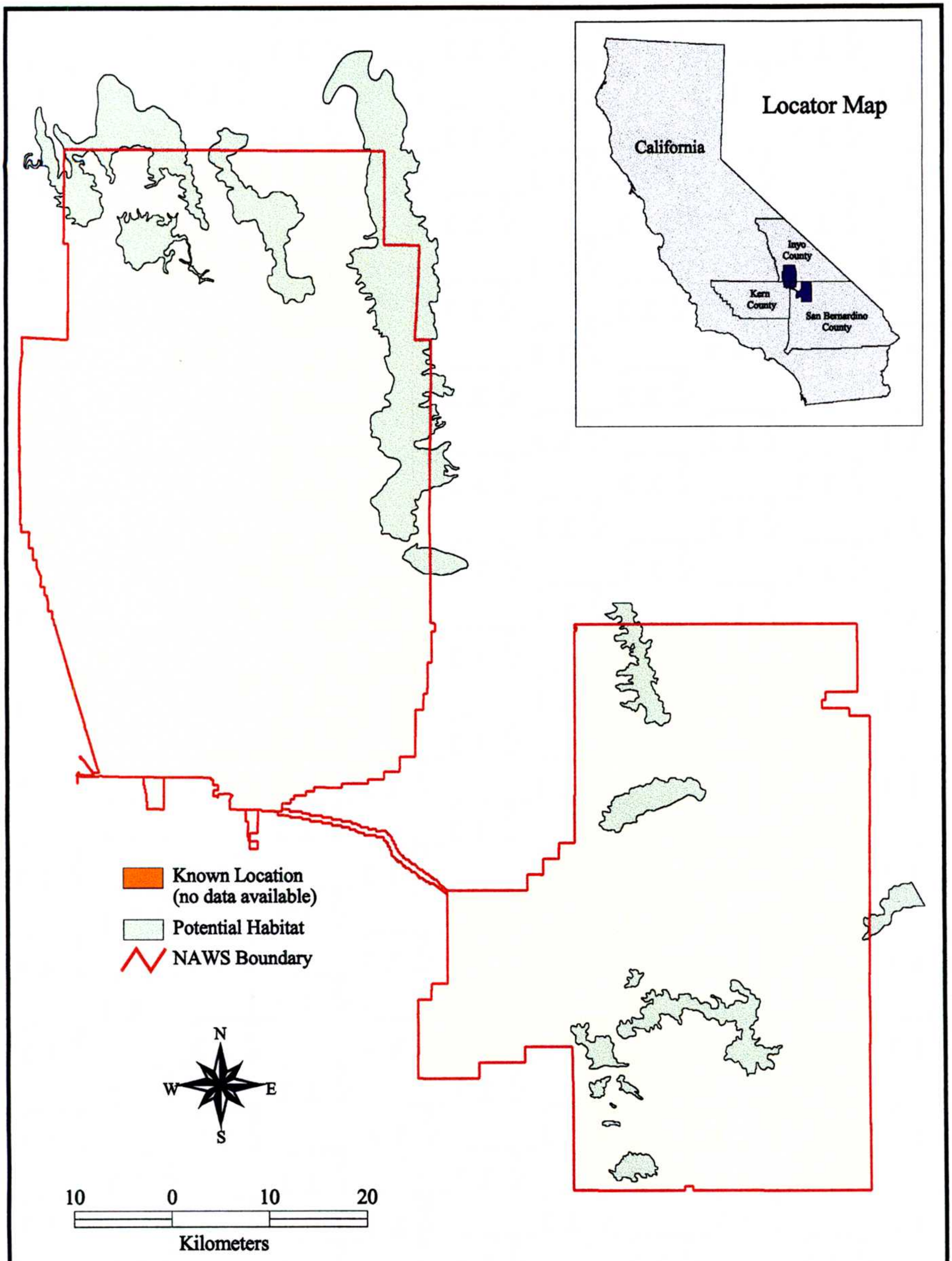

Figure 12 Known Locations and Potential Distribution of *Dudleya saxosa ssp. saxosa* (Panamint Dudleya) on NAWS/CL

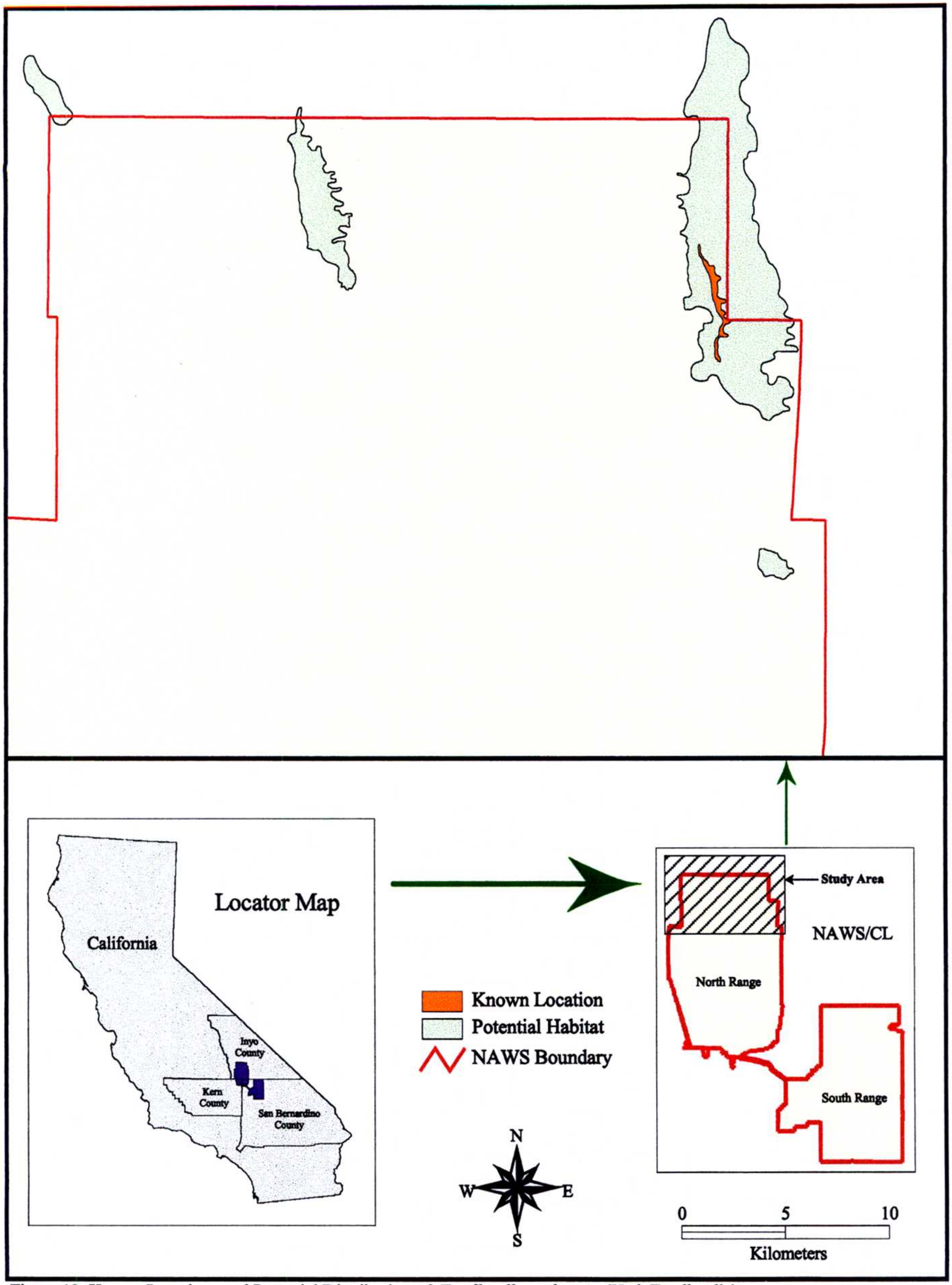

Figure 13 Known Locations and Potential Distribution of *Fendlerella utahensis* (Utah Fendlerella) on NAWS/CL

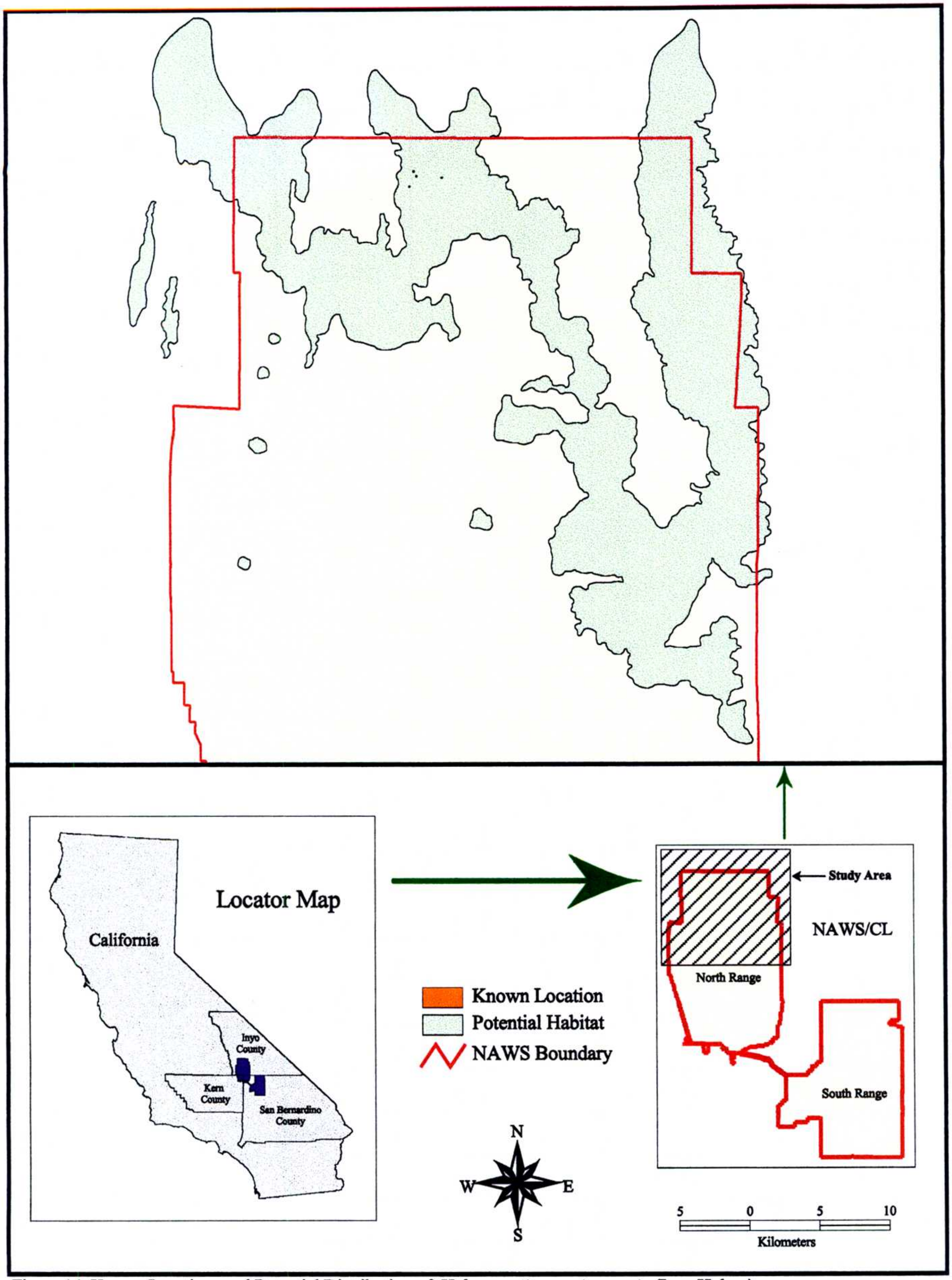

Figure 14 Known Locations and Potential Distribution of *Hulsea vestita ssp. inyoensis* (Inyo Hulsea) on NAWS/CL

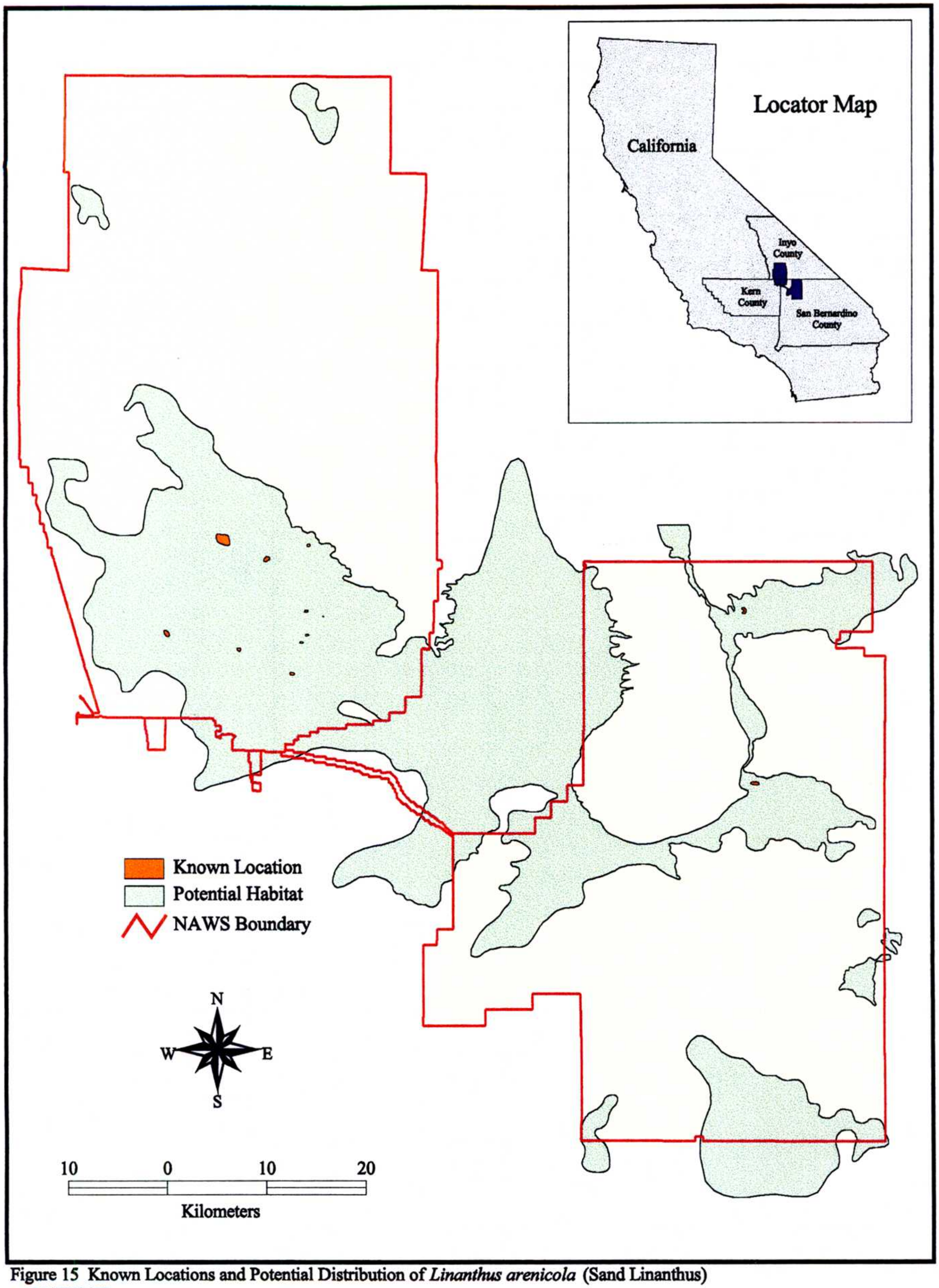

Figure 15 Known Locations and Potential Distribution of *Linanthus arenicola* (Sand Linanthus) on NAWS/CL

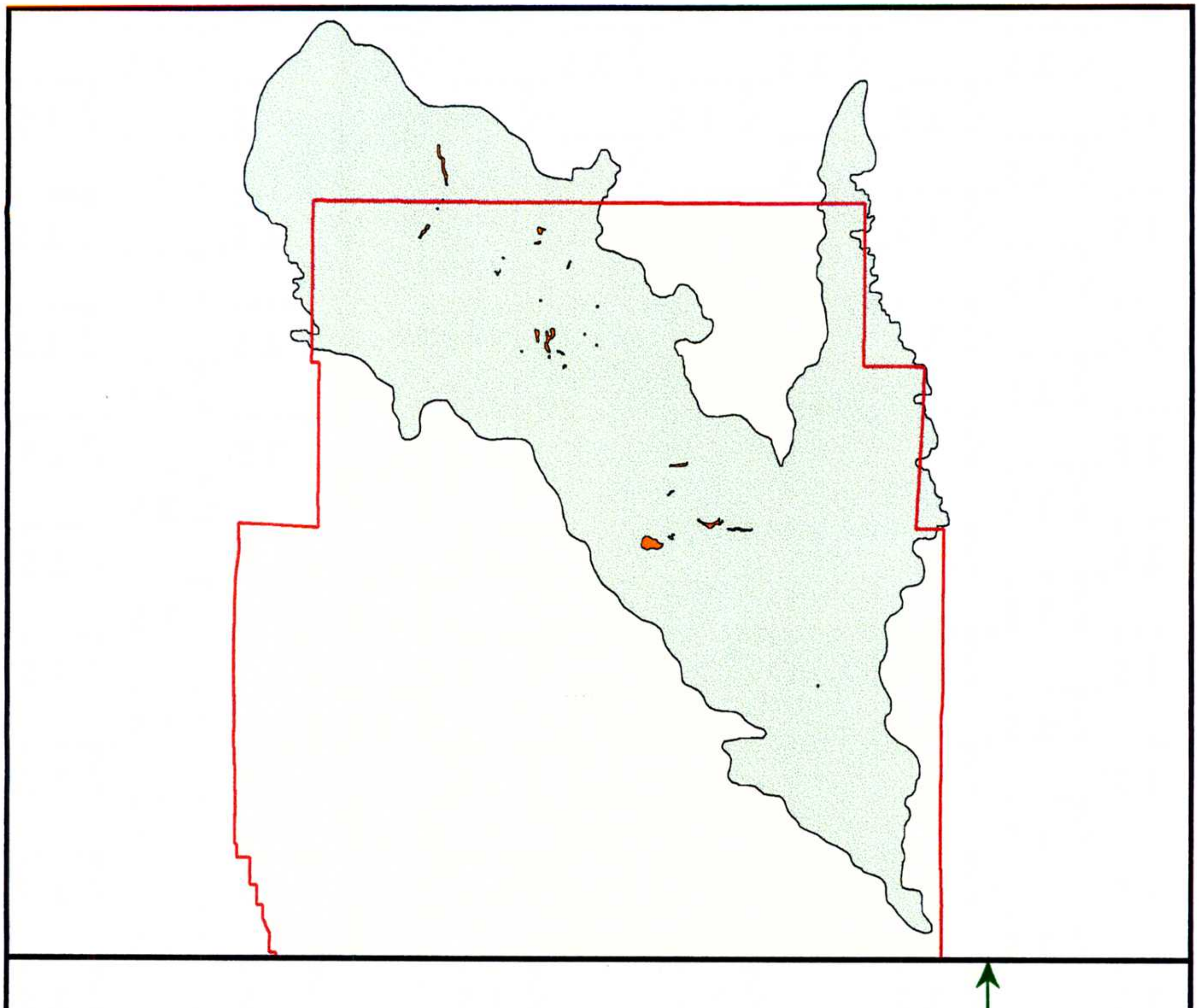

Figure 16 Known Locations and Potential Distribution of *Lupinus magnificus var. glarecola* (Coso Mountains Lupine) on NAWS/CL

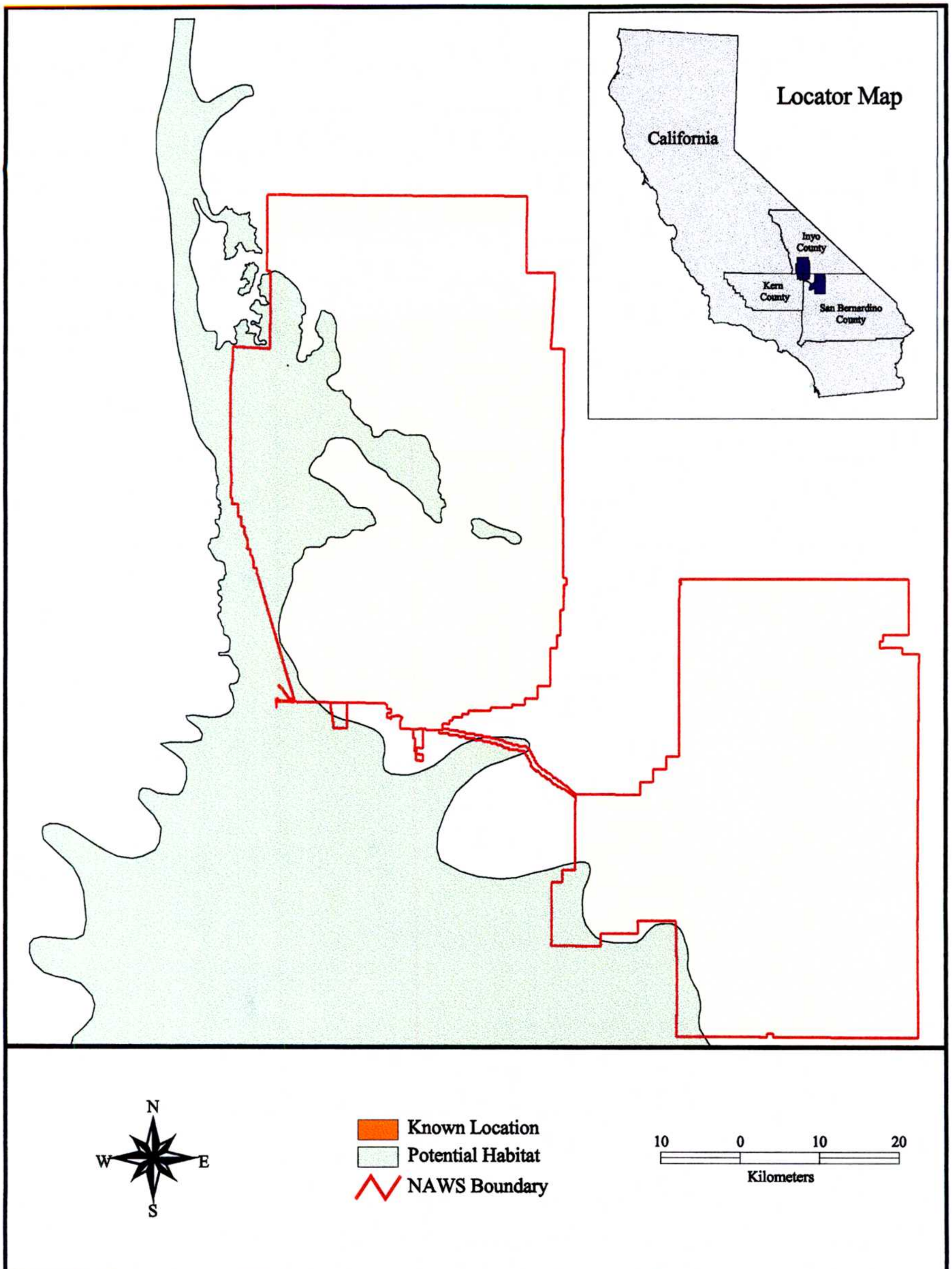

Figure 17 Known Locations and Potential Distribution of *Muilla coronata* (Crowned Muilla) on NAWS/CL

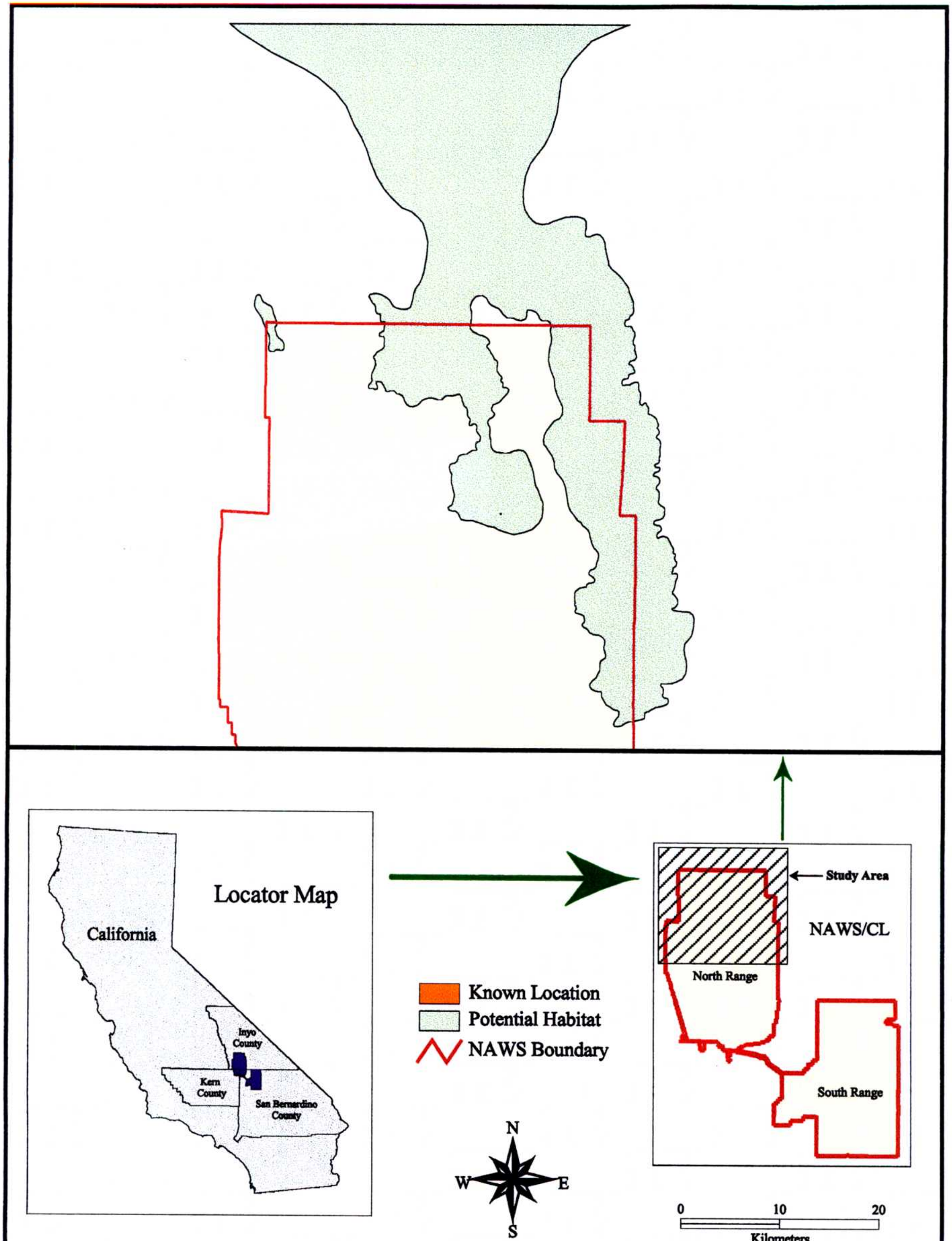

Figure 18 Known Locations and Potential Distribution of *Oenothera caespitosa ssp. crinita* (Limestone Evening Primrose) on NAWS/CL

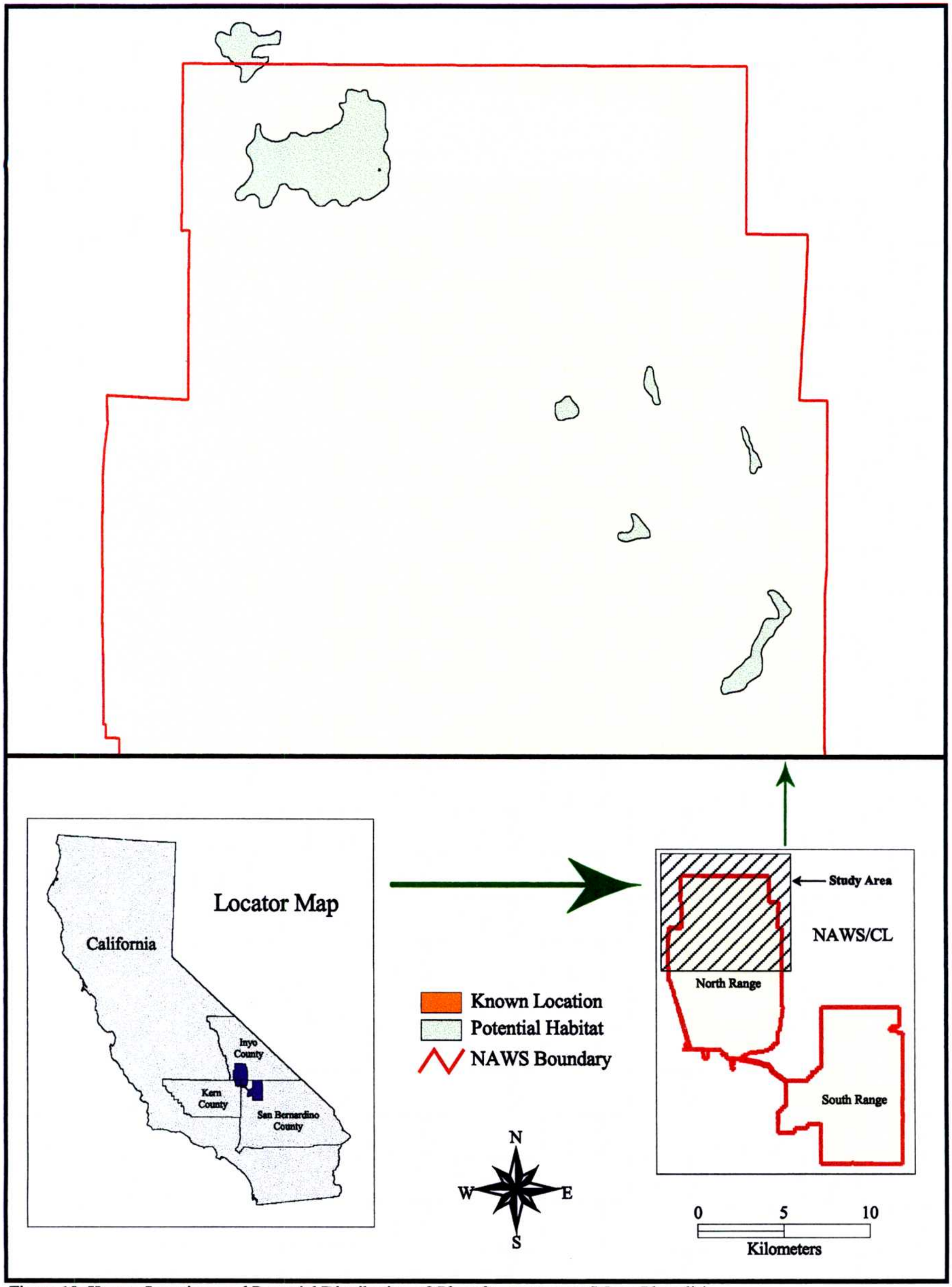

Figure 19 Known Locations and Potential Distribution of *Phacelia monoensis* (Mono Phacelia) on NAWS/CL

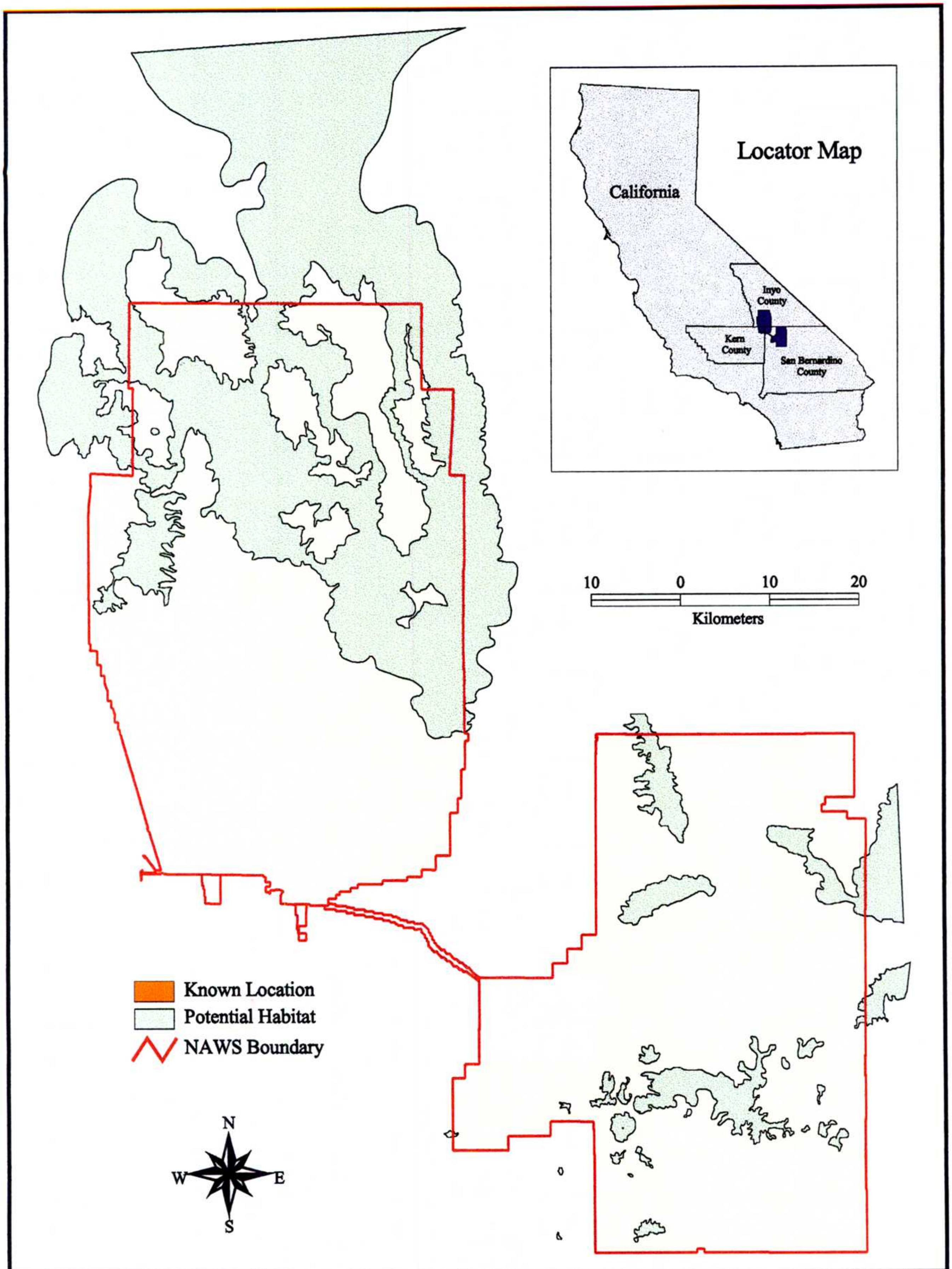

Figure 20 Known Locations and Potential Distribution of *Phacelia mustelina* (Weasel Phacelia) on NAWS/CL

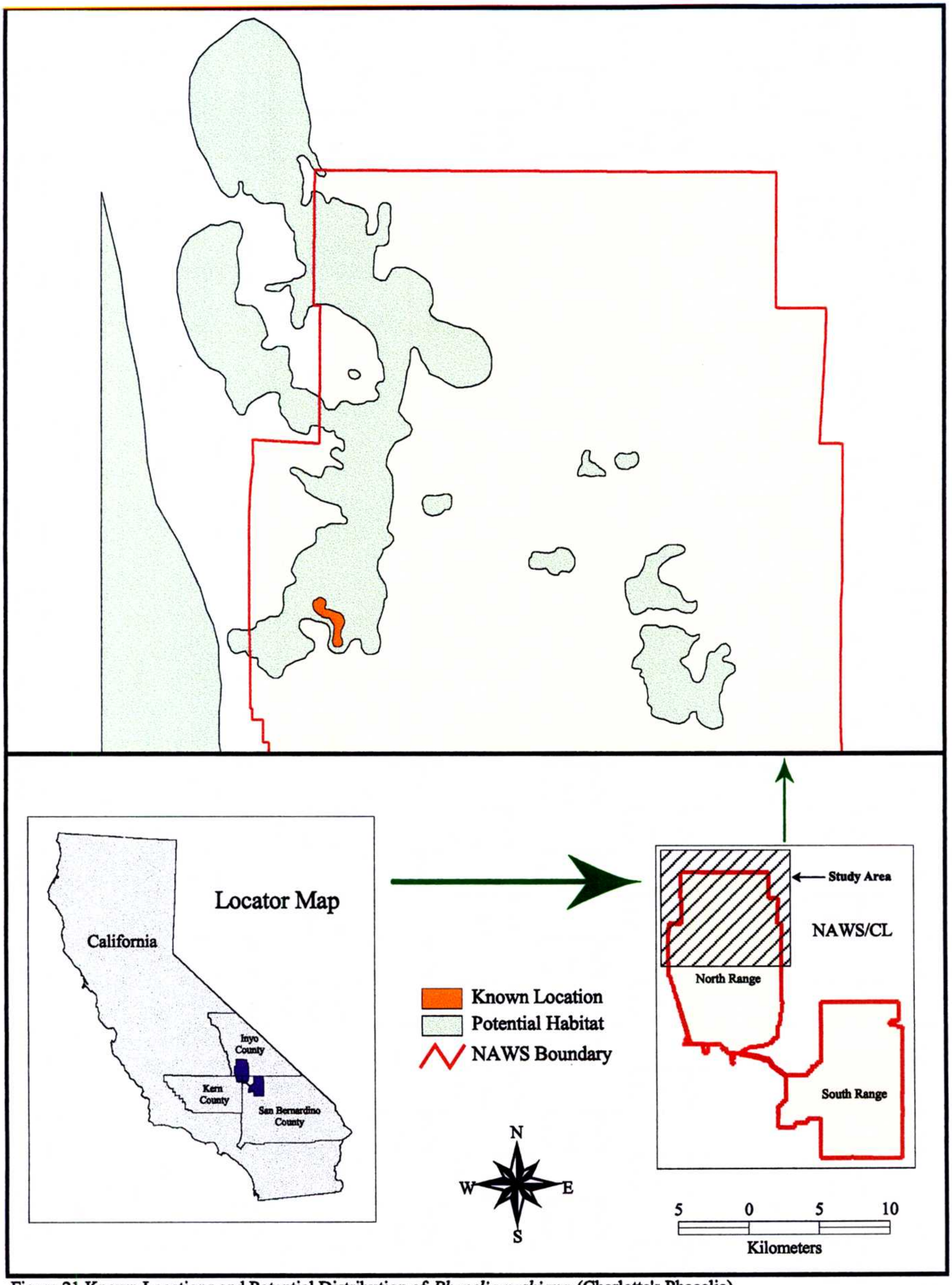

Figure 21 Known Locations and Potential Distribution of *Phacelia nashiana* (Charlotte's Phacelia) on NAWS/CL

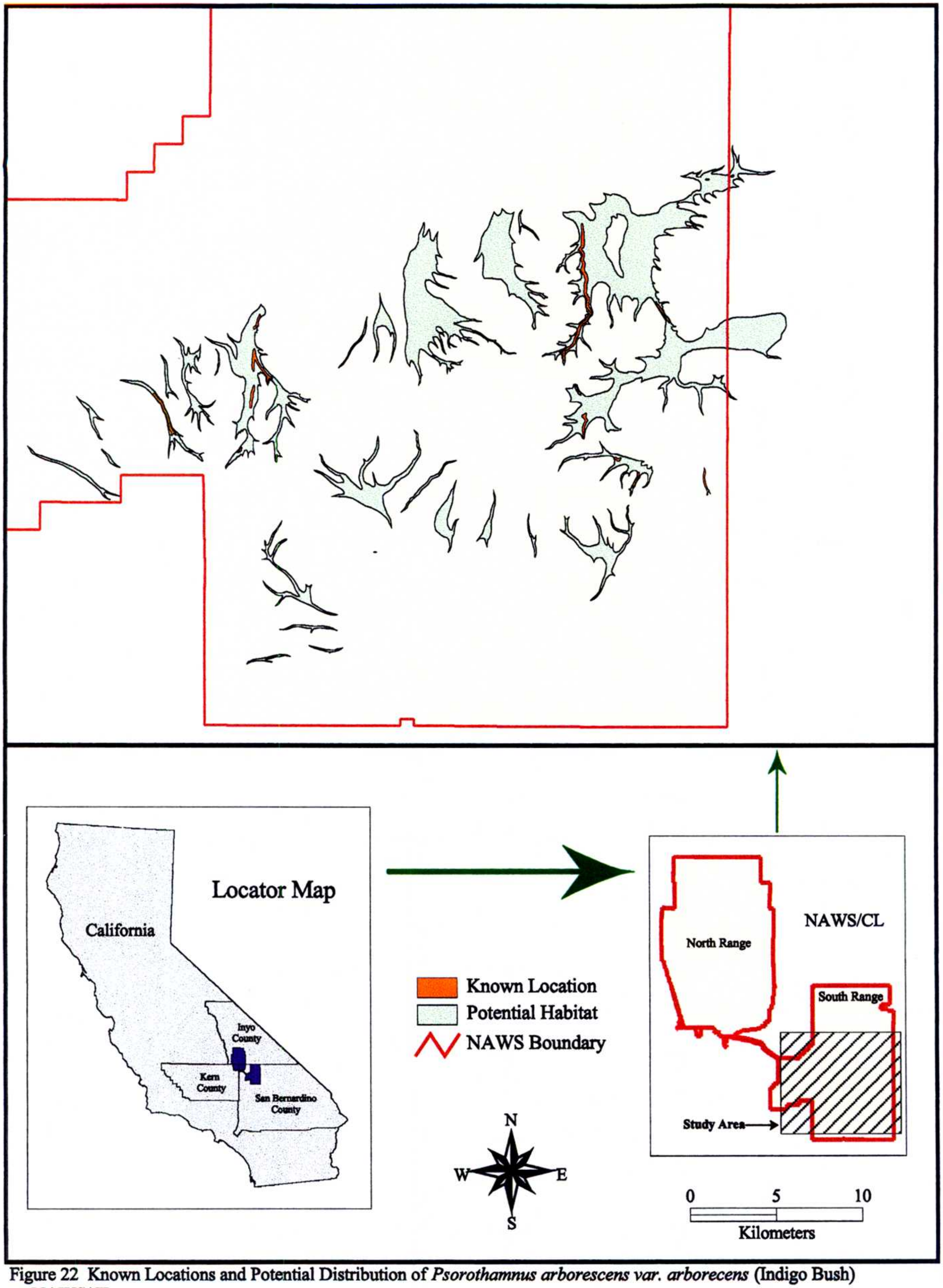

Figure 22 Known Locations and Potential Distribution of *Psorothamnus arborescens var. arborecens* (Indigo Bush) on NAWS/CL

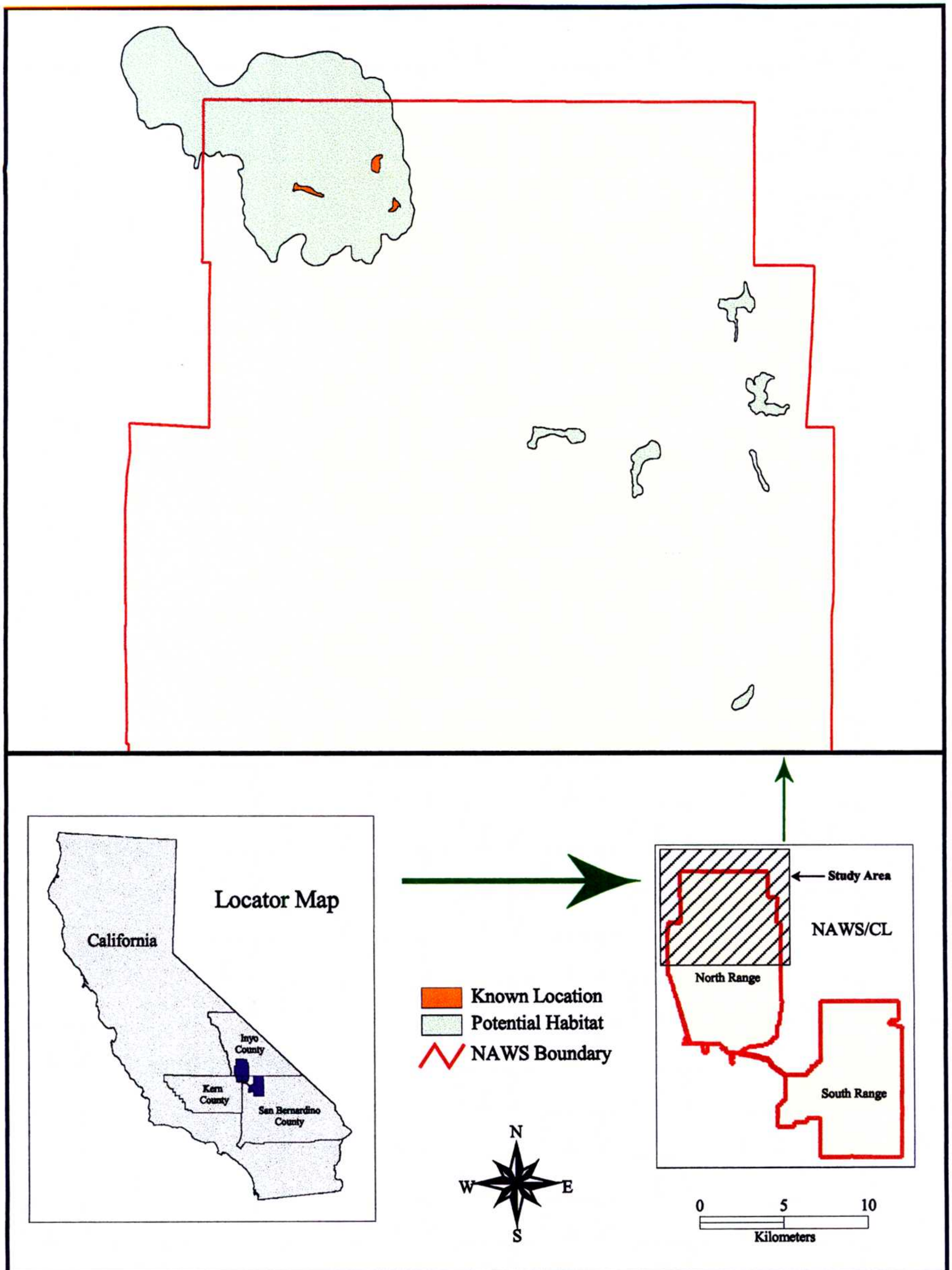

Figure 23 Known Locations and Potential Distribution of ***Salvia columbariae*** (Chia, white-flowered form) on NAWS/CL

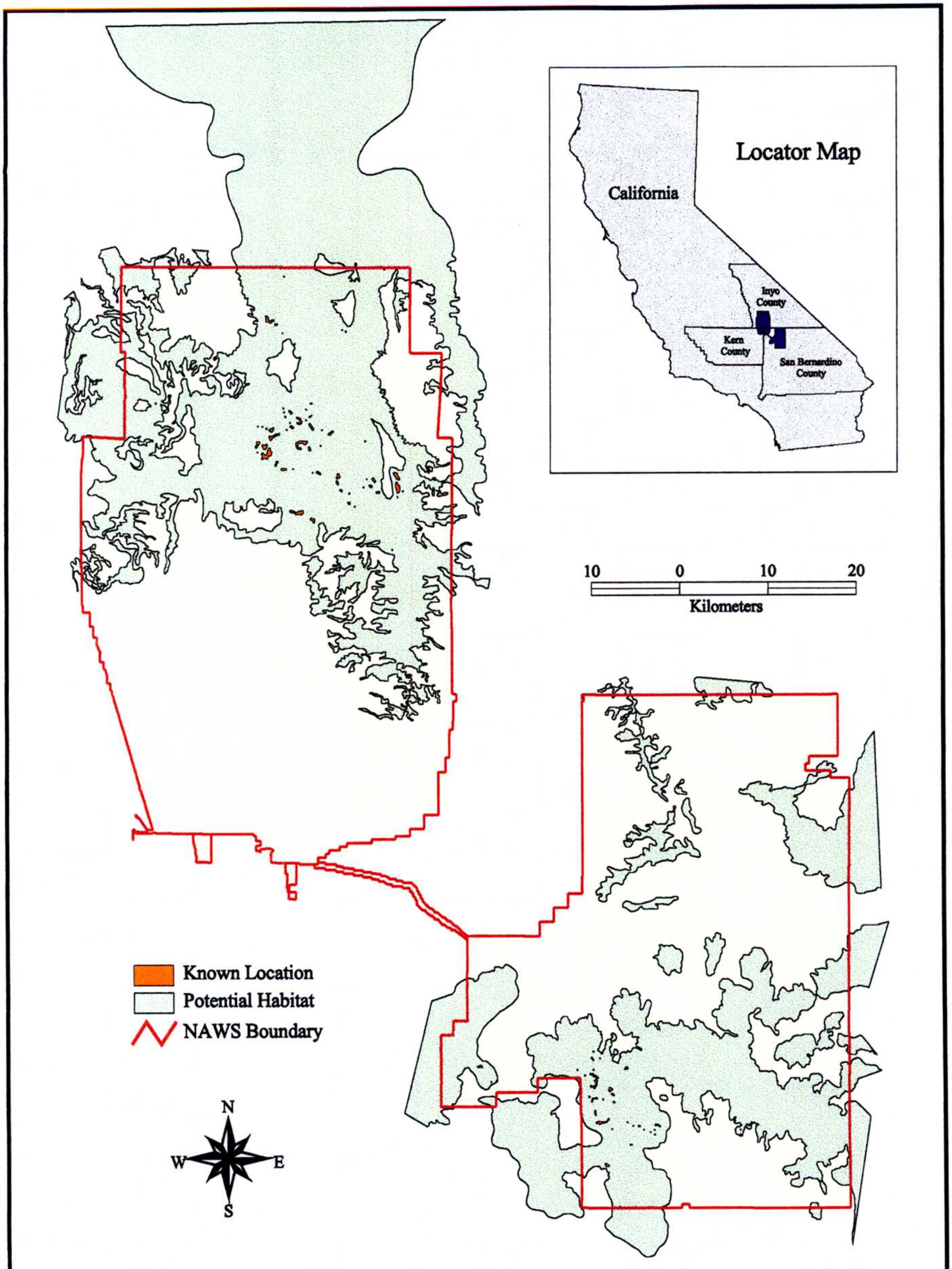

Figure 24 Known Locations and Potential Distribution of *Sclerocactus polyancistrus* (Mojave Fish Hook Cactus) on NAWS/CL

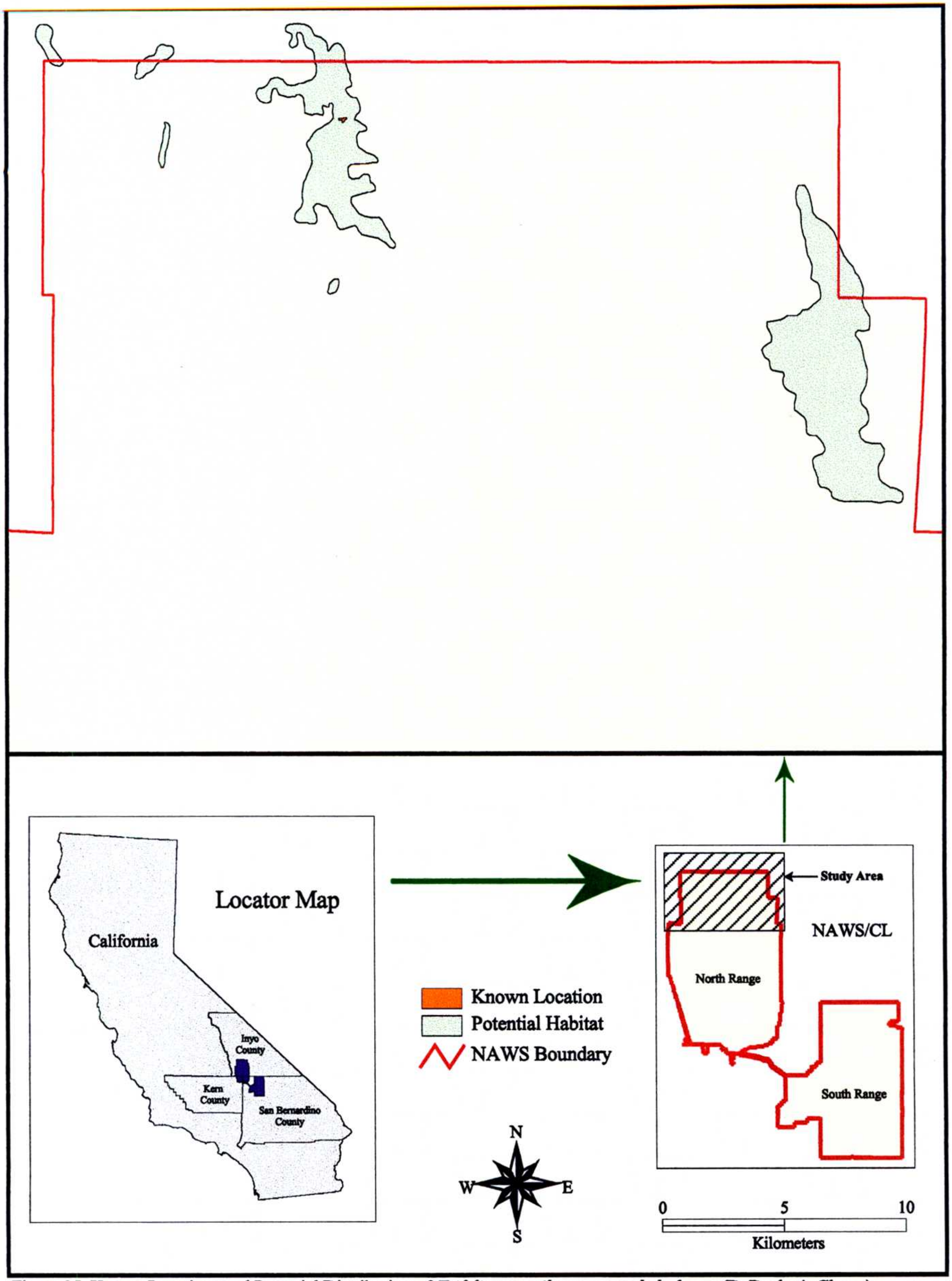

Figure 25 Known Locations and Potential Distribution of *Trifolium macilentum var. dedeckerae* (DeDecker's Clover) on NAWS/CL

SECTION 2.3.1.3e Background

NAWS Category 1a and 1b Status Plants

1a-1 Lane Mountain Milk-vetch (Astragalus jaegerianus)

Status and Distribution:

The nearest known population of Lane Mountain milk-vetch is five miles southeast of NAWS in Superior Valley. Its entire distribution is within an approximately 15-mile diameter circle. This species is federally listed as under CNPS List 1B, RED Code 3-3-3, State S1.1, Federal Proposed Endangered. A Recovery Plan is currently being prepared.

Potential habitat on NAWS is in Superior Valley and gentle slopes bordering the valley. Bagley (1987) states that Superior Valley appears to be likely habitat. This plant is so rare that any population found at NAWS would represent a significant percentage of total plants known.

CNPS (1994) states that potential threats to Lane Mountain milk-vetch include grazing and off-road vehicles although grazing in this area has not occurred since 1990 and ORV use of the area is very low. Currently the greatest threat to this species is the proposed expansion of the National Training Center at Ft. Irwin. Fires and testing activities in Superior Valley could be threats to the species if it is found on NAWS.

Biology and Ecology:

Lane Mountain milk-vetch is a slender, diffuse herbaceous perennial of the pea family (Fabaceae) with weak stems, often twining up through shrubs. It occurs on low granite hills and desert mesas, in granite soils and gravel, between 3,000 and 4,000 feet msl in Creosote Bush Scrub and Joshua Tree Woodland.

1a-2 Half-ring Milk-vetch (Astargalus mohavensis var. hemigyrus)

Status and Distribution:

Half-ring milk-vetch is known from only one recorded site near Pahrump, Nevada. Collections and taxonomy are ambiguous for this taxon. The common form occurs within one mile of NAWS in the north Argus Range near the J160 Pad.

Biology and Ecology:

Half-ring milk-vetch is a member of the Pea family (Fabaceae) and is a extremely rare form of the more common milk-vetch that is known throughout the northern Mojave Desert. The variety *hemigyrus* is a former ESA candidate taxon, but has never been relocated in California since a 1941 collection from Darwin Hills.

1b-1 Shining Milk-vetch (Astragalus lentiginosus var. micans)

Status and Distribution:

Shining milk-vetch is listed under CNPS List 1B, RED Code 3-2-3, State Rank S1.2, and Global Rank G5T1Q. It is known from the Eureka dunes. It has not been verified on NAWS.

Biology and Ecology: Shining milk-vetch is a member of the pea family (Fabaceae).

Taxonomically similar plants occur on NAWS and are distributed throughout the China Lake basin, Salt Wells Valley, and Searles Valley. They are described as var. *variablis*, but some botanists would group them with var. *micans*. These populations were probably considered in the separation of var. *micans*, but representative specimens may not have been available. Var. micans has been described (Barneby) as an intergrading taxon, presumably with var. *variablis*. If this was a strong factor in the proposed listing, then the listing is more locality-oriented rather than solely based on morphological differences. If this taxa were verified at NAWS, NAWS populations would represent the majority of plants known.

NAWS Category 2a Sensitive Plants

2a-1 Mohave Fish Hook Cactus (Sclerocactus polyancistrus)

Status and Distribution:

Mohave fish hook cactus is widely, but thinly, distributed across the western Mojave and Great Basin deserts of California and southwestern Nevada. This species is listed under CNPS List 4, RED Code 1-2-2, State S3.2, former Federal Category 3C, and Global Rank G4.

On NAWS it has been found in several locations in the Argus and Coso mountains. On South ranges it is found in Mojave B South Range in the Pilot Knob area and south of Eagle Crags. NAWS populations represent a moderate percentage (5-15%?) of total plants known; however, the quality of populations, habitat, and individual plant size may be the highest known for this unique cactus (May, 1982).

Biology and Ecology:

Mohave fish hook cactus is a small barrel-type cactus (Cactaceae) which grows to 7 decimeters tall. It can be recognized by long red fish hook shaped spines along with longer, wavy papery spines - these almost obscuring the usually solitary stem. Large magenta, purple, or rarely white flowers appear in late April to May. It occurs in well-drained soils on gentle to steep rocky terrain in a variety of rocky soils. It is most frequently found between 2,000 and 7,000 feet msl in a wide variety of plant communities ranging from Creosote Bush Scrub to Great Basin Mixed Scrub.

2a-2 Darwin Milk-vetch (Astragalus atratus var. mensanus)

Status and Distribution:

Prior to recent NAWS plant surveys, only five previous collections were made of this taxa (Bagley, 1986; CNDDB). The last collection prior to NAWS 1996 surveys was made in 1964 by

R. Barneby at Mill Creek divide in the Nelson Range. This taxa is listed under CNPS List 1 B with RED Code of 3-1-3, State rank S?, no Federal listing, and Global rank G4T2?

This taxa is known from eight recent and two historic populations at NAWS. Two collection sites in the Coso Mountains were made by E. Jaeger and R. Hoffman in 1930. Only one other population (Hunter Mountain at Mill Creek Divide) outside NAWS is known; thus NAWS plants represent the core of the population. This taxa has been identified from collections made in 1996 in the Coso Range south of Coso Peak (Silverman, Woodman & Hart, determined by R. Spellenberg NMSU, Jepson Manual *Astragalus* expert). NAWS populations occur in the Coso Peak, Guzzler #3, Whisky Tower Road, Guzzler #14, and south Etcheron Valley areas. Populations at NAWS range from 50 to 1,000 plants each (Silverman estimate).

Biology and Ecology:

Darwin milk-vetch is a small herbaceous perennial of the pea family (Fabaceae), which dies back in summer, thru winter, resprouting during springtime from the root crown. Plants often appear as wiry tufts growing between cobbles or under shrubs. Flowers range from whitish to pink-purple and are unique among *Astragalus* in having a folded constriction in the middle of the banner (dorsal petal) giving it a fiddle-shaped outline. Pods are also unique, being small, straight, and pendulous. In the NAWS region only Lane Mountain milk-vetch (*Astragalus jaegerianus*) has similar pods, though twice the size. The variety *mensanus*, found in the northern Mojave Desert, is geographically isolated from the rest of the species mostly in the Great Basin Desert (Barneby, 1964). It occurs on open flats and hillside benches, between 5,800 and 7,600 feet msl, in volcanic clay and gravel, usually among low scrub formations associated with Blackbrush, Joshua Tree Woodland, Sagebrush, and Pinyon Woodland, and often under a low, woody shrub such as purple sage or low sagebrush species.

2a-3 Charlotte's Phacelia (Phacelia nashiana)

Status and Distribution:

This species is listed under CNPS List 1 B, RED Code 1-2-3, State S3.2, former Federal Category C2, and Global Rank G3. Charlotte's phacelia is known from three (maybe four?) populations in the southwestern Coso Range at NAWS, growing on steep cinder slopes in the vicinity of Volcano and Cinder peaks. Likely potential habitats at NAWS may be on other steep scree slopes in the western Coso Mountains, north of Volcano Peak.

Biology and Ecology:

Charlotte's phacelia is a glandular and odorous annual herb of the waterleaf family (Hydrophyllaceae), 1-2 decimeters tall. Leaves are rounded, thick, and crowded in the lower part of the stem. Flowers are large, deep blue, and bell-shaped. It occurs on steep talus, scree, or cinder slopes of steep desert-facing canyons of the Sierra Nevada between 2,000 and 7,200 feet msl. It grows down into Creosote Bush Scrub and up to Pinyon-Juniper Woodland. Less than two dozen widely scattered populations are known from north of Tehachapi to Haiwee Pass. A few populations occur in the desert in the western ends of the Coso and El Paso mountains.

2a-4 Gypsum Linanthus (Linanthus arenicola)

Status and Distribution:

Gypsum linanthus is listed under CNPS List 2, RED Code 1-2-1, State S2.2, former Federal Category 3C, and Global Rank G2?. This plant was discovered at NAWS during 1987 rare plant surveys by Mark Bagley on both North and South ranges. Populations of gypsum linanthus have been located in east Pilot Knob Valley, Wingate Pass, GI road, Paxton Ranch, North Lone Butte, Burro Canyon, and the K2 Track valley. All were associated with aeolian deposits in shrub cover ranging from Alkaline Sink Scrub to Creosote Bush Scrub, generally 2,000-3,000 feet msl.

Biology and Ecology:

Gypsum linanthus is a tiny annual herb of the phlox family (Polemoniaceae), rarely more than 3-4 inches high or wide and consisting of a tuft of linear, long-haired leaves with tiny cream-colored flowers crowded among the leaves. It occurs as scattered individuals in sandy areas and playa edges from the northwestern Mojave Desert to western Nevada.

2a-5 Weasel Phacelia (Phacelia mustelina)

Status and Distribution:

Weasel phacelia is uncommon, but widespread, in rocky places from mountains surrounding Death Valley east into southwestern Nevada. This species is listed under CNPS List 1 B, RED Code 2-1-2, State S?, former Federal Category 3C, and Global Rank G2G3.

On NAWS it is known from only two locations, near Granite Wells and Seep Spring (Westec 79) in the Mojave B South Range. It could occur in appropriate habitat, between 3,000 and 7,000 feet msl in the Argus Mountains, Mojave B, and Randsburg Wash ranges. The Seep Spring locality was verified in 1996 (Silverman) where plants occurred as a sparse population (< 20 plants) on boulders and outcrops of volcanic tuff.

Biology and Ecology:

Weasel phacelia is a small, branching annual of the waterleaf family (Hydrophyllaceae), 1-3 decimeters tall with small, violet flowers and a strong, disagreeable odor. It occurs in crevices and ledges on granitic, volcanic, and limestone rock outcrops and cliffs, between 3,000 and 7,000) feet msl in Creosote Bush Scrub, Mixed Desert Scrub, Sagebrush Scrub, and Pinyon-Juniper Woodland.

2a-6 Pinyon Rock Cress (Arabis dispar)

Status and Distribution:

Pinyon rock cress is known from the San Bernadino and Little San Bernadino mountains, Kern Plateau, and Panamint, Argus, and White-Inyo ranges. This species is listed under CNPS list 2, RED Code 2-1-1, State Rank S3, no Federal status, and Global Rank G3.

Pinyon rock cress is reported by Mary DeDecker (1980) as infrequent in Coso and Argus ranges, 5,000-7,600 feet msl. Mary Ann Henry has a record (1978) from the Silver Peak area. Current records at NAWS (Silverman, 1997) range from 5,800 to 7,800 feet msl and include sparse populations (<10 pis) on Birchum Mesa, south Etcheron Valley, and El Conejo gate. Larger populations (200+ pis) are located on cinders above guzzler #14 and throughout the basalt mesa of the Coso Peak area. Plants from the northern Mojave Desert may be distinct from *A. dispar* plants to the south (Andy Sanders, Curator of UCR Herbarium, pers. comm., during visit to NAWS 6/21/97).

Biology and Ecology:

Pinyon rock cress is an upright, perennial herb of the mustard family (Brassicaceae), identified by hoary dense hairs on pedicels, lower stems, and leaves and ascending pedicels and siliques. Siliques are of medium width having two rows of large, winged seeds per chamber. It usually grows on loose, gravelly slopes or on compact talus slopes from 4,000 to 8,000 feet msl.

2a-7 Coso Mountains Lupine (Lupinus magnificus var. glarecola)

Status and Distribution:

This taxa is listed under CNPS List 4, RED Code 1-1-3, State S?, no Federal Category, and Global Rank G3T3?. Coso Mountains lupine has been found on NAWS throughout high elevations in the Coso Range, including Upper Centennial Flat at the northern station boundary, Coso Peak, Silver Peak, El Conejo gate, and Louisiana Butte. This taxa has colonized road cuts at NAWS, especially on Louisiana Butte. Most plants counted at NAWS occur as a disclimax population on the Louisiana Butte road. There are less than 2,000 plants known from NAWS, representing a major percentage (30-40%?) of the total known for this taxa (Silverman estimate). About 1,500 plants were observed in 18 populations in the Coso Range during 1987 and 1993 sensitive plant surveys. Population sizes varied from one to several hundred plants; five had more than 100 plants while eight had 11 or fewer plants, including four populations with just a single individual observed. Undoubtedly, more plants will be found in other areas of NAWS.

Biology and Ecology:

Coso Mountains lupine, magnificent lupine, or Kerr lupine is a low growing herbaceous perennial of the pea family (Fabaceae) with a tall and colorful spike of purplish blue flowers. Leaves are crowded in rosettes around the base of the plant. Stems and leaves have both soft hairs and barbed hairs, giving the plant an ashen appearance. It occurs on scree and open slopes in sandy or gravelly soils, usually from decomposed granite. It grows between 5,000 and 8,000 feet msl in Joshua Tree Woodland, Sagebrush Scrub, Blackbrush Scrub, and Pinyon-Juniper Woodland. It is infrequent on slopes of the eastern Sierra Nevada Mountains from Sawmill Creek south to Carrol Creek and in the Coso and Argus mountains.

2a-8 Panamint Bird's Beak (Cordylanthus eremicus ssp. eremicus)

Status and Distribution:

This taxa is widespread and locally abundant in high elevations of NAWS North ranges, ranging from 5,000 feet msl in the Moscow Spring area extending to the western flanks of Maturango Peak and throughout the Coso Range, up to 8,000 feet msl. A 1993 survey (Kiva Biological Consulting, 1993) found the species extremely abundant in many areas and widespread in the Argus and Coso ranges. 1993 and 1995 were evidently excellent years for this species;

conspicuous skeletons left from these years helped to identify additional sites for this taxa at NAWS in 1996 and 1997. Populations at NAWS range from 100 plants up to uncountable, contiguous stretches of more than 20,000 (Silverman estimate) plants. NAWS populations represent the majority of plants known (all available records clearly indicate this). This taxa listed under CNPS List 4, RED Code 1-1-3, State S2?, former Federal Category 3C, and Global Rank G3T2. CNPS is proposing to elevate the status of this taxa to List 2.

Biology and Ecology:

Panamint bird's beak is a late blooming annual species of the figwort family (Scrophulariaceae). It is tall and robust for an annual plant. Dried skeletons are persistent and conspicuous after a good growth year. It occurs on gentle to moderate slopes of all aspects, in small washlets, and at the edge of broad washes. Soils are usually stony to gravelly, mostly derived from volcanic or marine sedimentary deposits. Panamint bird's beak grows from 4,900 to 8,400 feet msl in Sagebrush Scrub and Pinyon-Juniper Woodland. It is endemic to the Coso, Argus, Nelson, San Bernadino and Panamint ranges.

2a-9 Indigo Bush (Psorothamnus arborescens var. arborescens)

Status and Distribution:

Indigo bush is listed under CNPS list 4, RED Code: 1-1-1, former Federal Category 3C, State rank S?, and Global Rank G4T3. This taxa has been reported at NAWS but not fully acknowledged as a known occurrence. Taxonomic confusion over other varieties has caused botanists to question which varieties are present at NAWS. Populations at NAWS occur above 2,500 feet msl and are restricted to well-drained upper washes and alluvial terraces in Mojave Mixed Scrub, Joshua Tree Woodland, and Blackbrush Scrub. Hop-sage, cheesebush, bladder sage, and peachthorn are common associates. The distribution for *Psorothamnus arborescens* var. *arborescens* at NAWS includes all appropriate habitat south of Randsburg Wash. These occurrences bridge the two major populations of *P. arborescens* var. *arborescens* that occur in the Fort Irwin and northeastern Barstow area to the southeast and the area south of Fremont Peak to the southwest of NAWS. Eight populations are known at NAWS, ranging from 10 to 2,000 estimated plants (Silverman). NAWS populations represent a major percentage (10-20%?) of the total plants known (Silverman estimate).

Biology and Ecology:

Indigo bush is a low to medium-sized shrub of the pea family (Fabaceae) with gnarled woody trunks and lower stems which stiffly and divaricately branch into a spreading canopy. It is an attractive shrub, especially in the spring of good rain years when spikes of deep indigo blue flowers appear and are contrasted by densely tomentose, white foliage. Leaves are pinnate to lobed, very glandular with a strong resinous odor characteristic of most *Psorothamnus.* Plants often have a dull turquoise appearance when viewed from a distance. They are found in washes and upper bajada slopes of the central Mojave region, from east of Barstow, west to Randsburg, and north into NAWS. Dense populations are most commonly associated with wide washes of decomposed granite.

2b-2. Clokey Cryptantha (Cryptantha clokeyi)

Clokey Cyrptantha is a small, bright green, erect annual herb of the Borage family (Boraginaceae), from 10- 35 cm tall, with strigose to bristly herbage, ascending branching above with terminal flower clusters of white inconspicuous corollas. The plants are somewhat distinctive in fruit, with expanded bristly calyx clusters; the calyx sepals curving inward with slightly recurved tips. The nutlets of this taxon are highly distinctive and unique among the Borage family in the NAWS region; having numerous translucent-tipped tubercles. It occurs on steep gravelly slopes of various volcanic peaks and hills in the northern potion of the west-central Mojave desert, from 3700 to 5400 feet MSL. This species is listed under CNPS List 1B, Red Code 3-3-3. State S?, Federal Category? And Global Rank G?.

NAWS Category 2b Sensitive Plants with Probable Records on NAWS

2b-1 Crowned Muilla (Muilla coronata)

Status and Distribution:

This species is listed under CNPS List 4, RED Code 1-2-2, State Rank S?, former Federal Category 3C, and Global Rank G3?Q. At NAWS this species is documented from the Devil's Kitchen site in Coso Geothermal Area (Zembal *et al.,* 1979; RSA voucher). DeDecker (1980) reports this as occasional populations on heavy soil in the Coso and Argus ranges from 3,000 to 5,700 feet msl, including one old record in Indian Wells Valley at 3,000 feet msl. The crowned muilla CNPS listing was after most of the site surveys for the Coso Geothermal Area. This species should be expected on South ranges. They have an elusive nature and may be widespread at NAWS.

Biology and Ecology:

Crowned muilla is small bulb-forming member of lily family (Liliaceae) which resembles some onion *(Allium)* species. Like *Allium,* it has a few, basal, cylindrical leaves and a single flowering axis ending in an umbel of greenish-white to lilac flowers. Two other muillas near the region, *M. maritima* and *M. transmontana,* are separated from *M. coronata* by filament shape and flower size. It has a fairly wide distribution for a sensitive species, occurring at Fort Irwin (Bagley - Woodman), Antelope Valley, El Paso Mountains, Owens Valley, and into Nevada. Crowned muilla prefers rocky to clayey soils in Joshua Tree Woodland, Mixed Mojave Scrub, Creosote Bush Scrub, and Mojave-Great Basin transition communities. Like many other desert lily forms, they are usually restricted to patchy populations and bloom for a very brief period before going underground until the next good rain year.

2b-2 DeDecker's Clover (Trifolium macilentum var. dedeckerae)

Status and Distribution:

This taxa is listed under CNPS list 1 B, RED Code 3-1-3, State Rank S?, former Federal Category 3C, and Global Rank G?T2. It is known from fewer than 20 occurrences.

A likely perennial, *Trifolium* species was recently located northeast of Coso Peak (Silverman, 1996). These plants have a good fit to descriptions of T. *macilentum* var. *dedeckerae.* The population consists of approximately 100 plants on an upper talus slope of metamorphic granite at 7,500 feet msl. If this taxa is confirmed at NAWS, it would be a noteworthy population, disjunct from core populations in the Sierra Nevada. Such a population would further support the potential for numerous nearby Sierra Nevada sensitive species to occur at NAWS. Further determinations and collections need to be completed.

Biology and Ecology:

DeDecker's clover is a low, herbaceous perennial of the pea family (Fabaceae) with a loose crown of tripinnate leaves and distinctively arid-adapted features for a clover. Leaflets are relatively thick and hard for *Trifolium*, lanceolate in shape, and serrate all around. The slightly inflated flowers are held in a reflexed clump above mostly basal leaves. This plant is known from the eastern Sierra Nevada, representing a range of plant communities from Pinyon Woodland to Alpine Crests, 6,900 to 11,500 feet msl, usually growing in rock crevices.

2b-3 Inyo Hulsea (Hulsea vestita ssp. inyoensis)

Status and Distribution:

This taxa is listed under CNPS list 2, RED Code 2-2-1, State Rank S2, former Federal Category 3C, and Global Rank G5T2T3. On NAWS only one collection appears to have been made, in 1891, in the canyon next south of Crystal Spring in the Coso Mountains (Coville and ?). Potential habitat on NAWS is in disturbed areas and unstable slopes of coarse soil in the Coso and Argus mountains above about 5,000 feet msl.

Bagley (1985) states that human disturbance can enhance and enlarge populations of *Hulsea vestita*; however, it probably cannot withstand total habitat destruction. CNPS (1980) states that mining appears to be the main threat to this subspecies. Mining does not occur on NAWS; thus, there appears to be no current threat to populations that may be on NAWS.

Biology and Ecology:

Inyo hulsea is a low, herbaceous biennial or perennial of the aster family (Asteraceae) with a branching underground woody base, thick glandular-hairy leaves, and yellow ray and disk flowers. It occurs on steep slopes of unstable substrate, composed of dark slate, shale, or volcanic soils, between 4,600 to 7,600 feet msl in Desert Transition Scrub, Sagebrush Scrub, and Pinyon-Juniper Woodland. It is found in the Grapevine, Cottonwood, Inyo, and Coso mountains in California.

2b-4 Naked Milk-vetch (Astragalus serenoi var. shockleyi)

Status and Distribution:

This taxa is listed under CNPS list 2, RED Code 2-2-1, State Rank S?, no Federal status, and Global Rank G4T2. Gordon Pratt's 1996 plant list includes this species. He verified that the specimen collected was from the Cole Spring area. There remains some doubt on the proper identification of this specimen. Pods of naked milk-vetch are very characteristic, but *A. casei*, a species with similar vegetative structure, is also known from the Cole Spring area. The distribution of *A. serenoi* var. *shockleyi* and the similarity of habitat at NAWS suggest that this taxa could occur on North ranges.

Biology and Ecology:

Naked milk-vetch or Shockley milk-vetch is a spreading to upright perennial herb of the pea family (Fabaceae), bushy-clumped, with elongated pinnate leaves bearing few, linear leaflets, the terminal leaflet often confluent with the rachis. Flowers are not unique among *Astragalus*, but pods are distinct, being plump sausage-shaped with an abrupt short beak, then woody upon drying. It is moderately rare and scattered, but widely distributed, occurring from 4,000 - 7,000 feet msl through much of the White-Inyo Mountains and into Nevada. It generally prefers sagebrush or pinyon pine plant communities.

2b-5 Panamint Mariposa Lily (Calachortus panamintensis)

Status and Distribution:

Panamint mariposa lily is listed under CNPS List 4, RED Code 1-1-3, State Rank S2?, no Federal status, and Global Rank ?. If this taxa is verified at NAWS, then NAWS populations would represent a significant percentage of plants known.

Biology and Ecology:

Panamint mariposa lily is perennial, bulb-forming herb (Liliaceae) with one or two curly grass-like leaves and a flowering stem which usually winds up through low shrubs.

2b-6 Booth Evening Primrose (Camissonia boothii ssp. boothii)

Status and Distribution:

Booth evening primrose is a common plant in western Nevada but is rare in California, being known from Mono County, close to the Nevada border. Two old records come from Rose Valley and the Mojave River area. There has been no verification of these sites in recent years. This taxa is listed under CNPS list 4, RED Code 1-1-1, State Rank S?, no Federal status, and Global Rank G?T?. CNPS is proposing to move this taxa to List 2, RED Code 2-1-1.

This taxa is suspected on NAWS. Populations of *C. boothii* were observed with characteristics of ssp. *boothii* as dense populations on scree and cinder slopes in the southwestern Coso Range, at Cinder Peak, Volcano Peak, Sugarloaf, Coso Geothermal, Haiwee Spring, and Cactus Flat areas. Some of these sites are the same locality for Charlotte's phacelia populations. If verified at NAWS, then NAWS populations would represent a major percentage of plants known in California.

Biology and Ecology:

Booth evening primrose is a late spring annual in the evening primrose family (Onagraceae) with an early basal rosette of leaves, later withering and bare below as the flowering spikes unfurl over a protracted period, continuing into summer. These primroses are conspicuous after they dry up, becoming woody, fringed with old siliques, and persisting through several seasons anchored by a well developed taproot. In this condition they are sometimes known as the "Desert Woody Bottle Washer". Flowers are white and typical of other *Camissonia boothii* subspecies. Ssp. *boothii* differs from other subspecies in this area by the late phenology, withering basal rosette, ovate leaves, and dense spreading hairs on the young foliage.

2b-7 Evening Primrose (Oenothera caespitosa ssp. crinita)

Status and Distribution:

This taxa is listed under CNPS List 4, RED Code 1-2-1, State Rank S?, no Federal status, and Global Rank G5T?. The evening primrose subspecies is known from NAWS by one population identified in the 1993 summer sensitive plant survey; however, the plant material was not complete, and there is some question on the determination (Kiva Biological Consulting, 1994). Nearest known populations to NAWS are collections made near Darwin (Darwin, 4,600 ft., 28 Apr. 1897; Darwin, 5,000 ft., 23 Apr. 1937; 2 miles east of Darwin, 4500 ft., 6 May 1932; and 2 miles west of Darwin, 4,700 ft., 6 May 1932). Potential habitat on NAWS could be in gypsum and limestone areas above about 4,000 or 5,000 feet msl. Canyons in the northern Argus and Slate ranges and northwestern Coso Range have very good potential for this taxa.

Oenothera caespitosa ssp. *marginata* was reported on NAWS by DeDecker (1980). It is known from many localities on North ranges, particularly around springs and roadsides. It is also known from the El Conejo gate area and may intergrade, or be mistaken with, *Oenothera caespitosa* ssp. *crinita*. Taxonomic differences between the two subspecies range from subtle to highly distinct.

Biology and Ecology:

Evening primrose is an herbaceous perennial of the evening primrose family (Onagraceae), growing from a woody caudex with large, white flowers. It occurs on limestone and calcium soils in dry rock crevices and outcrops, between 3,800 and 11,000 feet msl in Mixed Desert Scrub, Pinyon-Juniper Woodland, Bristlecone Pine Forest, and Subalpine Coniferous Forest. The subspecies is found in several mountain ranges in the northern and eastern Mojave Desert. Populations are small and have a scattered nature. They tend to be in rugged, rocky areas, particularly canyon bottoms.

2b-8 Utah Fendlerella (Fendlerelia utahensis)

Status and Distribution:

This species is listed under CNPS List 4, RED Code 1-1-1, State S?, former Federal Category 3C, and Global Rank G4T3. On NAWS it is known from the Maturango Peak area (DeDecker, 1980). Potential distribution on NAWS would be in limestone areas of the northern Argus Range. Very little potential habitat at NAWS has been surveyed.

Biology and Ecology:

Utah fendlerella is a low, much-branched, erect shrub of the mock orange family (Philadelphaceae) with shreddy bark with small, white flowers. It occurs on dry limestone slopes between 5,000 and 8,400 feet msl in Shadscale Scrub, Mixed Desert Scrub, Sagebrush Scrub, Pinyon-Juniper Woodland, and White Fir-Pinyon Woodland. It is found throughout the Southwest in the mountains of the northern and eastern Mojave Desert, extending to Utah and Texas.

NAWS Category 2c Sensitive Plants with Suspect Records on NAWS

2c-1 Panamint Live-forever (Dudleya saxosa ssp. saxosa)

Status and Distribution:

This taxa is listed under CNPS List 4, RED Code 1-2-3, State Rank S?, former Federal Category C2, and Global Rank G4T1T3. The BLM (1980) reports a disjunct population (45 miles south) on Pilot Knob on the Mojave B South Range. This locality is inconsistent with the types of habitats in the Panamint Mountains. This area, including Granite Wells, Granite Mountain, and Seep Spring, does have minimal potential *Dudleya* habitats and a number of disjunct plant occurrences, such as *Phacelia mustelina, Pentagramma triangularis,* and *Eriogonum heermannii.*

Biology and Ecology:

Panamint live-forever is a small succulent perennial of the stonecrop family (Crassulaceae) with a rosette of fleshy, lanceolate leaves and semisucculent tubular flowers on short spikes. It is only known from the Panamint Mountains from Augerberry Point in the north to Arrastre Springs in the south. It occurs between 3,000 and 7,100 feet msl in Creosote Bush Scrub and Pinyon-Juniper Woodland. It is usually restricted, but locally common, growing on dry stony slopes, bouldery areas, and crevices in granitic or carbonate soils.

2c-2 Darwin Rock Cress (Aabis pulchra var. munciensis)

Status and Distribution:

It is known mostly to the northeast of NAWS and into Nevada. One verified record comes from the Darwin Hills, a few miles north of NAWS. This taxa is listed under CNPS list 2, RED Code 3-1-1, State Rank S1?, no Federal status, and Global Rank G5T?.

Biology and Ecology:

Darwin rock cress is a slim, upright, perennial herb of the mustard family (Brassicaceae), distinguished by dense pubescence and appressed siliques. It usually grows in crevices of rocky areas and in the protection of shrubs. It was reported by Leitner in 1979 during a Coso Geothermal study (but never determined). Habitats in this area are unlikely, but many potential sites occur elsewhere at NAWS in the northern Coso and Argus ranges.

2c-3 Winged Cryptantha (Cryptantha holoptera)

Status and Distribution:

Winged cryptantha is most frequently encountered in the Colorado Desert but occurs as far north as Panamint Valley, southern Death Valley, and into Nevada. This species is listed under CNPS list 4, RED Code 1-1-2, State Rank S?, no Federal status, and Global Rank G3G4.

There may be some confusion with old NAWS records concerning a previous synonym of *C. holoptera*. Some of the *Cryptanthas* that were called *C. inaequata* have been lumped into *C. holoptera*. The majority of *C. inaequata* with heteromorphous nutlets, angled, rather than winged (locally known as the Darwin cryptantha) were lumped into *C. angustifolia.* One NAWS record of *C. inaequata* is mentioned in the 1980 M. DeDecker Flora of the NAWS region. It is only described as: China Lake area at 3,200 feet. This is likely *C. angustifolia* or a questionable determination. It should be further investigated.

There is much potential *C. holoptera* habitat on South ranges. The *Cryptantha* genus is well represented at NAWS. There is difficulty in identifying annual cryptanthas without close examination and experience. The nature of *C. holoptera* distribution is unpredictable in the Mojave, and seasonal availability for the survey of annual plants is unpredictable. For these reasons, future surveys for *C. holoptera* will probably be less effective that other rare plant search efforts. Because of the low status ranking, this species should not be targeted for survey until better information on NAWS occurrences exists. All botanical surveys in appropriate habitat should be aware of its potential occurrence.

Biology and Ecology:

Winged cryptantha is an annual in the borage family (Boraginaceae) with stiff-hairy foliage and tiny white flowers that unfurl from a scorpioid spike. Many annual cryptanthas are similar in appearance. In *C. holoptera* the flowering spike is less tightly curled and more racemose in appearance (due to the visible pedicels). Nutlets are most diagnostic, all four being similar (homomorphous) and bearing winged edges. It is an infrequent, but widely distributed, species of low deserts, favoring the alluvium of lower canyons, washes, and bajadas.

2c-4 Mt Pinos Larkspur (*Delphinium parryi* ssp. *purpureum*)

Status and Distribution:

This subspecies occurs in the Transverse Range and the Tehachapi Mountains in dry chaparral and sagebrush scrub. This taxa is listed under CNPS list 4, RED Code 1-1-3, State Rank S2s3, former Federal Category 3C, and Global Rank G4T2T3.

A former synonym, *D. parishii* ssp *purpureum,* was reported (M. DeDecker 1980) from the eastern side of the Argus Range. Current treatments for *D. parryi* ssp *purpureum* isolate it well away from NAWS. The NAWS records were likely *D. parishii* ssp *parishii.* This record needs to be verified.

Biology and Ecology:

Mt Pinos larkspur is a perennial herb of the crowfoot family (Rannunculaceae) which sprouts up from a shallow, fleshy-fibrous root, usually producing a basal tuft of palmate leave and a single, tall flowering raceme. Flowers are bilateral with deep blue or purplish petals.

2c-5 Clark Mtn Heerman Buckwheat (Eriogonum heermannii var. floccosum)

Status and Distribution:

This taxa is listed under CNPS list 4, RED Code 1-1-3, State Rank S?, Federal Category 3C, and Global Rank G5T2T3. This plant has a similar current status to Mt Pinos larkspur. It has been reported from NAWS (DeDecker, 1980) as rare in the Argus Range and Junction Ranch area from 5,000 to 6,000 feet msl. Plants at NAWS often have weakly floccose stems. Current treatments for the various *E. heermannii* varieties are ambiguous as a result of intergrading taxa and lack of ecological definitions. It is unlikely that the plants known as var. *floccosum* occur at NAWS, even though some *E. heermannii* at NAWS can be morphologically assigned to that variety. DeDecker 1980 localities need to be verified and compared to herbarium specimens.

Biology and Ecology:

Clark Mtn Heerman buckwheat is a low, stiff, intricately branched shrub or subshrub of the buckwheat family (Polygonaceae) with floccose-hairy flowering stems. It is known from the eastern Mojave Desert, usually in limestone ranges.

NAWS Category 2d Potentially Sensitive Plants on NAWS being Reviewed for CNPS Listing

Information on status, distribution, biology, and ecology of category 2d plants will be compiled during 1998-2002.

2d-1 Shockley columbine (*Aquilegia shockleyi*)
2d-2 Dainty rock-cress (*Sibara rosulata*)
2d-3 Wing-fruited primrose (*Camissonia pterosperma*)
2d-4 Tall perityle (*Perityle magalocephala* var. *oligophylla*)
2d-5 Pagoda buckwheat (*Eriogonum rixfordii*)
2d-6 Mojave buckwheat (*Eriogonum mohavense*)
2d-7 Indian parsley (*Cymopterus aboriginum*)
2d-8 Panamint parsley (*Cymopterus panamintensis* var. *panamintensis*)
2d-9 Gum-leaved brickellia (*Brickellia multiflora*)
2d-10 Holly dandelion (*Glyptopleura marginata*) (including *G. setulosa*)
2d-11 Ives phacelia (*Phacelia ivesiana*) (including *P. pediculoides*)

NAWS Category 2e Other Potential Sensitive Plants on NAWS

2e-1 Pygmy Poppy (Canbya candida)

Status and Distribution:

Pygmy poppy occurs close to the NAWS western boundary of North ranges and is known from Rose Valley at 3,200-3,500 feet msl (DeDecker, 1980). The general range of *Canbya candida* is in the southern Sierra-Mojave transition from southern Owens Valley thru Red Rock Canyon, Rand Mountains, Kramer Hills, Lucerne Valley, Mojave, and Lancaster. This distribution suggests that the pygmy poppy is more common than documented. However, many populations are on private lands or have other threats. This species is listed under CNPS list 1B, RED Code 2-2-3, State Rank S2s3, no Federal status, and Global Rank G2T3.

Biology and Ecology:

Pygmy poppy (Papaveraceae) is an extremely diminutive annual with white flowers above a minute clump of foliage. This species very likely occurs on North ranges and perhaps in the Pilot Knob area of South ranges. It appears to be restricted to coarse, loose decomposed granite gravels, often where slopes are frequently shifting. Similar habitat of good quality occurs in several locations in the western Coso Mountains. These plants are easily missed and may not show up in poor rain years. This is one of the most unique plants in the region.

2e-2 Pinyon Mesa Buckwheat (Eriogonum panamintense (or other taxa?))

Status and Distribution:

Pinyon Mesa buckwheat is found from the Guzzler #3 area up to Coso Peak and slightly west. It is found on rolling terrain and benches with stony soil and low-growing cover shrubs such, as big sage brush, low sagebrush (*Artemisia* sp.), purple sage, or sticky-leaved rabbitbrush (*Chrysothamnus viscidiflorus* ssp *puberulus*).

This plant is being proposed as a distinct taxa or species by Gordon Pratt (UCR entomologist, specialist of the *Eriogonum* genus) to be separated from other *E. panamintense*. James Morefield (Rancho Santa Ana Botanic Garden) treats this plant as *E. mensicola* in his flora of the White Mountains (*Plant Biology of Eastern California*, 1988, Hall, Jr. and Doyle-Jones). This plant appears to very distinct, both morphologically and ecologically from the old Panamint buckwheat (E. *panamintense* ssp. *panamintense)*, which occurs infrequently at NAWS. Panamint buckwheat is found on generally lower elevations, steep scree banks, and slopes as short-lived, fluctuating populations. Pinyon Mesa buckwheat (*E. mensicola*) generally grows at higher elevations as long-lived plants with stable populations. Morphologically, they are very distinct, with the Panamint buckwheat differing from the Pinyon Mesa buckwheat by having numerous spreading flowering stems with conspicuous leafy orbicular bracts (*E. mensicola* are scale-like) and smaller, more numerous, late developing involucres. Panamint buckwheat is generally a smaller plant.

This plant is so closely associated with other sensitive plant species habitat that protection will probably be partially afforded until the taxonomic status is determined. The most likely taxonomic change would be back to the 1941 description *Eriogonum mensicola* Stokes. Current records would indicate that the plants which fit *E. mensicola* are fairly widespread in the White, Inyo, Panamint and Coso ranges and probably unlikely to be listed in the near future as a sensitive or threatened taxa. If described as a new taxa, NAWS plants could be considered rare or of concern.

Biology and Ecology:

Pinyon Mesa buckwheat is a perennial of the buckwheat family (Polygonaceae), currently determined and placed by the *Jepson Manual* (Hickman, 1993) under *Eriogonum panamintense*. Prior to this treatment, in *Flora of Southern California* (Munz, 1974), it was described as *Eriogonum panamintense* Morton ssp. *mensicola* (Stokes) Munz, comb., nov.. This plant was originally described by Stokes (1941) in *Leaflets of Western Botany* 3:16, as *Eriogonum mensicola* Stokes.

This buckwheat is a cespitose, low growing perennial with a crown of oval-shaped, densely tomentose leaves at the soil surface and erect, weakly branched flowering stems. Involucres are few, large, and appear as red buttons prior to flowering. Plants are supported through dormancy by a long tap root. Pinyon Mesa buckwheat grows in close association with several other sensitive species, including Darwin milk-vetch, Panamint mariposa lily, pinyon rock cress, Panamint bird's beak, and potentially the new *Lomatium* sp (See common lomatium (*Lomatium utriculatum*) in next description).

2e-3 Common Lomatium (Lomatium utriculatum - other sp?) new taxa?

Status and Distribution:

This plant is known in the NAWS region from Nelson, Coso, and Argus ranges. At NAWS it is patchy in distribution but appears to be locally common. Common lomatium usually occurs on rocky to gravelly igneous substrate, especially among basalt cobbles, at elevations ranging from 3,600 to 7,000 feet msl. Surrounding plant communities usually include low scrub covers and range from Mojave Mixed Scrub to Pinyon Woodland. These habitats are unique from those which most of the species frequents in other parts of California. Richard Zembel *et al.* (1979) reports common lomatium from the Coso Geothermal Area as "*occasional throughout the Coso Hot Springs area; most abundant on slopes and gravelly soils*". In addition, Zembel made collections and sent them to Robert F. Thorne, curator of the Rancho Santa Ana Botanic Garden, for determination. Thorne wrote back (25 Jan. 1979), "*I mentioned the Lomatium utriculatum as way out of range. It does look much like that species but I suspect it is something distinct, possibly a new subspecies. I think we should send it along to Dr. Lincoln Constance at Berkeley for his study.*"

Eventual disposition and determination of the specimens are not known. Since no one has gone out of their way to mention, publish, or recollect these parsleys from the Cosos, it is likely that they are no different from the variable complex of *L. utriculatum*, despite the geographic remoteness. Further specimens of this parsley have been collected from Birchum Mesa in May 1997 and will be sent to Lincoln Constance or Barbara Ertter for (further?) determination.

Biology and Ecology:

Common lomatium is a low growing perennial herb in the carrot family (Apiaceae) that dies back underground during summer and fall. During late winter and spring it puts out a short stem and spray of compound, weakly incised, mostly unscented, parsley-like leaves followed by tightly clumped umbel of small yellow flowers which drop rapidly after opening. Fruits are smooth, green, elliptic, and flat, similar to *L. nevadense*, but with broader wings. It is known from much of California below 5,000 feet msl, including some of the Channel Islands, Coastal Sage Scrub areas, interior grasslands, and foothills from northern Baja California to British Columbia. In most of the range common lomatium grows in open grassy slopes, meadows, and woodlands. This species is considered to be taxanomically variable and was formerly separated into two species (the other being *L. vaseyi*).

NAWS Category 3a Unique Plant Localities

Background information for the following unique localities will be compiled during 1998-2002.

3a-1 El Conejo area
3a-2 Coso Peak lava flow
3a-3 Coso Known Geothermal Resource Area
3a-4 Pilot Knob region
3a-5 Birchum Mesa area

3a-6 East China Lake sand dunes
3a-7 North Argus Range
3a-8 Wilson and Mountain springs area canyon bottoms
3a-9 Darwin Plateau
3a-10 Haiwee Spring area
3a-11 Pink Hill Spring area
3a-12 Red Hill Mine area
3a-13 Guzzler Number 14 area

NAWS Category 3b Unique Plant Taxa and Individual Forms

3b-1 Plants that are Essential Hosts to Sensitive or Status Animals

Background information for the following unique plant taxa and individual forms will be compiled during 1998-2002.

- Riparian trees for Inyo California towhee
- Cottonwood (*Populus fremontii*), arroyo willow (*Salix lasiolepis*), red willow (*S. laevigata*), yellow willow (*S. lutea*), narrow-leaf willow (*S. exigua*), desert olive (*Forestiera pubescens*), mesquite (*Populis glandulosa*), and seepwillow (*Braccharis salicifolia*) for other birds
- Joshua trees
- Parry saltbush (*Atriplex parryi*) in the China Lake Basin for Darwin Tiemann's beetle
- Four-wing saltbush (*A. canescens*) at El Conejo Gate for *Pholisora alpherus*
- *canescens* association with *Formica piliconis* and *Plebejulina emigdionis*
- Erigonum spp. host relationship to rare butterflies

3b-2 Creosote Clonal rings (Larrea tridentata)

Creosote bush (*Larrea tridentata*) is the most common and widely distributed shrub in the deserts of North America, occurring on well-drained sandy to rocky flats, bajadas, and steep slopes from sea level to about 4,000 feet msl (Benson and Darrow, 1981). While creosote is common in a wide variety of soil, topographical, and elevation types, creosote clones are generally found only on stable alluvial fans and bajadas with sandy soils. Creosote clones typically are formed by plants with spreading root systems. As root systems (and plants) grow outward, the center of the shrub dies and/or is covered by sand, leaving the center bare of the original plant. The largest known clones are the King Clone with a maximum width of 22 meters and the Emperor Clone with a maximum width of 36 meters. Dr. Frank Vasek (1980) has calculated that plants over the past five to seven centuries grow at a mean rate of 0.66 mm per year. Although, greatly different in size Vasek believes these two clones are similar in age, approximately 11,700 years old.

Creosote clones on NAWS are found from Wilson Canyon, south along the southeastern edge of Indian Wells Valley. The area of greatest concentration is around the K2 Track. There are thousands of clones in this area, the largest measuring 20 meters wide. Clones of this size are believed to be more than 10,000 years of age (Vasek, 1980). Vasek stated in a letter to Captain Haff in 1981 that this area is perhaps unrivaled in terms of a population of ancient plants.

3b-3 Other Clones

Yucca brevifolia, Ephedra, Prunus andersonii (Mozingo), etc. may, be recognized as unique for their antiquity. It is unlikely that any other species at NAWS could grow as old as *Larrea*, though there are likely to be several species which produce larger colonies or "rings". Saltgrass produces the largest cloning formations at NAWS.

3b-4 Trees of Limited Distribution

Background information on the following trees with limited distribution will be compiled during 1998-2002.

- Maple (*Acer glabrum*)
- Elderberry (*Sambucus mexicana*)
- Serviceberry (*Amelanchier utahensis*)
- Singleleaf ash (*Fraxinus anolmola*)

3b-5 Joshua Tree Spikes and Other Exceptional Tree Forms

Background information on Joshua tree spikes and other exceptional tree forms will be compiled during 1998-2002.

3b-6 Plants of Noteworthy Occurrences, Range Extensions, Etc.

Background information on the following plants of noteworthy occurrence, range extension, etc. will be compiled during 1998-2002.

- *Fragonia laevis*
- *Salvia pachyphylla*
- *Keckiella* spp.
- *Cercocarpus*
- *Malcothamnus fremontii*
- *Horkeliella congdonis*
- *Mammilaria tetrancistra*
- *Viola purpurea*

3b-7 Mockorange, 3b-8 Orchids, 3b-9 Solomon's seal, 3b-10 Snowberry, and 3b-11 Plants previosly recognized as sensitive such as Pholisma

Background information for the above categories will be compiled during 1998-2002.

NAWS Category 3c Unique Plant Habitats

3c-1 Riparian Areas and Surrounding Habitat

Riparian areas at NAWS, including ephemeral streams, have highly restricted plant communities. They are less affected by floristic influences and often include species of worldwide distribution. In general riparian plant compositions change less with elevation than do other plant communities. Willows, cattails, rushes, grasses, exotics, and aquatic-herbaceous plant types are frequent at springs, while large deeply-rooted shrubs like rabbitbrush, thornbush (*Lycium*), scalebroom (*Lepidospartum*), and saltbush (particularly *Atriplex canescens* and *A. polycarpa*) occur in ephemeral streams and washes below such springs.

Alkaline-adapted riparian communities occur in the China Lake basin. Saltgrass (*Distichlis spicata*) is usually the dominant cover species. Surrounding plant associations are often near-monoculture mosaics which are distributed with subtle changes in hydrology, salinity, and drainage. These plant communities change rapidly with water table alterations. The most endangered of plant communities are those species, often relictual, that depend on microhabitats adjacent to springs. These areas are subject to compaction or desication of soils, concentrated herbivory, and increased competition with weedy species, most of which are the result of activities of cattle, feral horses, and burros. Past human uses and water diversions have also impacted riparian sites. Any rare plant species found in riparian areas are usually of great interest because they are endangered for the same reasons in other parts of their ranges. Such species in the region may include *Puccinellia parishii, Hemizonia arida, Ranunculus hydrocharoides,Calachortus striatus,* and *Juncus nodosus*.

Adjacent terrain surrounding riparian zones often has unique and diverse subassociations of common plant communities, resulting from high water tables and protective microhabitats. These particular areas may be the most endangered of all NAWS vegetation because they are limited to riparian zones but unlike riparian plants are less adapted to disturbances and are not reclaimed after disturbances by high water events. These areas have suffered from wild and feral livestock disturbances which radiate out from water sources; thus the adjacent vegetation is most impacted. Examples are the *Hymenoclea salsola* replacement of diverse Mojave Mixed Scrub in the vicinity of Amity Spring in southeastern Slate Range and heavy surface disturbances that surrounds China Garden, Indian Garden Springs, and Crystal Spring.

Riparian areas including springs and seeps and locations of guzzlers found on North and South ranges are shown in the INRMP at Figures 6.3.1a and 6.3.1b respectively. Riparian areas have received the best level of previous vegetation survey at NAWS, and these data are incorporated into a higher resolution mapping effort of the many riparian types. The size of these plant communities is usually small (<50 meter^2), and their individual species change abruptly with hydrology. The 1:100,000 scale map cannot show these vegetation zones without confusion of conflicting polygon edges. These are the most limited, sensitive, and diverse vegetation (as well as biological) communities at NAWS. Available data on these areas should continue to be organized and assessed so that new data collection on these areas can be initiated.

3c-2 Through 3c-10 and 3c-12

Background information for the categories listed below will be compiled during 1998-2002.

3c-2 Dense Joshua tree woodland areas
3c-3 Dense perennial grass associations
3c-4 Dry lakes, pools, and lacustrine basinsof higher elevations
3c-5 Juniper areas
3c-6 Concentrations of cactus
3c-7 Lava flows of higher elevations

3c-8 Desert pavements
3c-9 Sand fields and dunes
3c-10 Dolomite/marble formations
3c-12 Other unique geology

3c-11 Cinder Formations

There are large and diverse areas of volcanic and cinder formations at NAWS. These areas are relatively inaccessible, mostly unexplored botanically, and tend to be botanically active only in good rain years. Two NAWS-SC annual plants are found in the Volcano and Cinder peaks areas, Charlotte's phacelia and Booth primrose. Another annual plant in the area, pagoda buckwheat (*Eriogonum rixfordii*), is proposed for list 4 by CNPS. Cinder areas should be more closely investigated as they have potential for specialized floral and faunal resources, some which may be undiscovered endemics.

Most plant taxa of scree and cinders can tolerate certain impacts, and some even thrive with high impact levels. Impacts on cinder change the availability of water for plants. When plants recolonize disturbed areas on cinder, they will recover rapidly in zones within the disturbed area that have the most favorable slopes.

Cinder formations are difficult substrates for construction, and it is anticipated that beyond mining, these areas will remain mostly undeveloped at NAWS, except for instrumentation and some target sites.

SECTION 2.3.1.3f Sensitive Species Protection

The Endangered Species Act of 1973 provides protection to listed species. Of foremost importance to Federal agencies, section 7(a)(2) of the Act requires Federal agencies to ensure that they do not jeopordize the continued existance of any listed species or adversely modify or destroy their designated critical habitat. Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.

Federal court rulings have upheld the Service's definition of "harm" as this term is used in relation to prohibited actions under section 9. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.

Incidental take is defined as take that incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7 (o)(2), taking that is incidental to an not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an incidental take statement contained in a biological opinion.

Plant taxa listed as threatened or endangered cannot be removed and reduced to possession or maliciously damaged on areas under Federal jurisdiction. Section 9 of the Act also prohibits the destruction of the listed plants on non-federal areas in violation of the State law or regulation or in the course of any violation of the State criminal trespass law.

Ecologically, gene pools associated with populations of this size are usually considered not viable. For this reason land owners wishing to protect plant diversity in total or equal to other sensitive resources must implement policies and actions that are more restrictive than protections required under the ESA. Some rare plant species show robust survival characteristics in populations containing very narrow gene pools, often in primitive or clonal species. Few animals that are reduced to populations with narrow gene pools have such robust survival characteristics.

Beyond the ESA, most direct individual plant taxa protections legally required at NAWS might only exist within specific federal agency policies and interagency habitat conservation plans. Other specific plant taxa protections exist below the federal level and in international trading restrictions under Commission on International Trade of Endangered Species.

The ESA candidates (now PE and PT) have little or no protection under ESA but receive consideration through land planning laws such as NEPA. These processes represent indirect protection for individual plant taxa that are rare or endangered. At the federal level the issue of which plants beyond the ESA candidate list get consideration in these processes is unclear. Most protection afforded to plants in these situations are through planned avoidance, which is the policy at NAWS.

Laws protecting archaeological and cultural sites have even greater levels of indirect protection for associated plants. Usually these sites are too small to protect an entire plant population. However, at NAWS large buffer zones are given to some sites to avoid potential errors in testing and training. Archaeological sites, in particular, often have geologic similarities to sensitive plant habitats. These areas probably provide the highest level of protection that plants receive at NAWS, except where rare plants are in endangered species habitats or wetland areas.

The greatest variety and extent of indirect plant protection at the federal level preserve plants through the protection of certain biological habitats. High levels of indirect protection for plants at NAWS occur where plant habitats overlap the critical habitat designated for animals listed under the ESA. Associated plants are treated as essential components of the endangered animal's habitat. The level of indirect protection to the plant in this situation is more restrictive and more strongly enforced than protections directly afforded a plant listed as endangered under the ESA.

The State of California ranks, lists, and protects endangered or threatened plant taxa under several laws, primarily the California Endangered Species Act and California Environmental Quality Act (CEQA). Until recently plants listed as sensitive by the CNPS and the CDFG were required to be considered under the CEQA. At that time this probably represented the most extensive level of plant protection in the United States. Plants included in these special plants lists were much closer to the true number and types of plants that are threatened and endangered than those listed by either state or federal endangered species laws. Plant taxa in these lists are no longer required (since 1996) to be considered under the CEQA, although this ruling is under appeal.

California also protects certain non-endangered or threatened plants with high public interest or vulnerable to over-collection and commercial pressures. This includes most types of cactus and succulents, orchids, certain trees, and a few shrubs. This protection may be applicable to NAWS if these resources are transported from NAWS or utilized commercially.

The most basic level of plant protection lies with the actions of individual land users who choose to avoid or protect certain plants, especially trees, that are of personal or community interest. Local expectations of what is considered wise land use are important factors in non-legal situations dealing with plant conservation. The NAWS plant collection policy provides good protection for sensitive plants, yet allows for the advancement of scientific knowledge for these species.

SECTION 2.3.1.4a Chronological Record and Abstract of Surveys

The following chronology is a compilation of many references from a wide array of sources. Original notes and incomplete references are retained to assist future researchers of NAWS resources.

NAWS Botanical Work Chronology and Abstracts

1974:
Quimette, J.R. 1974. *Survey and Evaluation of the Environmental Impact of Naval Weapons Center Activities*. Naval Weapons Center, China Lake, CA.

Barling

1976:
Barling

1978:
Mary Ann Henry's work, mostly 1978, and information, much of which is represented under the work of others, primarily Mary DeDecker (1980) and Beckingham *et al.* (1981).

1979:
Westec Services, Inc. 1979. *Environmental Assessment for Naval Weapons Center Withdrawal of Mohave B Ranges*. Technical appendix, 2 vols., prepared for China Lake Naval Weapons Center Public Works Dept. 107 pp.

Zembal, R.C., C. Gall, D. Kruska, and P. Lobnitz. 1979. *An Inventory of the Vascular Plants and Small Mammals of the Coso Hot Springs Area, Inyo County, California*. Department of the Navy, Naval Weapons Center, China Lake, CA. 120 pp.

Henrickson, J. 1979. *Botany of the Coso Geothermal Study Area*. In Rockwell International, 1980, *Field Ecology Technical Report on the Coso Geothermal Study Area in Support of Geothermal Development Environmental Statement*. Bureau of Land Management, Bakersfield, CA.

1980:
Phillips, Brandt, Reddick, Inc. and PRC Troups. 1980. *Inventory of the Vascular Plants and Vertebrate Fauna of the Randsburg Wash Test Range Area of the China Lake Naval Weapons Center, China Lake, California*. 84 pp.

Michael Brandman Associates, Inc. 1980. *Inventory of the Plants and Vertebrates of the Randsburg Wash Test Range Area*. Prepared for the Naval Weapons Center Environmental Branch (Code 2692), China Lake, CA; Santa Ana, CA. approx. 30 pp. + appendices.

Brandman - Principal-in-charge; L. Munsey - Project Director; Eric Hanson - Senior Investigator; Karlin G. Marsh, Kent K. Norton, Cynthia Gall, Lori Nicholson, and Richard Zembal - Field Investigators. Study occurred on bajada NW of Black Hills from 31 October to November 1, 1979.

DeDecker, M. 1980. *A Flora of the Naval Weapons Center and Bordering Areas in Portions of Kern, Inyo and San Bernadino Counties*. Self-published by Mary DeDecker, Independence, CA. 51 pp.

Observations based on Mary DeDecker's field surveys and personal herbarium for the region.

Henrickson, J. 1980. *Botany of the Coso Geothermal Study Area*. In Rockwell International. 1980. *Field Ecology Technical Report on the Coso Geothermal Study Area*. BLM Report, Bakersfield, CA. 6: 97 pp.

Rockwell International. 1980. *Field Ecology Technical Report on the Coso Geothermal Study Area*. Newbury Park, CA.

1981:

Beckingham, D.L., D. LaBerteaux, J. Lorenzana, and A.P. Woodman. 1981. *Inventory of the Vascular Plants and Vertebrates at China Lake Naval Weapons Center*. Unpublished Draft Report. 104 pp.

Thomas McGill - Project Supervisor; Dianne L. Beckingham, Denise LaBerteaux, Juanita Lorenzana, and Peter Woodman - Research Staff, Field Crew and Authors. A field study was conducted from 14 July to 14 September 1981 to inventory vascular plants and vertebrates at four areas of NAWS: Wildrose Spring in Mountain Springs Canyon, sand dunes in the K2 Track area, Lark Seep, and Upper Cactus Flat. Vegetation descriptions were written of the four areas. Quantitative sampling with belt transects (Mueller-Dombois and Ellenberg, 1974) Not in ref were completed at the Mountain Springs Canyon (+ one line intercept transect), K2 Track area, and Upper Cactus Flat. A modified belt transect was completed at Lark Seep. These were analyzed for cover, composition, and density (Appendix A- table one) and results described. Plants were identified and collected as vouchers (NAWS herbarium). A plant list was created with cross references to the four study areas (Appendix A - table two). In addition, two other plant lists were presented (Appendix A - table three) from the previous work of Mary Ann Henry at Mountain Springs Canyon (1972-75, 1978) and the K2 Track area (March 1978).

Phillips, Brandt, Reddick. 1981. *Feral Burro Management Program, Naval Weapons Center, China Lake, CA*. Technical Appendix I to Final Environmental Impact Statement, Irvine, CA.

1982:

May, Richard W. Plants were observed and reported in *Distribution and Status of Sclerocactus polyancistrus on the Naval Weapons Center - A Survey*, prepared for the Public Works Department by, (Texas A&M?), October 1982 (NWC TP 6403 - 201.02 002).

T&E/PW plants were observed and reported in *Naval Weapons Center Resource Management Plan for the Mojave B and Randsburg Wash Ranges*. August 19, 1982. Draft copy for Internal Navy Review prepared by Test and Evaluation Directorate and Public Works Department.

Westec Services, Inc. 1983. *Biological Resources Survey of Mountain Springs Canyon on the Naval Weapons Center*. Unpublished report, NAWS technical publication (NWC TP 6424) produced by WESTEC Services, Inc., San Diego, CA. 82 pp.

John Westermeir - project manager; Stephen Lacey - project coordinator; Jack Fisher - senior botanist; and Thomas Huffman and Curt Uptain - associate biologists. A biological resource study of the 8,500-acre Mountain Springs Canyon at NAWS was conducted in May 1982 to update the general biological database for NAWS and gain specific information for future resource management considerations. Birds, mammals, reptiles, amphibians, and plants were surveyed. Plants were identified and presented as a plant list with cross-references to plant communities (Table AA-1). Seven vegetative habitats were identified: Creosote Bush Scrub, Grayia-Lycium, Artemisia-Coleogyne, Haplopappus-Coleogyne, Desert Wash, Riparian Woodland, and Pinyon Pine Woodland. Discussions of general vegetation and plant classification systems as they relate to Mountain Springs Canyon were presented. Extensive plant collections were made for each of the representative areas. Voucher specimens from this study were submitted to University NV; taxa were keyed to Munz (1979) and common names to Jaeger (1969). Plant species inventories were obtained by general qualitative surveys from May 3-10. Plant communities and associations were determined by general foot survey of the study area. Further quantitative vegetation measurements were completed in each of the representative areas. Belt line transects (50 X 3 meter; [Mueller-Dombois, and Ellenberg, 1974]) of three randomly-spaced lines were done in close proximity to wildlife study plots. Shrub height, frequency, cover, and density were calculated. Evenly-spaced plots for annual plants and substrate were also surveyed along these transects. Riparian areas were sampled by estimation of cover. Sensitive plant species were surveyed, but none were found. The study observed numerous burro-related impacts to vegetation. Statistical comparisons were made between burrobush cover of Mountain Springs Canyon and other sites in the Mojave Desert. Burrobush was found to be significantly reduced in cover size at Mountain Springs Canyon.

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B. Ertter (with mark Bagley and (previous?)

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SECTION 2.3.1.4b Plant Taxa Locations

Aceraceae	**Maple Family**	
Acer glabrum var. *diffusum*	Mountain Maple	One tree located on northwestern Maturango Peak east of Argus Spring along old mining road that ascends north slope (G. Pratt 96).
Amaranthaceae	**Amaranth Family**	
Amaranthus albus	Tumbleweed	Occasional weed in disturbed areas such as at Coso Hot Springs (MD80).
Tidestromia oblongifolia	Honey-Sweet	Eastern base of Argus Range in Panamint Valley, below 2,500 feet, (MD80). Leadpipe Spring, eastern Layton Canyon, expected along roads and in washes (DS).
Apiaceae	**Carrot Family**	
Berula erecta	Water Parsnip	Aquatic plant at Little Lake, 3,300 feet (MD80). Haiwee Spring, expected at other riparian sites (DS96).
Cymopterus aboriginum	Indian Parsley	Argus Range (GP96). Argus Sterling Mine (DS96).
Cymopterus panamintensis var. *panamintensis*	Panamint Indian Parsnip	Occasional in the Coso Range, more frequent in the Argus Range, 3,000-6,500 feet (MD80). Slate Range (G. Pratt, 1996). Louisiana Butte, Wilson, Moscow, Mountain Springs, Water, and Sheperd canyons (DS).
Lomatium mohavense	Mohave Parsley	Common throughout NAWS in well drained, gravelly, and rocky areas, 2,200-7,000 feet (DS96).
Lomatium nevadense var. *parishii*	Parish Parsley	Locally common in rolling terrain of North ranges at high elevations, 5,500-7,500 feet (DS96).
Lomatium utriculatum	Parsley	Locally common at 4,800-5,500 feet, Coso and Argus ranges (MD80). Northern Birchum Mesa and Coso Peak area on basalt; NAWS plants should be taxanomically investigated (DS96).
Apocynaceae	**Dogbane Family**	
Apocynum cannabinum	Indian Hemp	Slate Range (G. Pratt, 1996).
Asclepiadaceae	**Milkweed Family**	
Asclepias erosa	Desert Milkweed	Randsburg Wash Road, Seep Spring.
Asclepias fascicularis	Milkweed	Haiwee, Lone Cabin, and Mariposa Springs (DS).
Asclepias vestita	Wooly Milkweed	Northeast of Coso Village gate in Hymenoclea - Joshua Tree zone of broad sandy hills (G.Pratt, 1996), former NAWS collections at RSA; a northern extent for the species.
Sarcostemma hirtellum	Rambling milkweed	Slate Range Canyons.
Asteraceae	**Aster Family**	
Acamptopappus sphaerocephalus	Goldenhead	Abundant small shrub, frequent in zone between Creosote Bush Scrub and Mojave Mixed Scrub.
Adenophyllum cooperi	Dyssodia	Common in washes south of Randsburg Wash Road (DS96).
Ambrosia acanthicarpa	Annual Ragweed	Roadsides, disturbed sites (especially old housing areas), and sand fields.
Ambrosia dumosa	Burro Bush	
Amphipappus fremontii	Chaff Bush	

Anisocoma acaulis	Snakehead	
Artemisia douglasiana	Douglas Mugwort	
Artemisia dracunculus	Tarragon, Mugwort	Common at spings throughout NAWS (D96).
Artemisia ludoviciana var. *albula*	Western Mugwort	Common at springs throughout NAWS North ranges (DS).
Artemisia ludoviciana var. *ludoviciana*	Western Mugwort	Water Canyon, 5,100 feet.
Artemisia nova	Black Sagebrush	Northeastern Argus Range (DS96).
Artemisia spinescens	Bud Sagebrush	
Artemisia tridentata var. *tridentata*	Big Sagebrush	
Baccharis brachyphylla	Seepwillow	China Lake 2,100 feet (unlikely record, maybe Lepidospartum) (DS96).
Baccharis salicifolia	Seepwillow	Lark Seep, north fork of Wilson Canyon, many other springs, one plant outside the Bio Hut (DS96).
Baccharis sergiloides	Seepwillow	At most springs at NAWS, dense populations in eastern Argus canyons.
Baileya pleniradiata	Wooly Marigold	
Bebbia juncea var. *aspera*	Sweetbush, Chuckawalla's Delight	Wilson Canyon.
Brickellia arguta var. *arguta*	Pungent Brickellia	Wilson Canyon and throughout NAWS rocky areas (DS96).
Brickellia californica	Brickellia	New House Spring Canyon waterfall seep (DS96).
Brickellia desertorum	Desert Brickellia	
Brickellia microphylla	Brickellia	Abundant in basalt canyon bottoms of Coso Range.
Brickellia multiflora	Gum-leaved Brickellia	
Brickellia oblongifolia var. *linifolia*	Pinyon Brickellia	Common along washes, roadsides, and other disturbed areas above 5,000 feet on North ranges (DS96).
Brickelliax knappiana	Knapp Brickellia	North fork of Wilson Canyon (DS96).
Calycoseris parryi	Yellow Tack-stem	Mountain Springs Canyon (Mary Ann Henry, 1972-1978).
Calycoseris wrightii	White Tack-stem	
Chaenactis carphoclinia var. *carphoclinia*	Pebble Pincushion	
Chaenactis douglasii var. *douglasii*	Douglas Pincushion	
Chaenactis fremontii	Fremont Pincushion	
Chaenactis macrantha	Pincushion	Mountain Springs Canyon (Mary Ann Henry, 1972-78).
Chaenactis stevioides	Pincushion	
Chaenactis xantiana	Xantus Pincushion	Common in sandy areas of Argus Range, above 3,000 feet (DS).
Chamomilla suaveolens	Pineapple Weed	Common weed of lawns, present in silty washes of southeastern Slate Range playa basin, Birchum Springs (DS).
Chrysothamnus nauseosus ssp. *consimilis*	Rubber Rabbitbrush	
Chrysothamnus nauseosus ssp. *hololeucus*	Rubber Rabbitbrush	
Chrysothamnus nauseosus ssp. *mohavensis*	Rubber Rabbitbrush	
Chrysothamnus paniculatus	Blackband Rabbitbrush	
Chrysothamnus teretifolius	Rabbitbrush	
Chrysothamnus viscidiflorus ssp. *puberulus*	Sticky-leaved Rabbitbrush	Common throughout Great Basin areas at NAWS.
Chrysothamnus viscidiflorus ssp. *viscidiflorus*	Sticky-leaved Rabbitbrush	Common in Great Basin areas.

Cirsium mohavense	Thistle	Seep Spring, Wilson, lower Mill Canyon, and Haiwee Spring (DS).
Cirsium neomexicanum	Thistle	
Cirsium occidentale var. *venustum*	Thistle	
Conyza canadensis	Horseweed	Somewhat moist, disturbed places, Coso Mountains (MD80).
Conyza coulteri	Coulter Horseweed	Area R complex off G1 Road, eastern end in new-forming semi-alkaline seep with tamarisk, saltgrass, Typha, and *Solanum americanum* (DS 12/20/96 tamarisk survey). Also pond site at X-ray building of Clip area (DS97). Weedy annual. Agricultural areas at low elevations (MD84).
Coreopsis bigelovii	Coreopsis	Widespread often abundant, throughout region, 2,100-5,700 feet (MD80).
Crepis occidentalis	Western Hawksbeard	Upper slopes of Coso Peak region, northeastern Birchum Mesa, and Guzzler #3.
Dicoria canescens	Dicoria	Low sandy places, 2,300-2,600 feet. ssp. *hispidula* at west end near Trona, 2,250 feet (MD80).
Encelia actoni	Brittlebush	*E. virginensis* ssp. *actoni* northern Coso and Argus ranges, 3,000-5,700 feet (MD80).
Encelia actonii X E. farinosa	Brittlebush	Lower Wilson Canyon, expected in other nearby canyons.
Encelia farinosa	Brittlebush	Southern Argus Range on southwestern facing rocky slopes in Creosote Bush Scrub, similar slopes in Slate Range and southern Panamint Valley (DS).
Encelia frutescens	Brittlebush	Eastern Argus Range, below 2,800 feet.
Ericameria cooperi var. *cooperi*	Cooper Goldenbush	Common and widespread throughout the region, 2,500-5,750 feet (MD80). Widespread and sometimes a codominant in Mojave Mixed Scrub.
Ericameria cooperi X linearfolia	Goldenbush Natural Hybrid	Granite Wells, some of these hybrids were present at the Montana Mine for *Astragalus jaegerianus* (DS96).
Ericameria cuneata	Cliff Goldenbush	Coso and Argus Ranges, 3,400-7,200 feet (MD80). Nearly always on rock outcrops and cliffs. Wilson Canyon, Argus Crest, and Granite Wells (DS96).
Ericameria linearifolia	Linear Leaved Goldenbush, Showy Goldenbush	Frequent in Coso and Argus ranges, 3,700-6,050 feet (MD80).
Erigeron aphanactis	Fleabane Daisy, Gold Buttons	Infrequent, Coso and Argus ranges, 5,000-8,100 feet (MD80). Rolling hills north of Silver Peak, Birchum Mesa, Cinder Peak, north of guzzler #13, and southeast of Coles Flat (DS).
Erigeron breweri var. *covillei*	Fleabane Daisy	Common in flats and washes in Great Basin Mixed and Sagebrush Scrub of upper Coso and Argus ranges (DS96).
Erigeron breweri var. *porphyreticus*	Boulder Daisy	Coso Village area, Coso Range, 5,700 feet (MD80). Lacey Canyon on northern facing rock wall (DS96).
Eriophyllum ambiguum	Wooly Sunflower	Frequent throughout lower elevations of mountains, 2,350-7,000 feet (MD80). Upper Moscow Springs to Wison Canyon, Mountain Springs, and Water Canyon (DS).
Eriophyllum pringlei	Wooly Sunflower, Bud Eriophyllum	Lower elevations of Coso and Argus ranges up to 5,500 feet (MD80).
Eriophyllum wallacei	Wooly Sunflower, Easter bonnets	Lower elevations of Coso and Argus ranges, 2,200-5,300 feet (MD80).
Filago arizonica	Herba Impia	Occasional, Coso Range, up to 5,000 feet (MD80).
Filago depressa	Herba Impia	No record, but it should be present at low elevations (MD80). Abundant on flats and bajada of IWV, should be abundant in Creoste Bush Scrub areas throughout NAWS (DS).
Geraea canescens	Desert Sunflower	Occurs on borders of the region as far north as Coso Mountains, Panamint Valley, and southwestern corner of Argus Range, rarely up to 4,400 feet (MD80). Salt Wells Valley and southern Slate Range (DS).
Glyptopleura marginata	Holly Dandelion	*G. marginata,* occasional in Coso Range and southwestern

		corner of Argus Range, 2,250-4,900 feet (MD80). *G. setulosa,* low elevations throughout region 2,000-3,700 feet (MD80). K2 Valley (DS96).
Gnaphalium canescens ssp. *beneolens*	Everlasting	Margaret Ann Spring on shady rock outcrops (DS).
Gnaphalium luteo-album	Cudweed	Haiwee Spring and Wilson Spring (DS).
Gnaphalium palustre	Cudweed	Mill Spring and Coso Mountains (DS96).
Gnaphalium stramineum	Cudweed	*Gnaphalium chilense,* moist, waste places such as Haiwee Springs and Coso Hot Springs in the Coso Range, up to 5,000 feet (MD80).
Gutierrezia microcephala	Matchweed	Lower elevations of Coso and Argus ranges, 2,000-6,000 feet (MD80). Widespread, especially near washes; in many plant communities (DS).
Gutierrezia sarothrae	Snakeweed	Vicinity of Devil's Kitchen, Coso Moutains, 4,000 feet (MD80). Renegade Canyon, Haiwee Spring, Leadpipe Spring, and Coso target areas (DS).
Heliomeris multiflora var. *nevadensis*	Nevada Golden-eye	Infrequent, Coso and Argus ranges, 5,000-6,150 feet (MD80). Widespread in Sagebrush Scrub up to Pinyon Woodland, frequent along roadsides (DS96).
Hulsea heterochroma	Great Hulsea	Two plants located 6-29-96 (DS&ES) where lower east fork of road ends on the east face of Burl Parkinson Peak, shady seep area above rocky ravine, with *Keckiella rothrockii, Fraxinus anomala, Philadelphus microphyllus* (extending down ravine), *Penstemon rostriflorus, Huechera rubescens, Galium* cf *multiflorum* in Pinyon Woodland community.
Hulsea vestita ssp. *inyoensis*	Inyo Hulsea	One record at NAWS from 1891 at 6,070 feet in Coso Range, canyon south of Crystal Spring.
Hymenoclea salsola var. *patula*	Cheesebush	Widespread variety at NAWS especially higher elevations.
Hymenoclea salsola var. *salsola*	Cheesebush	Hidden Spring wash (DS).
Iva axillaris ssp. *robustior*	Poverty Weed	Mill Spring, Pinyon Bridge, and Upper Centennial Flat (DS96).
Lactuca serriola	Prickly Lettuce	An occasional weed near springs (MD80). A marshy stand of tall individuals forms below a seep in the north fork of Wilson Canyon (DS96).
Lasthenia californica	Alkali Goldfields	Occasional in basins and lower mountain slopes, up to 3,600 feet (MD80).
Lasthenia microglossa	Modest Lasthenia	Uncommon, Argus Range, 3,000-4,000 feet (MD80). K2 Track area (Mary Ann Henry, 1978).
Labia glandulosa	White Tidy Tips	Widespread, Coso and Argus ranges, 3,100-6,200 feet (MD80).
Lepidospartum squamatum	Scale Broom	Occasional in Coso and Argus ranges, 3,000-4,250 feet (MD80). Locally common, but restricted to large washes with good underground moisture, Wilson Canyon, Lower Mountain Springs, Stone Corrall (DS96).
Lessingia lemmonii var. *lemmonii*	Vinegar Weed	Eagle Crags north of Mesquite Spring.
Lessingia lemmonii var. *ramulosissima*	Lemmon Vinegar Weed	Occasional, especially near springs, 3,600-5,500 feet (MD80). Also at Carricut Lake? (DS).
Machaeranthera canescens var. *canescens*	Hoary-aster	Coso Mountains (DS96).
Machaeranthera carnosa	Shrubby Alkali Aster	Frequent associate with *Atriplex parryi, Cleomella obtusifolia* on mounds, low aeolian formations next to playas and flats. Saltgrass is a frequent nearby plant community. China Lake basin, from Lark Seep to Paxton Ranch and east to Baker Range Road area (and Salt Wells?)(DS96).
Malacothrix coulteri	Snake's Head	Coso and Argus ranges and basins, 2,300-6,000 feet (MD80).

Malacothrix glabrata	Desert Dandelion	Common, often abundant, and widespread, 2,200-5,500 feet (MD80). As high as Birchum Springs, widespread annual of NAWS (DS).
Malacothrix stebbinsii	Stebbins Dandelion	Coso Range, 3,500 feet (MD80).
Monoptilon bellidiforme	Gray Desert Star	Fairly common, Coso and Argus ranges, 3,100-5,300 feet (MD80).
Monoptilon bellioides	Desert Star	Occasional in the Argus Range, 2,350-3,600 feet (MD80).
Nicolletia occidentalis	Hole-in-the-sand Plant	Infrequent at low elevations in the Coso and Argus ranges, 2,400-3,500 feet (MD80). Stabilized sand deposits, Burro Canyon, K2, CT, and Skytop (DS96).
Palafoxia arida var. *arida*	Spanish Needle	Deadman Canyon, 2,450 feet (MD80). Stabilized sand, disturbed areas, and Burro Canyon. (DS96).
Perityle emoryi	Emory Rock Daisy	Argus Range, 2,250-3,500 feet (MD80).
Perityle megalocephala var. *oligophylla*		Location? sp. mentioned in Kiva 93 report.
Peucephyllum schottii	Pygmy Cedar	Eastern Argus Range, 1,800-3,850 feet (MD80).
Pleurocoronis pluriseta	Hofmeistra Pluriseta	K2 Track area, Mary Ann Henry (March 1978). Eastern Argus Range, 2,200-3,600 feet (MD80). Expected on South ranges (DS).
Pluchea odorata	Salt Marsh Fleabane	Lark Seep (DS96).
Pluchea sericea	Arrow-weed	Salt Wells, Disclimax occurrence.
Prenanthella exigua	Bright White	Infrequent, 3,000-5,000 feet (MD80).
Psathyrotes annua	Mealy Rosette, Fan-leaf	Little Lake, 3,200 feet, China Lake, 2,200 feet (MD80).
Psathyrotes ramosissima	Turtle Plant, Velvet Rosette	Northern Coso Range, 4,600 feet (MD80). Randsdburg Wash Road (DS96).
Rafinesquia californica	California Chicory	Among basalt boulders, southern Birchum Mesa, with *Uropappus lindleyi*. Also at Margaret Ann Spring (DS97).
Rafinesquia neomexicana	White Chicory	Widespread at lower elevations, 2,200-5,500 feet (MD80). Widespread throughout NAWS at low elevations in Creoste Bush Scrub and Mojave Mixed Scrub (DS).
Senecio flaccidus var. *monoensis*		Occasional in Coso and Argus ranges, 3,100-4,000 feet (MD80). Common in washes, scree slopes, and canyon bottoms (DS96).
Solidago confinus	Southern Goldenrod	Mill, Margaret Ann Springs (DS).
Solidago spectablis	Showy Goldenrod, Basin Goldenrod	Is this *Solidago* at NAWS high elevation springs? (DS).
Sonchus asper ssp. *asper*	Common Sow Thistle	Occasional weed at springs and seeps (MD80).
Stephanomeria exigua ssp. *exigua*	Annual Mitra	Coso and Argus ranges, 2,800-6,000 feet (MD80). Stabilized sand dunes, sand fields, and washes; patchy, but locally common throughout NAWS, 2,000-6,000 feet (DS96).
Stephanomeria parryi	Parry Rock Pink	Rose Valley, 3,400-3,700 feet (MD80). Widely distributed throughout NAWS, 3,000-6,500 feet (DS).
Stephanomeria pauciflora var. *pauciflora*	Wire Lettuce, Desert Milk Aster	Throughout the region, 2,000-3,400 feet (MD80). Frequent at low to moderate elevations, usually rocky areas, roadsides, and washes, throughout NAWS (DS96).
Stephanomeria spinosa		Frequent on dry slopes above 7,000 feet, Coso and Argus ranges, (DS96).
Stylocline gnaphalioides	Nest Straw	Probably throughout the region up to 5,500 feet (MD80). K2 track area (M.A. Henry 78).
Stylocline micropoides	Desert Nest Straw	Common and widespread up to 4,000 feet (MD80). K2 track area, Mary Ann Henry (March 1978).
Syntrichopappus fremontii	Fremont Xerasid	Locally abundant in good years, Coso and Argus ranges, 3,400-6,250 feet (MD80).
Tetradymia axillaris var. *axillaris*	Cotton-thorn	Northern Coso Mountains, 4,850 feet (MD80).
Tetradymia axillaris var.	Cotton-thorn	Common in the Coso and Argus ranges, 5,000-6,100 feet

longispina		(MD80).
Tetradymia canescens	Grey Horsebrush	Scattered in Pinyon and Great Basin Mixed Scrub from upper Mountain Springs Canyon to Maturango and Coso peaks (DS96).
Tetradymia glabrata	Desert Horsebrush	Dry lakes of basins, 2,200-5,600 feet (MD80). Burro Canyon, south of Lark Seep, west of Aircraft Survivability, and Searles Station Road (DS96).
Tetradymia stenolepis	Mojave Horsebrush	Infrequent, Coso and Argus ranges, 3,200-4,900 feet (MD80).
Townsendia scapigera	Ground Daisy	Stony soils of rounded ridge line dividing Mill and Chappo Spring canyons (Pratt, 5/97).
Uropappus lindleyi	Silver Puffs, Silver Stars	*M. linearfolia* - Coso and Argus ranges, 3,000-7,100 feet (MD80). Common in rocky areas, from Mixed Mojave Scrub up to Pinyon Woodland (DS96).
Vigueria reticulata	Reticulated Golden-eye	Uncommon, Coso and Argus ranges, 2,000-4,500 feet (MD80).
Xylorhiza tortifolia var. *tortifolia*	Mojave Desert Aster	Common and widespread in the Coso and Argus ranges, 2,000-5,650 feet (MD80).
Boraginaceae	**Borage Family**	
Amsinckia menzieii var. *intermedia*		Occasional in Coso and Argus ranges, 3,400-6,100 feet (MD80). Common in Birchum Springs and Birchum Mesa areas, uncommon at Seep Springs (DS96).
Amsinckia tessellata	Fiddleneck	Common and widespread, 2,350-5,100 feet (MD80). Dominant weed of Creosote Bush Scrub at NAWS.
Amsinckia vernicosa	Fiddleneck	Shephard Canyon, 4,600 feet (MD80).
Cryptantha barbigera	Forget-me-not	Common in rocky places, mostly below 5,000 feet (MD80).
Cryptantha circumscissa	Capped Forget-me-not	Extremely common and widespread, up to 6,100 feet (MD80).
Cryptantha confertiflora	Yellow Cryptantha	Common in limestone outcrops and washes of the western side of northeastern Argus Range, Louisiana Butte summit, Metamorphic granite, same substrate occurrence as in Owens Peak Wilderness (DS96).
Cryptantha decipiens	Gravel Forget-me-not	Red Hill and Little Lake, 3,400 feet (MD80). Bajada outwash of Black Canyon, Coso Range, and Stone Canyon, northeast Argus Range 4,500 feet (DS96).
Cryptantha dumetorum	Forget-me-not	Frequent in Coso Range, less so in the Argus Range, 2,250-4,500 feet (MD80). Granite Wells (DS96).
Cryptantha echinella	Forget-me-not	Bircum Mesa, rare in clay flats between basalt boulders, Coso Peak area , infrequent in mud flats on basalt mesas and benches (DS97).
Cryptantha gracilis	Slender Forget-me-not	Shephard Canyon, 6,250 feet (MD80).
Cryptantha intermedia	Common Forget-me-not	Little Lake to Argus Range, 3,300-5,500 feet (MD80). Mountain Springs Canyon (Mary Ann Henry, 1972-1978).
Cryptantha maritima	Guadalupe Forget-me-not	Desert borders southeast Argus Range up to 2,500 feet (MD80). K2 track area (Mary Ann Henry, March 1978).
Cryptantha micrantha	Purple-rooted Forget-me-not	Common in sandy places, Rose Valley to the Argus Range up to 2,400-5,000 feet (MD80).
Cryptantha nevadensis	Nevada Cryptantha	Occasional in Rose Valley and in the Coso and Argus ranges, 2,100-5,500 feet (MD80). Burro Canyon (DS96).
Cryptantha pterocarya var. *cycloptera*	Wing-nut Forget-me-not	A four-nutlet form, visually distinct, but otherwise the same (DS). Reported from Argus Range (MD80).
Cryptantha pterocarya var. *pterocarya*	Wing-nut Forget-me-not	Common throughout the region up to 5,000 feet (MD80). The more common three-nutlet form is widespread at NAWS (DS).
Cryptantha racemosa	Bushy Forget-me-not	East side of the Argus Range. Canyon and cliff areas throughout NAWS at middle elevations.
Cryptantha recurvata		Argus Range, 5,000 feet (MD80).
Cryptantha utahensis	Fragrant Forget-me-not	Occasional in the Coso Range to Paxton Ranch, 2,200-5,000

		feet (MD80).
Heliotropium curassavicum var. *oculatum*	Heliotrope	Low, moist places, Paxton Ranch and Little Lake, 2,200-3,200 feet (MD80). Frequent weed of seeps, moist, alkaline places, Lark Seep, golf course, roadsides (DS96).
Pectocarya penicillata	Comb-bur	Rose Valley, 3,350 feet (MD80).
Pectocarya platycarpa	Broad-toothed Comb-bur	Frequent in Coso and Argus ranges up to 4,000 feet (MD80).
Pectocarya recurvata	Curved Comb-bur	Frequent throughout the region, 2,250-3,600 feet (MD80). Mountain Springs Canyon (Mary Ann Henry, 1972-1978).
Pectocarya setosa	Round Comb-bur, Bristly Comb-bur	Coso and Argus ranges, 4,000-6,000 feet (MD80).
Plagiobothrys arizonicus	Arizona Popcorn-flower	Basins and lower mountain slopes, 3,000-4,500 feet (MD80). EPO trailer parking lot, southwestern Coso Mountains (DS97).
Plagiobothrys canescens	Valley Popcorn-flower	Frequent in Coso Hot Springs area (Zembal 79). Southeast of Barstow, West of Camp Rock Road, south of Red Rock Canyon, Chuckawalla Peak, Lone Tree Canyon DWP Road (DS95).
Plagiobothrys jonesii	Popcorn-flower	Uncommon in Coso and Argus ranges, 3,500-4,600 feet (MD80). Ord Mountains (DS).
Plagiobothrys leptocladus	Prostrate Popcorn-flower	Little Lake volcanic area, 3,300 feet (MD84).
Tiquilia nuttallii		K2 track area (Mary Ann Henry, March, 1978). Burro Canyon, with *Coldenia plicata* north of Hinkely (DS).
Tiquilia plicata	String Plant	Sandy places, 2,000-2,700 feet (MD80).
Brassicaceae	**Mustard Family**	
Arabis dispar	Pinyon Rock Cress	Silver Peak (MH79). Infrequent in Coso and Argus ranges, 5,000-7,600 feet (MD80). Scattered-rare at southwestern Birchum Mesa, southwestern Etcheron Valley, El Conejo gate, south and southwest of Coso Peak, and Guzzler #3 (DS 96). Coso Peak, China Gardens, Telescope Peak, and Ballarat 7.5 topos -(CNPS T&E).
Arabis glaucovalvula	Blue Pod Rock Cress	Infrequent in Coso and Argus ranges, 3,500-5,000 feet (MD80). Joshua Tree-Shadscale Region southwest of Coso Village down to Darwin Wash (DS96).
Arabis inyoensis	Inyo Rock Cress	Infrequent in Coso and Argus ranges, 4,600-7,000 feet (MD80).
Arabis perennens	Arched Rock Cress	Shepherd Canyon, Argus Range, 4,800 feet (MD80). Mostly on limestone, 2,400-8,500 feet (MD84). Lacey Canyon (DS96).
Arabis pulchra var. *gracilis*	Beautiful Rock Cress	Infrequent in Coso and Argus ranges, 4,500-6,000 feet (MD80).
Arabis pulchra var. *munciensis*	Darwin Rock Cress	
Arabis pulchra var. *pulchra*	Beautiful Rock Cress	Frequent in Coso and Argus ranges, 3,600-7,600 feet (MD80).
Arabis sparsiflora var. *sparsiflora*		Rare on the desert, Argus Range on granite 3,000 feet (MD84).
Brassica nigra	Black Mustard	A weed which is rare here, northern Coso Range, 4,500 feet (MD80).
Brassica tournefortii	Mustard	Abundant weed of Etcheron Valley (DS96).
Caulanthus cooperi		Frequent in the Coso and Argus ranges, 3,000-5,800 feet (MD80). K2 track area (Mary Ann Henry, March 1978).
Caulanthus coulteri		Coso Range, north of Little Petroglyph Canyon may be northerly limit, 5,000 feet (MD80).
Caulanthus crassicaulis var. *crassicaulis*	Thick-stemmed Wild Cabbage	Northern Argus Range, rare, on dolomite/limestone outcrops above Argus Sterling Mine (DS96). Nelson, Cottonwood, Inyo-White Moutains (MD84).
Caulanthus inflatus var.	Desert Candle	Nato Site (DS97).

inflatus		
Caulanthus pilosus	Chocolate Drops	Northern portion of Coso Range, 3,800-5,100 feet (MD80). Darwin Road along northern boundary of NAWS.
Descurainia pinnata	Tansy Mustard	A common weed throughout the region, 2,400-5,800 feet (MD80). Abundant annual especially under shrubs in Creosote Bush Scrub (DS).
Descurainia sophia	Flixweed	Frequent but less common than *D. pinnata*, up to 4,000 feet (MD80). Upper south fork of Margaret Ann Spring (DS).
Dithyrea californica	Spectacle-pod	Low, sandy places, 2,100-3,750 feet (MD80). Sandy areas of K2 track valley, in Creosote Bush Scrub.
Draba cuneifolia	Desert Draba	Var. *integrifolia* - Argus Range, mostly on the east side, 1,850-4,000 feet (MD80). K2 track area (Mary Ann Henry, March 1978).
Erysimum capitatum ssp. *capitatum*	Wallflower	Locally frequent in the northern Coso and Argus ranges, 3,700-6,100 feet (MD80).
Guillenia lasiophylla	California Mustard	*Thelypodium lasiophyllum* var. *utahense* - Frequent in Coso and Argus ranges up to 2,250-5,000 feet (MD80).
Halimolobus jaegeri	Rock Mustard	*H. diffusa* var. *jaegeri* - Centennial Canyon, Coso Range, 5,550 feet (MD80).
Hutchinsia procumbens		Upper Moscow Spring (DS97). Short Canyon list (MH95). Little Lake and Rose Valley 3,200 feet (MD80).
Lepidium flavum var. *flavum*	Yellow Pepper-grass	Common, often abundant on lower slopes and basin floors up to 5,300 feet (MD80).
Lepidium fremontii var. *fremontii*	Desert Alyssum	Frequent throughout the region, 1,900-5,400 feet (MD80). Common to abundant in Alkaline Sink, Shadscale, and Mixed Mojave Scrubs throughout NAWS (DS96).
Lepidium lasiocarpum var. *lasiocarpum*	Modest Pepper Grass	Common in Coso and Argus ranges, 2,250-5,600 feet (MD80). Abundant in Creosote Bush and Mixed Mojave Scrub types (DS96).
Rorippa nasturtium-aquatica	Water Cress	Coso Village, Coso Range, 5,700 (MD80). Aquatic, common at springs (DS).
Sisymbrium altissimum	Tumble Mustard	Occasional weed in sandy places.
Sisymbrium irio	London Rocket	Common weed of disturbed areas and roadsides in Creosote Bush Scrub (DS).
Stanleya elata	Prince's Plume	Infrequent, northern Coso and Argus ranges, 4,450-6,000 feet (MD80). Lower Centennial Flat, abundant and widespread to the north of NAWS.
Stanleya pinnata var. *pinnata*	Prince's Plume	Occasional in the northern Coso and Argus ranges up to 3,000-6,000 feet (MD80).
Streptanthella longirostris		Frequent and widespread in sandy places, 2,100-5,600 feet (MD80).
Thysanocarpus curvipes	Fringe-pod	Occasional at low elevations in the Coso and Argus ranges, 3,000-5,000 feet (MD80).
Thysanocarpus laciniatus	Fringe-pod	Infrequent in Coso and Argus ranges, up to 5,600 feet (MD80).
Tropidocarpum gracile	Keel Fruit	Frequent in Indian Wells Valley, occasional in the Coso and Argus ranges up to 4,100 feet (MD80). Sandy soils in Creosote Bush Scrub, Inyokern area, common annual of western-most Mojave Desert.
Cactaceae	**Cactus Family**	
Echinocactus polycephalus var. *polycephalus*	Cottontop Cactus	Coso and Argus ranges, 1,850-4,350 feet (MD80). Steep rocky slopes and cliffs usually with south aspects. Common throughout NAWS; Coso, Argus, Slate, Quail, Eagle Crags mountains; in rocky areas of low to middle elevations (DS96).
Echinocereus englemanii var. *chrysocentrus*	Hedgehog Cactus	Rare in northern Coso and Argus ranges, 3,800-5,850 feet (MD80).
Mammillaria tetrancistra	Fish Hook Cactus	Rare east side of Argus range, 1,800-2,850 feet (MD80).

		Eastern Slate Range (RM82). Widely distributed throughout the Mojave and western Sonoran Desert, lower foothills of Eagle Crags (DS96).
Opuntia basilaris var. *basilaris*	Beavertail Cactus	Frequent and widespread in Coso and Argus ranges, 1,900-6,250 feet (MD80).
Opuntia echinocarpa	Golden Cholla	Common on sandy or gravelly soils throughout the region, 1,900-5,700 feet (MD80). Frequent in Joshua Tree Woodland, Desert Transition Scrub, Mojave Mixed Scrub, and Creosote Bush Scrub, throughout NAWS to 6,500 feet (DS96).
Opuntia erinacea var. *erinacea*	Mojave Prickly Pear	Common at higher elevations in Coso and Argus moutains usually in Pinyon Woodland or Great Basin Mixed Scrub.
Opuntia erinacea var. *ursina*	Grizzly Bear Cactus	Argus Range southeast of Carricut Lake, 5,700 feet (MD80); merely an ecotype (DS).
Opuntia ramosissima	Diamond Cholla	Southeast Slate Range bajada around East Howitzer inter line. Another disjunct locale in hills west of Slocum Mountain.
Sclerocactus polyancistrus	Mojave Fish-hook Cactus	Rare in both the Coso and Argus ranges, 5,350-5,600 (MD80). Eagle Crags-Pilot Knob-Granite Mountain Area, Louisiana Butte-Big petroglyph Canyon-El Conejo mine area, Coso Village-Darwin Wash (DS).
Campanulaceae	**Bellflower Family**	
Nemacladus glanduliferus var. *orientalis*	Threadplant, Lake Mead Nemacladus	Frequent in sandy places, 2,900-5,650 feet (MD80).
Nemacladus rubescens	Threadplant, Desert Nemacladus	Frequent in sandy places at low elevations up to 4,000 feet (MD80).
Nemacladus sigmoideus	Threadplant, Inyo Nemacladus	Occasional in sandy or gravelly places, 3,500-5,000 feet (MD80).
Capparaceae	**Caper Family**	
Cleomella obtusifolia	Common Stinkweed	Alkaline places, mostly low elevations (MD80). Common in China Lake Basin (DS).
Oxystylis lutea		Christmas Canyon, Garlock fault, south Searles Lake (DS96).
Caprifoliaceae	**Honeysuckle Family**	
Sambucus mexicana	Elderberry	Coso Bridge (GP).
Symphoricarpos longiflorus	Desert Snowberry	Limestone in northern Coso and Argus ranges, 5,600 to 5,800 feet (MD80). Limestone canyon bottoms in the northeastern Argus Moutains and felsic-metamorphic granites in Lacey Canyon, northwestern Coso Mountains, Mill Spring, Coso Bridge (DS96).
Caryophyllaceae	**Pink Family**	
Achyronychia cooperi	Frost-mat	Occasional in sandy areas up to 3,200 feet (MD80).
Arenaria kingii var. *glabrescens*	Dolomite Sandwort	Reported from northern Coso Range (MD80). On exposed felsic dike ridges north of Silver Peak area (DS96).
Arenaria macradenia ssp. *ferrisiae*	Baby's Breath	Infrequent, northern Coso Range, 4,000-5,000 feet (MD80).
Arenaria macradenia var. *macradenia*	Mojave Sandwort	Infrequent, northern Coso and Argus ranges, 4,200-6,500 feet (MD80). Throughout high elevation rocky areas of NAWS North Ranges (DS96).
Arenaria macradenia var.	Green Baby's Breath	Rare in Argus Range, apparently limited to limestone 6,000-6,500 feet (MD80).

parishiorum		
Silene verecunda ssp. *andersonii*	Mountain Campion	Argus and Coso ranges in Pinyon Woodland (DS96).
Spergularia bocconii	Boccone Sand Spur	Reported from Coso Hot Springs area (MD80).
Spergularia marina		Slate Range, Amity Spring (DS96).
Ceratophyllaceae	**Hornwort Family**	
Ceratophyllum demersum	Hornwort	China Garden cattle tank (DS96).
Chenopodiaceae	**Goosefoot Family**	
Allenrolfea occidentalis	Pickleweed	Paxton Ranch, Indian Wells Valley, 2,150 feet (MD80).
Atriplex canescens	Four-wing Saltbush	Common throughout the region, 2,200-6,200 feet (MD80).
Atriplex confertifolia	Shadscale	Common to dominant on flats and basins, 2,150-4,400 feet (MD80).
Atriplex hymenelytra	Desert Holly	Locally common, Owens Lake, northern Coso Range, China Lake, and southern Argus Range, 2,200-4,350 feet (MD80). Forming monocultures or co-dominant with other *Atriplex* or Creosote Bush Scrub.
Atriplex lentiformis var. *torreyi*	Torrey Saltbush, Nevada Saltbush	Places with high groundwater, Paxton Ranch, Little Lake, 2,150-3,300 feet (MD80). Flats near semi-dunes on Baker Range Road (DS).
Atriplex parryi	Parry Saltbush	Alkali flats in Kern County and Owens Lake 2,200-3,630 feet (MD80). Widespread, sometimes dominant on alkline basin and playa edges - China Lake, Salt Wells valley, Searles playa, Owens Lake (DS).
Atriplex phyllostegia	Arrowscale	Moist, alkaline places, Little Lake and Owens Lake, up to 3,650 feet (MD80). Alkaline playas, often near saltgrass, China Lake Basin (DS96).
Atriplex polycarpa	Allscale, Cattle Spinach	Common to dominant on flats and basins up to 4,000 feet (MD80). Dominant shrub of China Lake Basin. Also at other basins, springs, washes, canyons, and playas throughout NAWS (DS).
Atriplex rosea	Tumbling Oracle	China Garden Spring - locally common weed (DS97).
Atriplex spinifera	Spinescale	Widespread, sometimes dominant on flats and sinks in Superior Valley, North Towers playa, and Cactus Flats (DS).
Chenopodium californicum	Soap Plant	Frequent in volcanic areas of Coso and Argus ranges, 3,600-5,700 feet (MD80). Frequent at North ranges springs -DS96.
Chenopodium desiccatum var. *leptophylloides*	Narrow-leaf Goosefoot	Disturbed places in the Coso Range (MD80).
Chenopodium fremontii	Fremont Goosefoot	Occasional in northern Coso and Argus ranges, 5,000-7,600 feet (MD80).
Chenopodium incanum var. *occidentale*	Granite Goosefoot	Infrequent in disturbed places up to 5,000 feet (MD80). Weed along Etcheron Valley Road (DS96).
Grayia spinosa	Spiny Hopsage	Common to dominant at middle elevations, Coso and Argus ranges, 2,200-7,600 feet (MD80). Widely distributed at NAWS, many plant communities, sometimes dominant, occasionally forming near-monocultures (DS96).
Kochia americana	Gray Molly	Infrequent in Coso Range, 4,300-5,000 feet (MD80). Limestone and altered granite hilltops of the Darwin Hills (DS).
Kochia californica	Mojave Red Sage	Alkali flats, Kern County and Paxton Ranch, about 2,200 feet (MD80). Common and characteristic shrub of the China Lake Basin in Alkali Sink Scrub (DS96).
Kochia scoparia	Summer Cypress	Common weed of alkaline seeps and roadsides of south China Lake.

Krascheninnikovia lanata	Winterfat	Common and widespread, pure stands in some places, 2,250-5,650 feet (MD80). Common throughout NAWS in Mixed Mojave Scrub, Shadscale, Joshua Tree, and Hop-sage Scrub; appears to favor calcareous soils (DS96).
Monolepis nuttalliana		Infrequent on playas (MD80). (at NAWS? DS).
Nitrophila occidentalis	Alkali Pink	Little Lake, Owens Lake, 3,200-3,650 feet (MD80). Common at Lark Seep, G1 Seep, channels, ponds, etc. (DS).
Salsola paulsenii	Barbwire Russian Thistle	An agressive weed, common on limestone or somewhat alkaline soils.
Salsola tragus	Tumbleweed, Russian Thistle	*S. iberica* - Common weed, agressive in disturbed somewhat moist places (MD80).
Suaeda moquinii	Bush Seepweed, Inkweed	*S. Torreyana* var. *ramosissima* - Common around Owens Lake, 3,650 feet (MD80). Common in alkaline basins at NAWS, unique upland population with *A. polycarpa* and Red Willow at Moonshine Spring.
Crassulaceae	**Stonecrop Family**	
Dudleya saxosa ssp. *saxosa*	Panamint Dudleya	Pilot Knob-BLM 1980 report.
Crossosomataceae	**Crossosoma Family**	
Forsellesia nevadensis	Nevada Forsellesia	Calcareous formations of northwestern Coso Range and Bendire Canyon in the Argus Range, 4,000-4,350 feet (MD80). Stone Canyon and canyon south of Zinc Hill, Argus Range, dolomite - marble formations (DS).
Cucurbitaceae	**Melon Family**	
Cucurbita palmata	Coyote Melon	Coso Hot Springs, Coso Range, 3,600 feet (MD80). Disclimax populations at CLIP area (DS96).
Cupressaceae	**Cypress Family**	
Juniperus osteosperma	Utah Juniper, One-seeded Juniper	Northern Coso Mountains, northeast of Cole Spring, and as extensive mix with pinyon southwest of Coso Peak (DS96).
Cuscutaceae	**Dodder Family**	
Cuscuta denticulata	Toothed Dodder	Frequent in Coso and Argus ranges up to 5,000 feet (MD80). Expected throughout NAWS in Creosote Bush Scrub and Mojave Mixed Scrub (DS).
Cuscuta nevadensis	Nevada Dodder	Occasional up to 4,500 feet (MD80). (At NAWS ? - DS).
Cyperaceae	**Sedge Family**	
Carex alma	Sedge	Wilson Canyon and Moscow Springs (DS).
Carex praegracilis	Sedge	Sheperd Canyon (DS).
Eleocharis parishii	Parish Spikerush	Owens Lake (Ash Spring), Mill Spring, Junction Ranch upper pond, Pink Hill Spring, and Haiwee Spring (DS96). Little Lake and Haiwee Spring (MD80).
Scirpus acutus	Common Tule	Lark Seep (DS96).
Scirpus maritimus	Alkali Bulrush	Channel with Distichlis on west side of north Poleline Road, tamarisk, Typha also in channel nearby (DS97).
Scirpus robustus	Bulrush	Haiwee Spring (Reddick 83, DS96), Little Lake, and Owens Lake, 3,200-3,600 feet (MD80).

Ephedraceae	**Ephedra Family**	
Ephedra aspera	Ephedra, Joint-fir	This one-seeded *Ephedra* has been reported from sites in Rose Valley and Coso and Argus ranges, 3,400-4,100 feet. It should be confirmed by more study (MD80). Unlikely at NAWS. A common shrub in the Arizona deserts (DS).
Ephedra funerea	Death Valley Ephedra	A common ephedra in upper rocky areas of Slate, North Argus, Brown, and Quail mountains, on all soils but most closely associated with limestone and metamorphic rocks (DS).
Ephedra nevadensis	Nevada Ephedra	Frequent throughout the region, mostly 3,000-5,000 feet (MD80). Widespread throughout NAWS, usually on rocky slopes, upper bajada, or washes, 2,200-6,500 feet (DS96).
Ephedra viridis	Mormon Tea	Northern Coso Range and throughout the Argus Range, mostly from 4,000 feet to mountain summits (MD80). Throughout NAWS, above 4,500 feet, common, sometimes dominant in the Coso and Argus ranges, uncommon elsewhere (DS96).
Euphorbiaceae	**Spurge Family**	
Chamaesyce albomarginata	Rattlesnake Weed, Spurge, Sand Mat	Coso and Argus ranges, 3,750-6,250 (MD80). Throughout NAWS at many elevations (DS96).
Chamaesyce micromera	Spurge, Sand Mat	Infrequent, sandy places below 3,000 feet (MD80). Common weed in Ridgecrest area (DS).
Chamaesyce ocellata var. *arenicola*	Spurge, Sand Mat	Burro Canyon (DS96).
Chamaesyce ocellata var. *kirbyi*	Spurge, Sand Mat	Rare, near Vocano Peak, 4,400 feet (MD80). (Mary Ann Henry feets record?)
Chamaesyce polycarpa var. *polycarpa*	Spurge, Sand Mat	Occasional up to 3,600 feet (MD80). (At NAWS or var. *hirtella*) Var. *polycarpa* is a distinct form - southeastern Arizona and southwestern California - a southern California Chaparral - Sonoran/Madrean plant (DS).
Chamaesyce setiloba	Spurge, Sand Mat	Infrequent, Coso Hot Springs area, Coso Range and Shepherd Canyon, Argus Range up to 3,600 feet (MD80). Darwin Wash (DS96).
Eremocarpus setigerus	Dove Weed	Little Lake area, Rose Valley, 3,300 feet (MD80). Weed of disturbed areas, roadsides, and low elevations (DS96).
Stillingia paucidentata	Stillingia	Low elevations as far north as Rose Valley up to 3,400 feet (MD80). Sandy areas and roadsides (DS).
Stillingia spinulosa	Stillingia	Southern Argus Range, 2,250-2,350 (MD80). Sandy, semi-dune areas, generally sandier habitats than *S. paucidentata* , Burro Canyon CLIP area roadsides (DS).
Fabaceae	**Pea Family**	
Astragalus acutirostris	Milk-vetch	Fairly widespread, Coso and Argus ranges, 3,400-5,600 feet (MD80).
Astragalus atratus var. *mensanus*	Darwin Mesa Milk-Vetch	Apparently rare in the northern Coso and Argus ranges, about 5,600 feet (MD80). Common in Coso Bridge area, northeast of Silver Peak, low sagebrush scrub in pinyon openings. Also in El Conejo Mine/south Coles Flat area - low scrub with Blackbrush, Joshua Tree, and Great Basin Mixed (DS).
Astragalus casei	Case Locoweed	Northern portion of Coso Range, 4,100-6,750 feet (MD80). Common around El Conejo Mine area, Coles Spring, and

		Coso Peak (DS96).
Astragalus coccineus	Scarlet Loco	Eastern Argus Range, 3,900-5,650 feet (MD80). Western canyons of northern Argus Range, uncommon on ridges, lower slopes, and canyon bottoms particularly dolomites washes (DS96).
Astragalus didymocarpus var. *didymocarpus*	Two-Seeded Milk-Vetch	Occasional, Coso and Argus ranges, 3,400-5,500 feet (MD80). Nato site, probably abundant in many areas of the South Range (DS).
Astragalus didymocarpus var. *dispermus*	Two-Seeded Milk-Vetch	Occasional at lower elevations, 2,200-3,500 feet (MD80). Characteristic of Mojave Sand Field (DS).
Astragalus layneae	Layne Locoweed	Middle elevations of Coso and Argus ranges, 3,500-5,100 feet (MD80). Widespread in Mixed Mojave Scrub and upper Creosote Bush Scrub (DS).
Astragalus lentiginosus var. *fremontii*	Freckeled Milk-vetch	Abundant in high areas of Argus and Coso ranges.
Astragalus lentiginosus var. *variabilis*	Freckeled Milk-Vetch	Infrequent, southern Argus Range and Rose Valley, 2,400-3,400 feet (MD80). Locally abundant on sandy areas of the China Lake Basin, Salt Wells Valley, and South ranges (where uncommon). Plants in China Lake Basin sand fields approach (or are) var. *micans* (DS96).
Astragalus newberryi var. *newberryi*	Newberry Locoweed	On calcareous sites, northwestern Coso Range and at southern Etcheron Valley, 4,350-7,100 feet (MD80). Some, or all collections at NAWS may be confused with *A. purshii* var. *tinctus*. Expected at higher elevations on limestone in the Argus Range (DS).
Astragalus purshii var. *tinctus*	Pursh Locoweed	On granite and basalt, Coso and Argus ranges, 4,300-7,100 feet (MD80). Widespread on North ranges at higher elevations, locally common on Straw Peak (and further north on the Slate Range?) on South ranges (DS96).
Lotus humistratus	Short-podded Lotus	Occasional in the Coso and Argus ranges, 5,000-6,100 feet (MD80). Locally abundant in the west Mojave from 2,500-4,000 feet (DS).
Lotus nevadensis var. nevadensis	Sierra Lotus	Occasional in Coso and Argus ranges, 3,450-6,000 feet (MD80).
Lotus procumbens var. *procumbens*	Prostrate Lotus	Millspaugh area, Argus Range, 6,200 feet (MD80). Apparently widespread, especially along roadsides of the upper (above 4,500 feet) North ranges (DS).
Lotus purshianus var. *purshianus*		Mill Spring.
Lotus rigidus	Rock Pea	Rare in the Coso Range, occasional in the Argus Range, 3,200-5,400 feet (MD80). Locally common in Mountain Springs Canyon (DS96).
Lotus strigosus	Sand Lotus, Stiff-haired Lotus	*L tomentellus* - Occasional in Coso Range and southern Argus Range, 2,250-5,500 feet (MD80). *L. strigosus* - Infrequent, Coso Range, 5,000-5,700 feet.
Lotus wrangelianus	Short-winged Lotus	Reported from Mountain Springs Canyon, 3,600 feet (MD80).
Lupinus argenteus	Silver Lupine	Slopes, washes, and roadsides at high elevations of North ranges, Coso and Argus ranges (DS96).
Lupinus bicolor	Miniature Lupine	*L. polycarpus* Greene-Clay Lupine-Coso Hot Springs area, 3,600 feet (MD80). This may have been previously reported as *L. nanus*.
Lupinus brevicaulis	Short-stemmed Blue Lupine	Infrequent, Coso and Argus ranges, 4,500-6,000 feet (MD80).
Lupinus concinnus	Bajada Lupine	Frequent at low elevations, 3,000-5,700 feet (MD80). Most common lupine at NAWS, especially South ranges, most of NAWS *L. cocinnis* were previously called var. *orcuttii* (DS).
Lupinus excubitus var.	Inyo Bush Lupine, Grape	Infrequent populations, Coso and Argus ranges, 3,600-6,100 feet (MD80).

excubitus	Soda Lupine, Adonis Lupine	
Lupinus flavoculatus	Yellow-eyes	Infrequent, northern Coso and Argus ranges, 5,000-6,000 feet (MD80). Locally abundant in Coso Range near Louisiana Butte (DS).
Lupinus magnificus var. *glarecola*	Coso Mountains Lupine, Kerr Lupine	Infrequent in Coso and Argus ranges, 5,000-6,850 feet (MD80). Coso Moutains to Louisiana Butte and East Sierra slope to north (DS).
Lupinus microcarpus var. *microcarpus*	Chick Lupine	
Lupinus nanus	Grass Lupine	Reported from the Silver Peak area of the Coso Range and the Maturango Peak area of the Argus Range, 6,750-7,900 feet. That is so far out of its range that the determination has to be questioned (MD80). Probably *L. bicolor* (DS).
Lupinus odoratus	Royal Desert Lupine, Mojave Lupine	Infrequent, Coso Hot Springs and borders of the range, Rose Valley, 3,300-3,600 feet (MD80). Locally abundant in sandy areas of Cactus Flats-Coso Geothermal Area and Superior Valley (DS).
Lupinus ruber	Red Lupine	Infrequent, Coso and Argus ranges, 5,400-5,800 feet (MD80). northern Coso Mountains at 6,900 feet in Pinyon Woodland with *A. atratus* var. *mensanus* (DS).
Lupinus shockleyi	Shockley Lupine	Infrequent on sandy places up to 4,500 feet (MD80). Burro Canyon and other sand fields of the southwestern Argus Range (DS).
Lupinus subvexus	Hairy Lupine	Reported from Mountain Springs Canyon and Coso Hot Springs area, 3,600 feet (MD80). Locally abundant around Black Hills and adjacent areas of South ranges, Ridgecrest (where native), IWV, Rand Mountains east to Black Mountain, and Hinkley area (DS).
Melilotus alba	White Sweetclover	Haiwee Spring (DS).
Prosopis glandulosa var. *torreyana*	Honey Mesquite	Mesquite Spring, Eagle Crags, Shepherd Canyon, and China Garden Spring (DS97). Argus Range, 3,400 feet (MD80).
Psorothamnus arborescens var. *arborescens*	Indigo Bush	Upper well-drained wash zones only, sometimes on adjacent bajada terraces or disturbances, usually with Mixed Mojave Scrub and Desert Wash Scrub including *Salazaria, Hymenoclea, Lycium* and *Grayia*. From Black Hills and Randsburg Wash southeast towards Barstow and Fort Irwin (DS96).
Psorothamnus arborescens var. *minutifolius*	Indigo Bush	Common and widespread throughout the region, 2,200-5,400 feet (MD80). On rocky bajada, subalkaline basins, stabilized sand and occasionally washes, sympatric with *P. arborescens* var. *arborescens* at east Randsburg Wash near Fort Irwin boundary (DS96).
Psorothamnus polydenius	Indigo Bush	Sea Site 1 - on disturbances and adjacent washes. Barstow area, Alvord Well, and locally abundant in sand fields of the southern Great Basin Desert (DS).
Robinia pseudoacacia	Black Locust	Ridgecrest, Coso Village, and China Lake.
Senna armata	Desert Senna	Widespread on South ranges in washes and well-drained bajada, usually in Creosote Bush Scrub, less common on North ranges, being mostly restricted to the IWV-Salt Wells Valley areas (DS).
Trifolium gracilentum		
Trifolium macilentum var. *dedeckerae*	DeDecker's Clover	
Geraniaceae	**Geranium Family**	
Erodium cicutarium	Filaree, Storks Bill	A common weed throughout the region up to 3,600 feet

		(MD80).
Erodium texanum	Texas Filaree	Rare at low elevations, Little Lake to Argus Range, 3,300 feet (MD80).
Grossulariaceae	**Gooseberry Family**	
Ribes cereum	wax current	
Ribes velutinum		Common in Pinyon Woodland canyons of the Coso and Argus ranges (DS96).
Hydrophyllaceae	**Waterleaf Family**	
Emmenanthe penduliflora var. *penduliflora*	Whispering Bells	Infrequent in Coso and Argus ranges, 3,000-5,750 feet (MD80).
Eucrypta chrysanthemifolia var. *bipinnatifida*		Frequent in sheltered places throughout the region, 2,000-5,500 feet (MD80).
Eucrypta micrantha	Small-flowered Eucrypta	Well distributed at low elevations, 2,100-4,000 feet (MD80).
Nama aretioides var. *multiflorum*	Sagebrush Nama	Fairly frequent, 3,300-6,800 feet (MD80).
Nama demissum var. *demissum*	Purple Mat	Occasional populations, Coso and Argus ranges and their borders, 2,200-6,000 feet (MD80).
Nama hispidum var. *spathulatum*	Hispid Nama	Volcanic area in northwestern Coso Range, 4,300-4,600 feet. Should occur elsewhere (MD80).
Nemophila menziesii ssp. *integrifolia*	Baby Blue Eyes	Rare in Coso and Argus ranges, 3,500-5,100 feet (MD80).
Phacelia bicolor var. *bicolor*	Sticky Yellow Throats	Sandy places, 2,200-3,600 feet (MD80).
Phacelia cicutaria var. *cicutaria*	Caterpillar Phacelia	Infrequent in Coso and Argus ranges, 3,700-4,500 feet (MD80).
Phacelia crenulata	Purple Phacelia	*P. crenulata* var. *funerea* - Calcareous places, northern Coso Range and eastern Argus Range, 3,000-5,800 feet (MD80). var. *crenulata* - Infrequent in Coso and Argus ranges, 2,250-5,800 feet (MD80).
Phacelia cryptantha	Limestone Phacelia	Rare, calcareous places in the Coso and Argus ranges, 3,100-4,600 feet (MD80).
Phacelia curvipes	Dwarf Phacelia	Occasional in the Coso and Argus ranges, 5,000-6,850 feet (MD80).
Phacelia distans	Blue Phacelia	Common to widespread except on calcareous places, 3,400-6,000 feet (MD80).
Phacelia fremontii	Yellow Throats	Common to abundant throughout the region, 2,300-7,600 feet (MD80).
Phacelia humilis	Low Phacelia	High portions of the Coso Range, 6,500-7,000 feet (MD80).
Phacelia ivesiana	Ive's Phacelia, Sand Phacelia	Plants at NAWS with deltate leaf lobes, seeds with 5-7 cross-furrows and n=23; have been called *P. pediculoides* J.T Howell Construction and *P. ivesiana* var. *pediculoides* J.T Howell (JM93). Sandy places at low elevations, infrequent, 2,100-3,600 feet (MD80). Sandy areas of Argus Range, 2,600-5,000 feet (DS).
Phacelia mustelina	Death Valley Round-leaved Phacelia	Growing in cracks of boulders and outcrops, Granite Wells and Seep Springs (DS).
Phacelia nashiana	Charlotte's Phacelia	Cinder hills of southwestern Cosos Mountains.
Phacelia pedicellata	Specter Phacelia	Rare, Shepherd Canyon, Argus Range, 4,600 feet (MD80).
Phacelia perityoides var. *perityloides*	Panamint Phacelia	Calcareous cliffs, Argus Range, mostly above 4,000 feet (MD80). Darwin, northeast Argus Range (DS).
Phacelia ramosissima var.		Infrequent, Coso Range, middle elevations.

latifolia		
Phacelia rotundifolia	Round-leaved Phacelia	Infrequent but fairly widespread in range, 2,900-3,500 feet (MD80).
Phacelia tanacetifolia		Common among shrubs of upper bajada, especially South ranges. Observed at Margaret Ann Spring area of North ranges (DS).
Phacelia vallis-mortae	Death Valley Phacelia	Infrequent, calcareous places, 3,000-5,000 feet (MD80).
Pholistoma membranaceum	White Fiesta Flower	Protected places in the southern part of the Coso and Argus ranges, as far north as Little Lake, 2,500-4,500 feet (MD80).
Tricardia watsonii	Three Hearts	Infrequent but with a wide range, 2,000-6,000 feet (MD80).
Juncaceae	**Rush Family**	
Juncus balticus	Wire Grass	Most common rush at NAWS, at most springs, large patches at Lark Seep, G1 (DS96). Common in moist places, Little Lake, 3,200 feet (MD80).
Juncus bufonius var. *bufonius*	Toad Rush	Upper Wilson Spring (DS96).
Juncus mexicanus	Mexican Rush	Little Lake and Haiwee Spring, 3,200-4,800 feet (MD80).
Juncus rugulosus	Rush	Haiwee Spring and Mill Spring (DS96).
Juncus xiphioides	Iris-leaved Rush	Tennessee, New House Springs, Haiwee Spring, and Margaret Ann Spring (DS96). Haiwee Spring, 4,800 feet (MD80).
Krameriaceae	**Kraemeria Family**	
Krameria erecta	Range Rhatany, Pima Rhatany, Purple Heather	Rocky to gravelly bajada slopes. Southeastern portions of Randsburg Wash Range, particularly Eagle Crags foothills, frequent in this area with Mixed Mojave Scrub and diverse Creosote Bush Scrub(DS96).
Lamiaceae	**Mint Family**	
Marrubium vulgare	Horehound	A weed in some spring areas, up to 5,500 feet (MD80). Roadsides, disturbances, and riparian zones. Etcheron Valley (DS96).
Monardella exilis	Annual Monardella	Coso Geothermal Area (Zembel 79).
Monardella linoides ssp. *linoides*	Flax-leaved Monardella, Pennyroyal	Northern Coso and Argus ranges, only occasional, 4,500-6,500 feet (MD80).
Monardella odoratissima ssp. *odoratissima*		At NAWS? Argus Sterling Mine (DS96).
Salazaria mexicana	Bladder Sage	Common in Coso and Argus ranges (MD80). Washes, lower slopes at lower elevations, becoming less restricted at higher elevations. Sometimes forming monotypic stands on steep slopes at upper elevational range in Desert Transition Scrub (DS96).
Salvia carduacea	Thistle Sage	Occasional in the southern part of the Coso Range, Wilson Canyon in the Argus Range, 3,150-3,700 feet (MD80).
Salvia columbariae	Chia	Frequent in the Coso and Argus ranges, 2,250-6,700 feet (MD80).
Salvia dorrii var. *dorrii*	Purple Sage	Coso and Argus ranges, 3,800-7,100 feet (MD80).
Salvia pachyphylla	Thick Leaf Sage	Lacey Canyon, northwestern Coso Moutains, northern and northwestern lower rocky slopes (DS).
Stachys albens		Haiwee, Mill, and Newhouse Springs (DS).
Lennoaceae		
Pholisma arenarium	Sand Plant	Rare, southern portions of the Coso and Argus ranges, sandy

		places, 2,250-3,600 feet (MD80).
Liliaceae	**Lily Family**	
Allium atrorubens var. *atrorubens*	Great Basin Onion	Coso Mountains var. and var. *inyonis* from Coso and Argus (MD80).
Allium lacunosum ssp. *davisiae*		Birchum Mesa (DS97).
Calochortus kennedyi var. *Kennedyi*	Mariposa Lily	Widely distributed at NAWS in shallow-sloped rocky areas, upper Creosote Bush Scrub to Pinyon Woodland (DS96). Occasional populations, Coso and Argus ranges and their borders, 3,600-7,100 feet (MD80).
Calochortus panamintensis	Panamint Mariposa Lily	Basalt benches southwest of Coso Peak area, north of Coso bridge, uncommon (DS-UCR 97).
Dichelostemma capitatum	Blue Dicks	Widespread, especially on boulder basalt soils (DS96). 2,250-6,850 feet (MD80).
Muilla coronata	Crowned Muilla	Devil's Kitchen area (Zembal 79). Occasional populations on heavy soil, Coso and Argus ranges 3,000-5,700 feet (MD80).
Smilacina stellata	Panicled False Solomon's-seal	Mill Spring.
Yucca brevifolia	Joshua Tree	
Loasaceae	**Stick-Leaf Family**	
Eucnide urens	Rock Nettle	Infrequent, mostly calcareous cliffs, Coso Range east of Little Lake and eastern Argus Range, 1,800-3,500 feet (MD80). Washes and rocky areas in southern Panamint Valley (DS).
Mentzelia affinis	Yellow Comet	Southern portions of the Coso and Argus ranges, 2,300-5,600 feet (MD80). Locally abundant south of Slocum Mountain (DS).
Mentzelia albicaulis	Blazing Star	Northern and western borders of the Coso Range up to 4,400 feet (MD80). Plants with n=27 have been called *M. mojavensis* H.J. Thompson & Joyce Roberts - B. Prigge (JM93).
Mentzelia congesta	Flower Baskets, Blazing Star	Infrequent, Coso and Argus ranges, 5,100-7,600 feet (MD80).
Mentzelia inyoensis	Inyo Blazing Star	Northern Coso Range and eastern Argus Range, rare, calcareous formations, 4,000-5,250 feet (MD80).
Mentzelia nitens	Venus Blazing Star	K2 track area (Mary Ann Henry, March 1978).
Mentzelia obscura	Blazing Star	Sandy areas in the southern Argus Range (DS).
Mentzelia veatchiana	Copper Blazing Star	
Petalonyx nitidus	Shining Sand Paper Plant	Occasional populations, Coso Hot Springs area and eastern Argus Range, 3,400-4,000 feet (MD80).
Petalonyx thurberi ssp. *thurberi*	Sand Paper Plant	Sandy places at low elevations, Coso and Argus ranges, up to 3,000 feet (MD80).
Malvaceae	**Mallow Family**	
Eremalche exilis	White Mallow	Low elevations throughout the region, 2,350-5,000 feet (MD80). Mountain Springs Canyon (Mary Ann Henry, 1972-1978).
Eremalche rotundifolia	Desert Five Spot, Globe Mallow	Infrequent at low elevations in the Coso and Argus ranges, up to 4,300 feet (MD80).
Malacothamnus fremontii	Bush Mallow	Coso Mountains (?) (Kiva 93 and Pratt 96).

Sphaeralcea ambigua ssp. *ambigua*	Apricot Mallow	Common and widespread in the Coso and Argus ranges, 2,650-6,050 feet (MD80).
Nyctaginaceae	**Four-O'Clock Family**	
Abronia pogonantha	Mojave Sand Verbena	Sandy places, Rose Valley to Argus Range, 2,450-6,250 feet (MD80). Sandy areas at low to middle elevations as at Burro Canyon in the Argus Range and Cactus Flats in Coso Range (DS).
Abronia villosa var. *villosa*	Desert Sand Verbena	Sandy places, low elevations, Indian Wells Valley up to 2,450 feet (MD80). Sandy areas of the south Argus Range (DS96).
Mirabilis bigelovii var. *retrorsa*	Wishbone Bush	Frequent throughout region, 2,200-6,000 feet (MD80).
Mirabilis bigelovii x *M. californica intergrade*	Wishbone Bush	Intergrades with var. *retorsa* (or separate taxa?). Willow patch Canyon below mine above upper Wilson Spring-north tributary, Rand Mountains (DS97), intergrades between var. *bigelovii* and *M. californica* occur along the western border of the Colorado Desert (DS).
Mirabilis multiflora var. *glandulosa*	Giant Four O'Clock	Infrequent, Coso and Argus ranges, 5,000-5,700 feet (MD80).
Oleaceae	**Olive Family**	
Forestiera pubescens	Desert Olive	Occasional in the vicinity of water, Coso and Argus ranges, 4,200-5,400 feet (MD80).
Fraxinus anomala	Single-leaf Ash	East face of Burl Parkinson Peak, top of ? fork of Bendire Canyon.
Fraxinus velutina	Velvet Ash	Birchum; hort ?
Menodora spinescens		Northern Coso Range, 4,000-5,800 feet (MD80). Upper east fork of Darwin Wash, Brown Mountain -South ranges (DS96).
Onagraceae	**Evening-Primrose Family**	
Camissonia boothii ssp. *boothii*	Booth Evening Primrose	Southwestern Coso Mountains at Cinder and Volcano peaks, Sugarloaf area, north and east to other cinder formations (DS96).
Camissonia boothii ssp. *desertorum*	Booth Evening Primrose	Frequent throughout region, 2,400-5,500 feet (MD80). One of the most widespread annuals at NAWS (DS).
Camissonia boothii ssp. *inyoensis*	Inyo Primrose	Northern Coso Range on calcareous soils, 4,000-5,000 feet (MD80).
Camissonia brevipes	Yellow Sun Cups	Uncommon, possibly limited to calcareous soils, northern Coso Range and eastern Argus Range, 3,400-4,600 feet (MD80).
Camissonia campestris ssp. *campestris*	Mojave Sun Cup	Mostly low elevations, 2,350-4,200 feet (MD80). K2 track area (Mary Ann Henry, March 1978).
Camissonia cardiophylla var. *robusta*	Heart-leaved Primrose	Rare in region, calcareous places in Argus Range, 2,600-4,600 feet (MD80). Northern Argus Range, Lookout City, Lower Stone Canyon, patches in limestone wash cobble of Stone Canyon alluvial fan. Black Mountain road cut thru basalt on South ranges (DS96).
Camissonia chamaeneroides	Modest Evening Primrose	Infrequent in the Coso and Argus ranges, 3,100-6,200 feet (MD80). K2 track area (Mary Ann Henry, March 1978).
Camissonia claviformis ssp. *claviformis*	Brown-eyed Primrose	Frequent throughout the region, 2,100-6,050 feet (MD80).
Camissonia ignota	Small Primrose	Reported from Rose Valley and Coso Range north of Coso

		Hot Springs, 3,400-3,700 feet (MD80).
Camissonia kernensis ssp. *gilmanii*	Gilman Primrose	Infrequent, Argus Range, 4,600-5,800 feet (MD80).
Camissonia palmeri	Palmer Primrose	Infrequent, sandy places in Coso Range, as far north as Haiwee, 3,600-5,100 feet (MD80). Haiwee and Coso areas (MD84).
Camissonia pterosperma		Infrequent, Coso Range, middle elevations. (MD80).
Camissonia pubens	Hairy Primrose	Reported from Mountain Springs Canyon, Argus Range, 4,200 feet (MD80). Mountain Springs Canyon (Mary Ann Henry, 1972-1978).
Camissonia pusilla	Slender Hairy Primrose	Infrequent, Coso and Argus ranges, 3,750-6,250 feet (MD80). Mountain Springs Canyon (Mary Ann Henry, 1972-1978).
Camissonia refracta		Northern border of the Coso Range, 4,300 feet (MD80).
Camissonia walkeri ssp. *torilis*	Rock Primrose	Rare in the region, rocky calcareous places, Argus Range up to 5,000 feet
Oenothera caespitosa ssp. *crinita*	Caespotose Evening Primrose	
Oenothera caespitosa ssp. marginata		Infrequent, Coso and Argus Range, 3,600-6,800 feet (MD80).
Oenothera californica ssp. *avita*		Sandy places in the southern part of the region and northern Coso Range, 2,400-5,700 feet (MD80).
Oenothera deltoides	Birdcage Primrose	Sandy places at low elevations in the southern part of the region, 2,250-2,700 feet (MD80).
Oenothera primiveris	Large Yellow Evening Primrose	Uncommon, mostly in Rose Valley and the Coso Hot Springs, but also on Cactus Flats and Wilson Canyon, 3,100-3,600 feet (MD80). Mountain Springs Canyon (Mary Ann Henry, 1972-1978).
Orchidaceae	**Orchid Family**	
Epipactis gigantea		Southern Owens Lake, 3,600 feet (MD80). Margaret Ann Spring (Reddick 83).
Orobanchaceae	**Broom-Rape Family**	
Orobanche cooperi ssp. *cooperi*	Broom Rape	Rare in region, northern Coso Mountains, 4,900-5,200 feet (MD80).
Orobanche fasciculata	Broom Rape	Rare in region, Maturango Peak area, Argus Range, 7,600 feet (MD80). Locally common along roadside and nearby flats in lower bench of baslat flow southwest of Coso Peak, Upper Wilson Spring, sandy-gravelly bank next to *Chrysothamnus viscidiflorus* ssp. *viscidiflorus* (DS97).
Oxalidaceae	**Wood-Sorrel Family**	
Oxalis corniculata		
Papaveraceae	**Poppy Family**	
Argemone corymbosa	Prickley Poppy	
Argemone munita	Prickley Poppy	Ssp. *argentea* - Infrequent in Coso and Argus ranges, 2,450-5,700 feet (MD80). Ssp. *rotundata* - Infrequent in Coso and Argus ranges up to 6,000 feet (MD80).
Eschscholzia glyptosperma	Desert Gold Poppy	Frequent in Coso and Argus ranges, 2,200-6,200 feet (MD80).
Eschscholzia minutiflora ssp.	Coville Gold Poppy	Infrequent, northern Coso and Argus ranges, up to 6,250 feet

covillei		(MD80). Rodman-Newberry Mountains, NAWS at Land Site 2 (DS96).
Eschscholzia minutiflora ssp. *minutiflora*	Little Gold Poppy	Frequent in basins and Coso and Argus ranges, 2,200-5,800 feet (MD80).
Platystemon californicus	Cream Cups	Rare in the region, Coso Hot Springs area and Argus Peak, 3,600-4,400 feet (MD80).
Philadelphaceae	**Mock-Orange Family**	
Fendlerella utahensis	Yerba Desierto	Maturango Peak area.
Philadelphus microphyllus		Maturango and Burl Parkinson peaks on northern and eastern slopes in canyons.
Pinaceae	**Pine Family**	
Pinus monophylla	Singleleaf Pinyon Pine	Coso and Argus ranges, above 5,000 feet (MD80).
Plantaginaceae	**Plantain Family**	
Plantago major	Common Plantain	Coso Village cattle pond (DS-UCR97).
Plantago ovata		
Plantago patagonica	Pursh Plantain	Infrequent in both the Coso and Argus ranges, 5,500-6,000 feet (MD80).
Poaceae	**Grass family**	
Achnatherum hymenoides		Common throughout NAWS, from Alkaline Basin to Pinyon Woodland (DS96). Common and widespread throughout region (MD80).
Achnatherum occidentalis ssp. *occidentalis*	Needlegrass	Coso Peak area? (DS-UCR97).
Achnatherum parishii	Needlegrass	
Achnatherum speciosum	Needlegrass	Common on rocky slopes throughout NAWS from upper Creosote Bush Scrub to lower Pinyon Woodland. Locally dominant in western Superior Valley-Grass Valley on sandy bajada soils (DS96). Common in the Coso and Argus ranges, 2,800-5,500 feet (MD80).
Aristida purpurea var. *fendleriana*	Fendler Three-awn	Coso Village area (MD80).
Aristida purpurea var. *nealleyi*	Reverchon Three-awn	Devil's Kitchen area (MD80).
Bouteloua barbata var. *barbata*	Six Weeks Gramma Grass	Locally common at Coso Hot Springs. Able to sprout without summer rainfall by growing close to fumarole ground moisture. This species is rarely seen in the region because it usually appears only after sufficient summer thunderstorms (DS96). Common in Coso Hot Springs area, 3,600 (MD80).
Bromus arizonicus		Seep Spring (DS96). Vicinity of Little Lake, 3,200 feet (MD80).
Bromus carinatus var. *carinatus*	California Brome	Mill Spring, growing among rock house ruins (DS96). Argus Range near Junction Ranch, 6,500 feet (MD80).
Bromus catharticus	Rescue Grass	Occasional up to 4,000 feet, Argus, Black, and Panamint ranges (MD84).
Bromus ciliatus	Fringed Brome	Seep Spring (DS96).
Bromus diandrus	Ripgut	Seep Spring and Upper Wilson Seep (DS97).
Bromus madritensis ssp.	Foxtail Chess	Similar habitats to *B. tectorum* but lower elevations and

rubens		rockier sites (DS96).
Bromus tectorum	Downy Chess	The most abundant annual species at NAWS, from Saltbush Scrub to Pinyon Woodland (DS96).
Bromus trinii	Chilean Chess	Common throughout NAWS region, among shrubs and rocks, from upper Creosote Bush Scrub to upper Mixed Mojave Scrub (DS96). Frequent in region up to 4,500 feet (MD80).
Cynodon dactylon	Burmuda Grass	Golf Course, landscaping and housing (DS). An agressive weed about habitations in moist places, up to 3,700 feet (MD80).
Distichlis spicata	Saltgrass	China Lake Basin, common to dominant in low, moist alkaline areas, often associated with seasonal pooling of water, from Alkaline Riparian to Saltbush Scrub (DS96).
Elymus elymoides ssp. *elymoides*	Squirreltail	Common and widespread throughout NAWS, from Mojave Mixed Scrub to Pinyon Woodland (DS96). Frequent Coso and Argus ranges, middle and high elevations (MD80).
Elymus multisetus	Big Squirreltail	Occasional, Coso and Argus ranges, middle and high elevations (MD80).
Erioneuron pulchellum	Fluffgrass	
Hordeum murinum ssp. *leporinum*	Wild Barley	Granite Wells (DS96).
Leymus cinereus	Ashy Wildrye	El Conejo gate, Birchum Springs, local near riparian areas, washes, etc., Coso and Argus ranges, from Sagebrush Scrub up to Pinyon Woodland (DS96). Infrequent, Argus Range, up to 7,500 feet (MD80).
Leymus condensatus	Big Wildrye	Petroglyph Canyon, 5,000 feet (MD80).
Leymus triticoides	Creeping Wildrye	Tenessee, Newhouse, and Haiwee springs (DS96).
Melica frutescens	Tall Melica	Infrequent, Coso and Argus ranges, 3,500-4,500 feet (MD80).
Melica imperfecta	Small-flowered Melica	Common in rocky canyons, bouldery slopes. Abundant at Seep Springs and in lava flow canyon bottoms of North ranges (DS96). var. *flexuosa* - Occasional Coso and Argus ranges, 4,100-4,900 feet (MD80). var. *refracta* - Haiwee Spring, 4,800 feet (MD80).
Melica stricta	Rock MelicGrass	Mill Canyon, Newhouse Canyon, expected elsewhere on exposed rocky lower slopes with nothern aspects in lower Pinyon Woodland and upper Great Basin Mixed Scrub (DS96). Infrequent, Coso and Argus ranges, 5,700-6,600 feet (MD80).
Muhlenbergia asperifolia	Mist Grass	Owens Lake, no name Canyon, Haiwee Spring
Muhlenbergia porteri	Bush Muhly	Northeastern Coso Range, lower Water Canyon, Petroglyph boulders west of Darwin Wash (DS96).
Muhlenbergia rigens	Deergrass	Ephemeral stream bottoms, seeps, and springs as at Seep Spring, Wilson Canyon, Moscow Spring, and Haiwee Spring (DS96).
Paspalum distichum	Ditch Grass	Coso Village cattle pond (DS-UCR97). Wet places, marshes, ditches, etc. at Owens Lake (DS).
Phragmites australis	Common Reed	Newhouse Spring, Shepherd Canyon (DS96). Infrequent, moist or wet places up to 3,500 feet (MD80).
Pleuraphis jamesii	James Galleta Grass	Occasional populations, especially in calcareous areas, 4,500-7,600 feet (MD80). Throughout Coso and Argus ranges, from upper Shadscale Scrub and Mixed Mojave Scrub to Pinyon Woodland. Highly impacted by cattle grazing (DS96).
Poa fendleriana ssp. *longiligula*	Longtongue Mutton Grass	Silver Peak area, Coso Range, 6,600 feet (MD80).
Poa secunda ssp. *secunda*	Pine BlueGrass, Nevada Bluegrass	Abundant in rocky areas and slopes throughout NAWS, Mixed Mojave Scrub to Pinyon Woodland. The most frequently grazed perennial grass at NAWS (DS96). Frequent to Coso and Argus ranges, 3,600-5,000 feet (MD80). *P. nevadensis* at Silver Peak, 6,600 feet, Renegade Canyon, 4,900 feet (MD80).
Polypogon monspeliensis	Rabbitfoot Grass	Common at most NAWS riparian areas (DS96). Occasional, in

		moist or wet places, Little Lake and Haiwee Spring, 3,200-4,800 feet (MD80).
Schismus arabicus	Split Grass	Rose Valley and Indian Wells Valley, 2,150-3,350 feet (MD80).
Schismus barbatus	Split Grass	Locally abundant, dominant annual in sandy areas at low elevations, Saltbush Scrub to Mojave Mixed Scrub (DS96). . Common in favorable places in the Argus and Coso ranges, low elevations (MD80).
Sporobolus airoides	Alkali Sacaton	Low growing meadow at China Garden Spring, 2 plants at Myrick Spring (DS96). Haiwee area, up to 4,500 feet (MD80).
Vulpia microstachys var. *pauciflora*		Locally abundant in Mixed Mojave Scrub in the west Mojave region (DS96).
Vulpia octoflora var. *octoflora*	Six Weeks Fescue	Common throughout the region up to 5,000 feet (MD80).
Polemoniaceae	**Phlox Family**	
Eriastrum densifolium var. *mohavense*		Burro Canyon, K2 and nearby sand field areas.
Eriastrum diffusum	Wooly Star	Shepherd Canyon, Argus Range, 5,850 feet (MD80). Rand Mountains (DS96).
Eriastrum eremicum ssp. *eremicum*	Wooly Star	Infrequent, mostly in Coso Range up to 6,200 feet (MD80). Widespread and common (DS96).
Eriastrum sparsiflorum	Wooly Star	Mountain Springs Canyon, Argus Range, 6,000 feet (MD80).
Eriastrum wilcoxii	Wooly Star	Frequent in sandy places, Coso and Argus ranges, 5,500-7,500 feet (MD80).
Gilia aliquanta ssp. *aliquanta*	Puffed-calyx Gilia	Infrequent, Argus Range, 4,400-5,000 feet (MD80).
Gilia brecciarum var. *argusana*		Infrequent, Argus Range, 2,800-5,800 feet (MD80).
Gilia brecciarum var. *brecciarum*	Nevada Small Gilia	Infrequent, Coso and Argus ranges, about 3,000 feet (MD80).
Gilia brecciarum var. *neglecta*	Inyokern Gilia	Collected on the borders of the Coso Range, 4,000-4,500 feet (MD80). Widespread, showy *Gilia* of the region, especially SNE foothills (DS96).
Gilia cana ssp. *cana*	Showy Gilia	Infrequent, Coso Range, 5,250-6,800 feet (MD80).
Gilia cana ssp. *triceps*	Showy Gilia	Infrequent in the Coso and Argus ranges, apparently on calcareous sites, 4,200-5,200 feet (MD80).
Gilia filiformis	Thread-stemmed Gilia	Infrequent, Coso and Argus ranges, 3,100-5,700 feet (MD80).
Gilia hutchinsifolia	Pale Gilia	Infrequent, Argus Range, 4,200-4,600 feet (MD80). Mountain Springs Canyon (Mary Ann Henry, 1972-1978).
Gilia latiflora ssp. *cosana*	Coso Broad-flowered Gilia	Infrequent, Coso Range, 5,250-6,800 feet (MD80).
Gilia latiflora ssp. *elongata*	Broad-flowered Gilia	Infrequent, mostly in the Coso Range, 3,300-4,850 feet (MD80). Black Rock Hills, Rand, and El Paso ranges (Grant & Day).
Gilia latiflora ssp. *latiflora*	Broad-flowered Gilia	Apparently frequent, reported up to 5,600 feet (MD80). Mountain Springs Canyon (Mary Ann Henry, 1972-1978).
Gilia latifolia	Broad-leaved Gilia, Holly Gilia	Infrequent in the Coso and Argus ranges, usually on limestone, 2,250-3,400 feet (MD80).
Gilia leptomeria	Great Basin Gilia, Sand Gilia	Reported from Bendire Canyon, Argus Range, 3,000 feet (MD80).
Gilia malior	Scrub Gilia	Infrequent, Coso and Argus ranges, 3,100-5,300 feet (MD80).
Gilia micromeria		Infrequent, Rose Valley and Argus Range, 3,400-3,800 feet (MD80). Mountain Springs Canyon (Mary Ann Henry, 1972-1978). Wash sand of Indian Wells Canyon (DS95).

Gilia minor		Frequent, Coso and Argus ranges, 2,350-5,600 feet (MD80).
Gilia modocensis		Northern Coso Range, 5,350-6,800 feet (this species may be confused with *G. brecciarum* ssp. *neglecta*) (MD80) (MD84).
Gilia ochroleuca ssp. *orchroleuca*		Infrequent, Coso and Argus ranges, 3,200-6,200 feet (MD80).
Gilia opthalmoides	Pinyon Gilia	Infrequent, Coso and Argus ranges, 4,800-6,100 feet (MD80).
Gilia scopulorum	Rock Gilia	Infrequent, Coso and Argus ranges, 2,400-3,500 feet (MD80).
Gilia sinuata		Frequent, basins and the Coso and Argus ranges, 2,350-5,600 feet (MD80).
Gilia stellata		Occasional in the Coso and Argus ranges.
Gilia transmontana		Infrequent, Coso and Argus ranges, 3,000-3,700 feet (MD80).
Gilia triodon	Toothed Gilia	Infrequent, Coso and Argus ranges, 4,400-5,400 feet (MD80).
Ipomopsis polycladon		Apparently rare in the region, Argus Range, 5,000 feet (MD80). South Superior Valley, off Copper City Road (DS, 5/95).
Langloisia setosisima ssp. *punctata*		Infrequent, Coso and Argus ranges, 3,600-4,400 feet (MD80).
Leptodactylon pungens	Prickly Phlox	Infrequent, Argus Range, 4,000-7,600 feet (MD80).
Linanthus arenicola	Sand Linanthus	K2 valley and Paxton ranch.
Linanthus aureus var. *aureus*	Golden Linanthus	Fairly frequent in Coso Range but less so in Argus Range, 3,300-5,800 feet (MD80).
Linanthus bigelovii		Infrequent, Coso and Argus ranges, 3,000-3,450 feet (MD80).
Linanthus ciliatus	Whisker Brush	Northern Coso Range, 6,100-7,150 feet (MD80).
Linanthus dichotomus	Evening Snow	Frequent, Coso and Argus ranges, 2,400-5,700 feet (MD80).
Linanthus parryae	Sand Blossoms	Frequent, IWV, Coso and west slope of Argus Range, 2,350-4,000 feet (MD80). Mountain Springs Canyon (Mary Ann Henry, 1972-1978).
Loeseliastrum matthewsii	Desert Calico, Sunbonnets	Common throughout the region (MD80).
Loeseliastrum schottii		Desert Sand Field, K2 track area (DS96).
Microsteris gracilis ssp. *humilis*	Annual Phlox	Uncommon, Etcherron Valley and Argus Range, 5,350-5,700 feet (MD80).
Phlox gracilis		Uncommon, Etcherron Valley and Argus Range, 5,350-5,700 feet (MD80). Igneous soils, Grapevine and Argus Range (MD84).
Phlox stansburyi	Phlox	Infrequent, Coso and Argus ranges, 5,100-7,000 feet (MD80). Common in Great Basin areas (DS).
Polygonaceae	**Buckwheat Family**	
Centrostegia thurberi	Red Triangles	Common, Coso and Argus ranges, 3,400-5,800 feet (MD80).
Chorizanthe brevicornu ssp. *brevicornu*	Brittle Spine Plant	Common and widespread, 2,200-3,700 feet (MD80).
Chorizanthe rigida	Rigid Spine Plant, Rosy-Thorn	Common, low elevations, throughout the region, 1,900-3,600 feet (MD80).
Chorizanthe watsonii	Spine Plant	Infrequent, Coso Range, 3,500-5,000 feet (MD80). Locally abundant in Indian Wells Valley (DS90).
Chorizanthe xantii var. xantii	Spine Plant	Rare, Silver Peak in Coso Range 7,150 feet and Maturango Peak 7,600 feet (MD80).
Eriogonum angulosum	Angle-stemmed Buckwheat	Infrequent, Argus Range, 4,600-5,000 feet (MD80). Locally common in southwestern South ranges, west of Pilot Knob (DS96).
Eriogonum baileyi var. *baileyi*	Bailey Buckwheat	Infrequent, Coso and Argus ranges, 3,600-6,000 feet (MD80). Abundant along roads, middle and higher elevations of North and South ranges (DS96).

Eriogonum brachyanthum	Yellow Buckwheat	Frequent, Coso Range and its borders, 2,500-5,000 feet (MD80).
Eriogonum brachypodum	Tecopa Skeleton Weed	Infrequent, calcareous sites, Argus Range, 3,000-3,100 feet (MD80). Common along South Range roads, east of Indian Springs on crusty extrusive (tuff, basalt, etc.) formations. Disclimax occurence on northeastern Superior Valley target area (DS96).
Eriogonum davidsonii	Heerman Buckwheat	
Eriogonum deflexum ssp. *baratum*	Tall Skeleton Weed	Infrequent, Coso Range, about 3,500 feet (MD80). The most common form of *E. deflexum* at NAWS, especially at higher elevations. Large plants occur in clay playas of the Coso Geothermal Area (DS96).
Eriogonum deflexum var. *deflexum*	Skeleton Weed	Infrequent, Coso and Argus ranges, 2,900-5,400 feet (MD80).
Eriogonum fasciculatum ssp. *polifolium*	California Buckwheat	Common and widespread in the Coso and Argus ranges, 2,400-5,700 feet (MD80).
Eriogonum glandulosum	Pink Mist	Infrequent, Coso Range, 3,500-5,000 feet (MD80).
Eriogonum gracillimum	Slender Buckwheat	Infrequent, Coso and Argus ranges, 3,600-5,800 feet (MD80). Mountain Springs Canyon (Mary Ann Henry, 1972-1978).
Eriogonum heermannii var. *argense*	Heerman Buckwheat	Presumably the form most widespread at NAWS. Limestone places, Argus Range, 5,000 feet (MD80).
Eriogonum heermannii var. *floccosum*	Clark Mountain Buckwheat	Rare, Argus Range and Junction Ranch area, 5,000-6,000 feet (MD80). Plants at Seep Spring have weakly floccose stems. Most descriptions suggest this form is geographically restricted to the east Mojave (DS96).
Eriogonum heermannii var. *humilius*	Heerman Buckwheat	Dry north-facing upper slopes above Tenessee Spring, Argus Range.
Eriogonum inflatum var. *inflatum*	Desert Trumpet	The most abundant buckwheat at NAWS (DS96). Common to abundant, Coso and Argus ranges, 1,900-5,300 feet (MD80).
Eriogonum kennedyi var. *purpusii*	Kennedy Mojave Buckwheat	Common in Great Basin Scrub on rolling semi-barren terrain of Coso Range (DS96). On granite at high elevations in the Coso Range, 5,000 to 6,800 feet (MD80).
Eriogonum maculatum	Spotted Buckwheat	Common borders of Coso Range, 3,200-3,700 feet (MD80).
Eriogonum microthecum var. *laxiflorum*	Buckwheat	Widespread, especially on loose, northern slopes, in Great Basin and Pinyon zones of the Coso and Argus ranges (DS96).
Eriogonum mohavense	Mojave Buckwheat	Indian Wells Valley, 2,500 feet (MD80). Apparently common and widespread in the China Lake Basin on aeolian deposits and sand fields such as VABM (Baby Mountain) Peak, Baker Range, K2, Burro Canyon, etc. (DS96).
Eriogonum nidularium	Whisk Broom Buckwheat	The most widespread and abundant annual *Eriogonum* sp at NAWS (DS96). Infrequent, Coso and Argus ranges, 2,800-6,500 feet (MD80).
Eriogonum nudum var. *nudum*	Nude Buckwheat	Presumably this is the common tall variety which resemble *E. inflatum*. Widespread in the Coso, Argus, and Slate ranges (intergrading with ssp. *deductum* at NAWS?) (DS96). *E. n.* ssp. *saxicola,* Infrequent, often on volcanics, Coso and Argus ranges, 3,600-7,600 feet (MD80).
Eriogonum nudum var. *westonii*	Cinder Nude Buckwheat	Classic form occurs in the Volcano Peak cinder formations of southwestern Coso Range with *Camissonia boothii* ssp. *boothii*, *Eriogonum rixfordii* and *Petalonyx nitidus* (DS96).
Eriogonum ovalifolium var. *ovalifolium*	Oval-leaved Buckwheat	High elevations in Coso and Argus ranges, 5,700-6,700 feet (MD80).
Eriogonum palmerianum	Buckwheat	
Eriogonum panamintense (ssp. *mensicola)*	Buckwheat	On basalt bedrock and cobble terraces in the Coso Peak area and east of El Conejo gate on steep rocky granite slope with *E. microthecum, E wrightii,* and *E. umbellatum* (DS96).
Eriogonum panamintense (ssp. *panamintense)*	Buckwheat	Crystal Spring area, Argus Sterling Mine, usually on steep, north-facing, loose DG scree slopes.

Eriogonum plumatella	Buckwheat	Upper sandy zones of K2 area, Walker Pass, Victorville, Joshua Tree National Park, Kelbaker Road, and I-8 (DS).
Eriogonum pusillum	Yellow Turbans	Occasional in Coso and Argus ranges, Rose Valley, and Olancha, 3,300-5,800 feet (MD80).
Eriogonum reniforme	Kidney-leaved Buckwheat	Infrequent, Coso and Argus ranges, and Searles Valley, 1,800-3,500 feet (MD80).
Eriogonum rixfordii	Pagoda Buckwheat	South Panamint Range, west of Red Hill Mine, Cinder Peak in southwestern Coso Range (DS96).
Eriogonum saxatile	Rock Buckwheat	Frequent on dry, mostly north-facing scree slopes of Argus and Coso ranges on granite (DS96). Infrequent, Coso and Argus ranges, 4,000-7,600 feet (MD80).
Eriogonum spergulinum var. *reddingianum*	Buckwheat	Coso Bridge Road (DS97).
Eriogonum trichopes var. *hooveri*	Little Trumpet	Widespread in open, sometimes disturbed areas from Creosote Bush Scrub into lower Great Basin Scrub. Forms distinct monocultures, especially on clay, ash, or caliche soils (DS96). Calcareous soils, Rose Valley, Coso and Argus ranges, 3,000-5,400 feet (MD80).
Eriogonum umbellatum var. *nevadense*		Common species in most Great Basin areas.
Eriogonum wrightii var. *subscaposum*		Common in most Great Basin and upper Mojavean zones. Barren southern and southeastern exposures (grows similar to (or is) var. *wrightii*) in washes at NAWS (DS96). Infrequent, Coso Range, 5,000-6,850 feet (MD80).
Oxytheca dendroidea		Sandy or disturbed areas in Pinyon Woodland, Coso and Argus ranges (DS96).
Oxytheca perfoliata	Saucer Plant	Frequent, Coso and Argus ranges, 3,100-5,400 feet (MD80). Widespread throughout NAWS (DS96).
Polygonum arenastrum		
Pterostegia drymarioides		Infrequent, in the shelter of rocks or cliffs, Little Lake eastern Argus Range, 1,850-4,000 feet (MD80). K2 track area (Mary Ann Henry, March 1978). Short Canyon (MH).
Rumex crispus	Dock	Seep Spring (DS96).
Rumex salicifolius var. *denticulatus*	Dock	
Portulacaceae	**Purslane Family**	
Calandrinia ciliata		
Calyptridium monandrum	Sand Cress	Occasional, Rose Valley, Coso and Argus ranges, 2,400-3,700 feet (MD80). Spangler Hills, Walker Pass, and Lucerne Valley (DS96).
Calyptridium parryi var. *nevadense*	Pussy Paws	High elevations, Cosos and Argus ranges up to 8,100 feet (MD80).
Claytonia rubra	Miner's Lettuce	Reported from the Argus Range (MD80).
Potamogetonaceae	**Pondweed Family**	
Potamogeton pusillus	Small Pondweed	Lark Seep (or other *Potamogeton* sp) (DS96).
Pteridaceae	**Terrestrial Ferns**	
Cheilanthes covillei	Coville Lip Fern, Bead Fern	Well distributed in the Coso and Argus ranges, 3,400-5,800 feet (MD80).
Cheilanthes parryi	Parry Cloak Fern	On limestone in the Argus Range, 1,850-4,000 feet (MD80).
Cheilanthes viscida	Sticky Lip Fern	Occasional in the Argus Range, 3,000-3,500 feet (MD80).

Pellaea mucronata var. *californica*	Bird's Foot Fern	Wilson Canyon, Argus Range, 3,100 feet (MD80).
Pentagramma triangularis ssp. *triangularis* (*Pityogramma t.* var. *t.*)	Goldenback Fern	Coso Range (MD80). Seep Spring, no name Canyon, and Wilson Canyon (DS96).
Ranunculaceae	**Crowfoot Family**	
Aquilegia shockleyi		Tenessee Spring and upper Newhouse Spring Canyon waterfall seep (DS96). Argus Mountains (Munz 74).
Clematis ligusticifolia	Virgin's Bower	Uncommon, Coso and Argus ranges, 4,100-5,400 feet (MD84). Mountain Springs Canyon, Margaret Ann Spring (DS).
Delphinium parishii ssp. *parishii*	Larkspur	Occasional in the Coso and Argus ranges, 3,600-5,700 (MD84).
Delphinium parryi ssp. *purpureum?*	Larkspur	Eastern Argus Range (MD80). Same thing (DS).
Ranunculus cymbalaria var. *saximontanus*		
Resedaceae	**Mignonette Family**	
Oligomeris linifolia		Myrick Spring (DS96).
Rhamnaceae	**Buckthorn Family**	
Ceanothus greggii var. *vestitus*	Buckbrush	Coso Range (DS96, Kiva 93).
Rosaceae	**Rose Family**	
Amelanchier utahensis	Service-berry	Coso Mountains (DS96, Kiva 93). Birchum Springs area 6,550 feet (MD80).
Cercocarpus intricatus	Little Mahogany	On dolomite hills, outcrops, northern Argus Range (G. Pratt 96) . Argus Sterling Mine (DS97).
Chamaebatiaria millefolium	Fern Bush	Argus Range, Maturango Peak area, 8,800 feet (MH78, MD80).
Coleogyne ramosissima	Blackbrush	Widely distributed throughout NAWS at higher elevations, 3,500-7,000 feet.
Holodiscus microphyllus	Small-leaved Cream Bush	Argus Range above 7,000 feet, except at Margaret Ann Spring.
Horkeliella congdonis		Mill Spring (G. Pratt 96, DS96).
Prunus andersonii	Desert Peach	Upper Centennial Flat, forms large clones (DS96).
Prunus fasciculata var. *fasiculata*	Desert Almond	Granite Mountain, Stone corral area, Seep Spring (DS96).
Purshia mexicana var. *stansburiana*	Cliffrose	Northern Argus Range limestone areas such as Argus Sterling Mine, J160 area (GP96, DS96).
Purshia tridentata var. *glandulosa*	Bitterbrush	Abundant, widespread in Great Basin Areas, replaced by *P. mexicana* in northern Argus Range limestones (DS96).
Rosa woodsii var. *ultramontana*	Wild Rose	Common at springs in the Coso and Argus ranges, higher elevations (DS).

Rubiaceae	**Madder Family**	
Galium aparine	Catchweed Bedstraw	Crow Canyon, Argus Range, 4,150 feet (MD80).
Galium argense	Argus Bedstraw	Head of Shepherd Canyon, Argus Range, 5,400 feet (MD80).
Galium hilendiae ssp. *hilendiae*	Bristly Bedstraw	Infrequent, Coso Range up to 5,800 feet (MD80). Louisiana Butte, Mill Spring (DS96).
Galium matthewsii	Bushy Bedstraw	Common in canyons at middle elevations (DS). Fairly frequent, Coso and Argus ranges, 4,100-6,800 feet (MD80).
Galium stellatum var. *eremicum*	Desert Bedstraw	Common among rocks at mid to lower elevations (DS96).
Rutaceae	**Rue Family**	
Thamnosma montana	Turpentine Bush	Uncommon, eastern Argus Range, 2,300-3,400 feet (MD80). Patchy, but locally abundant in South ranges above 3,000 feet (DS96).
Salicaceae	**Willow Family**	
Populus fremontii ssp. *fremontii*	Cottonwood	Mill Spring, Mountain Springs Canyon, Junction Ranch pond, numerous horticultural plantings at NAWS (DS96).
Salix exigua	Narrow-leaved Willow	Crow Canyon, Argus Range 4,050 feet (MD80). Middle willow seeps, Newhouse Canyon, Argus Range, Upper Wilson Spring, Sheperd Canyon (DS96).
Salix laevigata	Red Willow	Margaret Ann Spring, Mountain Springs Canyon, Upper Wilson, Moonshine, China Garden, and Haiwee Springs (DS96). Mountain Springs Canyon (MD80).
Salix lasiolepis	Arroyo Willow	Common in riparian areas throughout NAWS, middle and higher elevations (DS96).
Salix lucida ssp. *lasiandra*	Shining Willow, Yellow Willow	*S. lasiandra benth.* Yellow Willow Tree, Haiwee Spring, 4,800 feet (MD80).
Saxifragaceae	**Saxifrage Family**	
Heuchera rubescens var. *alpicola*	Alumroot	Argus Range, eastern face of Burl Parkinson Peak (DS96, Kiva 93).
Scrophulariaceae	**Figwort Family**	
Antirrhinum coulterianum	Coulter Snapdragon	Infrequent, Coso and Argus ranges, 3,100-3,500 feet (MD80).
Antirrhinum filipes	Twining Snapdragon	Coso and Argus ranges, 2,250-3,700 feet - MD80. Expected thoughout South ranges (DS).
Antirrhinum kingii	Least Snapdragon	Infrequent , Coso and Argus ranges, 3,100-5,600 feet (MD80).
Castilleja angustifolia	Desert Indian Paintbrush	Occasional at middle to high elevations, Coso and Argus ranges, 3,600-7,000 feet (MD80). Widespread throughout NAWS in rocky areas and washbanks (DS96).
Castilleja exserta ssp. *exserta*	Purple Owl's Clover	Baby Mountain (Bob Joy, 4-94), Rose Valley, IWV, southern Coso and Argus ranges up to 3,700 feet (MD80).
Castilleja linariifolia	Long-leaved Paintbrush	Characteristic associate of higher elevation springs of the Argus and Coso ranges (DS96). Infrequent, moist places, Coso and Argus ranges up to 4,000 feet (MD80).
Collinsia callosa	Granite Collinsia	Frequent in Coso and Argus ranges, 4,000 to 7,900 feet, (MD80). Locally abundant in Mixed Desert, Sagebrush Scrub, and Pinyon Woodland west of NAWS (DS96).

Cordylanthus eremicus ssp. *eremicus*	Panamint Bird's Beak, Desert Bird's-beak	Rolling terrain in many Great Basin habitat types and soils, usually avoiding steep slopes. From Upper Moscow Springs area north to Indian Garden Spring, Coso Mountains and Tenessee Spring, Argus Range, Nelson Range, Cushenbury Springs (SnBr Mountains), Panamint Mountains and White Mountains, Silver Canyon (DS95).
Cordylanthus kingii ssp. *helleri*	Bird's Beak	Northern Coso Mountains (Zembal ?, DS). Locally abundant in the Inyo Mountains, Pinyon Woodland (DS).
Keckiella breviflora var *breviflora*	Bush Penstemon	Rare, Mill Canyon on rock outcrops at base of slope below lower spring (DS96).
Keckiella rothrockii var. *rothrockii*	Bush Penstemon	Argus Range, eastern face of Burl Parkinson Peak, with *Fraxinus anomala, Philadelphus microphyllus, Galium* sp., *Penstemon rostriflorus*, and *Huechera rubescens*; seep community among Pinyon Woodland. (DS96, Kiva 93).
Mimulus bigelovii	Monkey Flower	Widespread thoughout NAWS, mostly in washes and upper bajada (DS), both former varieties at NAWS (MD80).
Mimulus cardinalis	Monkey Flower	Haiwee, Mill, and upper and lower Newhouse springs (DS96).
Mimulus guttatus	Monkey Flower	Mill Spring, Seep Spring, and upper Moscow Spring (DS96).
Mimulus pilosus	Monkey Flower	Renegade Canyon, 4,900 feet (MD80).
Mimulus rubellus	Monkey Flower	Moist sand along rocky drainage paths and washes. At 7,000 feet, Newhouse Spring Canyon (DS96). Coso and Argus ranges, 4,100- 5,600 feet (MD80).
Mohavea confertiflora	Mojave Ghost flower	Washes, gravelly slopes (JM), rare in Coso Range, infrequent in Argus Range, 3,000 to 3,500 feet (MD80). Shepherd Canyon (DS96).
Penstemon fruticiformis var. *fruticiformis*	Desert Mountain Penstemon	Slate Range (G. Pratt), Limestone canyons in the Argus Range (DS96). Calcareous formations, Argus Range, 4,000-7,000 feet (MD80).
Penstemon incertus	Western Desert Penstemon	Common along disturbances and washes and slopes, Coso and Argus ranges (DS96).
Penstemon monoensis	Mono Penstemon	Rare in northwestern Coso Range on calcareus formations, 4,250-4,350 feet (MD80).
Penstemon palmeri var. *palmeri*	Palmer Penstemon	Uncommon, washes and sandy slopes of northwestern Coso Range, such as Mill, Lacey, and south Crystal Spring canyons (DS96).
Penstemon patens	Owens Valley Penstemon	Centennial Canyon, 5,250 feet (MD80).
Penstemon rostriflorus	Penstemon	Coso and Argus mountains, in upper canyons as at upper Bendire Canyon, Mill Spring (DS96).
Penstemon speciosus	Showy Penstemon	Common in rocky areas of Great Basin plant communities, Louisiana Butte to northern Coso and Argus ranges (DS96). Coso and Argus ranges, 5,000-7,900 feet (MD80).
Scrophularia desertorum	Figwort	Common, restricted to rocky drainages and springs, Coso and Argus ranges (DS96). Infrequent in moist places, Coso and Argus ranges, 4,450-6,100 feet (MD80).
Solanaceae	**Nightshade Family**	
Datura wrightii	Jimson Weed	Disturbed areas and washes (DS96). Infrequent at low elevations below 4,000 feet (MD80).
Lycium andersonii	Anderson Thornbush, Desert Tomato	Common throughout NAWS, rocky slopes, washes and bajadas, from Shadscale Scrub (where sometimes codominant with *Atriplex confertifolia, Grayia spinosa,* or *Hymenoclea salsola*) to Saltbush Scrub (DS96).
Lycium cooperi	Peach Thorn	Patchy to common, throughout NAWS, washes, slopes, and canyons, 2,500-7,000 feet (DS96).

Nicotiana attenuata	Coyote Tobacco	Occasional as natural occurrences, mostly along washes as at Mill Spring. Locally abundant in disturbed areas like roadsides of southern Etcheron Valley and Crystal Spring (DS96). Rare in the Coso Range, below 5,000 feet (MD80).
Nicotiana obtusifolia	Desert Tobacco	Infrequent, Coso and Argus ranges, 1,800 to 4,100 feet (MD80). Wilson Canyon, Granite wells (DS96).
Physalis crassifolia	Ground Cherry	Rocky areas, usually at the shady base of outcrops or under boulders. Washes occasionally as at South Panamint Valley wash (DS96).
Solanum americanum	Nightshade	Mesquite Spring, Haiwee Spring, Area R, Wilson Canyon (DS96).
Tamaricaceae	**Tamarisk Family**	
Tamarix aphylla	Athel	North of Coso Hot Springs (MD80).
Tamarix parviflora	French Tamarisk	Ornamental planted at old ranches, housing, China Lake complex (DS96).
Tamarix ramosissima	Tamarisk, Salt Cedar	Lark Seep and other moist alkaline channels in the China Lake Basin (DS96).
Typhaceae	**Cattail family**	
Typha domingensis	Southern Catttail	
Urticaceae	**Nettle Family**	
Parietaria hespera var. *hespera*		Argus Range (MD84). To be expected in other rocky canyons at NAWS (DS).
Urtica dioica ssp. *holosericea*	Nettle	Haiwee Spring, Margaret Ann Spring (DS96, GP96).
Verbenaceae	**Verbena Family**	
Verbena bracteata	Verbena	Junction Ranch pond (DS96).
Violaceae	**Violet Family**	
Viola purpurea ssp. *purpurea*	Violet	Pinyon Bridge area (G. Pratt 96). var. *venosa* from Hunter Mountain 6,800 feet (MD84). Also ssp. *mohavensis* here (DS).
Viscaceae	**Mistletoe Family**	
Arceuthobium divaricatum	Mistletoe	Silver Peak area, 7,050 feet (MD80).
Vitaceae	**Grape Family**	
Vitis girdiana	Desert Wild Grape	Rare, Haiwee Spring, 4,800 feet (MD80). Upper south fork Margaret Ann Spring (DS97).
Zygophyllaceae	**Caltrop Family**	
Fagonia laevis		Southern Argus Range, 2,250 feet (MD80). Northwestern extreme for species (DS).
Larrea tridentata	Creosote Bush	Dominant shrub of lower elevations, avoiding poorly drained, alkaline sites (DS96).

Peganum harmala	North African Rue	Randsburg Wash Central site and nearby roadsides (first California occurrence) (DS96).

SECTION 2.3.1.4c Acronym Key to the Plants of the NAWS Region

Acronym Key to the Plants of the Naval Air Weapons Station region

ABICON = Abies concolor
ABIMAG = Abies magnifica
ABRNANC = Abronia nana ssp. covillei
ABRPOG = Abronia pogonantha
ABRTUR = Abronia turbinata
ABRVILV = Abronia villosa var. villosa
ACAGRE = Acacia greggii
ACASPH = Acamptopappus sphaerocephalus
ACEGLAD = Acer glabrum var. diffusum
ACHARI = Achnatherum aridium
ACHCOO = Achyronychia cooperi
ACHCOR = Achnatherum coronatum
ACHHYM = Achnatherum hymenoides
ACHLEM = Achnatherum lemmonii
ACHMIL = Achillea millefolium
ACHNELD = Achnatherum nelsonii ssp. dorei
ACHNEV = Achnatherum nevadensis
ACHOCCO = Achnatherum occidentalis ssp. occidentalis
ACHOCCP = Achnatherum occidentalis ssp. pubescens
ACHPAR = Achnatherum parishii
ACHPIN = Achnatherum pinetorum
ACHSPE = Achnatherum speciosum
ACHTHU = Achnatherum thurberianum
ACHWEB = Achnatherum webberi
ACOCOL = Aconitum columbianum
ACTRUB = Actaea rubra
ADECOO = Adenophyllum cooperi
ADEPOR = Adenophyllum porophylloides
AGAURT = Agastache urticifolia
AGAUTA = Agave utahensis
AGEOCC = Ageratina occidentalis
AGOGLAL = Agoseris glauca var. laciniata
AGOGLAM = Agoseris glauca var. monticola
AGRCAP = Agrostis capillaris
AGRDES = Agropyron desertorum
AGREXA = Agrostis exarata
AGREXAM = Agrostis exarata var. monolepis
AGRIDA = Agrostis idahoensis
AGRPAL = Agrostis pallens
AGRSCA = Agrostis scabra
AGRSTOP = Agrostis stolonifera var. palustris
AGRSTOS = Agrostis stolonifera var. stolonifera
AGRVIR = Agrostis viridis
ALLATRA = Allium atrorubens var. atrorubens
ALLBISB = Allium bisceptrum var. bisceptrum
ALLFIMM = Allium fimbriatum var. mohavense
ALLGILV = Allophyllum gilioides ssp. violaceum
ALLINC = Allionia incarnata
ALLOCC = Allenrolfea occidentalis
ALLSHE = Allium shevockii
ALLVAL = Allium validum
ALOAEQ = Alopecurus aequalis
AMAALB = Amaranthus albus
AMBACA = Ambrosia acanthicarpa
AMBDUM = Ambrosia dumosa
AMBERI = Ambrosia eriocenta
AMEUTA = Amelanchier utahensis
AMPFRE = Amphipappus fremontii
AMSMENI = Amsinckia menzieii var. intermedia
AMSTES = Amsinckia tessellata
AMSVER = Amsinckia vernicosa
ANAMAR = Anaphalis margaritacea
ANDBRE = Androstephium breviflorum
ANDGLOS = Andropogon glomeratus var scabriglumis
ANECAL = Anemopsis californica
ANGLIN = Angelica lineariloba
ANIACA = Anisocoma acaulis
ANTCOT = Anthemis cotula
ANTCOU = Antirrhinum coulterianum
ANTFIL = Antirrhinum filipes
ANTKIN = Antirrhinum kingii
ANTPUL = Antennaria pulchella
ANTROS = Antennaria rosea
ANUANN = Anulocaulis annulatus
APEINT = Apera interrupta
APOAND = Apocynum androsaemifolium
APOCAN = Apocynum cannabinum
AQUFOR = Aquilegia formosa
AQUFORT = Aquilegia formosa var. truncata
AQUPUB = Aquilegia pubescens
AQUSHO = Aquilegia shockleyi
ARABOD = Arabis bodiensis
ARACOB = Arabis cobrensis
ARADIS = Arabis dispar
ARADRU = Arabis drummondii
ARAFERS = Arabis fernaldiana var. stylosa
ARAGLA = Arabis glaucovalvula
ARAHOLP = Arabis holboellii var. pinetorum
ARAHOLR = Arabis holboellii var. retrofracta
ARAINY = Arabis inyoensis

Acronym Key to the Plants of the Naval Air Weapons Station region

ARAMICM	= Arabis microphylla var. microphylla
ARAPER	= Arabis perennens
ARAPIN	= Arabis pinzlae
ARAPLAP	= Arabis platysperma var. platysperma
ARAPULG	= Arabis pulchra var. gracilis
ARAPULM	= Arabis pulchra var. munciensis
ARAPULP	= Arabis pulchra var. pulchra
ARAPYG	= Arabis pygmaea
ARASHO	= Arabis shockleyi
ARASPAS	= Arabis sparsiflora var sparsiflora
ARATIE	= Arabis tiehmii
ARAXDIV	= Arabis xdivaricarpa
ARCDIV	= Arceuthobium divaricatum
ARCMEC	= Arctomecon merriamii
ARCPAT	= Arctostaphylos patula
AREKING	= Arenaria kingii var. glabrescens
AREMACF	= Arenaria macradenia ssp. ferrisiae
AREMACM	= Arenaria macradenia var. macradenia
ARGCOR	= Argemone corymbosa
ARGJON	= Argyrochosma jonesii
ARGMUN	= Argemone munita
ARIADS	= Aristida adscensionis
ARICALC	= Aristida californica var. californica
ARIPURF	= Aristida purpurea var. fendleriana
ARIPURL	= Aristida purpurea var. longiseta
ARIPURN	= Aristida purpurea var. nealleyi
ARIPURPA	= Aristida purpurea var. parishii
ARIPURPU	= Aristida purpurea var. purpurea
ARIPURW	= Aristida purpurea var. wrightii
ARNCHAF	= Arnica chamissonis ssp. foliosa
ARNSOR	= Arnica sororia
ARTBIG	= Artemisia bigelovii
ARTCANB	= Artemisia cana ssp. bolanderi
ARTDOU	= Artemisia douglasiana
ARTDRA	= Artemisia dracunculus
ARTLEN	= Artemisia lentiformis?????
ARTLUD	= Artemisia ludoviciana var albula
ARTLUDL	= Artemisia ludoviciana var ludoviciana
ARTNOV	= Artemisia nova
ARTSPI	= Artemisia spinescens
ARTTRI	= Artemisia tridentata var parishii
ARTTRI	= Artemisia tridentata var tridentata
ARUDON	= Arundo donax
ASCCAL	= Asclepias californica
ASCERO	= Asclepias erosa
ASCFAS	= Asclepias fascicularis
ASCSPE	= Asclepias speciosa
ASCSUB	= Asclepias subulata
ASPOFF	= Asparagus officinalis
ASTACU	= Astragalus acutirostris
ASTARGA	= Astragalus argophyllus var. argophyllus
ASTASC	= Aster ascendens
ASTATRM	= Astragalus atratus var. mensanus
ASTCAS	= Astragalus casei
ASTCOC	= Astragalus coccineus
ASTDIDD	= Astragalus didymocarpus var. didymocarpus
ASTDIDDIS	= Astragalus didymocarpus var. dispermus
ASTEAT	= Aster eatonii
ASTERT	= Astragalus ertterae
ASTFRO	= Aster frondosus
ASTFUN	= Astragalus funereus
ASTGEYG	= Astragalus geyeri var. geyeri
ASTGIL	= Astragalus gilmanii
ASTINT	= Aster integrifolius
ASTINY	= Astragalus inyoensis
ASTJAE	= Astragalus jaegerianus
ASTJOH	= Astragalus johannis-howellii
ASTKEND	= Astragalus kentrophyta var. danaus
ASTKENE	= Astragalus kentrophyta var. elatus
ASTLANH	= Aster lanceolatus ssp. hesperis
ASTLAY	= Astragalus layneae
ASTLENF	= Astragalus lentiginosus var. fremontii
ASTLENK	= Astragalus lentiginosus var. kernensis
ASTLENM	= Astragalus lentiginosus var. micans
ASTLENP	= Astragalus lentiginosus var. piscinensis
ASTLENS	= Astragalus lentiginosus var. sesquimetralis
ASTLENT	= Astragalus lentiformis
ASTLENV	= Astragalus lentiginosus var. variabilis
ASTMOJH	= Astragalus mojavensis var. hemigyrus
ASTMOJM	= Astragalus mojavensis var. mojavensis
ASTMONM	= Astragalus monoensis var. monoensis
ASTNEWN	= Astragalus newberryi var newberryi
ASTOCC	= Aster occidentalis
ASTOOPL	= Astragalus oophorus var. lavinii
ASTOXY	= Astragalus oxyphysus
ASTPACP	= Astragalus pachypus var pachypus
ASTPAN	= Astragalus panamintensis
ASTPAU	= Aster pauciflorus
ASTPLA	= Astragalus platytropis
ASTPREI	= [illegible]

Acronym Key to the Plants of the Naval Air Weapons Station region

ASTPREP = Astragalus preussii var. preussii
ASTPSE = Astragalus pseudiodanthus
ASTPURL = Astragalus purshii var. lectulus
ASTPURT = Astragalus purshii var. tinctus
ASTRAV = Astragalus ravenii
ASTSERS = Astragalus serenoi var. shockleyi
ASTWHIW = Astragalus whitneyi var. whitneyi
ATRARGM = Atriplex argentea var. mohavensis
ATRCAN = Atriplex canescens
ATRCON = Atriplex confertifolia
ATRELEF = Atriplex elegans ssp. fasciculata
ATRHYM = Atriplex hymenelytra
ATRLEN = Atriplex lentiformis var lentiformis
ATRLENT = Atriplex lentiformis var. torreyi
ATRPAR = Atriplex parryi
ATRPHY = Atriplex phyllostegia
ATRPLA = Atrichoseris platyphylla
ATRPOL = Atriplex polycarpa
ATRSEM = Atriplex semibaccata
ATRSER = Atriplex serenana
ATRSPI = Atriplex spinifera
AVEFAT = Avena barbata
AVEFAT = Avena fatua
AVESAT = Avena sativa
BACBRA = Baccharis brachyphylla
BACEMO = Baccharis emoryi
BACSAL = Baccharis salicifolia
BACSAR = Baccharis sarothroides
BACSER = Baccharis sergiloides
BAIMUL = Baileya multiradiata
BAIPAU = Baileya pauciradiata
BAIPLE = Baileya pleniradiata
BALSAG = Balsamorhiza sagittata
BARORT = Barbarea orthoceras
BASHYS = Bassia hyssopifolia
BEBJUNA = Bebbia juncea var. aspera
BERERE = Berula erecta
BERHAE = Berberis haematocarpa
BETOCC = Betula occidentalis
BIDCERC = Bidens cernua var. cernua
BIDFRO = Bidens frondosa
BLEKIN = Blepharidachne kingii
BOTLUN = Botrychium lunaria
BOUBARB = Bouteloua barbata var. barbata
BOUERI = Bouteloua eriopoda
BOUTRI = Bouteloua trifida
BOWINC = Bowlesia incana
BRANIG = Brassica nigra
BRATOU = Brassica tournefortii
BRIARG = Brickellia arguta var. arguta
BRICAL = Brickellia californica
BRIDES = Brickellia desertorum
BRIINC = Brickellia incana
BRIKNA = Brickellia knappiana
BRILON = Brickellia longifolia
BRIMIC = Brickellia microphylla
BRIMUL = Brickellia multiflora
BRIOBLL = Brickellia oblongifolia var. linifolia
BROARI = Bromus arizonicus
BROCARC = Bromus carinatus var. carinatus
BROCAT = Bromus catharticus
BROCIL = Bromus ciliatus
BRODIA = Bromus diandrus
BROELE = Brodiaea elegans
BROINEI = Bromus inermis ssp. inermis
BROJAP = Bromus japonicus
BROLAE = Bromus laevipes
BROMADR = Bromus madritensis ssp. madritensis
BROMADR = Bromus madritensis ssp. rubens
BROTEC = Bromus tectorum
BROTRI = Bromus trinii
BUDUTA = Buddleja utahensis
BURMIC = Bursera microphylla
CAEGIL = Caesalpinia gillesii
CALBRU = Calochortus bruneaunis
CALCAN = Calamagrostis canadensis
CALCIL = Calandrinia ciliata
CALEXC = Calochortus excavatus
CALKEN = Calochortus kennedyi var Kennedyi
CALKEN = Calochortus kennedyi var munzii
CALLEI = Calochortus leichtlinii
CALMON = Calyptridium monandrum
CALPAN = Calochortus panamintensis
CALPAR = Calycoseris parryi
CALSP = Callitriche sp.
CALSTR = Calochortus striatus
CALSTRI = Calamagrostis stricta ssp. inexpansa
CALUMB = Calyptridium umbellatum
CALWRI = Calycoseris wrightii
CALYPARN = Calyptridium parryi var. nevadense

Acronym Key to the Plants of the Naval Air Weapons Station region

CAMARE = Camissonia arenaria
CAMBOOA = Camissonia boothii ssp. alysoides
CAMBOOB = Camissonia boothii ssp. boothii
CAMBOOC = Camissonia boothii ssp. condensata
CAMBOODE = Camissonia boothii ssp. decorticans
CAMBOODE = Camissonia boothii ssp. desertorum
CAMBOOI = Camissonia boothii ssp. inyoensis
CAMBRE = Camissonia brevipes
CAMCAM = Camissonia campestris
CAMCARR = Camissonia cardiophylla var robusta
CAMCHA = Camissonia chamaeneroides
CAMCLAC = Camissonia claviformis ssp. claviformis
CAMCLAF = Camissonia claviformis ssp. funerea
CAMHET = Camissonia heterochroma
CAMKER = Camissonia kernensis ssp kernensis
CAMMUN = Camissonia munzii
CAMPALM = Camissonia palmeri
CAMPALP = Camissonia pallida ssp. pallida
CAMPAR = Camissonia parvula
CAMPTE = Camissonia pterosperma
CAMPUB = Camissonia pubens
CAMPUS = Camissonia pusilla
CAMREF = Camissonia refracta
CAMWALT = Camissonia walkeri ssp. tortilis
CANCAN = Canbya candida
CAPBUR = Capsella bursa-pastoris
CARAQU = Carex aquatilis
CARAQUA = Carex aquatilis var. aquatilis
CARATH = Carex athrostachya
CARAUR = Carex aurea
CARBRE = Cardamine breweri
CARCON = Carex congdonii
CARDIS = Carex disperma
CARDOU = Carex douglasii
CARDRA = Cardaria Draba
CARELE = Carex eleocharis
CARFILE = Carex filifolia var. erostrata
CARFIS = Carex fissuricola
CARFRA = Carex fracta
CARGAR = Carex garberi
CARHAS = Carex hassei
CARHET = Carex heteroneura
CARHETH = Carex heteroneura var. heteroneura
CARINCD = Carex incurviformis var. danaensis
CARJON = Carex jonesii
CARLAN = Carex lanuginosa
CARLENI = Carex lenticularis var. impressa
CARLEP = Carex leporinella
CARLUZ = Carex luzulina
CARLUZ = Carex luzulina
CARMIC = Carex microptera
CARNEB = Carex nebrascensis
CARNOR = Carex norvegica
CARPAPH = Carex parryana var. hallii
CARPET = Carex petasata
CARPRA = Carex praegracilis
CARPRA = Carex praticola
CARPUB = Cardaria pubescens
CARROS = Carex rossii
CARSCO = Carex scopulorum
CARSCOB = Carex scopulorum var. bracteosa
CARSPE = Carex spectabilis
CARSUB = Carex subfusca
CARTIO = Carex tiogana
CARWHI = Carex whitneyi
CASANG = Castilleja angustifolia
CASAPP = Castilleja applegatei var martinii
CASAPPP = Castilleja applegatei ssp pinetorum
CASEXEE = Castilleja exserta ssp exserta
CASEXEV = Castilleja exserta ssp. venusta
CASLAC = Castilleja lacera
CASLIN = Castilleja linariifolia
CASMINM = Castilleja miniata ssp miniata
CASPIL = Castilleja pilosa
CAUCOO = Caulanthus cooperi
CAUCOU = Caulanthus coulteri
CAUCRA = Caulanthus crassicaulis
CAUGLA = Caulanthus glaucus
CAUINF = Caulanthus inflatus var inflatus
CAUJAE = Caulostramina jaegeri
CAUPIL = Caulanthus pilosus
CEACOR = Ceanothus cordulatus
CEAGREV = Ceanothus greggii var vestitus
CEAVELV = Ceanothus velutinus var. velutinus
CEN = Centaurea sp
CENEXA = Centaurium exaltatum
CENINC = Cenchrus incertus
CENLON = Cenchrus longispinus
CENTHU = Centrostegia thurberi
CERFLOF = Cercidium floridum ssp. floridum

Acronym Key to the Plants of the Naval Air Weapons Station region

CERFONV = Cerastium fontanum ssp. vulgare
CERINT = Cercocarpus intricatus
CERLED = Cercocarpus ledifolius
CHAALB = Chamaesyce albomarginata
CHACARC = Chaenactis carphoclinia var. carphoclinia
CHADOU = Chaenactis douglasii var douglasii
CHADOUA = Chaenactis douglasii var. alpina (C. alpina)
CHAFRE = Chaenactis fremontii
CHAMAC = Chaenactis macrantha
CHAMAC = Chamaesyce maculata
CHAMIC = Chamaesyce micromera
CHAMIL = Chamaebatiaria millefolium
CHANAN = Chamaesaracha nana
CHAOCC? = Chamaesyce ocellata var ?
CHAOCC = Chamomilla occidentalis
CHAOCCA = Chamaesyce ocellata var arenicola
CHAPOLH = Chamaesyce polycarpa var. hirtella
CHAPOLP = Chamaesyce polycarpa var polycarpa
CHASAN = Chaenactis santolinoides
CHASET = Chamaesyce setiloba
CHASTES = Chaenactis stevioides
CHASUA = Chamomilla suaveolens
CHAVAL = Chamaesyce vallis-mortae
CHAXAN = Chaenactis xantiana
CHEALB = Chenopodium album
CHEATR = Chenopodium atrovirens
CHECAL = Chenopodium californicum
CHECOV = Cheilanthes covillei
CHEDES = Chenopodium desiccatum
CHEINCO = Chenopodium incanum var. occidentale
CHELEP = Chenopodium leptophyllum
CHEPAR = Cheilanthes parryi
CHESIM = Chenopodium simplex
CHEVIS = Cheilanthes viscida
CHEWOO = Cheilanthes wootonii
CHILIN = Chilopsis linearis
CHLVIR = Chloris virgata
CHOBREB = Chorizanthe brevicornu ssp. brevicornu
CHOBRES = Chorizanthe brevicornu ssp. spathulata
CHOCOR = Chorizanthe corrugata
CHORIG = Chorizanthe rigida
CHOSPI = Chorizanthe spinosa
CHOWAT = Chorizanthe watsonii
CHOXAN = Chorizanthe xantii var xantii
CHRGRA = Chrysothamnus gramineus
CHRNAUA = Chrysothamnus nauseosus ssp. albicaulis
CHRNAUCE = Chrysothamnus nauseosus var ceruminosus
CHRNAUCO = Chrysothamnus nauseosus var consimilis
CHRNAUHO = Chrysothamnus nauseosus var hololeucus
CHRNAUL = Chrysothamnus nauseosus ssp leiospermus
CHRNAUM = Chrysothamnus nauseosus ssp. mohavensis
CHRPAN = Chrysothamnus paniculatus
CHRPAR = Chrysothamnus parryi
CHRSEM = Chrysolepis sempervirens
CHRTER = Chrysothamnus teretifolius
CHRVISP = Chrysothamnus viscidiflorus ssp. puberulus
CHRVISV = Chrysothamnus viscidiflorus ssp. viscidiflorus
CICDOU = Cicuta douglasii
CICINT = Cichorium intybus
CIRAND = Cirsium andersonii
CIRDOUD = Cirsium douglasii var. douglassii
CIRMOH = Cirsium mohavense
CIRNEO = Cirsium neomexicanum
CIROCCV = Cirsium occidentale var. venustum
CIRSCA = Cirsium scariosum
CIRVUL = Cirsium vulgare
CLAMEG = Claytonia megarhiza
CLAPARP = Claytonia parviflora ssp. parviflora
CLAPERPER = Claytonia perfoliata ssp perfoliata
CLARUB = Claytonia rubra
CLAUMB = Claytonia umbellata
CLEBRE = Cleomella brevipes
CLELIG = Clematis ligusticifolia
CLEOBT = Cleomella obtusifolia
CLEPAR = Cleomella parviflora
COLCAL = Collinsia callosa
COLGRA = Collomia grandiflora
COLLIN = Collomia linearis
COLPAR = Collinsia parviflora
COLRAM = Coleogyne ramosissima
COLTIN = Collomia tinctoria
COLTORW = Collinsia torreyi var. wrightii
CONARV = Convolvulus arvensis
CONCAN = Conyza canadensis
CONMAC = Conium maculatum
CORBIG = Coreopsis bigelovii
CORCAL = Coreopsis calliopsidea
CORCALC = Coreopsis californica var californica
CORERE = Cordylanthus eremicus ssp. eremicus
COREREK = Cordylanthus eremicus ssp. kernensis

Acronym Key to the Plants of the Naval Air Weapons Station region

CORKINH = Cordylanthus kingii ssp. helleri
CORMARC = Cordylanthus maritimus ssp. canescens
CORSEL = Cortaderia selloana
CORSERS = Cornus sericea ssp. sericea
CORTEC = Cordylanthus tecopensis
CREINT = Crepis intermedia
CREOCC = Crepis occidentalis
CRERUNH = Crepis runcinata ssp. hallii
CROCAL = Croton californicus
CRYACR = Cryptogramma acrostichoides
CRYAMB = Cryptantha ambigua
CRYANG = Cryptantha angustifolia
CRYBAR = Cryptantha barbigera
CRYCIR = Cryptantha circumscissa
CRYCIRS = Cryptantha circumcissa forma similis
CRYCLO = Cryptantha clokeyi
CRYCON = Cryptantha confertiflora
CRYCOS = Cryptantha costata
CRYDEC = Cryptantha decipiens
CRYDUM = Cryptantha dumetorum
CRYECH = Cryptantha echinella
CRYGRA = Cryptantha gracilis
CRYHOL = Cryptantha holoptera
CRYINT = Cryptantha intermedia
CRYMAR = Cryptantha maritima
CRYMIC = Cryptantha micrantha
CRYMOH = Cryptantha mohavensis
CRYMUR = Cryptantha muricata
CRYNEV = Cryptantha nevadensis
CRYOXY = Cryptantha oxygona
CRYPTE = Cryptantha pterocarya var pterocarya
CRYPTEC = Cryptantha pterocarya var. cycloptera
CRYRAC = Cryptantha racemosa
CRYREC = Cryptantha recurvata
CRYROO = Cryptantha roosiorum
CRYSCO = Cryptantha scoparia
CRYTOR = Cryptantha torreyana
CRYTUM = Cryptantha tumulosa
CRYUTA = Cryptantha utahensis
CRYVIR = Cryptantha virginensis
CRYWAT = Cryptantha watsonii
CUCFOE = Cucurbita foetidissima
CUCPAL = Cucurbita palmata
CUPARI = Cupressus arizonica
CUSDEN = Cuscuta denticulata
CUSNEV = Cuscuta nevadensis
CUSQUA = Cusickiella quadricostata
CYMABO = Cymopterus aboriginum
CYMDES = Cymopterus deserticola
CYMGIL = Cymopterus gilmanii
CYMPANP = Cymopterus panamintensis var. panamintensis
CYMPUR = Cymopterus purpurascens
CYMRIP = Cymopterus ripleyi
CYMTERC = Cymopterus terebinthinus var. californicus
CYNDAC = Cynodon dactylon
CYPNIG = Cyperus niger
CYPNIGC = Cyperus niger var. capitatus
CYPSQU = Cyperus squarrosus
CYSFRA = Cystopteris fragilis
DACGLO = Dactylis glomerata
DALMOL = Dalea mollis
DALMOLLI = Dalea mollissima
DATGLO = Datisca glomerata
DATWRI = Datura wrightii
DEDEUR = Dedeckera eurekensis
DELAND = Delphinium andersonii
DELGRA = Delphinium gracilentum
DELINO = Delphinium inopinum
DELPARP = Delphinium parishii ssp. parishii
DELPARPAL = Delphinium parishii ssp. pallidum
DELPARPUR = Delphinium parryi ssp purpureum?
DESCAEC = Deschampsia cespitosa ssp. cespitosa
DESCAL = Descurainia californica
DESINC = Descurainia incana
DESPIN = Descurainia pinnata
DESSOP = Descurainia sophia
DICCAN = Dicoria canescens
DICCAP = Dichelostemma capitatum
DISSPI = Distichlis spicata
DITCAL = Dithyrea californica
DITNEO = Ditaxis neomexicana
DODALP = Dodecatheon alpinum
DODRED = Dodecatheon redolens
DRAASTA = Draba asterophora var. asterophora
DRACAL = Draba californica
DRACAN = Draba cana
DRACRU = Draba cruciata
DRACUN = Draba cuneifolia
DRAINC = Draba incrassata
DRAMON = Draba monoensis

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DRASHA	=	Draba sharsmithii
DRASIE	=	Draba sierrae
DRASUB	=	Drâba subumbellata
DRYFIL	=	Dryopteris filix-mas
DUDCAL	=	Dudleya calcicola
DUDPULA	=	Dudleya pulverulenta ssp. arizonica
DUDSAXS	=	Dudleya saxosa ssp. saxosa
DUGHOO	=	Dugaldia hoopesii
ECHCOL	=	Echinochloa colonum
ECHCRU	=	Echinochloa crus-galli
ECHENGC	=	Echinocereus englemanii var. chrysocentrus
ECHPOLP	=	Echinocactus polycephalus var. polycephalus
ECHTRI	=	Echinocereus triglochidiatus
ELAANG	=	Elaeagnus angustifolius
ELEBOL	=	Eleocharis bolanderi
ELEMAC	=	Eleocharis macrostachya
ELEPAR	=	Eleocharis parishii
ELEPAU	=	Eleocharis pauciflora
ELEROS	=	Eleocharis rostellata
ELODE	=	Elodea sp.
ELYELO	=	Elytrigia elongata
ELYELYC	=	Elymus elymoides ssp. californicus
ELYELYE	=	Elymus elymoides ssp. brevifolius
ELYELYE	=	Elymus elymoides ssp. elymoides
ELYGLA	=	Elymus glaucus
ELYINTI	=	Elytrigia intermedia ssp. intermedia
ELYLANL	=	Elymus lanceolatus ssp. lanceolatus
ELYPONP	=	Elytrigia pontica ssp. pontica
ELYSAU	=	Elymus saundersii (E. multisetus?, E. elymoides?)
ELYSCR	=	Elymus scribneri
ELYTRAS	=	Elymus trachycaulus ssp. subsecundus
ELYTRAT	=	Elymus trachycaulus ssp. trachycaulus
EMMPEN	=	Emmenanthe penduliflora
ENCACT	=	Encelia actoni
ENCACTX	=	Encelia actonii X E. farinosa
ENCCOV	=	Enceliopsis covillei
ENCFAR	=	Encelia farinosa
ENCFRU	=	Encelia frutescens
ENCFRU	=	Encelia frutescens
ENCNUD	=	Enceliopsis nudicaulis
ENCVIR	=	Encelia virginensis (incl E. v. ssp. virginensis)
EPHASP	=	Ephedra aspera
EPHCAL	=	Ephedra californica
EPHFUN	=	Ephedra funerea
EPHNEV	=	Ephedra nevadensis
EPHVIR	=	Ephedra viridis
EPIANGC	=	Epilobium angustifolium ssp. circumvagum
EPIBRA	=	Epilobium brachycarpum
EPICILC	=	Epilobium ciliatum ssp. ciliatum
EPIGIG	=	Epipactis gigantea
EPIGLA	=	Epilobium glaberrimum
EPIHOW	=	Epilobium howellii
EPILAC	=	Epilobium lactiflorum
EQUARV	=	Equisetum arvense
EQUHYEA	=	Equisetum hyemale ssp. affine
EQULAE	=	Equisetum laevigatum
ERACIL	=	Eragrostis cilianensis
ERACURC	=	Eragrostis curvula var. curvula
ERALEH	=	Eragrostis lehmanniana
ERAMEXV	=	Eragrostis mexicana ssp. virescens
ERAMIN	=	Eragrostis minor
ERAPEC	=	Eragrostis pectinacea
EREEXI	=	Eremalche exilis
EREROT	=	Eremalche rotundifolia
ERESET	=	Eremocarpus setigerus
ERIAMB	=	Eriophyllum ambiguum
ERIANG	=	Eriogonum angulosum
ERIAPH	=	Erigeron aphanactis
ERIBAIB	=	Eriogonum baileyi var. baileyi
ERIBAIP	=	Eriogonum baileyi var praebens
ERIBEA	=	Eriogonum beatleyae
ERIBIF	=	Eriogonum bifurcatum
ERIBLO	=	Ericameria bloomeri
ERIBRA	=	Eriogonum brachyanthum
ERIBRAC	=	Eriogonum brachypodum
ERIBREB	=	Erigeron breweri var. breweri
ERIBREP	=	Erigeron breweri var. porphyreticus
ERIBREP	=	Erigeron cocinnus
ERICAE	=	Eriogonum caespitosum
ERICAL	=	Erigeron calvus
ERICER	=	Eriogonum cernuum
ERICGIL	=	Ericameria gilmanii
ERICLO	=	Erigeron clokeyi
ERICOM	=	Erigeron compositus
ERICON	=	Eriogonum contiguum
ERICON	=	Eriophyllum confertiflorum
ERICOOC	=	Ericameria cooperi var. cooperi
ERICOOX	=	Ericameria cooperi X E. linearfolia
ERICOU	=	Erigeron coulteri
ERICUN	=	Ericameria cuneata

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ERIDAV	= Eriogonum davidsonii
ERIDEF	= Eriogonum deflexum var deflexum
ERIDEFB	= Eriogonum deflexum ssp. baratum
ERIDEFN	= Eriogonum deflexum ssp. nevadense
ERIDEFR	= Eriogonum deflexum ssp. rectum
ERIDENM	= Eriastrum densifolium var. mohavense
ERIDIF	= Eriastrum diffusum
ERIDIS	= Ericameria discoidea
ERIDIV	= Erigeron divergens
ERIELAE	= Eriogonum elatum var. elatum
ERIELAV	= Eriogonum elatum var. villosum
ERIERE	= Eriogonum eremicola
ERIEREE	= Eriastrum eremicum ssp. eremicum
ERIESME	= Eriogonum esmeraldense var. esmeraldense
ERIFASF	= Eriogonum fasciculatum ssp. flavoride
ERIFASP	= Eriogonum fasciculatum ssp. polifolium
ERIFOL	= Erigeron foliosus var?
ERIGIL	= Eriogonum gilmanii
ERIGLA	= Eriogonum glandulosum
ERIGRA	= Eriogonum gracillimum
ERIHEEA	= Eriogonum heermannii var. argense
ERIHEEF	= Eriogonum heermannii var. floccosum
ERIHEEH	= Eriogonum heermannii var. heermannii
ERIHEEHU	= Eriogonum heermannii var. humilius
ERIHEES	= Eriogonum heermannii var. sulcatum
ERIHOFH	= Eriogonum hoffmannii var. hoffmannii
ERIHOFR	= Eriogonum hoffmannii var. robustius
ERIINFD	= Eriogonum inflatum var. deflatum
ERIINFI	= Eriogonum inflatum var. inflatum
ERIINT	= Eriogonum intrafractum
ERIKENP	= Eriogonum kennedyi var. purpusii
ERILAN	= Eriophyllum lanosum
ERILIN	= Ericameria linearifolia
ERIMAC	= Eriogonum maculatum
ERIMICA	= Eriogonum microthecum var. ambigium
ERIMICL	= Eriogonum microthecum var. lapidicola
ERIMICLA	= Eriogonum microthecum var. laxiflorum
ERIMICP	= Eriogonum microthecum var. panamintense
ERIMICS	= Eriogonum microthecum var. simpsonii
ERIMOH	= Eriogonum mohavense
ERIMOH	= Eriophyllum mohavense
ERINAN	= Ericameria nana
ERINID	= Eriogonum nidularium
ERINUDD	= Eriogonum nudum ssp deductum
ERINUDN	= Eriogonum nudum var. nudum
ERINUDP	= Eriogonum nudum var. pubiflorum
ERINUDW	= Eriogonum nudum var. westonii
ERINUM	= Eriogonum nummulare
ERINUT	= Eriogonum nutans
ERIOCHA	= Eriogonum ochrocephalum var. alexanderae
ERIOVAN	= Eriogonum ovalifolium var. nivale
ERIOVAO	= Eriogonum ovalifolium var. ovalifolium
ERIPAL	= Eriogonum palmerianum
ERIPAN	= Eriogonum panamintense (ssp panamintense)
ERIPANM	= Eriogonum panamintense (ssp mensicola)
ERIPANR	= Eriogonum panamintense (E. racemosum)
ERIPANRU	= Eriogonum panamintense (E. rupinum)
ERIPERC	= Erigeron peregrinus ssp. callianthemus
ERIPIL	= Erioneuron pilosum
ERIPLU	= Eriogonum plumatella
ERIPRI	= Eriophyllum pringlei
ERIPRI	= Eriophyllum pringlei
ERIPUB	= Eriogonum puberulum
ERIPUL	= Erioneuron pulchellum
ERIPUMI	= Erigeron pumilus var. intermedius
ERIPUS	= Eriogonum pusillum
ERIREN	= Eriogonum reniforme
ERIRIX	= Eriogonum rixfordii
ERISAP	= Eriastrum sapphirinum.
ERISAP	= Eriastrum sapphirinum
ERISAX	= Eriogonum saxatile
ERISHOS	= Eriogonum shockleyi var. shockleyi
ERISPA	= Eriastrum sparsiflorum
ERISPER	= Eriogonum spergulinum var. reddingianum
ERISPER	= Eriogonum spergulinum var. spergulinum
ERISUF	= Ericameria suffruticosa
ERITHO	= Eriogonum thomasii
ERITRI	= Eriogonum trichopes var hooveri
ERITRIT	= Eriogonum trichopes var trichopes
ERIUMBC	= Eriogonum umbellatum var chlorothamnus
ERIUMBN	= Eriogonum umbellatum var. nevadense
ERIUMBS	= Eriogonum umbellatum var subaridum
ERIUMBU	= Eriogonum umbellatum var. umbellatum
ERIUMBV	= Eriogonum umbellatum var versicolor
ERIUNCU	= Erigeron uncialis var. uncialis
ERIVIR	= Eriogonum viridescens
ERIWAL	= Eriophyllum wallacei
ERIWIL	= Eriastrum wilcoxii
ERIWRIO	= Eriogonum wrightii var olancherse
ERIWRIS	= Eriogonum wrightii var subscaposum

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RIWRIW = Eriogonum wrightii var wrightii
ROCIC = Erodium cicutarium
ROTEX = Erodium texanum
RYCAP = Erysimum capitatum ssp. capitatum
RYCAPP = Erysimum capitatum ssp. perenne
SCGLY = Eschscholzia californica
SCGLY = Eschscholzia glyptosperma
SCMINC = Eschscholzia minutiflora ssp. covillei
SCMINM = Eschscholzia minutiflora ssp minutiflora
SCMINT = Eschscholzia minutiflora ssp twisselmannii
SCPAR = Eschscholzia parishii
UCCHRB = Eucrypta chrysanthemifolia var. bipinnatifida
UCMIC = Eucrypta micrantha
UCURE = Eucnide urens
UPINC = Euphorbia incisa
UTOCC = Euthamia occidentalis
AGLAE = Fagonia laevis
ENUTA = Fendlerella utahensis
ERCYLL = Ferocactus cylindraceus var. lecontei
ESPRA = Festuca pratensis
ESRUB = Festuca rubra
FILARI = Filago arizonica
ILCAL = Filago californica
ILDEP = Filago depressa
IMTHE = Fimbristylis thermalis
ORPUB = Forestiera pubescens
OUSPLS = Fouquieria splendens ssp. splendens
RAANO = Fraxinus anomala
FRASAL = Frankenia salina
FRAVEL = Fraxinus velutina
FRECALC = Fremontodendron californicum ssp californicum
FRIPIN = Fritillaria pinetorum
FULPAR = Fallugia paradoxa
GALARG = Galium argense
GALARG = Galium hilendiae ssp. hilendiae
GALBIF = Galium bifolium
GALHILC = Galium hilendiae ssp. carneum
GALHYPT = Galium hypotrichium ssp. tomentellum
GALMAT = Galium matthewsii
GALPAR = Galium parishii
GALSTEE = Galium stellatum var. eremicum
GALTRI = Galium trifidum
GALTRIFL = Galium triflorum
GAYDEC = Gayophytum decipiens
GAYDIFP = Gayophytum diffusum var. parviflorum
GENPRO = Gentiana prostrata
GENTHOL = Gentianopsis holopetala
GERCAN = Geraea canescens
GERRIC = Geranium richardsonii
GEUMAC = Geum macrophyllum
GILALIA = Gilia aliquanta ssp aliquanta
GILALIB = Gilia aliquanta ssp breviloba
GILBRE = Gilia brecciarum var argusana
GILBRE = Gilia brecciarum var brecciarum
GILBRE = Gilia brecciarum var neglecta
GILCAM = Gilia campanulata
GILCANC = Gilia cana ssp. cana
GILCANS = Gilia cana ssp speciformis
GILCANS = Gilia cana ssp. speciosa
GILCANT = Gilia cana ssp triceps
GILCAP = Gilia capitata
GILCLO = Gilia clokeyi
GILFIL = Gilia filiformis
GILHUT = Gilia hutchinsifolia
GILINC = Gilia inconspicua
GILINT = Gilia interior
GILINY = Gilia inyoensis
GILLAT = Gilia latifolia
GILLATC = Gilia latiflora ssp. cosana
GILLATD = Gilia latiflora ssp davyii
GILLATE = Gilia latiflora ssp elongata
GILLEP = Gilia leptomeria
GILLEP = Gilia leptomeria
GILLEPP = Gilia leptantha ssp purpusii
GILLUT = Gilmania luteola
GILMAL = Gilia malior
GILMIC = Gilia micromeria
GILMIN = Gilia minor
GILMOD = Gilia modocensis
GILOCHB = Gilia ochroleuca ssp bizonata
GILOCHO = Gilia ochroleuca ssp orchroleuca
GILOPT = Gilia opthalmoides
GILRIP = Gilia ripleyi
GILSCO = Gilia scopulorum
GILSIN = Gilia sinuata
GILSTE = Gilia stellata
GILSUB = Gilia subacaulis
GILTRA = Gilia transmontana
GLYELA = Glyceria elata
GLYGRA = Glyceria grandis

Acronym Key to the Plants of the Naval Air Weapons Station region

GLYLEP = Glycyrrhiza lepidota
GLYMAR = Glyptopleura marginata
GLYSTR = Glyceria striata
GNACANB = Gnaphalium canescens ssp. beneolens
GNACANC = Gnaphalium canescens ssp canescens
GNALUT = Gnaphalium luteo-album
GNAPAL = Gnaphalium palustre
GNASTR = Gnaphalium stramineum
GOOLUT = Goodmania luteola
GRASPI = Grayia spinosa
GRIFRA = Grindelia fraxino-pratensis
GRISQU = Grindelia squarrosa var. serrulata
GUILAS = Guillenia lasiophylla
GUTMIC = Gutierrezia microcephala
GUTSAR = Gutierrezia sarothrae
HAC = Hackelia
HACBRE = Hackelia brevicula
HACMIC = Hackelia micrantha
HACSHA = Hackelia sharsmithii
HALJEA = Halimolobus jaegeri
HALVIR = Halimolobos virgata
HECSHO = Hecastocleis shockleyi
HELANN = Helianthus annuus
HELCONC = Heliotropium convolvulaceum var. californicum
HELCUR = Heliotropium curassavicum var oculatum
HELMULN = Heliomeris multiflora var. nevadensis
HELNUT = Helianthus nuttallii
HEMARI = Hemizonia arida
HEMARI = Hemizonia mohavensis
HESCOMC = Hesperostipa comata ssp. comata
HESUND = Hesperocaulis undulata
HETSESE-CF = Heterotheca sessiliflora ssp. echioides
HEUDUR = Heuchera duranii
HEURUBA = Heuchera rubescens var. alpicola
HOLDIS = Holodiscus discolor
HOLLAN = Holcus lanatus
HOLMIC = Holodiscus microphyllus
HORBRA = Hordeum branchyantherum
HORCON = Horkeliella congdonis
HORCON = Horkeliella congdonis
HORFUS = Horkelia fusca
HORHIS = Horkelia hispidula
HORINT = Hordeum intercedens
HORJUB = Hordeum jubatum
HORMARG = Hordeum marinum ssp. gussoneanum
HORMURG = Hordeum murinum ssp. glaucum
HORMURL = Hordeum murinum ssp. leporinum
HORVUL = Hordeum vulgare
HULVESI = Hulsea vestita ssp. inyoensis
HUTPRO = Hutchinsia procumbens
HYMFIL = Hymenopappus filifolius
HYMSALP = Hymenoclea salsola var patula
HYMSALS = Hymenoclea salsola var. salsola
HYPANA = Hypericum anagalloides
HYPEMO = Hyptis emoryi
IMPBRE = Imperata brevifolia
IPOAGG = Ipomopsis aggregata
IPOARI = Ipomopsis arizonica
IPODEP = Ipomopsis depressa
IPOPOL = Ipomopsis polycladon
IRIMIS = Irismissouriensis
ISOACR = Isocoma acradenia var eremophila
ISOACRA = Isocoma acradenius ssp acradenius
ISOARB = Isomeris arborea
IVAACE = Iva acerosa
IVAAXI = Iva axillaris
IVAAXIR = Iva axillaris ssp. robustior
IVEARIA = Ivesia arizonica var. arizonica
IVECAM = Ivesia campestris
IVEKINK = Ivesia kingii var. kingii
IVESAX = Ivesia saxosa
JAMAMER = Jamesia americana var. rosea
JUNBAL = Juncus balticus
JUNBUFB = Juncus bufonius var. bufonius
JUNCOO = Juncus cooperi
JUNCOVO = Juncus covillei var. obtusatus
JUNDRU = Juncus drummondii
JUNDUB = Juncus dubius
JUNHEMA = Juncus hemiendytus var. abjectus
JUNMAC = Juncus macrandrus
JUNMER = Juncus mertensianus
JUNMEX = Juncus mexicanus
JUNNEV = Juncus nevadensis
JUNNOD = Juncus nodosus
JUNOCCO = Juniperus occidentalis var. occidentalis
JUNORT = Juncus orthophyllus
JUNOST = Juniperus osteosperma
JUNPAR = Juncus parryi
JUNSAX = Juncus saximontanus
JUNTOR = Juncus torreyi

Acronym Key to the Plants of the Naval Air Weapons Station region

JUNXIP = Juncus xiphioides
KALPOL = Kalmia polifolia
KECBREB = Keckiella breviflora var breviflora
KECROTR = Keckiella rothrockii var. rothrockii
KOBBEL = Kobresia bellardii
KOCAME = Kochia americana
KOCCAL = Kochia californica
KOCSCO = Kochia scoparia
KOEMAC = Koeleria macrantha
KRAERE = Krameria erecta
KRAGRA = Krameria grayi
KRALAN = Krascheninnikovia lanata
LACSER = Lactuca serriola
LANSETP = Langioisia setosisima ssp. punctata
LANSETS = Langloisia setosisima ssp setosisima
LAPREDR = Lappula redowskii var. redowskii
LARTRI = Larrea tridentata
LASCAL = Lasthenia californica
LASCAL = Lasthenia californica
LASLEP = Lasthenia leptalea
LASMIC = Lasthenia microglossa
LATLANA = Lathyrus lanszwertii var. aridus
LATLAT = Lathyrus latifolius
LATSUL = Lathyrus sulphureus
LAYGLA = Layia glandulosa
LEDGLA = Ledum glandulosum
LEEORY = Leersia oryzoides
LEMNA = Lemna sp.
LEPCAM = Lepidium campestre
LEPDEN = Lepidium densiflorum
LEPFAS = Leptochloa fasicularis
LEPFLAF = Lepidium flavum var. flavum
LEPFREF = Lepidium fremontii var fremontii
LEPFRES = Lepidium fremontii var stipitatum
LEPLASL = Lepidium lasiocarpum var. lasiocarpum
LEPPER = Lepidium perfoliatum
LEPPUN = Leptodactylon pungens
LEPSQU = Lepidospartum squamatum
LEPUNI = Leptochloa uninerva
LEPVIRP = Lepidium virginicum var. pubescens
LEPVIRV = Lepidium virginicum var. virginicum
LESKINK = Lequerella Kingii ssp kingii
LESKINL = Lequerella Kingii ssp latifolia
LESLEM = Lessingia lemmonii
LESLEML = Lessingia lemmonii var lemmonii
LESLEMR = Lessingia lemmonii var peirsonii
LESLEMR = Lessingia lemmonii var. ramulosissima
LEWDIS = Lewisia disepala
LEWRED = Lewisia rediviva
LEWTRI = Lewisia triphylla
LEYCIN = Leymus cinereus
LEYCON = Leymus condensatus
LEYSALM = Leymus salinus var mohavensis
LEYTRI = Leymus triticoides
LIGGRA = Ligusticum grayi
LILKEL = Lilium kelleyanum
LILPAR = Lilium parvum
LILPARD = Lilium pardalinum
LINARE = Linanthus arenicola
LINAUR = Linanthus aureus var aureus
LINAURD = Linanthus aureus var. decorus
LINBIG = Linanthus bigelovii
LINBRE = Linanthus breviculus
LINCIL = Linanthus ciliatus
LINDEM = Linanthus demissus
LINDIC = Linanthus dichotomus
LINJON = Linanthus jonesii
LINLEW = Linum lewisii
LINLIN = Linanthus liniflorus
LINNUT = Linanthus nuttallii
LINOBL = Linanthus oblanceolatus
LINPAC = Linanthus pachyphyllus
LINPAR = Linanthus parryae
LINPAR = Linanthus parviflorus
LOBCARP = Lobelia cardinalis var. pseudosplendens
LOEMAT = Loeseliastrum matthewsii
LOESCH = Loeseliastrum schottii
LOESQUA = Loeflingia squarrosa var. artemisiarum
LOESQUS = Loeflingia squarrosa var. squarrosa
LOMDISD = Lomatium dissectum var. dissectum
LOMDISM = Lomatium dissectum var. multifidum
LOMFEOI = Lomatium feoniculaceum ssp. inyoense
LOMFIMF = Lomatium foeniclaceum var fimbriatum
LOMMOH = Lomatium mohavense
LOMNEVP = Lomatium nevadense var parishii
LOMPAR = Lomatium parryi
LOMRIG = Lomatium rigidum
LOMSHE = Lomatium shevockii
LOMUTR = Lomatium utriculatum
LOTCOR = Lotus corniculatus

Acronym Key to the Plants of the Naval Air Weapons Station region

LOTHUM	= Lotus humistratus	LYTCAL	= Lythrum californicum
LOTOBLO	= Lotus oblongifolius var. oblongifolius	MACARI	= Machaeranthera arida
LOTPRO	= Lotus procumbens	MACCANC	= Machaeranthera canescens var. canescens
LOTPROJ	= Lotus procumbens var. jepsonii	MACCANL	= Machaeranthera canescens var leucanthemifolia
LOTPURP	= Lotus purshianus var. purshianus	MACCAR	= Machaeranthera carnosa
LOTRIG	= Lotus rigidus	MADELED	= Madia elegans ssp. densifolia
LOTSTR	= Lotus strigosus	MADGLO	= Madia glomerata
LUPAND	= Lupinus andersonii	MADMIN	= Madia minima
LUPARG	= Lupinus argenteus	MALCOU	= Malacothrix coulteri
LUPARGH	= Lupinus argenteus var. heteranthus	MALFRE	= Malacothamnus fremontii.
LUPARGME	= Lupinus argenteus var. meionanthus	MALGLA	= Malacothrix glabrata
LUPARGMO	= Lupinus argenteus var. montigenus	MALNEG	= Malva neglecta
LUPARI	= Lupinus arizonicus	MALSON	= Malacothrix sonchoides
LUPBIC	= Lupinus bicolor	MALSTE	= Malacothrix stebbinsii
LUPBRE	= Lupinus brevicaulis	MAMTET	= Mammillaria tetrancistra
LUPCON	= Lupinus concinnus	MARFAB	= Marah fabaceus
LUPDUR	= Lupinus duranii	MARFABA	= Marah fabaceus ssp. agrestis
LUPEXCE	= Lupinus excubitus var. excubitus	MARPAR	= Marina parryi
LUPEXCM	= Lupinus excubitus var. medius	MARVUL	= Marrubium vulgare
LUPFLA	= Lupinus flavoculatus	MAUPET	= Maurandya petrophila
LUPFUL	= Lupinus fulcratus	MEDLUP	= Medicago lupulina
LUPGRA	= Lupinus gracilentus	MEDSAT	= Medicago sativa
LUPHOL	= Lupinus holmgrenanus	MELALB	= Melilotus alba
LUPLATC	= Lupinus latifolius var. columbianus	MELBUL	= Melica bulbosa
LUPLEPC	= Lupinus lepidus var. confertus	MELFRU	= Melica frutescens
LUPLEPCU	= Lupinus lepidus var. culbertsonii	MELIMP	= Melica imperfecta
LUPMAGG	= Lupinus magnificus var. glarecola	MELIND	= Melilotus indicus
LUPMAGH	= Lupinus magnificus var. hesperius	MELOFF	= Melilotus officinalis
LUPMAGM	= Lupinus magnificus var. magnificus	MELSTR	= Melica stricta
LUPMICD	= Lupinus microcarpus var. densiflorus	MENALB	= Mentzelia albicaulis
LUPMICH	= Lupinus microcarpus var. horizontalis	MENARV	= Mentha arvensis
LUPMICM	= Lupinus microcarpus var. microcarpus	MENCON	= Mentzelia congesta
LUPODO	= Lupinus odoratus	MENDIS	= Mentzelia dispersa
LUPPAD	= Lupinus padre-crowleyi	MENERE	= Mentzelia eremophila
LUPPOLB	= Lupinus polyphyllus Lindley var. burkie	MENINV	= Mentzelia involucrata
LUPPRAP	= Lupinus pratensis var. pratensis	MENLAE	= Mentzelia laevicaulis
LUPRUB	= Lupinus ruber	MENORE	= Mentzelia oreophila
LUPSHO	= Lupinus shockleyi	MENPIP	= Mentha piperita
LUPSUB	= Lupinus subvexus	MENPUB	= Mentzelia puberula
LUZCOM	= Luzula comosa	MENSPIN	= Menodora spinescens
LUZPAR	= Luzula parviflora	MENSPIS	= Mentha spicata var. spicata
LYCAME	= Lycopus americanus	MENTRIC	= Mentzelia tricuspis
LYCAND	= Lycium andersonii	MENTRID	= Mentzelia tridentata
LYCCOO	= Lycium cooperi	MENVEA	= Mentzelia veatchiana
LYCPALO	= Lycium pallidum var. oliglspermum	MENXPIP	= Mentha xpiperita

Acronym Key to the Plants of the Naval Air Weapons Station region

MICNUT	= Microseris nutans
MIMAUR	= Mimulus aurantiacus
MIMBIG	= Mimulus bigelovii
MIMBRE	= Mimulus breweri
MIMCAR	= Mimulus cardinalis
MIMFRE	= Mimulus fremontii
MIMGLAU	= Mimulus glabratus ssp. utahensis
MIMGUT	= Mimulus guttatus
MIMLEW	= Mimulus lewisii
MIMMEP	= Mimulus mephiticus
MIMMOH	= Mimulus mohavensis
MIMPAL	= Mimulus palmeri
MIMPAR	= Mimulus parishii
MIMPAR	= Mimulus parryi
MIMPIL	= Mimulus pilosus
MIMPRI	= Mimulus primuloides
MIMRUB	= Mimulus rubellus
MIMRUP	= Mimulus rupicola
MIMSHE	= Mimulus shevockii
MIMSUK	= Mimulus suksdorfii
MIMTIL	= Mimulus tilingii
MINOBT	= Minuartia obtusiloba
MIRBIG	= Mirabilis bigelovii
MIRBIGB	= Mirabilis bigelovii var. bigelovii
MIRBIGR	= Mirabilis bigelovii var. retrorsa
MIRMULG	= Mirabilis multiflora var glandulosa
MIRMULP	= Mirabilis multiflora var pubescens
MITBRE	= Mitella breweri
MOHBRE	= Mohavea breviflora
MOHCON	= Mohavea confertiflora
MONBEL	= Monoptilon bellidiforme
MONBELIO	= Monoptilon bellioides
MONBEN	= Monardella beneolens
MONCHA	= Montia chamissoi
MONEXI	= Monardella exilis
MONLIN	= Monardella linioides
MONLINL	= Monardella linoides ssp. linoides
MONNUT	= Monolepis nuttalliana
MONODOO	= Monardella odoratissima ssp. odoratissima
MONODOP	= Monardella odoratissima ssp. pallida
MONSPA	= Monolepis spathulata
MORALB	= Morus alba
MOSS	= moss
MUCPER	= Mucronea perfoliata
MUHAND	= Muhlenbergia andina
MUHASP	= Muhlenbergia asperifolia
MUHFIL	= Muhlenbergia filiformis
MUHMIN	= Muhlenbergia microsperma
MUHMIN	= Muhlenbergia minutissima
MUHPOR	= Muhlenbergia porteri
MUHRIC	= Muhlenbergia richardsonis
MUHRIG	= Muhlenbergia rigens
MUICOR	= Muilla coronata
MUIMAR	= Muilla maritima
MUSA	= Musa sp.
MYOSO	= Myosotus sp.
NAMARE	= Nama aretioides
NAMDEM	= Nama demissum
NAMDEND	= Nama densum var. densum
NAMDEP	= Nama depressum
NAMPUS	= Nama pusillium
NAMROT	= Nama rothrockii
NAVBRE	= Navarretia breweri
NEMBRE	= Nemophila breviflora
NEMGLAG	= Nemacladus glanduliferus var glanduliferus
NEMGLAO	= Nemacladus glanduliferus var. orientalis
NEMGRA	= Nemacladus gracilis
NEMMENI	= Nemophila menziesii ssp. integrifolia
NEMRUB	= Nemacladus rubescens
NEMSIG	= Nemacladus sigmoideus
NICATT	= Nicotiana attenuata
NICOBT	= Nicotiana obtusifolia
NICOCC	= Nicolletia occidentalis
NITMOH	= Nitrophila mohavensis
NITOCC	= Nitrophila occidentalis
NOTALP	= Nothocalais alpestris
OENCALA	= Oenothera californica ssp. avita
OENCALE	= Oenothera californica ssp. eurekensis
OENDEL	= Oenothera deltoides
OENELAHI	= Oenothera elata ssp. hirsutissima
OENELAHO	= Oenothera elata ssp. hookeri
OENMARC	= Oenothera caespitosa ssp. crinita
OENMARM	= Oenothera caespitosa ssp. marginata
OENPRI	= Oenothera primiveris
OLILIN	= Oligomeris linifolia
OPUACAC	= Opuntia acanthocarpa var. coloradensis
OPUBASB	= Opuntia basilaris var. basilaris
OPUBIG	= Opuntia biglovii
OPUECH	= Opuntia echinocarpa
OPUERIE	= Opuntia erinacea var. erinacea

Acronym Key to the Plants of the Naval Air Weapons Station region

OPUERIU = Opuntia erinacea var ursina
OPUERIU = Opuntia erinacea var. utahensis
OPUPHA = Opuntia phaeacantha
OPUPUL = Opuntia pulchella
OPURAM = Opuntia ramosissima
OROCOOC = Orobanche cooperi ssp cooperi
OROCOR = Orobanche californica ssp feudgei
OROCOR = Orobanche corymbosa
OROFAS = Orobanche fasciculata
OROPARP = Orobanche parishii ssp parishii
OROUNI = Orobanche uniflora
OROVALV = Orobanche valida ssp valida
ORTCUSC = Orthocarpus cuspidatus ssp. copelandii
ORYNEV = Oryctes nevadensis
OSMCHI = Osmorhiza chilensis
OSMOCC = Osmorhiza occidentalis
OXACOR = Oxalis corniculata
OXYDEFS = Oxytropis deflexa var. sericea
OXYDEN = Oxytheca dendroidea
OXYDIG = Oxyria digyna
OXYPER = Oxytheca perfoliata
OXYWAT = Oxytheca watsonii
PALARIA = Palafoxia arida var. arida
PARCAL = Parishella californica
PARHESH = Parietaria hespera var hespera
PARVIT = Parthenocissus vitacea
PASDIA = Paspalum dialatum
PASDIS = Paspalum distichum
PECHET = Pectocarya heterocarpa
PECLINF-CF = Pectocarya linearis ssp. ferocula
PECPAPP = Pectis papposa var. papposa
PECPEN = Pectocarya penicillata
PECPLA = Pectocarya platycarpa
PECREC = Pectocarya recurvata
PECSET = Pectocarya setosa
PEDCAS = Pediomelum castoreum
PEDCRE = Pedicularis crenulata
PEDSEM = Pedicularis semibarbata
PEGHAR = Peganum harmala
PELBRE = Pellaea breweri
PELMUCC = Pellaea mucronata ver californica
PENALB = Penstemon albomarginatus
PENBAR = Penstemon barnebyi
PENCAL = Penstemon calcareus
PENFLO = Penstemon floridus var austinii
PENFRUA = Penstemon fruticiformis var. amargosae
PENFRUF = Penstemon fruticiformis var. fruticiformis
PENHETH = Penstemon heterodoxus var. heterodoxus
PENINC = Penstemon incertus
PENLAE = Penstemon laetus
PENMON = Penstemon monoensis
PENNEW = Penstemon newberryi
PENPALP = Penstemon palmeri var. palmeri
PENPAP = Penstemon papillatus
PENPAT = Penstemon patens
PENROS = Penstemon rostriflorus
PENRYDO = Penstemon rydbergi var. oreocharis
PENSPE = Penstemon speciosus
PENSTE = Penstemon stephensii
PENTRIT = Pentagramma triangularis ssp. triangularis
PEREMO = Perityle emoryi
PERINY = Perityle inyoensis
PERMEGO = Perityle megalocephala var. oligophylla
PERPAR = Perideridia parishii
PERVIL = Perityle villosa
PETCAE = Petrophyton caespitosum ssp acuminatum
PETCAE = Petrophyton caespitosum ssp caespitosum
PETNIT = Petalonyx nitidus
PETTHO = Peteria thompsoniae
PETTHUG = Petalonyx thurberi ssp. gilmanii
PETTHUT = Petalonyx thurberi ssp. thurberi
PEUSCH = Peucephyllum schottii
PEUSCH = Peucephyllum schottii
PHAAFF = Phacelia affinis
PHAAMA = Phacelia amabilis
PHAANE = Phacelia anelsonii
PHABICB = Phacelia bicolor var. bicolor
PHACAL = Phacelia calthifolia
PHACAMV = Phacelia campanularia var. vasiformis
PHACRE = Phacelia crenulata
PHACRY = Phacelia cryptantha
PHACUR = Phacelia curvipes
PHADIS = Phacelia distans
PHAFRE = Phacelia fremontii
PHAHASC = Phacelia hastata var. compacta
PHAHETV = Phacelia heterophylla ssp. virgata
PHAHUM = Phacelia humilis
PHAHYD = Phacelia hydrophylloides
PHAIMB = Phacelia imbricata
PHAINY = Phacelia inyoensis

Acronym Key to the Plants of the Naval Air Weapons Station region

PHAIVE = Phacelia ivesiana
PHALEM = Phacelia lemmonii
PHAMIN = Phalaris minor
PHAMON = Phacelia monoensis
PHAMUS = Phacelia mustelina
PHANAS = Phacelia nashiana
PHANEG = Phacelia neglecta
PHANOV = Phacelia novenmillensis
PHAPAC = Phacelia pachyphylla
PHAPAR = Phacelia parishii
PHAPED = Phacelia pedicellata
PHAPER = Phacelia perityoides
PHAPULG = Phacelia pulchella var. goodingii
PHARAME = Phacelia ramosissima var. eremophila
PHARAMS = Phacelia ramosissima var. subglabra
PHAROT = Phacelia rotundifolia
PHATAN = Phacelia tanacetifolia
PHAVAL = Phacelia vallis-mortae
PHIMIC = Philadelphus microphyllus
PHLALP = Phleum alpinum
PHLCON = Phlox condensata
PHLDIF = Phlox diffusa
PHLDIS = Phlox dispersa
PHLGRA = Phlox gracilis
PHLHOOC = Phlox hoodii ssp canescens
PHLSTA = Phlox stansburyi
PHOARE = Pholisma arenarium
PHOCAL = Phoradendron californicum
PHOCHE = Phoenicaulis cheiranthoides
PHODEN = Phoradendron densum
PHOMEM = Pholistoma membranaceum
PHRAUS = Phragmites australis
PHYBRE = Phyllodoce breweri
PHYCHA = Physaria chambersii
PHYCRAC = Physalis crassifolia var. crassifolia
PHYCRAC = Physalis hederifolia var. fendleri
PINALB = Pinus albicaulis
PINCONM = Pinus contorta ssp. murrayana
PINFLE = Pinus flexilus
PINJEF = Pinus jeffreyi
PINLON = Pinus longaeva
PINMON = Pinus monophylla
PINPON = Pinus ponderosa
PIPMIC = Piptatherum micranthum
PLAARI = Plagiobothrys arizonicus
PLACAL = Platystemon californicus
PLACAN = Plagiobothrys canescens
PLACUS = Plagiobothrys cusickii
PLAGLO = Plagiobothrys glomeratus
PLAHIS = Plagiobothrys hispidus
PLAJON = Plagiobothrys jonesii
PLAKINH = Plagiobothrys kingii var. harknessii
PLAKINK = Plagiobothrys kingii var kingii
PLALAN = Plantago lanceolata
PLALEP = Plagiobothrys Leptocladus
PLALEU = Platanthera leucostachys
PLAMAJ = Plantago major
PLAOVA = Plantago ovata
PLAPAR = Plagiobothrys parishii
PLAPAT = Plantago patagonica
PLARAC = Platanus racemosa
PLASAL = Plagiobothrys salsus
PLASPA = Platanthera sparsiflora
PLEJAM = Pleuraphis jamesii
PLEPLU = Pleurocoronis pluriseta
PLERIG = Pleurophis rigida
PLUSER = Pluchea sericea
POAABRM = Poa abbreviata ssp. marshii
POAABRP = Poa abbreviata ssp. pattersonii (P. pattersonii)
POAANN = Poa annua
POABIG = Poa bigelovii
POACOM = Poa compressa
POAFENL = Poa fendleriana ssp. longiligula
POALEPL = Poa leptocoma ssp. leptocoma
POAPAL = Poa palustris
POAPRAP = Poa pratensis ssp. pratensis
POASECS = Poa secunda ssp. secunda
POAWHE = Poa wheeleri
PODNEV = Podistera nevadensis
POLAMPE = Polygonum amphibium var. emersum
POLARE = Polygonum arenastrum
POLBIS = Polygonum bistortoides
POLCAL = Polemonium californicum
POLCHA = Polemonium chartaceum
POLDOU = Polygonum douglasii
POLDOUD = Polygonum douglasii ssp. douglasii
POLDOUJ = Polygonum douglasii ssp. johnstonii
POLDOUM = Polygonum douglasii ssp. majus
POLHET = Polygala heterorhyncha
POLINT = Polypogon interruptus

Acronym Key to the Plants of the Naval Air Weapons Station region

POLMON = Polypogon monspeliensis
POLPOLK = Polygonum polygaloides ssp. kelloggii
POLPUN = Polygonum punctatum
POPANG = Populus angustifolia
POPBALT = Populus balsamifera ssp. trichocarpa
POPFREF = Populus fremontii ssp. fremontii
POPTRE = Populus tremuloides
PORGRA = Porophyllum gracile
POROLE = Portulaca oleracea
POTBIE = Potentilla biennis
POTCON = Potentilla concinna
POTCRI = Potamogeton crispus
POTDIVD = Potentilla diversifolia var. diversifolia
POTDRUD = Potentilla drummondii ssp. drummondii
POTFIL = Potamogeton filiformis
POTFOLF = Potamogeton foliosus var foliosus
POTFRU = Potentilla fruticosa
POTGLA = Potentilla glandulosa
POTGRAE = Potentilla gracilis var. elmeri
POTGRAF = Potentilla gracilis var. flabelliformis
POTLAT = Potamogeton latifolius
POTMOR = Potentilla morefieldii
POTNEW = Potentilla newberryi
POTNOR = Potentilla norvegica
POTPUS = Potamogeton pusillus
POTROB = Potamogeton robbinsii
PREEXI = Prenanthella exigua
PROGLAT = Prosopis glandulosa var. torreyana
PROPUB = Prosopis pubescens
PRUAND = Prunusandersonii
PRUEMA = Prunusemarginata
PRUFASF = Prunus fasciculata var fasiculata
PSAANN = Psathyrotes annua
PSAANN = Psathyrotes ramosissima
PSARAM = Psathyrotes ramosissima
PSESPIS = Pseudoroegneria spicata ssp. spicata
PSICOO = Psilostrophe cooperi
PSOARBA = Psorothamnus arborescens var. arborescens
PSOARBM = Psorothamnus arborescens var. minutifolius
PSOFREA = Psorothamnus fremontii var. attenuatus
PSOFREF = Psorothamnus fremontii var. fremontii
PSOLAN = Psoralidium lanceolatum
PSOPOL = Psorothamnus polyadenius
PSOSPI = Psorothamnus spinosus
PTEAND = Pterospora andromedea
PTEAQUP = Pteridium aquilinum var. pubescens
PTEDRY = Pterostegia drymarioides
PTIKIN = Ptilagrostis kingii
PUCNUT = Puccinellia nuttalliana
PUCPAR = Puccinelliaparishii
PUCSIM = Puccinelliasimplex
PURMEXS = Purshia mexicana var. stansburyana
PURTRIG = Purshia tridentata var. glandulosa
PURTRIT = Purshia tridentata var. tridentata (P.t.)
PYRASAA = Pyrola asarifolia ssp. asarifolia
PYRRAC = Pyrrocoma racemosa
PYRRACP = Pyrrocoma racemosa var. paniculata
RAFCAL = Rafinesquia californica
RAFNEO = Rafinesquia neomexicana
RAISCA = Raillardella scaposa
RANALI = Ranunculusalismifolius
RANAQU = Ranunculusaquatilis
RANCYMS = Ranunculus cymbalaria var. saximontanus
RANFLA-CF = Ranunculus cf. flammula (incl vars. ovalis,
RANHYD = Ranunculus hydrocharoides
RHARUB = Rhamnusrubra
RHUTRI = Rhus trilobata
RIBCER = Ribes cereum
RIBINEI = Ribes inerme var. inerme
RIBMON = Ribes montigenum
RIBNEV = Ribes nevadense
RIBVEL = Ribes velutinum
ROBPSE = Robinia pseudoacacia
RORNAS = Rorippa nasturtium-aquatica
RORPALO = Rorippa palustris var. occidentalis
RORSIN = Rorippa sinuata
RORSPH = Rorippa sphaerocarpa
ROSWOOU = Rosa woodsii var. ultramontana
RUMACE = Rumex acetosella
RUMCRI = Rumexcrispus
RUMHYM = Rumex hymenosepalus
RUMOCC = Rumex occidentalis
RUMPAU = Rumex paucifolius
RUMSALD = Rumex salicifolius var. denticulatus
RUMSALT = Rumex salicifolius var. triangulivalvis
SAGAPE = Sagina apetala
SAGSAG = Sagina saginoides
SAGSAGH = Sagina saginoides var. hesperia
SALBOO = Salix boothii
SALBRAB = Salix brachycarpa var. brachycarpa

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SALCAR = Salvia carduacea
SALCOL = Salvia columbariae
SALDORD = Salvia dorrii var. dorrii
SALDRU = Salix drummondiana
SALEXI = Salix exigua
SALFUN = Salvia funerea
SALGEY = Salix geyeriana
SALGOO = Salix goodingii
SALLAE = Salix laevigata
SALLASIO = Salix lasiolepis
SALLIG = Salix ligulifolia
SALLUCC = Salix lucida ssp. caudata
SALLUCL = Salix lucida ssp. lasiandra
SALLUT = Salix lutea
SALMEX = Salazaria mexicana
SALMOH = Salvia mohavensis
SALPAU = Salsola paulsenii
SALRETN = Salix reticulata ssp. nivalis
SALSCO = Salix scouleriana
SALTRA = Salsola tragus
SALUTA = Salicornia utahensis
SAMMEX = Sambucus mexicana
SAMRACM = Sambucus racemosa var. microbotrys
SAPOFF = Saporania officionalis
SARHIR = Sarcostemma hirtellum
SARVER = Sarcobatus vermiculatus
SAXODO = Saxifraga odontoloma
SCHARA = Schismus arabicus
SCHBAR = Schismus barbatus
SCHNIG = Schoenus nigricans
SCIACU = Scirpus acutus
SCIAME = Scirpus americanus
SCICLE = Scirpus clementis
SCIMIC = Scirpus microcarpus
SCINEV = Scirpus nevadensis
SCIPUM = Scirpus pumilus
SCIPUN = Scirpus pungens
SCIROB = Scirpus robustis
SCLPOL = Sclerocactus polyancistrus
SCRDES = Scrophularia desertorum
SCULAT = Scutellaria lateriflora
SEDOBTO = Sedum obtusatum ssp. obtusatum
SELLEU = Selaginella leucobryoides
SELNEV = Selinocarpus nevadensis
SENARM = Senna armata
SENCAN = Senecio canus
SENFLAD = Senecio flaccidus var. douglasii
SENFLAM = Senecio flaccidus var. monoensis
SENHYD = Senecio hydrophilus
SENINTE = Senecio integerrimus var. exaltatus
SENMOH = Senecio mohavensis
SENMUL = Senecio multilobatus
SENPAT = Senecio pattersonensis
SENSERS = Senecio serra var. serra
SENTRI = Senecio triangularis
SESVER = Sesuvium verrucosum
SETGRA = Setaria gracilis
SETVER = Setaria verticillata
SHEARG = Shepherdia argentea
SIBDES = Sibara desertii
SIBPRO = Sibbaldia procumbens
SIBROS = Sibara rosulata
SIDCOV = Sidalcea covillei
SIDORES = Sidalcea oregana ssp. spicata
SILBERM = Silene bernardina ssp maguirei
SILMEN = Silene menziesii
SILVERA = Silene verecunda ssp andersonii
SISALT = Sisymbrium altissimum
SISBEL = Sisyrinchium bellum
SISHAL = Sisyrinchium halophilum
SISIRI = Sisymbrium irio
SISORI = Sisymbrium orientale
SMIRAC = Smilacina racemosa
SMISTE = Smilacina stellata
SOLAME = Solanum americanum
SOLCAL = Solidago californica
SOLCANE = Solidago canadensis ssp. elongata
SOLCON = Solidago confinus
SOLDUL = Solanum dulcamara
SOLELA = Solanum elaeagnifolium
SOLMUL = Solidago multiradiata
SOLSPE = Solidago spectablis
SOLXAN = Solanum xanti
SONASPA = Sonchus asper ssp. asper
SONOLE = Sonchus oleraceus
SPAGRA = Spartina gracilis
SPEBOC = Spergularia bocconii
SPEMAR = Spergularia marina
SPHAMBA = Sphaeralcea ambigua ssp. ambigua
SPHAMBR = Sphaeralcea ambigua var rosacea

Acronym Key to the Plants of the Naval Air Weapons Station region

SPHCAP	=	Sphenosciadium capitellatum
SPHOBT	=	Sphenopholis obtusata
SPHRUS	=	Sphaeralcea rusbyi var. eremicola
SPIDEN	=	Spiraea densiflora
SPOAIR	=	Sporobolus airoides
SPOCRO	=	Sporobolus contractus
SPOCRY	=	Sporobolus cryptandrus
SPOFLE	=	Sporobolus flexuosus
STAALB	=	Stachys albens
STAELA	=	Stanleya elata
STAPINI	=	Stanleya pinnata var inyoensis
STAPINP	=	Stanleya pinnata var pinnata
STEEXIGE	=	Stephanomeria exigua ssp. exigua
STELONL	=	Stellaria longipes var. longipes
STEPAR	=	Stephanomeria parryi
STEPAUP	=	Stephanomeria pauciflora var. pauciflora
STEPAUPA	=	Stephanomeria pauciflora var. parishii
STESPI	=	Stephanomeria spinosa
STETEN	=	Stephanomeria tenuifolia
STIPAU	=	Stillingia paucidentata
STISPI	=	Stillingia spinulosa
STRCOR	=	Streptanthus cordatus
STRCOR	=	Streptanthus cordatus var piutensis
STRGRA	=	Streptanthus gracilis
STRLON	=	Streptanthella longirostris
STROLI	=	Streptanthus oliganthus
STRTOR	=	Streptanthus tortuosus
STYGNA	=	Stylocline gnaphalioides
STYMIC	=	Stylocline micropoides
STYPSI	=	Stylocline psilocarphoides
SUAMOQ	=	Suaeda moquinii
SWAALE	=	Swallenia alexandrae
SWERAD	=	Swertia radiata
SYMLON	=	Symphoricarpos longiflorus
SYMROT	=	Symphoricarpos rotundifolius var parishii
SYNFRE	=	Syntrichopappus fremontii
SYNLEM	=	Syntrichopappus lemmonii
TAMAPH	=	Tamarix aphylla
TAMPAR	=	Tamarix parviflora
TAMRAM	=	Tamarix ramosissima
TAROFF	=	Taraxacum officinale
TETARG	=	Tetradymia argyraea
TETAXIA	=	Tetradymia axillaris var. axillaris
TETAXIL	=	Tetradymia axillaris var. longispina
TETCAN	=	Tetradymia canescens
TETGLA	=	Tetradymia glabrata
TETILI	=	Tetracoccus ilicifolius
TETSPI	=	Tetradymia spinosa
TETSTE	=	Tetradymia stenolepis
THAFENF	=	Thalictrum fendleri var. fendleri
THAMON	=	Thamnosma montana
THASPA	=	Thalictrum sparsiflorum
THEINTA	=	Thelypodium integrifolium var affine
THELAC	=	Thelypodium laciniatum
THYCUR	=	Thysanocarpus curvipes
THYLAC	=	Thysanocarpus laciniatus
TIDOBL	=	Tidestromia oblongifolia
TIQNUT	=	Tiquilia nuttallii
TIQPAL	=	Tiquilia palmeri
TIQPLI	=	Tiquilia plicata
TONEXI	=	Tonestus eximius
TORPALP	=	Torreyochloa pallida var. pauciflora
TOWPAR	=	Townsendia parryi
TOWPAR	=	Townsendia scapigera
TRADUB	=	Tragopogon dubius
TRAPOR	=	Tragopogon porrifolius
TRAPRA	=	Tragopogon pratensis
TRIANDB	=	Trifolium andersonii var. beatleyae
TRICAN	=	Trisetum canescens
TRICER	=	Trisetum cernuum
TRICOND	=	Triglochin concinna var. debilis
TRICYA	=	Trifolium cyathiferum
TRIFRA	=	Trifolium fragiferum
TRIGRA	=	Trifolium gracilentum
TRIIXIA	=	Triteleia ixioides ssp. anilina
TRILONN	=	Trifolium longipes var. nevadense
TRIMACD	=	Trifolium macilentum var. dedeckerae
TRIMIC	=	Trifolium microcephalum
TRIMON	=	Trifolium monanthum
TRIMUT	=	Tridens muticus
TRIPRA	=	Trifolium pratense
TRIREP	=	Trifolium repens
TRISPI	=	Trisetum spicatum
TRITER	=	Tribulus terrestris
TRIWAT	=	Tricardia watsonii
TRIWOR	=	Trifolium wormskioldii
TROGRA	=	Tropidocarpum gracile
TYPANG	=	Typha angustifolia
TYPDOM	=	Typha domingensis
TYPLAT	=	Typha latifolia

Acronym Key to the Plants of the Naval Air Weapons Station region

ULMUS	= Ulmus pumila
UROLIN	= Uropappus lindleyi
URTDIOH	= Urtica dioica ssp. holosericea
VACCAE	= Vaccinium caespitosum
VALCAL	= Valeriana californica
VERAME	= Veronica americana
VERANA	= Veronica anagallis-aquatica
VERCALC	= Veratrum californicum var. californicum
VERPERX	= Veronica peregrina ssp. xalapensis
VERSERH	= Veronica serpyllifoila ssp. humifusa
VERTHA	= Verbascum thapsus
VICAMEA	= Vicia americana var. americana
VIGPAR	= Vigueria parishii
VIGRET	= Vigueria reticulata
VIOAUR	= Viola aurea
VIOPURI	= Viola purpurea ssp. integrifolia
VIOPURP	= Viola purpurea ssp. purpurea
VITGIR	= Vitis girdiana
VULMICP	= Vulpia microstachys var. pauciflora
VULOCTH	= Vulpia octoflora var hirtella
VULOCTO	= Vulpia octoflora var octoflora
WASFIL	= Washintonia filifera
WHOORE	= Woodsia oregana
WYEMOL	= Wyethia mollis
XANSTR	= Xanthium strumarium
XYLTOR	= Xylorhiza tortifolia
XYLTORT	= Xylorhiza tortifolia var. tortifolia
YUCBAC	= Yucca baccata
YUCBRE	= Yucca brevifolia
YUCSCH	= Yucca schidigera
ZIGBRE	= Zigadenus brevibracteatus
ZIGPAN	= Zigadenus paniculatus

SECTION 3.2.2.1.2 General Management Criteria of Status and Sensitive Plants Known to or Suspected to Occur on NAWS/CL

Status or Sensitive Plant Known or Suspected to Occur on NAWS/CL Lands	ESA Federal Status	CNPS R-E-D Code	Distribution, Rareness, and Significance of Populations on NAWS/CL Lands	Regional Endangerment Factors	Interaction with NAWS/CL Activities	Management Considerations on NAWS/CL Lands
Lane Mountain Milk-vetch (*Astragalus jaegerianus*)	FE	3-3-3	Populations of this taxon locally distributed; unknown on NAWS lands currently, extremely rare in 3 active populations SE of Superior Valley, < 5 mi. from NAWS South Ranges, with potential for important to core populations on NAWS lands.`	Stochastic extinction, habitat loss, military expansion, mining.	Potentially low overlap with areas used for NAWS activities.	Need for verified presence or absence at NAWS, (potential management issues regarding joint military use?).
Half-ring Milk-vetch (*Astragalus mojavensis* var. *hemigyrus*)?	C2**	Extinct in CA? 3-3-2, if extant.	Populations of this taxon widely distributed; unknown on NAWS lands currently, extremely rare from one historic record (1941) at Darwin, < 3 mi. from NAWS North Ranges, only known extant site is in the Spring Mtns, Nevada; potential for important to core populations to occur on NAWS lands.	Stochastic extinction, mining, rural development in NV.	Potentially low overlap with areas used for NAWS activities.	No current management issues, potential need for verified presence at NAWS.
Clokey's Cryptantha (*Cryptantha clokeyi*)	?	3-3-3	Populations of this taxon locally distributed; extremely rare, with restricted distribution on NAWS lands within the Mojave B South range; with core populations on NAWS lands.	Stochastic extinction, fire type conversion, exotic weeds, military expansion.	Low overlap with areas used for NAWS activities.	Potential management issues regarding fire prevention, (and management issues with joint military use?).
Mono Phacelia (*Phacelia monoensis*)	C2**	3-3-2	Populations of this taxon widely distributed; extremely rare, with restricted distribution on NAWS lands within the Coso Peak Range, with important populations on NAWS lands.	Cattle grazing, wild horses, exotic weeds, fire type conversion.	Low overlap with areas used for NAWS activities.	Current and potential management issues regarding, cattle grazing, wild horses.`
Shining Milk-vetch (*Astragalus lentiginosus* var. *micans*?, incl. var. *variabilis*)	PT	3-2-3	Populations of this intergrading taxon regionally distributed, specific taxon highly restricted in Eureka Valley; intergrading taxon common to abundant and widely distributed at lower elevations on NAWS lands, primarily North Ranges; with minor to potentially core populations of intergrading taxon on NAWS lands.	Off-road vehicles, stochastic extinction.	Potentially high overlap with areas used for NAWS activities.	No current management issues, potential need for verified taxanomic presence at NAWS.

Status or Sensitive Plant Known or Suspected to Occur on NAWS/CL Lands	ESA Federal Status	CNPS R-E-D Code	Distribution, Rareness, and Significance of Populations on NAWS/CL Lands	Regional Endangerment Factors	Interaction with NAWS/CL Activities	Management Considerations on NAWS/CL Lands
Darwin Milk-vetch (*Astragalus atratus* var. *mensanus*)	none	3-1-3	Populations of this taxon locally distributed; rare to locally common in patchy populations on NAWS lands from the Coso Peak Range, south, to southern Etcheron Valley; with core populations on NAWS lands.	Cattle grazing, wild horses, exotic weeds, fire type conversion, military training.	High overlap with areas used for NAWS activities.	Current and potential management issues regarding Coso Peak range training, cattle grazing, wild horses.
DeDecker's Clover (*Trifolium macilentum* var. *dedeckerae*)	C3c**	3-1-3	Populations of this taxon widely distributed; extremely rare and restricted on NAWS lands within the Coso Peak Range, with minor to potentially important populations on NAWS lands.	No current threats.	Low overlap with areas used for NAWS activities.	No current management issues, potential need for more distribution information.
Darwin Rock Cress (*Arabis pulchra* var. *munciensis*)	None	3-1-1	Populations of this taxon widely distributed; unknown on NAWS lands currently, one report (1980s) from north KGRA, nearest collection site is historic (1897) at Darwin, < 3 mi. from NAWS; with potential minor to important populations on NAWS lands.	Mining.	Potentially low overlap with areas used for NAWS activities.	No current management issues, potential need for verified presence at NAWS.
Inyo Hulsea (*Hulsea vestita* ssp. *inyoensis*)	none	2-2-1	Populations of this taxon widely distributed; extremely rare and restricted on NAWS lands with one historic collection (1891) from Coso Peak Range; with potential minor to important populations on NAWS lands.	Mining.	Low overlap with areas used for NAWS activities*.	No current management issues, potential need for more distribution information.
Naked Milk-vetch (*Astragalus serenoi* var. *shockleyi*)	none	2-2-1	Populations of this taxon widely distributed; unknown on NAWS lands currently, with one report (1997) from Coles Flat-Coles Spring, nearest collection site is 25 mi. N of NAWS; with potential minor populations on NAWS lands.	Mining, habitat loss.	Potentially low overlap with areas used for NAWS activities.	Potential need for verified presence at NAWS, potential management issues regarding cattle grazing, wild burros.
Weasel Phacelia (*Phacelia mustelina*)	C3c**	2-1-2	Populations of this taxon regionally distributed; rare in patchy, highly restricted populations on NAWS lands, within Mojave B South range; with minor to potentially important populations on NAWS lands.	No current threats.	Low overlap with areas used for NAWS activities.	No current management issues, potential need for more distribution information.

Status or Sensitive Plant Known or Suspected to Occur on NAWS/CL Lands	ESA Federal Status	CNPS R-E-D Code	Distribution, Rareness, and Significance of Populations on NAWS/CL Lands	Regional Endangerment Factors	Interaction with NAWS/CL Activities	Management Considerations on NAWS/CL Lands
Pinyon Rock Cress (*Arabis dispar*)	none	2-1-1	Populations of this taxon widely distributed; rare to frequent in well-dispersed or patchy populations on NAWS lands from the Coso Peak Range, south, to Birchum Mesa; with important to potentially core populations on NAWS lands.	Cattle grazing, wild horses, exotic weeds, fire type conversion, military training.	Moderate overlap with areas used for NAWS activities.	Potential management issues regarding cattle grazing, wild horses.
Charlotte's Phacelia (*Phacelia nashiana*)	C3c**	1-2-3	Populations of this taxon regionally distributed; rare in patchy, highly restricted populations on NAWS lands in the KGRA area; with minor populations to potentially important populations on NAWS lands.	Energy development, mining, cattle grazing.	Moderate overlap with areas used for NAWS activities.	Current and potential management issues regarding energy development.
Panamint Live-forever (*Dudleya saxosa* ssp. *saxosa*)	C2**	1-2-3	Populations of this taxon locally distributed; unknown on NAWS lands currently, one historic report (1980) from Pilot Knob of Mojave B South on NAWS South Ranges, remaining populations in the Panamint Mtns.; with potential minor to important populations on NAWS lands.	Stochastic extinction, horticultural collecting.	Low overlap with areas used for NAWS activities.	Need for verified presence at NAWS.
Crowned Muilla (*Muilla coronata*)	C3c**	1-2-2	Populations of this taxon regionally distributed; rare in patchy populations on NAWS lands, one collection from KGRA, reports from west of Baker Range area; with minor to potentially important populations on NAWS lands.	Rural development, mining, off-road vehicles, sheep and cattle grazing, energy development, exotic weeds, fire type conversion, military training.	Potentially high overlap with areas used for NAWS activities.	Current and potential management issues regarding energy development, need for more distribution information.
Mohave Fish Hook Cactus (*Sclerocactus polyancistrus*)	C3c**	1-2-2	Populations of this taxon widely distributed; rare to uncommon in widespread patchy populations at moderate elevations on NAWS lands; with core populations on NAWS lands.	Sheep and cattle grazing, wild horses and burros, horticultural collecting, mining, off-road vehicles, energy development, fire, military training.	Moderate overlap with areas used for NAWS activities.	Current and potential management issues regarding cattle grazing, wild horses, distribution information.
Gypsum Linanthus (*Linanthus arenicola*)	C3c**	1-2-1	Populations of this taxon widely distributed; rare to uncommon in widespread patchy populations at low elevations on NAWS lands; important populations on NAWS lands.	Off-road vehicles, exotic weeds, military training.	High overlap with areas used for NAWS activities.	Current management issues regarding distribution information.

Status or Sensitive Plant Known or Suspected to Occur on NAWS/CL Lands	ESA Federal Status	CNPS R-E-D Code	Distribution, Rareness, and Significance of Populations on NAWS/CL Lands	Regional Endangerment Factors	Interaction with NAWS/CL Activities	Management Considerations on NAWS/CL Lands
Evening Primrose (*Oenothera caespitosa* ssp. *crinita*)?	none	1-2-1	Populations of this taxon widely distributed; unknown on NAWS lands currently, or extremely rare on NAWS lands (based on one non-definitive collection, 1993) from east of Louisiana Butte; with potential minor populations on NAWS lands.	Cattle grazing, mining.	Low overlap with areas used for NAWS activities..	Need for verified presence at NAWS.
Panamint Mariposa Lily (*Calachortus panamintensis*)	none	1-1-3	Populations of this taxon regionally distributed; currently unknown on NAWS lands, or rare to uncommon (based on collections in determination, 1998) in patchy populations on NAWS lands within the Coso Peak Range; with potentially important populations on NAWS lands.	Cattle grazing, wild horses, exotic weeds, fire type conversion, military training.	Moderate overlap with areas used for NAWS activities.	Need for verified presence at NAWS, potential management issues regarding cattle grazing, wild horses.`
Coso Mountains Magnificent Lupine (*Lupinus magnificus* var. *glarecola*)?	none	1-1-3	Populations of this taxon regionally distributed; rare to uncommon, (or locally common on disturbances), in patchy populations on NAWS lands, from the Coso Peak Range, south; to Mountain Springs Canyon; with core populations on NAWS lands.	No current threats.	High overlap with areas used for NAWS activities.	Potential management issues regarding road maintenance, need for more distribution information.
Panamint Bird's Beak (*Cordylanthus eremicus* ssp. *eremicus*)	C3c**	1-1-3	Populations of this taxon widely distributed; common to abundant in one contiguous widespread population on NAWS lands, from the Coso Peak Range, south; to Moscow Spring; with core populations on NAWS lands.	Mining, water development, cattle grazing, wild horses, exotic weeds, fire type conversion.	Low overlap with areas used for NAWS activities.	No current management issues.
Indigo Bush (*Psosrothamnus arborescens* var. *arborescens*)	C3c**	1-1-1	Populations of this taxon regionally distributed; uncommon to common in linear patchy populations on NAWS lands within the Mojave B South and Randsburg Wash ranges; with important populations on NAWS lands.	Military training.	Low overlap with areas used for NAWS activities.	No current management issues.
Booth Evening Primrose (*Camissonia boothii* ssp. *boothii*)	none	1-1-1	Populations of this taxon widely distributed; currently unknown on NAWS lands, or locally common to abundant (based on collections in determination, 1997) in patchy populations on NAWS lands in the area of the KGRA; with core (in CA) populations on NAWS lands.	Energy development, mining.	Moderate overlap with areas used for NAWS activities.	Need for verified presence at NAWS, potential management issues regarding energy development.

Status or Sensitive Plant Known or Suspected to Occur on NAWS/CL Lands	ESA Federal Status	CNPS R-E-D Code	Distribution, Rareness, and Significance of Populations on NAWS/CL Lands	Regional Endangerment Factors	Interaction with NAWS/CL Activities	Management Considerations on NAWS/CL Lands
Utah Fendlerella (*Fendlerella utahensis*)	none	1-1-1	Populations of this taxon widely distributed; rare on NAWS lands (reported (collected?), 1980) in one population in the northern Argus mountains in theDarwin Wash range; with minor populations on NAWS lands.	Mining.	Low overlap with areas used for NAWS activities.	No current management issues, potential need for more distribution information.

** Former candidate rankings, no longer recognized.

Terms of Significance of Populations:
Core Populations - Highest density, best stand health and reproduction, high environmental integrity, and centered distributions among all known populations. These populations are essential to the long-term survival of the plant taxon.
Important Populations - Low to high density, good stand health, moderate environmental integrity, and strategic geographic locations. These populations aid in the long-term survival of the plant taxon by providing a more dispersed seed bank and adding genetic diversity.
Minor Populations - Low density, poor to good stand health, low to moderate environmental integrity. These populations minimally aid the long-term survival.

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APPENDIX B: Fauna at Naval Air Weapons Station China Lake

References to sections within this Appendix are related to sections of the Integrated Natural Resources Management Plan for Naval Air Weapons Station China Lake, California.

Table of Contents

SECTION 2.2.6 NAWS Surface Water Sources

Spring Name	State Coordinates	Location Description	Spring Elevation	Spring Type	WATER QUALITY	Flow	Present Development	Future Plans	Fenced	Biological Resources	Cultural Resources
Amity Spring	T26S/R45E-21 (SE)	Slate Range	3,428' (GPS)	Structure (Faulting)	NaHCO3 TDS: 610ppm	Moderate flow to trough.	Pipe to trough from fenced spring box. Overflow to ground guzzler nearby.	cleanout spring box, fence with Bighorn	Rehab/cleanout spring box, fence with Bighorn panels.	Rehab/cleanout spring box, fence with Bighorn panels.	Historic (cabin/ mines).
Bee Hole (Lower) Spring	T26S/R45E-21 (SE)	Slate Range, South of Amity Spring	3,403' (GPS)	Structure (Faulting)	NaHCO3 TDS: 520ppm	Moderate flow.	Old mine/dig.	Monitor flow, use by burros. Fence.	Yes - 1991	Past heavy use by burros.	Historic sites nearby
Bee Hole (Upper) Spring	T26S/R45E-28 (NW)	Up-canyon from Lower Bee Hole Spring.	3,623' (GPS)	Structure (Faulting)	NaHCO3 TDS:570ppm	Moderate flow from shaft	Mine shaft into side of slope in canyon bottom.	Monitor	Yes - 1991	Probably lots of use by upland game birds, coyotes, etc.	Historic site at throat (mine shaft)
Big Horn Spring	T29S/R46E-02 (NE)	Eagle Crags	3,800' (topo)	???	No sample	Probably flows in wet years.	None noted.	Monitor flow. Locate precisely on map.	No	Bighorn sheep, burros, and other wildlife	Probably some in cave located in wash bottom approximately 1/2 way canyon.
Blue Chalcedony Spring	T28S/R45E-25 (NE)	North of Eagle Crags	3,400' (topo)	Fracture Flow	No sample	Unknown	Unknown	Locate spring.	No	Unknown	Historic (stone walls/house).
Cattail Spring	T28S/R46E-20 (SE)	East of Remote Site, North of Eagle Crags.	3,300' (topo)	Fracture Flow	No sample	Moderate flow downslope, probably intermittent.	None	Monitor flow	No	Not much known about this spring. There are other springs in the area.	Unknown
Copper City Spring	T30S/R45E-05 (SE)	SE of Granite Mountain.	4,056' (topo)	Fracture Flow	No sample	Re-established by Billy mitchell in 1991. Now plugged.	Spring box, stone houses nearby. Cement troughs.	Clean out spring box and preclude additional soil erosion.	No	Burros, upland game birds, and native wildlife.	Historic
Copper City Windmill	T30S/R45E-05	SE of Granite Mountain (down wash from Copper City).	3,420' (topo)	???	No sample	Pump from old windmill still works if manually operated.	Windmill has been removed.	None	No	Unknown	Unknown
Cowboy Spring	T29S/R46E-28 (SE)	South of eagle Crags, near Indian Spring.	3,780' (topo)	Wash	No sample	Probably low flow at one time. Looks like a willow tree here.	Unknown	Locate and monitor for flow. Re-establish or enhance flow. Install panels.	No	Unknown	Unknown
Denise Spring	T28S/R45E-30 (SW)	East side of Robber's Mountain near Lead Pipe Spring.	3,800' (topo)	Structure (Dike)	No sample	Subsurface delineated by Baccharis.	None	Determine feasibility for development, such as spring box.	No	Unknown, subsurface water supports a small stand of Baccharis.	Unknown
Dust Bowl Spring	T25S/R44E-27	Slate Range, northernmost spring on west side.	2,355' (GPS)	Structure (Faulting)	NaCl- TDS:1930ppm	Yes	Historic water source for nearby miner site	Monitor	Yes- 1991	Lots of use by burros in the past. Now used by upland game birds and some burros.	Historic site approx. 1/4 mi. west of throat
Early Spring	T26S/R45E-22 (SW)	Slate Range, near Amity Spring.	3,010' (topo)	Structure (Dike)	No sample	Subsurface. Large stand of willows/mesquites.	Possibly	Re-establish flow. Will have to protect from burros with panels.	No	Subsurface water supports owls, migrant birds, and other wildlife. Bats in nearby mine shaft.	Historic (cabin/mines/vert.-horiz. shafts).
Fresno Spring	T29S/R26E-10 (center)	NW of Mesquite Spring, near small knoll.	3,600' (topo)		No sample	Subsurface. Lots of Baccharis in wash bottom.	Spring box.	Determine feasibility for rehab. of spring box.	No	Subsurface water supports stand of Baccharis.	Unknown

Spring Name	State Coordinates	Location Description	Spring Elevation	Spring Type	WATER QUALITY	Flow	Present Development	Future Plans	Fenced	Biological Resources	Cultural Resources
Granite Wells	T29S/R44E-35 (NW)	East of Pilot Knob.	4,360' (GPS)	Structure (Fracture Flow)	NaHCO3 TDS: 440ppm	Good flow to trough.	Pipe from spring box to concrete trough. Overflow to ground or cattle trough off-Station	Monitor flow and use by burros.	Barbed-wire with gate.	Burros, upland game birds, and other wildlife.	Pipe and trough may historic. Undoubted some pre-historic. W found button here.
Hidden Spring	T26S/R47E-20 (SE)	East border of NAWS, South of Windgale Pass.	3,576'	Structure (Dike/ Fractures)	NaHCO3 TDS: 450 ppm	Very good flow since excavation by Campbell/Stoner in 1992.	Fenced with Bighorn panels in 1986. Perforated pipe installed in 1987.	Re-establish flow below willow. Possibly install drinker box with overflow below willow.	Yes - 1986/ 1992.	Water supports upland game birds, coyotes (den), and other wildlife. Long-eared owls in willows. Lots of dove, quail, and some chuckar. Bobcat seen here in 1995.	Historic (cabin/corr nearby), also many fla grinding stones and ot evidence of Native American use.
Holley's Hollow Spring	T29S/R46E-32 (SW)	Eagle Crags	3,220' (topo)	Structure (Dike)	No sample	Moderate flow at source.	None. Flow probably maintained by burros (digging).	Monitor flow and use by burros. Needs to be dug out and have panels put up.	No	Thrashed by heavy burros use. Also used by upland game birds and other wildlife.	Unknown
Horn Tip Spring	T29S/R45E-03 (NE)	Eagle Crags	3,600' (?) (topo)	Fracture flow	No sample	Surface flow in wash at canyon bottom.	None (possibly dug out at one time).	Monitor flow. Fence	No	Bighorn, burros, upland game birds, and other wildlife.	Unknown. Large cave wash 1/2 way dow canyon may contai evidence of use by Na Americans. Lots o Bighorn sign.
Indian Spring	T30/R45E-04 (NE)	South of Eagle Crags.	3,460' (topo)	Wash	NaHCO3- TDS: 300ppm	Moderate to good flow.	Looks like it's been dug out at one time. Past burro use has been intensive at one time.	Monitor flow and use by burros. Pool established, panelled by Campbell/Stoner in 1995.	Yes - 1995	Some burro use, bobcat seen nearby, lots of dove and quail and other wildlife.	Unknown
Layton Canyon Spring (mouth)	T26S/R44E-14 (N. border)	Mouth of Layton Canyon.	2,240' (topo)	Wash	No sample	Yes, into 8-ft. diameter pool.	Maybe	Monitor	Yes - 1991	Lots of past use by burros. Currently, water is flowing into pool within panels.	Unknown
Layton Spring	T26S/R45E-07 (SW)	Slate Range	3,135' (topo)	Structure (Dike)	NaHCO3- TDS:1130ppm	Good flow to trough.	Piped from spring box to circular concrete trough.	Monitor flow and use by burros.	Yes - 1991	Heavy burros use, upland game birds and other wildlife. Bobcats, foxes, and coyotes seen here.	Historic (cabin nearb
Layton Wells	T26S/R45E-20 (NW)	Slate Range	3,840' (topo)	Dry Well	No sample	Possibly subsurface.	Cabin, mines nearby. This spring undoubtedly had water at one time.	Monitor flow (if any)	No	Subsurface water supports trees used for bird nesting/roosting.	Historic (cabins/min nearby).

Spring Name	State Coordinates	Location Description	Spring Elevation	Spring Type	WATER QUALITY	Flow	Present Development	Future Plans	Fenced	Biological Resources	Cultural Resources
Lead Pipe Spring	T28S/R45E-32 (SE)	Eagle Crags	3,030'	Structure (Dike)	NaHCO3-TDS:355ppm	Entire pool overgrown with rushes (Juncus).	Dug out by SeaBees in 1984 and again by Stoner/Millsop et. al. in 1995. Fenced with Bighorn panels in 1986.	Monitor flow, maintain water quality/availability by periodic vegetation removal.	Yes - 1986/ 1995	Upland game birds and other wildlife. Past heavy use by burros.	Historic (stone house/walls and cement trough).
Lone Willow Spring	T26S/R45E-21 (NE)	Slate Range	3,010' (topo)	Structure (Faulting)	No sample	Subsurface flow supports willow tree.	None. Soil compacted by burros. Used to have flow.	Re-establish flow, fence with panels.	No	Thrashed by burros. Small pockets of water appear due to burro digging. Limited value to wildlife at this time.	Unknown
Mesquite Spring	T29S/R46E-23 (NE)	Eagle Crags	3,720' (topo)	Structure (Dike)	NaHCO3-TDS:330ppm	Reduced flow. Entirely within mesquites.	Pipe to concrete trough then to corral about 1 mile north. Fenced with Bighorn panels in 1986.	Monitor flow. Maintain water quality and availability by periodic vegetation removal.	Yes - 1986	Upland game birds and other wildlife. Burros and cattle in the past.	Historic (cement trough and pipeline to downslope corral). Flakes and grinding stones, and other evidence of use by Native Americans.
Mine Shaft Spring	T26S/R45E-03 (SW)	E. side of Slate Range, N. of Layton Rd.	3,040' (topo)	???	No sample	Yes, moderate.	Old mine shaft about 15 feet deep.	Monitor	Yes - 1992	Fair number of quail, chuckar, and dove. Some use by burros.	Unknown
Moonshine Spring	T28S/R45E-26 (SE)	Eagle Crags	2,980' (topo)	Structure (Faulting)	No sample	Subsurface	Probably	Re-establish flow by hand-digging under tree where moist soil can be found.	No	Subsurface water supports a tree used as a nesting/roosting site by various bird species.	Unknown
Myrick Spring	T28S/R47S-07 (SW)	Near E. Border of NAWS, 4 miles S. of R/W Rd.	2,700' (topo)	Structure (Contact)	NaHCO3-TDS:2520ppm	Subsurface	Spring box.	Attempt to re-establish flow made by Stoner in 1995. Water level about 3 feet below grade.	No	Subsurface water supports a stand of salt grass. Limited use by native wildlife.	Historic (stone house with mine pads and stone walls).
New York Spring	T26S/R44E-02 (SE)	N. of Layton Canyon, on W. side of Slate Range.	2,356' (GPS)	Structure (Faulting/Dike)	NaCl-TDS:3390ppm	Yes. Limited flow in some spots along canyon bottom.	Mines nearby.	Monitor	Yes - 1991	Lots of past use by burros. Currently, water is flowing above and below panels.	Historic sites (mines, vert./horiz. shafts, bridge, etc.
Nunn Spring	T26S/R45E-04 (SE)	E. side of Slate Range, on low hills N. of Layton Rd.	2,480' (topo)	???	No sample	Yes, moderate.	None	Monitor. Remove cattails.	Yes - 1992	Fair number of quail, chuckar, and dove. Some use by burros.	Unknown
Pink Hill Spring	T29S/R24E-06 (NE)	Eagle Crags	3,520' (GPS)	Structure (Contact)	NaHCO3-TDS:355ppm	Moderate flow past panel about 50 feet. Overgrown with Typha.	Dug out by SeaBees in 1984 (?). Fenced with Bighorn panels. Dug out, pool lined with PVC by Stoner/Millsop et. al. in 1995.	Monitor flow. Periodically check on liner, etc.	Yes - 1986/ 1995	Upland game birds and other wildlife. Burros still use water outside panels.	Historic (water source appears to originate from old mine/dig.

Spring Name	State Coordinates	Location Description	Spring Elevation	Spring Type	WATER QUALITY	Flow	Present Development	Future Plans	Fenced	Biological Resources	Cultural Resources
PK Ranch (Windmill)	T30S/R44E-02 (NE)	South of Granite Mountain	4,117' (topo)	???	No sample	Very good flow to trough.	Windmill to concrete tank, then trough, then to trough off-Station. Windmill re-built in 1987.	Monitor flow and use by domestic livestock. Fence.	No	Burros, cattle, upland game birds and other wildlife.	Historic (former ranch with windmill, corra Probably some pre-his artifacts nearby.
Pot Hunter Spring	T29S/R44E-02 (SW)	3 miles NNW of Pilot Knob	???	???	No sample	Possibly subsurface.	None	Monitor flow, evaluate potential for rehab.	No	Unknown	Numerous habitation and other evidence of by Native American
Sandors Mine Spring	T25S/R45E-19/20	East side of Slate Range.	4,094' (topo)	???	No sample	Have seen water there.	Cabin/mines.	Investigate, fence with panels.	No.	Unknown	Unknown
Seep Spring	T29S/R45E-18 (NW)	2 mile NE of Pilot Knob.	3,835' (topo)	Structure (Fractures)	NaHCO3-TDS:305ppm	Moderate flow after rains. Limited (perennial) flow most of the time.	Pipe from spring box to storage tank and trough. More than one pipe/spring box here.	Monitor flow, repair existing pipe fence water area.	No	Upland game birds and other wildlife. Some use by burros.	Historic (cattle ranch Pictographs and oth evidence of use by Na Americans.
Stone Corral Spring	T29S/R44E-35 (NW)	Granite Mountain	4,180' (topo)	Structure (Fractures)	CaHCO3-TDS:395ppm	Good flow to trough.	Pipe from spring box to concrete tank, to trough then to ground or to trough off-Station.	Monitor flow and use by burros. Fence.	Barbed-wire with gate.	Intensive use by upland game birds and other wildlife as well as burros. Fishhook cactus nearby.	Historic (stone corr ranch site)
(Upper) Tunnel Spring	T29S/R45E-31 (NE)	East of Granite Mountain	4,300' (topo)	Structure (Faulting)	CaHCO3-TDS:415ppm	Some flow through pipe inside enclosure.	Possible spring box in dug out area. Pipe to concrete trough in enclosure.	Investigate. Re-establish adequate flow to trough. Fix pipe.	Yes - 1990	Upland game birds and other wildlife. Some former use by cattle and burros.	Historic (cement tro
(Lower) Tunnel Spring	T29S/R45E-32 (SW)	East of Granite Mountain	3,986' (topo)	Structure (Faulting)	No sample	A few drips from pipe which ends short of cement trough.	Water piped from long tunnel (mine?).	Monitor flow. Investigate. Re-establish adequate flow. Fence.	No	Upland game birds. Some former use by cattle and burros.	Historic (pipe to trou
Unnamed Spring	T27S/R45E-	South side of Brown Mountain	???	???	No sample	Unknown	Unknown	Confirm presence. Can be located on old topos.	No	Unknown	Unknown

Spring Name	State Coordinates	Location Description	Spring Elevation	Spring Type	WATER QUALITY	Flow	Present Development	Future Plans	Fenced	Biological Resources	Cultural Resources
Unnamed Springs (4or 5)	T25S/R44E- or T25S/R45E-	Slate Range, N. of Layton Canyon.	???	???	No sample	Unknown	Unknown	Locate, monitor for flow, investigate potential for development. Fence.	No	Undoubtedly used by burros where surface water is found.	Unknown
Unnamed Spring	T25S/R45E-29	Slate Range (E. side), S. of Sandors Mine Spring.	???	???	No sample	Have seen water there.	Cabin/mines	Investigate, fence with panels.	No	Unknown	Unknown

Spring Name	State Coordinates	Location Description	Spring Elevation	Watershed Mapped / Scale	Watershed Area	Water Quality	Spring Type	Surface Flow	Present Development	Future Plans	Fenced	Biological Resources	Cultural Resources	Published
Benko Spring	T23S/R42E-Section 34, NE	Argus Range, top of Homewood Canyon	3,743' (GPS)	Yes, 1"=100'	250 Acres	NaHCO3 TDS:530 ppm	Wash / Structural	Minimal (.50-1.0 gpm)	Existing pipe (corroded), water flows to tank near end of access road.	None, Homewood Canyon residents providing spring maintenance	No	Coyote, burros, upland game birds, arroyo willow	Historic watering hole (Jayhawker/Manly Party)	NAWS 1997
Bircham Spring	T23S/R42E, Section 20, NW	Argus Range SE of Mt. Spring Canyon (top)	5,640' (GPS)	Yes, 1"=150'	189 Acres	NaHCO3-TDS:295 ppm	Fault / Stratigraphic	.7 gpm, 3.4 ac. ft/yr	No present development, panelled in 1995	Fence and extend discharge pipe to wash	Yes, 1995	Deer, horses, birds, other wildlife. Arroyo willow, Mesquite, Psuedo Acacias, Conifer	Historic ranch site	NAWS 1995
Bircham (North) Spring	T23S/R42E-Section18, SE	Argus Range, SE of Mtn. Springs Canyon (top)	5,737' (GPS)	Yes, 1"=100'	139 Acres	NaHCO3-TDS:310ppm	Fault / Stratigraphic	1.5-2.0 gpm (est)	No development, panelled in 1995	Construct wildlife drinker ouside of panels	Yes, 1995	Deer, horses, upland game birds, and other wildlife, plants include mesquite (?), and rabbit brush	Unknown	NAWS 1997
Chappo Spring	T20S/R39E-Section14, S	North Coso Range, near spotting station 3	7,037' (GPS)	Yes, 1"=100'	62 Acres	CaHCO3-TDS:340 ppm	Wash / Fracture flow	1.0-2.0 gpm (est.)	Early development with pipes, fencing, etc.	None	No	Willows, Pinon pines, grasses(?)	Historic ranching/mining /etc.	NAWS 1997
China Garden Spring	T20S/R40E, Section 14, NE Corner	Coso Range, north end of North Range	4,960' (Topo)	Yes1"=150'	123 Acres	CaHCO3-TDS:375 ppm	Fracture flow	1.1 gpm, 1.8 ac ft/yr	Cistern, dam, underground pipe, watering trough	Install monitoring well adjacent to spring cistern	No	Arroyo willows, cottonwood (?)	Historic ranching, prehistoric unknown.	NAWS 1995
Cole Spring	T20S/R40E, Section 32, SW	Coso Range, north end of North Range	6,260' (Topo)	Yes, 1"=150'	50 Acres	CaHCO3-TDS:820 ppm	Fault / Stratigraphic	1.0-2.0 gpm to water tank, <1.0 gpm surface flow	Cistern, pipe, water tank (cattle), troughs, bldgs.	None		Limited riparian vegetation at the source	Historic cattle ranching	NAWS 1995
Coso Village	T20S/R40E Section 21, SW	Northwest of Coles Flat	5,809' (GPS)	Yes, 1'=100'	62 Acres	CaHCO3-TDS:580 ppm	Fault / Fracture flow	1 gpm (est)	Hand dug with pipe from spring throat to pond	Check collector system periodically	No	Limited vegetation with some grasses, horses, burros, deer, and other small wildlife	Historic mining camp	NAWS 1997
Coyote Spring	T23S/R42E-Section 5, NW	Argus Range, 3 mi north of Bircham Spring	5,368' (GPS)	Yes, 1"=100	67 Acres	No Sample	Fault / Stratigraphic	No surface water	Hand dug with piping and existing water trough	None	No	Deer (?), horses, burros, upland game birds, and other wildlife. Large willow thicket, and Joshua trees.	Historic cattle water trough	NAWS 1997
Coyote (South) Spring	T23S/R42E-Section 5, SW	Argus Range, 2.75 mi north of Bircham Spring	5,256' (GPS)	Yes, 1'=100'		CaHCO3-TDS:410 ppm	Wash / Structural	Seepage	None	Attempt to collect water sample.	No	Willows/Joshua/ grasses(?)	Unknown	NAWS 1997
Crystal Spring	T20S/R40E, Section 7, NW border	East flank of Coso Peak, 1 MI S of North boundary	6,400' (Topo)	Yes, 1"=150'	44 Acres	CaHCO3-TDS:315 ppm	Fault / Fracture flow	1 gpm, 1.6 ac ft/yr	Storage tank, pipe and watering trough	Check collector piping and valves periodically	Yes	Arroyo willow thicket	Prehistoric-Lots of flakes southeast of spring. Historic cattle water trough/tanks	NAWS 1995

Spring Name	State Coordinates	Location Description	Spring Elevation	Watershed Mapped / Scale	Watershed Area	Water Quality	Spring Type	Surface Flow	Present Development	Future Plans	Fenced	Biological Resources	Cultural Resources	Published
Darwin Spring	T21S/R41E, Section 18, SE border	Headwaters of China Gardens wash, east flank of Coso and Silver Peaks	5,320' (Topo)	Yes, 1'=100'	118 Acres	CaHCO3-TDS:520 ppm	Wash / Stratigraphic/ Fracture flow	ET: 17.4 ac ft/yr	Rock dam, corrugated steel collector, provides water supply to community of Darwin	Install and monitor observation well upsteam. Survey for standing water, protect if found.	No	Arroyo willow, Typha and Juncus, animal trails	Historical ruins (rock houses/fortress)	NAWS 1995
Dead End Cabin Spring	T21S/R40E, Section 6, SE	Coso Range, south flank of Silver Peak, South on rd from Cole Spring	6,080' (Topo)	Yes, 1'=100	111 Acres	CaHCO3-TDS:330 ppm	Wash / Structural	ET: 6.7 ac ft/yr, no surface flow	Abandoned cistern and casing	Install monitoring well. Survey area for standing water.	No	Arroyo willow, rabbitbush	Historic cabins/mining/ranch	NAWS 1995
Haiwee Spring	T21S/R39E, Section 10, SW	Coso Range on west flank of Coso Peak, North of Coso Hot Springs	4,680' (Topo)	Yes, 1"=100'	66 Acres	CaHCO3-TDS:285 ppm	Wash / Structural	14 ac ft/yr	None	None	No	Arroyo willow	Historic Ruins. Petroglyphs/prehistoric artifacts near source.	NAWS 1995
Haiwee (Upper) Spring	T21S/R39E-Section10, NW	Coso Range, 6 mi north of Coso Hot Springs	5,020' (Topo)	Yes, 1"=100'	111 Acres	CaHCO3-TDS:300 ppm	Wash / Stratigraphic	4.0-5.0 gpm (est.)	None	None	No	Arroyo willow	Prehistoric artifacts in adjacent canyon.	NAWS 1997
Indian Garden Spring	T20S/R40E, Section 10, SW	Lower eastern slope of Coso Range. 2.25 mi S of North Range boundary	5,280' (Topo)	Yes, 1'=150'	66 Acres	CaHCO3-TDS:500 ppm	Fault / Fracture flow	ET: 18.2 ac ft/yr, no surface flow	Cistern, corral	Observe cistern flow quarterly. Install wire gate in cistern	No	Arroyo willow	Historical Ruins	NAWS 1997
LaMotte Spring	T22S/R42E, Section 31, NE	Argus Range, eastside drainage, 2.5 mi SE of head of Mtn. Spring Canyon	5,360' (Topo)	Yes, 1"=150'	134 Acres	CaHCO3-TDS:390 ppm	Wash / Structural	ET: 6.9 ac ft/yr, no surface flow	None	None	No	Arroyo Willow	Unknown	NAWS 1995
Lost Cabin Spring		Coso Range, 1.5 mi SE of Silver Peak	6,496' (GPS)	Yes, 1"=100'	99 Acres	CaHCO3-TDS:440 ppm	Wash / Structural	Good flow	Corrugated cistern	Install panels, imprive cistern and flow lines	No	Arroyo willow	Historic ruins, cabins, reservoirs, etc.	NAWS 1997
Margaret Ann Spring, E.	T23S/R42E, Section 4, Center	Argus Range in Water Canyon, downgradient of Bircham & LaMotte Springs	4,750' (GPS)	Yes, 1"=150'	173 Acres	CaHCO3-TDS:1010 ppm	Wash / Structural/ Fracture flow	ET: 6.5 ac ft/yr, no surface flow	None	None	No	Arroyo Willow	Unknown	NAWS 1995
Mariposa Spring	T20S/R40E, Section 20, NE	Coso Range?	6,320' (Topo)	Yes, 1"=100'	58 Acres	CaHCO3-TDS:1360 ppm	Fault / Stratigraphic	ET: 1.3 ac ft/yr, no surface flow	Cistern, concrete trough	None	No	Arroyo Willow	Historic ruins, developed spring, etc.	NAWS 1995
Mill Spring	T20S/R39E-Section 23, NE	North Coso Range, near spotting station 4	6,840' (Topo)	Yes, 1"=100'	119 Acres	CaHCO3-TDS:370 ppm	Wash / Structural	Too much to measure in April 1997	No current development in place	None	No	Pinon pine, Joshua, etc.	Historic ruins/mill/etc.	NAWS 1997
Moscow (Unnamed North #1) Spring	T24S/R41E-Section 6, SE	Argus Range, 4 mi south of Bircham Spring	5,191' (GPS)	Yes, 1"=100'	138 Acres	CaHCO3-TDS:230 ppm	Wash / Structural/ Fracture flow	4.0-5.0 gpm (est) Spring 1997	Hand dug with existing piping	None	No	Arroyo willow	Historic watering hole (Jayhawker Party)	NAWS 1997

Spring Name	State Coordinates	Location Description	Spring Elevation	Watershed Mapped / Scale	Watershed Area	Water Quality	Spring Type	Surface Flow	Present Development	Future Plans	Fenced	Biological Resources	Cultural Resources	Published
Moscow (Unnamed West #2) Spring	T23S/R41E-Section 32, SW	Argus Range, 3.5 mi south of Bircham Spring	5,460' (GPS)	Yes, 1"=100'	37 Acres	CaHCO3-TDS:300 ppm	Wash / Structural/ Fracture flow	<1.0 gpm (est.)	None	None	No	Arroyo willow	Historic watering hole	NAWS 1997
Mountain Spring, N.	T23S/R41E-Section 9, SW	Argus Range in low section of canyon, 1.5 Mi E of Mt Springs gate	4,275' (Topo)	Yes, 1"=100'	Undetermined	CaHCO3-TDS:750 ppm	Fault / Fracture flow	ET: 15 ac ft/yr, no surface flow	Abandoned cistern	Monitor in late summer/fall for presence of shallow pools.	No	Arroyo Willows	Unknown	NAWS 1995
Mountain Spring (Upper Group #1)	T23S/R41E-Section 12, SW	Near top of Mtn Spring Canyon Road. North side of road.	4,960' (Topo)	Yes, 1"=100'	50 Acres	CaHCO3-TDS:350 ppm	Fault / Fracture flow	.50 gpm (est.)	Hand dug with dissconnected piping and trough. Panelled in 1994.	Enlarge panelled area, construct concrete water trap and install piping to trough.	Yes, 1994	Arroyo willows	Unknown	NAWS 1997
Mountain Spring (Upper Group #2)	T23S/R41E-Section 12, SW	Near top of Mtn Spring Road. North side of road.	4,960' (Topo)	Yes, 1"=100'	Undetermined	No Sample	Fault / Fracture flow	No surface water	None	None	No	Arroyo willows	Unknown	NAWS 1997
Mountain Spring (Upper Group #3)	T23S/R41E-Section 12, SW	Near top of Mtn Spring Road. North side of road.	4,960' (Topo)	Yes, 1"=100'	Undetermined	No Sample	Fault / Fracture flow	No surface water	None	None	No	Arroyo willows	Unknown	NAWS 1997
New House Spring	T21S/R41E-Section 13, SW	Argus Range in canyon dividing Maturango and Parkinson Peak watersheds. NE of Junction Ranch	6,294' (GPS)	Yes, 1"=200'	59 Acres	CaHCO3-TDS:210 ppm	Fault / Fracture flow	4.0 gpm/9.1 ac ft/yr	Wooden spring box, pipe, header box	Measure flows quarterly	Yes. 1993	Arroyo Willow common reed	Historic development for cattle	NAWS 1995
Old House Spring	T21S/R42E-Section 30, NW	Argus Range, west slope, 7,500 ft NE of Junction Ranch	6,432' (GPS)	Yes, 1"=100'	59 Acres	CaHCO3-TDS:275 ppm	Fault / Fracture flow	2.0-3.0 pgm/6.5 ac ft/yr	Earthen dam, ponds, pipe	Check dam erosion late summer/fall		Arroyo Willow, saltgrass, horses, other wildlife	Historic development for cattle	NAWS 1995
Quail Spring	T23S/R42E-Section 28, N	Argus Range, 1.5 mi SE of Bircham Spring	5,120' (Topo)	No	Undetermined	No Sample	Wash / Structural							No
Ruby West Spring	T23S/R42E-Section 21, SE	Argus Range, at the beginning of canyon, 7,000ft E of Bircham Spring	4,720' (GPS)	Yes, 1"=150'	197 Acres	CaHCO3-TDS:450 ppm	Wash / Structural	Et: 15 ac ft/yr, no surface flow	None	None	No	Arroyo Willow	Unknown	NAWS 1995
Shepherd Spring	T22S/R42E-Section 16, NE	Argus Range, SE of Carricut Lake	4,520' (Topo)	No	Undetermined	No Sample	Wash / Structural							No
Summer Spring	T21S/R40E-06, SE	Soutwestern base of Silver Peak	6,565' (GPS)	Yes, 1"100'	45 Acres	CaHCO3-TDS:410 ppm	Fracture flow	<1.0 gpm	None	None	No	Limited vegetation	Unknown	NAWS 1997
Tennessee Spring	T21S/R41E-Section 13, SW	Argus Range, on west slope of Maturango Peak, 11,500 ft N of Junction Ranch	6,009' (GPS)	Yes, 1"=100'	67 Acres	CaHCO3-TDS:260 ppm	Fault / Fracture flow	5.6 ac ft/yr	Wooden spring box with piping to North Forty (upgraded in 1993)	Quarterly flow measurements. Maintain spring box, piping and fencing.	Yes	Arroyo Willow	Unknown	NAWS 1995
Wild Horse Spring	T21S/R39E-Section 01, NE	Western base of Silver Peak	6,535' (GPS)	Yes, 1"=100'	61 Acres	CaHCO3-TDS:310 ppm	Wash / Structural/ Fracture flow	1.0-2.0 gpme	None	None	No	Arroyo Willow, Joshua, etc.	Historic prospects nearby	NAWS 1997

Stoner/1996

Spring Name	State Coordinates	Location Description	Spring Elevation	Watershed Mapped / Scale	Watershed Area	Water Quality	Spring Type	Surface Flow	Present Development	Future Plans	Fenced	Biological Resources	Cultural Resources	Published
Wild Rose Mine Spring	T23S/R41E-Section 11, SW	Argus Range, near head of canyon, S side of Mtn. Spring Rd.	5,160 (Topo)	Yes, 1"=150'	59 Acres	CaHCO3- TDS:385 ppm	Fault	2.75 ac ft/yr	Small pool of water fed by horizontal pipe in hillside.	None	No	Arroyo Willow, Cottonwood	Ruins, mining prospect adits nearby	NAWS 1995
Wilson Canyon (east) Spring	T24S/R41E-Section 3, SW	Argus Range, 3.5 Mi E of N Range Rd.	4,120' (Topo)	Yes, 1"=200'	56 Acres	NaHCO3- TDS:1080 ppm	Wash / Structural	ET: 10.5 ac ft/yr, no continuous surface flow	None	None	No	Squaw Willow, weed, rushes	Unknown	NAWS 1995
Unnamed/Unsurveyed Springs														
Tennessee Spr. North #1	T21S/R41E-Section 13 C01	1/2 mi N. of Tennessee Spr.	6,100' (Topo)											
Tennessee Spr. North #2	T21S/R41E-Section 11 N01	3/4 mi. N-NW of Tennessee Spr.	6,000' (Topo)											
Tennessee Spr. (NE)	T21S/R42E-Section 8 H01	2.6 mi. E-NE of Tennessee Spr.	5,760' (Topo)											
Deadman Cyn #1	T24S/R41E-Section K01	1.5 mi. N-NE Burro Cyn Test Facility	3,400' (Topo)											
Black Spring (Off NAWS)	T19S/R39E-Section227 Q01	3.5 mi. N-NW of Crystal Spr.	6,100'											
Wrinkle Springs (#1-#5)	T20S/R40E-Section 9	.50-.75 mi. W-NW of Indian Gardens Spr.	5,400' (Topo)											
Domingo Spring	T20S/R40E-Section 09 P01	1.0+ mi. W-NW of Indian Gardens Spr.	5,560' (Topo)											
Tub Spring	T20S/R40E-08 P01	1.75 mi. W-SW of Indian Gardens Spr.	5,960' (Topo)											
Darwin Spring - South	T20S/R40E-22 L01	.25 mi. S-SW of Darwin Spr.	5,360' (Topo)											
She Cat Spring	T20S/R40E-Section 28 A01	.90 mi. SW of Darwin Spr.	5,650' (Topo)											

ipring Name	State Coordinates	Location Description	Spring Elevatio n	Watershed Mapped / Scale	Watershed Area	Water Quality	Spring Type	Surface Flow	Present Development	Future Plans	Fenced	Biological Resources	Cultural Resources	Published
Coso (Cold) ipring (#2-#3)	T20S/R40E-Section 17 P01	.10-.25 mi. W of Coso (Cold) Spr.	5,800' (Topo)											
Mill Spring (NE)	TT20S/R39E-Sections 13/24	.50 mi. NE of Mill Spr	5,700' (Topo)											
happo Spring South/West)	T20S/R39E-Section 13 B/C01	South=.10 mi. S of Chappo Spr. / West=.30 mi. W of Chappo Spr.	South=7,020'/West=7,060' (Topo)											
Upper Centennial Spring	T19S/R39E-Section 32 H01	2.5 mi. N of Iron Hill	6,240' (Topo)											
Upper Centennial Spring (NW)	T19S/R39E-Section 32 C01	2.65 mi. N of Iron Hill	6,240' (Topo)											
Coso Hot Springs (SW)	T22S/R39E-Section 8 E01	1.0 mi. SW of Coso Hot Springs	4,400' (Topo)											
Shepherd Spring (N)	T22S/R42E-Section 4 P01	1.75 mi. N of Shepherd Spr.	4,700' (Topo)											
Shepherd pring (NE-#1-#2)	T22S/R42E-Section 15 A01	1.0 mi. E-NE of Shepherd Spr.	3,880' (Topo)											
Shepherd Spring (W)	T22S/R42E-Section16 E01	1.0 mi. W of Shepherd Spr.	5,400' (Topo)											
Shepherd Spring (SW)	T22S/R42E-Section20 H01	1.70 mi. SW of Shepherd Spr.	5,200' (Topo)											
Mud Hole Spring	T20S/R40E-Section 36 N01	3.25 mi. due S/SE of China Gardens Spr.	5,500' (Topo)											
Mud Hole Spring (W)	T20S/R40E-Section 36 N02	3.25 mi. due S/SE of China Gardens Spr.	5,540' (Topo)											
Mud Hole Springs (NE #1-#2)	T20S/R40E-36A01/02	.75 mi E-NE of Mud Hole Spring	5,160' (Topo)											
Mud Hole Springs SE (#3-#5)	T20S/R40E-36 R01-R03	.75 mi. E-SE of Mud Hole Spring	5,200' (Topo)											

Spring Name	State Coordinates	Location Description	Spring Elevation	Watershed Mapped / Scale	Watershed Area	Water Quality	Spring Type	Surface Flow	Present Development	Future Plans	Fenced	Biological Resources	Cultural Resources	Published
Wild Rose (SW	T23S/R41E-Section 15 A01	.30 mi. W/SW of Wild Rose Spring	5,260' (Topo)											
Wild Rose Spring (W)	T23S/R41E-Section 9 J01	1.2 mi. W of Wild Rose Spr.	5,060' (Topo)											
North Ruth Spring (W)	T24S/R42E-Section 3 A01	.30 mi. W/SW of Ruth Spring at end of Homewood Cyn.	4,080' (Topo)											
Parsons Spring	T23S/$2E-Section 27 P01	.70 mi. W/NW of Benko Spring. End of Homewood Cyn.	4,160' (Topo)											
Moscow Spring (S)	T24S/R42E-Section 7 H01	.30 mi. S/SW of Moscow Spr. North	5,200' (Topo)											
Quail Spring	T23S/R42E-Section 28 F01	2.1 mi. SW of Bircham Springs	4,880' (Topo)											
Quail Spring (NW)	T23S/R42E-Section 21 N01	.30 mi. NW of Quail Spring	4,960' (Topo)											
Ruby Spring (W)	T23S/R42E-Section 21 D01	1.1 mi. W of Ruby Spring	5,150' (Topo)											
Coyote Spring (SW)	T23S/R42E-Section 5 A01	.30 mi. SW of Coyote Spr.	5,420' (Topo)											
Margaret Ann Spring (SW #1-#2)	T23S/R42E-Section 4 P01/Q01	.50 mi. SW of Margaret Ann Spring	4,850' (Topo)											
Margaret Ann Spring SW #3)	T23S/R42E-Section 7 G01	1.0 mi. SW of Margaret Ann Spring	5,120' (Topo)											
Margaret Ann Spring (SE)	T23S/R42E-Section 10 D01	.90 mi. SE of Margaret Ann Spring	4,340' (Topo)											

SECTION 2.3.2.1a Reptile and Amphibian Species Known to Occur on NAWS/CL

Scientific Name	Common Name
Order Salientia (Frogs and Toads)	
Family Bufonidae	
Bufo boreas	Western toad
Family Hylidae (Hylid frogs)	
Pseudaeris regilla	Pacific tree-frog
Order Testudinata (Turtles)	
Family Testudinidae	
Gopherus agassizii	Desert tortoise
Chelydra serpentica	Snapping turtle
Order Squamata (Lizards and Snakes)	
Family Gekkonidae	
Coleonyx variegatus	Western banded gecko
Family Iguanidae	
Dipsosaurus dorsalis	Desert iguana
Sauromalus obesus	Chuckwalla
Callisaurus draconoides	Zebra-tailed lizard
Crotaphytus insularis	Collared lizard
Gambelia wislezennii	Leopard lizard
Sceloporus magister	Desert spiny lizard
Sceloporus graciosus	Sagebrush lizard
Sceloporus occidentalis	Western fence lizard
Urosaurus graciosus	Long-tailed brush lizard
Uta stansburiana	Side-blotched lizard
Phrynosoma platyrhinos	Desert horned lizard
Family Xantusidae	
Xantusia vigilis	Desert night lizard
Family Sinkidae	
Eumeces gilberti	Gilbert's skink
Family Teidae	

Scientific Name	Common Name
Cnemidophorus tigris	Western whiptail
Family Anguidae	
Elgaria panamintina	Panamint alligator lizard
Family Boidae (Boas)	
Lichanura trivirgata	Desert rosy boa
Family Colubridae (Colubrids)	
Diadophis amabilis	Western ring-necked snake
Phyllorhynchus decurtatus	Spotted leaf-nosed snake
Masticophis flagellum	Red racer
Masticophis taeniatus	Striped whipsnake
Salvadora hexalepis	Western patch-nosed snake
Arizona elegans	Glossy snake
Pituophis melanoleucus	Gopher snake
Lampropeltis getulus	Common king snake
Rhinocheilus lecontei	Long-nosed snake
Chionactis occipitalis	Western shovel-nosed snake
Hypsiglena torquata	Night snake
Family Viperidae	
Crotalus cerastes	Sidewinder
Crotalus mitchelli	Speckled rattlesnake
Crotalus scutulatus	Mojave rattlesnake

SECTION 2.3.2.1b Avian Species Known to Occur on NAWS/CL

MOCKINGBIRDS & THRASHERS
- __ Northern Mockingbird............cP
- __ Sage Thrasher.......xST,rFT,xW
- __ Brown Thrasher ....xFT
- __ California Thrasher ....xST
- __ Le Conte's Thrasher ....uP

PIPITS
- __ Red-throated Pipit...............xFV
- __ American Pipit.......................fW
- __ Sprague's Pipit....................xFV

WAXWINGS
- __ Bohemian Waxwing.............xW
- __ Cedar Waxwing ....iuW

SILKY-FLYCATCHERS
- __ Phainopepla.....................xS,uT

SHRIKES
- __ Northern Shrike.....................xW
- __ Loggerhead Shrike ....fP

STARLINGS
- __ European Starling (I).............cP

VIREOS
- __ White-eyed Vireo ....xSV
- __ Solitary Vireo..........................rT
- __ Warbling Vireo ....uT
- __ Red-eyed Vireo ....xSV

EMBERIZIDS

Wood-Warblers
- __ Orange-crowned Warbler.............cST,fFT,xW
- __ Nashville Warbler ....rT
- __ Virginia's Warbler..................xV
- __ Lucy's Warbler xV
- __ Northern Parula.....................xV
- __ Yellow Warbler.......................cT
- __ Magnolia Warbler................xFV
- __ Black-throated Blue Warbler...................xFV
- __ Yellow-rumped Warbler ....cW
- __ Black-throated Gray Warbler ....uT
- __ Townsend's Warbler.... rST,xFT
- __ Hermit Warbler ....xT
- __ Palm Warbler.......................xFV
- __ Blackpoll Warbler................xFV
- __ Black-and-white Warbler xV
- __ American Redstart.................xV
- __ Prothonotary Warbler .... xFV
- __ Ovenbird...................................xV
- __ Northern Waterthrush......... xFV
- __ Kentucky Warbler.............. xSV
- __ MacGillivray's Warbler........... rT
- __ Common Yellowthroat............fT
- __ Hooded Warbler ....xSV
- __ Wilson's Warbler..........cST,fFT
- __ Yellow-breasted Chat .... rT

Tanagers
- __ Summer Tanager xV
- __ Scarlet Tanager.................. xFV
- __ Western Tanager ....uT

Grosbeaks & Buntings
- __ Rose-breasted Grosbeak ... xSV
- __ Black-headed Grosbeak.........fT
- __ Blue Grosbeak.................xS*,rT
- __ Lazuli Bunting..............uST,rFT
- __ Indigo Bunting .... xSV
- __ Dickcissel .... xFV

Towhees, & Sparrows
- __ Green-tailed Towhee....rST,xFT
- __ Spotted Towhee .... rW
- __ California Towhee .... fP
- __ American Tree Sparrow ..... xFV
- __ Chipping Sparrow..................uT
- __ Clay-colored Sparrow......... xFV
- __ Brewer's Sparrow .... rT
- __ Black-chinned Sparrow .... IrS
- __ Vesper Sparrow.................. rFT
- __ Lark Sparrow...................xS,rW
- __ Black-throated Sparrow..cS,uW
- __ Sage Sparrow........................ fP
- __ Lark Bunting .... xFV
- __ Savannah Sparrow......... xS,cW
- __ Grasshopper Sparrow ....xFT
- __ Le Conte's Sparrow...... xFV,xW
- __ Fox Sparrow .... rT,xW
- __ Song Sparrow..................xS,fW
- __ Lincoln's Sparrow .... fW
- __ Swamp Sparrow ....xFT
- __ White-throated Sparrow . xT,xW
- __ Golden-crowned Sparrow........................rT,xW
- __ White-crowned Sparrow...... cW
- __ Harris' Sparrow ....xT,xW
- __ Dark-eyed Junco..................fW
- __ Lapland Longspur ....xFT

Blackbirds & Orioles
- __ Bobolink ....xST,rFT
- __ Red-winged Blackbird...........cP
- __ Tricolored Blackbird.............xS*
- __ Western Meadowlark...... uS,fW
- __ Yellow-headed Blackbird .... fS
- __ Rusty Blackbird............xFV,xW
- __ Brewer's Blackbird ....cP
- __ Great-tailed Grackle..............uP
- __ Brown-headed Cowbird ... fS,rW
- __ Orchard Oriole ....xFV
- __ Hooded Oriole..................... rST
- __ Baltimore Oriole ....xST
- __ Bullock's Oriole .... uS
- __ Scott's Oriole .... IuS,xW

OLD WORLD FINCHES
- __ Purple Finch ....xST,xW
- __ Cassin's Finch .... xFT,xW
- __ House Finch ....cP
- __ Red Crossbill ....xT,rW
- __ Pine Siskin .... rT
- __ Lesser Goldfinch .... uS,fT,rW
- __ Lawrence's Goldfinch ....IfS,xT
- __ American Goldfinch.........uT,rW
- __ Evening Grosbeak.......... xT,xW

OLD WORLD SPARROWS
- __ House Sparrow (I) ....cP

Notes

Checklist of the Birds of the Indian Wells Valley

Inyo, Kern, and San Bernardino Counties, California
Compiled by David Blue and Don Moore

April 28, 1998

This checklist includes 322 species of birds observed in the Indian Wells Valley and those canyons draining into it. Taxonomy and nomenclature conform to the Fortieth Supplement to the American Ornithologists' Union *Check-list of North American Birds*, 1995. Definitions for status and abundance codes are from *Distributional Checklist of North American Birds* by David DeSante and Peter Pyle. That standard was extended to include the fall and spring transient and vagrant status codes. Note that transient status is listed only if abundance is greater than that at other times of the year. The five introduced species are indicated with an "I" in parentheses following the name. Continued input from field observers is encouraged to improve the accuracy of this checklist. Observations of birds marked extremely rare should be documented with photographs and complete details, and every effort should be made to get other observers out to substantiate the sighting.

Please send sighting details, updates, or corrections, to either of the compilers, care of the Kerncrest Chapter, National Audubon Society, P.O. Box 984, Ridgecrest, CA 93556.

Status Codes

P - Permanent resident and confirmed breeder
P* - Non-breeding permanent resident
S - Summer resident and confirmed breeder
S* - Non-breeding summer resident
T - Transient (occurring within its established range during migration)
ST - Spring Transient FT - Fall Transient
V - Vagrant (occurring outside its established range during migration)
SV - Spring Vagrant FV - Fall Vagrant
W - Winter resident or visitant (January-February occurrences only)

Suffixes to status codes

+ - Assumed breeder but positive evidence of breeding is lacking

Abundance Codes	**A few individuals encountered on:**	**Many individuals encountered on:**
c - common or abundant	> 90% of days	> 50% of days
f - fairly common	50-90% of days	10-50% of days
u - uncommon	10-50% of days	< 10% of days
r - rare	< 10% of days	—
x - extremely rare	(10 or fewer records at that season)	

Abundance Modifiers

i - irregular (of cyclic or sporadic occurrence)
I - limited (to a geographic area that comprises 10% or less of the area)

LOONS
__ Common Loon .... rT

GREBES
__ Pied-billed Grebe .... uP
__ Horned Grebe .... xFT,xW
__ Eared Grebe .... cS,fW
__ Western Grebe .... xST,uFT
__ Clark's Grebe .... rT

PELICANS
__ American White Pelican .... fT
__ Brown Pelican xV

CORMORANTS
__ Double-crested Cormorant ... uT

BITTERNS & HERONS
__ American Bittern .... rT
__ Least Bittern .... xFT
__ Great Blue Heron ...... uS*,fT,xW
__ Great Egret .... fT,xW
__ Snowy Egret .... fT,xW
__ Cattle Egret .... uT
__ Green Heron .... rT
__ Black-crowned Night-Heron .... uS*,fT,xW

IBISES & SPOONBILLS
__ White-faced Ibis .... fT
__ Roseate Spoonbill xV

SWANS, GEESE & DUCKS
__ Tundra Swan .... rFT
__ Greater White-fronted Goose .... rFT,xW
__ Snow Goose .... cW
__ Ross' Goose .... uT,rW
__ Brant .... xST
__ Canada Goose .... xS*,fW
__ Wood Duck .... xST,rFT,xW
__ Green-winged Teal .... xS,cW
__ Mallard .... cP
__ Northern Pintail .... fW
__ Blue-winged Teal .... uST
__ Cinnamon Teal .... rS,cT,xW
__ Northern Shoveler .... cW
__ Gadwall .... uS,fW
__ Eurasian Wigeon xV
__ American Wigeon .... cW
__ Canvasback .... uW
__ Redhead .... xS,fW
__ Ring-necked Duck .... uW
__ Greater Scaup .... xFV,xW
__ Lesser Scaup .... uW
__ Oldsquaw .... xFV
__ Surf Scoter xV
__ Common Goldeneye .... rFT,xW
__ Bufflehead .... cW
__ Hooded Merganser .... xST
__ Common Merganser .... xST,rFT,xW
__ Red-breasted Merganser .... xS*,xST,rFT
__ Ruddy Duck .... cP

AMERICAN VULTURES
__ Turkey Vulture .... fS*,cT

KITES, EAGLES & HAWKS
__ Osprey .... rT
__ White-tailed Kite .... xST,xS*
__ Bald Eagle .... xT
__ Northern Harrier .... cP*
__ Sharp-shinned Hawk .... uW
__ Cooper's Hawk .... uW
__ Red-shouldered Hawk .... rT,xW
__ Swainson's Hawk .... xT
__ Red-tailed Hawk .... uS,cW
__ Ferruginous Hawk .... xT
__ Rough-legged Hawk .... xFT,xW
__ Golden Eagle .... uP*

FALCONS
__ American Kestrel .... uS,fT,uW
__ Merlin .... xT,xW
__ Peregrine Falcon .... xFT
__ Prairie Falcon .... uP

PARTRIDGES & QUAIL
__ Chukar (I) .... uP
__ Gambel's Quail (I) .... rP
__ California Quail .... uP
__ Mountain Quail .... rP

RAILS, GALLINULES & COOTS
__ Virginia Rail .... uT,xW
__ Sora .... xS,uT
__ Common Moorhen .... xST,xW
__ American Coot .... cP

CRANES
__ Sandhill Crane .... xT

PLOVERS
__ Black-bellied Plover .... uT
__ American Golden-Plover .... xFT
__ Snowy Plover .... xS*,uT
__ Semipalmated Plover .... uT
__ Killdeer .... fP
__ Mountain Plover .... xFT

STILTS & AVOCETS
__ Black-necked Stilt .... cS
__ American Avocet .... cS,rW

SANDPIPERS & PHALAROPES
__ Greater Yellowlegs .... fT,xW
__ Lesser Yellowlegs .... fT
__ Solitary Sandpiper .... uT
__ Willet .... uT
__ Wandering Tattler .... xSV
__ Spotted Sandpiper .... cT
__ Whimbrel .... rT
__ Long-billed Curlew .... rT
__ Marbled Godwit .... uT
__ Ruddy Turnstone .... xT
__ Black Turnstone .... xSV
__ Red Knot .... xFV
__ Sanderling .... rST,uFT,xW
__ Semipalmated Sandpiper xV
__ Western Sandpiper .... cT
__ Least Sandpiper .... cT
__ Baird's Sandpiper .... xST,rFT
__ Pectoral Sandpiper .... rFT
__ Dunlin .... xST,uFT,xW
__ Stilt Sandpiper .... xFT
__ Ruff xV
__ Short-billed Dowitcher .... uT
__ Long-billed Dowitcher .... cT
__ Common Snipe .... uT,xW
__ Wilson's Phalarope .... cT
__ Red-necked Phalarope .... cT
__ Red Phalarope .... xFT

SKUAS, GULLS & TERNS
__ Pomarine Jaeger .... xFV
__ Parasitic Jaeger .... xFV
__ Franklin's Gull .... rT
__ Little Gull .... xSV
__ Bonaparte's Gull .... xS*,uT
__ Ring-billed Gull .... fT,uW
__ California Gull .... uS*,fT,uW
__ Herring Gull .... xT
__ Black-legged Kittiwake .... xFV
__ Sabine's Gull .... rFV
__ Caspian Tern .... uT
__ Common Tern .... rT
__ Arctic Tern xV
__ Forster's Tern .... uT
__ Least Tern .... xSV
__ Black Tern .... fT
__ Black Skimmer .... xFV

PIGEONS & DOVES
__ Rock Dove (I) .... cP
__ Band-tailed Pigeon .... rST
__ White-winged Dove .... xS*
__ Mourning Dove .... cS,fW
__ Ruddy Ground-Dove .... xW

CUCKOOS & ROADRUNNERS
__ Yellow-billed Cuckoo .... xST
__ Greater Roadrunner .... uP

BARN OWLS
__ Barn Owl .... rP

TYPICAL OWLS
__ Flammulated Owl .... xT
__ Great Horned Owl .... uP
__ Burrowing Owl .... uS,xW
__ Long-eared Owl .... ifW
__ Short-eared Owl .... xT
__ Northern Saw-whet Owl ... xF,xW

GOATSUCKERS
__ Lesser Nighthawk .... fS
__ Common Nighthawk .... xT
__ Common Poorwill .... rS,xW

SWIFTS
__ Black Swift .... xFV
__ Chimney Swift .... xFV
__ Vaux's Swift .... xST
__ White-throated Swift .... rST

HUMMINGBIRDS
__ Broad-billed Hummingbird .. xSV
__ Black-chinned Hummingbird .... cS
__ Anna's Hummingbird .... cP
__ Costa's Hummingbird .... fS,xW
__ Calliope Hummingbird .... xST
__ Rufous Hummingbird .... uT

KINGFISHERS
__ Belted Kingfisher .... xT

WOODPECKERS
__ Lewis' Woodpecker xV
__ Acorn Woodpecker xV
__ Yellow-bellied Sapsucker xV
__ Red-naped Sapsucker .... xST,uFT
__ Red-breasted Sapsucker .... rFT
__ Williamson's Sapsucker .... IxST
__ Ladder-backed Woodpecker .... uP
__ Nuttall's Woodpecker .... xFT
__ Downy Woodpecker .... xST
__ Hairy Woodpecker .... xT
__ White-headed Woodpecker .... xFT
__ Northern Flicker .... cW

TYRANT FLYCATCHERS
__ Olive-sided Flycatcher .... xFT
__ Western Wood-Pewee .... uT
__ Willow Flycatcher .... fT
__ Hammond's Flycatcher .... rST
__ Dusky Flycatcher .... rST
__ Gray Flycatcher .... rST
__ Pacific-slope Flycatcher .... uT
__ Black Phoebe .... fP
__ Say's Phoebe .... fP
__ Vermilion Flycatcher .... xS,xV
__ Ash-throated Flycatcher .... uT
__ Cassin's Kingbird .... xST
__ Western Kingbird .... cS
__ Eastern Kingbird xV
__ Scissor-tailed Flycatcher .... xFV

LARKS
__ Horned Lark .... cP

SWALLOWS
__ Purple Martin xV
__ Tree Swallow .... cT
__ Violet-green Swallow .... uT
__ Northern Rough-winged Swallow .... xS,fT
__ Bank Swallow .... uT
__ Cliff Swallow .... fT
__ Barn Swallow .... cT

JAYS, MAGPIES & CROWS
__ Steller's Jay .... xT
__ Western Scrub-Jay .... xT,xW
__ Pinyon Jay .... xT
__ Clark's Nutcracker .... xFV
__ Black-billed Magpie .... xFV
__ Common Raven .... cP

TITMICE
__ Mountain Chickadee .... xT
__ Plain Titmouse .... xT

VERDINS
__ Verdin .... uP

BUSHTITS
__ Bushtit .... xT

NUTHATCHES
__ Red-breasted Nuthatch .. xT,xW
__ White-breasted Nuthatch .... xW
__ Pygmy Nuthatch .... xFT

CREEPERS
__ Brown Creeper .... xFT

WRENS
__ Cactus Wren .... uP
__ Rock Wren .... uP
__ Canyon Wren .... IxP
__ Bewick's Wren .... rS,uT,rW
__ House Wren .... uT,xw
__ Winter Wren .... xT
__ Marsh Wren .... xS,cW

MUSCICAPIDS
Kinglets & Gnatchatchers
__ Golden-crowned Kinglet .... xFT
__ Ruby-crowned Kinglet .... fT,uW
__ Blue-gray Gnatcatcher .... uS,uT

Solitaires & Thrushes
__ Western Bluebird .... xS,uT,xW
__ Mountain Bluebird .... uT,xW
__ Townsend's Solitaire .... rW
__ Swainson's Thrush .... rST,xFT
__ Hermit Thrush .... uT,rW
__ American Robin .... xS,fW
__ Varied Thrush .... xST,rFT

SECTION 2.3.2.1c Mammal Species Known to Occur on NAWS/CL

Scientific Name	Common Name
Order Insectivora	
Family Soricidae	
Notiosorex crawfordi	Desert shrew
Order Chiroptera	
Family Vespertilionidae	
Myotis lucifugus	Little brown myotis
Myotis volans	Long-legged myotis
Myotis thysanodes	Fringed myotis
Myotis volans	Hairy-winged myotis*
Myotis evotis	Long-eared myotis*
Myotis californicus	California myotis
Myotis yumanensis	Yuma myotis*
Myotis ciliolabrum	Western small-footed myotis
Lasiurus cinereus	Hoary bat*
Lasiurus blossevillii	Western red bat*
Lasionycteris noctivagans	Silver-haired bat*
Pipistrellus hesperus	Western pipistrel
Eptesicus fuscus	Big brown bat
Euderma maculatum	Spotted bat
Corynorhinus townsendii	Townsend's big-eared bat
Antrozous pallidus	Pallid bat
Family Molossidae	
Tadarida brasiliensis	Mexican free-tailed bat
Eumops perotis	Western mastiff bat
Order Lagomorpha	
Family Leporidae	
Sylvilagus audubonii	Desert cottontail
Lepus californicus	Black-tailed jackrabbit
Order Rodentia	
Family Scuiridae	
Spermophilus beecheyi	California ground squirrel

Scientific Name	Common Name
Ammospermophilus leucurus	White-tailed antelope squirrel
Spermophilus mohavensis	Mohave ground squirrel
Eutamias panamintinus	Panamint chipmunk
Family Geomyidae	
Thomomys bottae	Botta's pocket gopher
Family Heteromyidae	
Perognathus longimembris	Little pocket mouse
Perognatus parvus	Great basin pocket mouse
Chaetodipus penicillatus	Desert pocket mouse
Chaetodipus formosus	Long-tailed pocket mouse
Dipodomys merriami	Merriam's kangaroo rat
Dipodomys microps	Chisel-toothed kangaroo rat
Dipodomys panamintinus	Panamint kangaroo rat
Dipodomys deserti	Desert kangaroo rat
Family Muridae	
Reithrodontomys megalotis	Western harvest mouse
Peromyscus maniculatus	Deer mouse
Peromyscus crinitus	Canyon mouse
Peromyscus eremicus	Cactus mouse
Peromyscus boylii	Brush mouse
Peromyscus truei	Pinyon mouse
Onychomys torridus	Southern grasshopper mouse
Neotoma fuscipes	Dusky-footed woodrat
Neotoma lepida	Desert woodrat
Microtus sp.	Vole (species unknown)
Family Erethizontidae	
Erethizon dorsatum	Common porcupine
Order Carnivora	
Family Canidae	
Canis latrans	Coyote
Vulpes macrotis	Desert kit fox
Urocyon cinereoargenteus	Common gray fox

Scientific Name	Common Name
Family Procyonidae	
Bassariscus astutus	Ringtail
Family Mustelidae	
Taxidea taxus	Badger
Mephitis mephitis	Striped skunk
Family Fedlidae	
Lynx rufus	Bobcat
Felis concolor	Mountain lion
Order Perissodactyla	
Family Equidae	
Equus asinus	Feral burro**
Equus caballus	Feral horse**
Order Artiodactyla	
Family Cervidae	
Odocoileus hemionus	Mule deer
Family Bovidae	
Ovis canadensis	Bighorn sheep***

* Species of potential occurrence on NAWS
** Introduced species
*** Reintroduced species

SECTION 2.3.2.2 Threatened and Endangered Species - General

Both the USFWS and CDFG have determined certain species to be rare and list them as either endangered or threatened. These species have specific legal protection as described in the federal Endangered Species Act (as amended in 1973) and State of California Endangered Species Act (as amended in 1984). Without federal consultation, NAWS mission and support activities cannot be initiated in habitat occupied by a federally-listed species. State-listed species are considered protected to the maximum extent practicable and in the case of the Mojave ground squirrel are usually afforded adequate protection through desert tortoise consultations and tortoise habitat protection measures. Projects initiated without federal consultation that result in take, harm, or harassment would result in violations of the law, law suits, and/or project delays. Personnel who approve or conduct activities that result in take, harm, or harassment may be held personally liable and subject to a maximum fine of $50,000 and/or up to one year in prison. NAWS's long-term management plans which are approved through the Section 7 process and covered with Biological Opinions for federally-listed species minimizes mission activity delays while information required for consultation is generated.

Identifying impacts and monitoring wildlife on NAWS enhances the Station's ability to meet Navy natural resource management mandates for wildlife and wildlife habitat protection. Navy policy, as described throughout Chapter 22 of OPNAVINST 5090.1B, states that Navy commands shall act responsibly in the public interest to restore, improve, preserve, and properly utilize natural resources on Navy-administered lands. Additionally, monitoring programs on NAWS are vital to support other natural resource management programs, including NEPA compliance, Endangered Species Management, Vegetation Management, and Grazing Management.

In addition to formally-listed species a variety of lists of species of special concern (SSC) have been created for a variety of uses. SSC lists have been created by the BLM, USFS, National Audubon Society, and CNDDB to serve as watch lists for species that may be deserving of formal listing. Perhaps the most important is the CNDDB list of SSC (January 1996). The intent of CNDDB for the special concern category was to give consideration to that species lacking legal protection, which may help avert costly recovery efforts that would otherwise be required to save such species (Jennings and Hayes, 1994). CDFG funds reviews of these species by initiating a series of reports for vertebrate groups that could be included under the special concern category. These reports are *Fish Species of Special Concern* (Moyle), *Amphibian and Reptile Species of Special Concern* (Jennings and Hayes, 1994), *Bird Species of Special Concern* (Remsen, 1978), and *Mammal Species of Special Concern* (Williams, 1986). An updated Bird Species of Special Concern is being prepared by Dr. Steve Laymon and Dr. Pam Williams and should be available in summer, 1996.

To establish a list of NAWS-SC, NAWS relied heavily on the CNDDB Special Animals List (January 1996). In addition, a list of sensitive species not on the CNDDB list was compiled by experts for those families or species. Dr. Pat Brown-Berry, who has conducted several surveys on NAWS and adjoining areas, compiled the list for bats. The list of sensitive invertebrates was prepared by Dr. Gordon Pratt, Dr. David Weismann, Dr. Larry Eng, and Derham Giuliani.

These species are not on the CNDDB list due to a variety of reasons, such as knowledge gaps, recent or unpublished work, and professional opinions by experts in the field. Determining whether a species is threatened is complicated by a number of factors, such as a lack of knowledge of species distribution, genetics involved in species classification, and isolation of the taxon. Most species in this category are invertebrates with generally little work on taxonomy, distribution, or life history of these species, but some are vertebrates. As more information becomes available, more species may be added to NAWS sensitive species list; some will probably be removed; and others may eventually be placed on State or federal sensitive species lists or be listed. Recognition of these species as sensitive and deserving consideration in the decision-making process, especially when approving new facilities or project sites, is part of the NAWS long-range management strategy.

SECTION 2.3.2.2.1a Mohave Tui Chub

Background

Mohave tui chub are native to the Mojave River basin. Mojave River head waters are along the northern boundary of the San Bernardino National Forest near Deep Creek. The river is mostly subsurface and daylights in the Mojave Narrows Park, and Afton Canyon. Much surface water is diverted, and groundwater is pumped to support agriculture and the communities of Barstow, Victorville, and Silver Lakes. There remains little to no native habitat for Mohave tui chub in the Mojave River.

In the 1930s fishermen introduced the Arroyo chub (*Gila orcutti*) to the Mojave River where they readily hybridized with the Mohave tui chub. By 1970 few genetically pure Mohave tui chub remained. A small population of what are thought to be genetically pure tui chub survived at Fort Soda near the southeastern edge of the dry Soda Lake lakebed. Fort Soda is part of the Mojave National Preserve, operated by a university consortium led by California State University, Fullerton.

A pond (Lake Tuendae) and a spring (MC Spring) at Fort Soda support a chub population. A second pond (West Pond) is in need of rehabilitation and cannot support wildlife at this time. MC Spring continues to support a small population of chub. However, in order to maintain open waters cattails must manually be removed annually. Lake Tuendae was excavated by Curtis Howe Springer who developed and operated a religious health retreat called Zzyzx Mineral Springs Resort until he was removed from BLM land in 1973. Prior to Springer's occupation of the site, it had been a railroad siding for the Tonopah and Tidewater Railroad and before that an Army fort (Taylor and Williams, 1984).

The Mohave Tui Chub Advisory Committee was established by CDFG to coordinate Mohave tui chub recovery efforts, such as drafting a Recovery Plan and assisting with future study designs and relocation efforts. The Advisory Committee consists of members from the CDFG, USFWS, USFS, BLM, universities, the Navy, and independent contractors.

Natural History

Mohave tui chub begin spawning in March or April when water warms to approximately 18° C (Vickers, 1973). Spawning can take place as long as water temperatures are between 17° and 26° C (Castleberry, 1985). Chub spawn in mass over vegetation where the eggs become attached after fertilization. Eggs are about one millimeter in diameter, are adhesive, and hatch in 6 to 8 days at 18-20° C. Prolarve spend about 12 hours on the bottom and then swim to the surface. During a June 1997 mark/recapture program it was noted that chub were still spawning.

Mohave tui chubs are not known to spawn before reaching one year of age. Data from Lake Tuendae at Fort Soda indicate that fry form small schools in shallow areas,;medium size chub (30-80 SL) school in areas 20 to 50 centimeters deep,;and chub larger than 80 millimeters are solitary and are usually captured in the deepest portion of the lake (Taylor and Williams, 1984).

Mohave tui chubs are morphologically adapted for feeding on plankton. However, food habits were difficult to assess because chubs consumed food scraps furnished by resort guests at Fort

Soda or Range personnel at NAWS. In fact, one channel on NAWS was named the Bologna Pool because workers in an adjacent building would feed the chub day-old bologna sandwiches.

Mohave tui chub are bright brassy-brown to dusky-olive dorsally, gold and finely speckled laterally, and bluish-white to silver on the belly. Fins are olive to rich brown with lower fins paling outward. The body is thick with a large head and short rounded fins. The snout is short; the mouth oblique; the interorbital space broad and rather flat; and the dorsal outline of the head slightly concave. A distinct hump sometimes develops behind the head in older fish. Sexual dimorphism is not exhibited in the chub (Taylor and Williams, 1984).

The Mohave tui chub was observed to be lacusterine, associated with deep pools and slough-like areas of the Mojave River. The occurrence of this species in streams without these features was rare. They do not endure flooding well but have adapted to an alkaline, hard water habitat. In studies at Fort Soda in 1981, the chub thrived in habitats where dissolved oxygen was less than 1 milligram/liter. Other studies show the chub's upper lethal temperature limit may be slightly above 30° C (Taylor and Williams, 1984).

Survey Methodology

A 1989 population survey used large baited minnow traps for a mark-recapture survey. The survey consisted of a single marking period followed by one recapture period the following day and used a Lincoln/Petersen population estimation formula. This could also be done with more capture periods (consecutive days), using the Schnabel equation. This requires a fin clip to mark all fish upon initial capture. At second capture all marked fish are noted; unmarked fish are marked; and so on for as many capture periods as is feasible or until the proportion of unmarked fish in a sample becomes small.

Vicker (1973) reported very few Mohave tui chub surviving as long as four years at Soda Springs. He did not believe the mortality of 2+ and 3+ year old fish was due to old age, but he did not offer an alternative. The Eagle Lake tui chub, a closely related subspecies, is known to live up to seven years (Kimsey, 1954). Without confirmation that Mohave tui chub survive longer than four years, it is assumed that is their maximum life span. Because of this short life span, an annual census is recommended, but not be less than every three years. Census should not occur during the winter inactive period. Late fall may be best as spawning will not be disrupted and young-of-the-year should be captured, allowing the confirmation of reproductive success.

If annual census is not possible, sight confirmation of chub existence must be documented at least annually or more often. Frequent checks for mortality could be part of a monitoring plan. If there are close to 20,000 fish in the system, a mass die-off would be difficult to miss during a check. However, at that point it would be too late. A gradual die-off would be more difficult to detect. Frequent visual checks for live and dead fish would be prudent.

Water Quality Monitoring

The Mohave tui chub is not as adapted to desert conditions as other desert fish (McClenahan *et al.*, 1986). Its natural environment, the Mojave River, is not subject to temperature extremes or alkalinities potentially occurring in their present refugia. Therefore, water quality of the Lark Seep system should be monitored regularly, and a remedial plan should be prepared in the event they face unacceptable water quality or quantity. It is recommended that a monthly (weekly for water depth, temperature, and dissolved oxygen) sampling of water quality occur at the nine sampling stations used by a previous study (Feldmeth *et al.*, 1989). Sampling stations are as follows:

- S-1. East Shop Channel at weir on north side of Water Road.
- S-2. East Shop Channel at conjunction with Lark Seep.
- S-3. Lark Seep Lagoon.
- S-4. G-1 Channel above weir below Lark Seep.
- S-5. G-1 Connector Channel north of Water Road.
- S-6. G-1 Channel at weir above Pole Line Road.
- S-7. G-1 Channel near Tower (G-1) Road.
- S-8. G-1 Seep Lagoon.
- S-9. Sewage Ponds (source of piped water to the system).
- (Some names have been changed from the 1989 report to remain consistent with road and channel names used by Bilhorn and Feldmeth (1991).

Water depth, temperature, and DO seem to be the most likely parameters that could affect the population. At a minimum, the following monitoring should be done: 1) check water depth/flow rates weekly year-round; 2) monitor DO weekly; and 3) check water temperature weekly when problems are most likely. This is not meant to diminish the importance of full quality checks on a regular basis.

If the physical system is altered sampling stations should be amended to sample appropriate areas.
In addition, general chub health should be monitored annually. Health indicators would include various parameters, such as growth rates, reproductive success, presence of internal and external parasites, and food availability. This could be done in conjunction with population estimate sampling.

Source evaporation pond and well waters should be analyzed annually for water quality. An extensive analysis was done in 1990 by Enseco. This study found arsenic, barium, molybdenum, and zinc in water samples. In sludge, arsenic, barium, cobalt, copper, lead, vanadium, and zinc were found. Based on this and another analysis by Feldmeth *et al.* (1989), samples should be sent to a lab annually for analysis of the following: nitrates, phosphates, magnesium, calcium, sodium, potassium, chloride, sulfur, ammonia, total dissolved solids, selenium, barium, arsenic, chromium, iron, lead, mercury, gold, molybdenum, and zinc.

Water Quality Measurements

Temperature

Temperature should be taken in the mid-water column where the fish are likely found. A standard pocket thermometer would suffice, but an electronic thermometer with a probe is preferable. Depending on the chub's acclimation temperature, critical thermal maxima ranged from 33.5 to 36.6^0 C, and critical thermal minima from 2.0 to 7.5^0 C (Feldmeth *et al.*, 1984). These temperature extremes are unlikely to be exceeded under normal conditions at Lark Seep. However, during an unusually hot summer or cold winter, water temperature should be closely monitored.

Dissolved Oxygen

Mohave tui chub can survive dissolved oxygen (DO) concentrations of 1 part per million (ppm) or less, at least for short periods of time (McClenahan *et al.*, 1986). Feldmeth *et al.* (1989) found DO generally remained above 6.0 ppm except in early morning at Lark Seep. The lowest DO readings (approaching 1.0 ppm) at Lark Seep were during summer in areas most heavily vegetated by cattails. DO readings were taken in the field with a Yellow Springs Instrument Dissolved Oxygen Meter (Model 57). Calibration is required, and the sensor must be replaced periodically.

pH

Feldmeth *et al.* (1984; 1989) found pH readings measured with an MHO pen pH meter ranging from 6.0 to 9.6 in the Lark Seep system. Most freshwater fishes are not tolerant of pH outside the 6.0 to 9.5 range (Cooperrider *et al.*, 1986). The critical range for survival and reproduction of the Mohave tui chub is unknown, although they seem to survive well within the range found at Lark Seep. The pH should be kept within the above range.

Conductivity

A range of 1,520 to 7,300 gmhos/cm was found in the Lark Seep system (Feldmeth *et al.*, 1984; 1989). The Lake Tuendae Mohave tui chub population survives in water with conductivity reaching as high as 19,100 gmhos/cm (Bilhorn and Feldmeth, 1985). Conductivity was measured with an MHO pen conductivity meter.

Total Dissolved Solids

A range of 1,300 to 5,600 ppm was found in the Lark Seep system (Feldmeth *et al.*, 1984; 1989). The Lake Tuendae Mohave tui chub population survives in water with a total dissolved solids (TDS) reaching as high as 12,500 mg/L (Bilhorn and Feldmeth, 1985). TDS was measured on a Myron-LDS meter (Model 532).

Alkalinity

Feldmeth *et al.* (1984; 1989) measured alkalinity by using phenothalien (for carbonate alkalinity) and methyl orange (for bicarbonate alkalinity) titrations. They reported carbonate ranged from 0 to 154 ppm in the seep system, although readings rarely exceeded 50 ppm. Bicarbonate ranged from 180 to 600 ppm, but was generally in the 300 to 500 ppm range. Carbonate in the sewage pond samples exceeded that of the seep system.

Salinity

Tui chubs osmoregulatory capacity began to diminish between salinities of 250 mOsm/1 and 323 mOsm/1 (8 and 11 parts per thousand), above which mortality seems likely (Feldmeth *et al.*, 1984). Feldmeth *et al.* (1984) found salinities rarely exceeded 3 ppt and never exceeded 6 ppt. Salinity was measured with a Yellow Springs Instruments Meter (Model 33).

Water Level Monitoring

Bilhorn and Feldmeth (1991) estimated a maximum water demand for the system at 993,000 gallons per day (gpd) (92.2 ft^3/min) in summer and a minimum water demand in winter at 622,170 gpd (57.8 ft^3/min). More than half of the demand is from G-1 Seep. Depending on season, Lark Seep supplied between 10 and 30 ft^3/min of the water for G-1 Seep through the G-1 Channel.

Water depth in the seep lagoons should be monitored weekly along with water flow rates at various weirs of the system. Seasonal variations in flow are to be expected. Drastic drops from that estimated by Feldmeth (1991) may indicate groundwater problems. However, an early warning system for this is available in existing wells.

Well water levels should be monitored monthly. Bilhorn and Feldmeth (1991) reported that wells J, MW-1, MW-2, MW-3, and I provide the needed water level data for monitoring and warning for Lark Seep. Wells B and C clusters will give warning of any lowering that could affect flow into the G-1 channel, and thus affect the level of G-1 Seep. They recommended bimonthly monitoring of water levels at each of these wells, plus well "H", while evaporative pond lining was occurring. Drops in well levels upstream from the Lark Seep system would provide early warning of a drop in water levels of the seep.

Bilhorn and Feldmeth (1991) proposed the construction of a pipeline to conduct water directly from WTF pond 9 to three sources in the Lark Seep system (East Shop Channel, George Channel, and G-1 Connector Channel) along with the creation of a detention pond along George Channel. They specified the estimated necessary delivery rate through each of these pipes. As they estimated a relatively short amount of time necessary for construction of this system (2 - 4 months), implementation of this plan could be postponed until a critical drop in water levels of the monitored wells was noted. This critical minimum must be determined, but presumably it would be based on the minimum levels recorded at respective wells during Bilhorn and Feldmeth's monitoring period.

SECTION 2.3.2.2.1b Biological Opinion for Enhancement of Mohave Tui Chub Habitat on the Naval Air Weapons Station, China Lake, Kern County, California

0 6 MAY 1997

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

May 2, 1997

Carolyn A. Shepherd
Head, Environmental Project Office
Public Works Department
Naval Air Weapons Station
1 Administration Circle
China Lake, California 93555-6100

Subject: Biological Opinion for Enhancement of Mohave Tui Chub Habitat on the Naval Air Weapons Station, China Lake, Kern County, California (5090 Ser 83EOOOD/0567) (1-8-97-F-15)

Dear Ms. Shepherd:

This biological opinion responds to your request for formal consultation with the U.S. Fish and Wildlife Service (Service) pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act). Your request was dated January 28, 1997 and received in our office on January 31, 1997. At issue are the effects that the Naval Air Weapons Station's (NAWS) proposed habitat enhancement activities near Lark Seep Lagoon may have on the Mohave tui chub (*Gila bicolor mohavensis*), federally listed as an endangered species.

This biological opinion was prepared using information from the following sources: your January 28, 1997, request for consultation regarding the proposed action; discussions between Navy and Service staff; and our files.

Biological Opinion

It is the opinion of the Service that the proposed action is not likely to jeopardize the continued existence of the Mohave tui chub. Critical habitat has not been designated for the Mohave tui chub.

Description of the Proposed Action

To maintain the water distribution capacity of a system of channels connecting the Lark and G-1 Seeps, the NAWS routinely excavates cattails (*Typha latifolia*) from the channel system.

Clearing is necessary because the channels in the Lark Seep/G-1 Spring system are not sufficiently deep to prevent cattails from spreading and clogging the channels. The channel clearing also benefits the Mohave tui chub because they prefer open water conditions. The proposed action, to deepen and widen approximately 250 feet of channel south of Lark Seep, is intended as an experiment to determine if NAWS can modify the channels to minimize maintenance needs and provide for improved habitat conditions for Mohave tui chub.

To accomplish the proposed action, the channel would be dredged, with widening to be accomplished by removing sediment on the east bank of the channel to preserve the existing saltgrass (*Distichlis* sp.) on the western bank. The width and depth of the channel would depend upon the capability of the heavy equipment employed but the NAWS anticipates that the channel would be 15 to 20 feet wide and 6 to 8 feet deep at the channel centerline. The east wall of the channel would be slope steeply while the west wall would slope gently to provide suitable habitat for cattails. The NAWS anticipates that the proposed modifications would increase flows to Lark Seep and minimize the need for recurring channel maintenance.

To improve flows to the channel system immediately downstream of the Bologna Pool and Water Road, a stand of tamarisk (*Tamarix* sp.) would be removed and a culvert placed to ensure flows continue through the area. To improve access to the culvert area and for maintenance purposes, the access road would be extended approximately 50 feet to the south to intersect Water Road.

The NAWS proposes to implement the following measures to minimize the effect of the action on the Mohave tui chub:

1. A seine would be used to move Mohave tui chub upstream toward the Bologna Pool. The seine would then be anchored to keep Mohave tui chub away from the construction zone.

2. Dredging would be accomplished in an upstream to downstream direction to ensure that disturbance of an area occurs only once.

3. Equipment operators would be briefed on the restrictions involved in working in the project area.

4. Removal of soil and vegetation would be accomplished carefully and slowly to minimize water turbidity.

5. The rate of water flow and water quality parameters (total dissolved solids, dissolved oxygen, pH, and temperature) will be monitored starting before dredging begins. Monitoring of the Mohave tui chub population will be accomplished with a mark/recapture program that would start before the project begins and continue on an annual basis, as funding permits, following completion of the enhancement work.

Effects of the Proposed Action on the Listed Species

Species Account

The Mohave tui chub occurred historically in the Mojave River from the confluence of the east and west forks at the base of the San Bernardino Mountains to its terminus at Soda Dry Lake. It is the only native fish in this river system. The Mojave tui chub currently does not exist in natural habitats within its native range with the possible exception of one small spring adjacent to Soda Dry Lake. Habitat modifications, including damming of the headwaters and withdrawals of the river's underflow, and hybridization with an introduced species, the arroyo chub (*Gila orcutti*), contributed to the decline of the species. The Mohave tui chub was listed as endangered by the Service in 1970 (35 FR 16047) and by the State of California in 1971. The recovery plan for the Mohave tui chub, issued by the Service in 1983, contains additional information on the life history and physiological requirements of the species.

Current information indicates that genetically pure populations of Mohave tui chub now exist only in the Lark and G-1 Seep system on the Naval Air Weapons Station at China Lake, MC Spring and Soda Springs, along the western shore of Soda Lake, and at Camp Cady, along the Mojave River channel west of Afton Canyon. All of these refugia require relatively intensive management that may include periodic excavation to maintain open water conditions.

Status of the Species in the Project Area

The Lark and G-1 Seep system on the NAWS occurs because the groundwater table in the area is elevated by seepage from the City of Ridgecrest's wastewater treatment ponds. In the 1960s the NAWS excavated the current system of channels to prevent damage to facilities from rising groundwater (Feldmeth 1984). The Mohave tui chub was introduced into the channel system in 1971 as part of a transplantation effort by the California Department of Fish and Game. As water levels rose through the years, the Mohave tui chub population increased and expanded in range. Recent estimates by the NAWS place the population of Mohave tui chub at approximately 10,000 individuals.

The channels carrying water from Lark Seep to G-1 Seep contain relatively more Mohave tui chub than the lagoon areas. The flowing water in these channels probably mitigates temperature and water quality problems which could occur during the summer months at the NAWS and may simulate the Mohave tui chub's natural habitat in the Mojave River. The lagoons and channels support extensive stands of cattails which periodically must be cleared to ensure water flow through the channel system and to maintain habitat for the Mohave tui chub. Clearing the channels of cattails is addressed in an existing biological opinion (1-6-90-F-40).

Analysis of Effects

Individual Mohave tui chubs within the project area may be injured or killed as a result of activities associated with seining the existing channel, dredging, and placement of the new culvert near Water Road. Increased turbidity in the channel could temporarily reduce the fitness of individual Mohave tui chubs and result in increased predation and susceptibility to disease or other environmental stresses. An unknown number of Mohave tui chub would be harassed as a result of this project.

Measures proposed by the NAWS would minimize the likelihood for injury or death of Mohave tui chubs during implementation of this action. In addition, the enhancement work would result in a number of benefits to the species including an increase in available habitat for the Mohave tui chub and habitat that would require less intensive management. Management of habitat is an increasingly significant issue as funds earmarked for channel maintenance decline. Thus, the proposed modifications to the channel system are desirable because they minimize the need for management activities and stabilize habitat conditions.

Due to the nature of the channels and the methods used to clear vegetation, ascertaining precisely how many Mohave tui chub are killed or injured by clearing activities will be difficult. However, in a report to the Service by the NAWS on a past clearing action, the on-site monitors observed only three dead or injured Mohave tui chub (NAWS 1990).

The Service believes that the effects described above are not likely to jeopardize the continued existence of the Mohave tui chub. We base this conclusion on the following facts:

1. The measures proposed by the NAWS should greatly minimize the likelihood for adverse effects to individual Mohave tui chubs.

2. Projects similar in overall disturbance to the proposed action have been accomplished with little adverse effect on the Mohave tui chub.

3. This action would help to insure the survival of the Mohave tui chub population on the NAWS and enhance available habitat for the species.

Cumulative Effects

Cumulative effects are those impacts of future State and private actions that are reasonably certain to occur in the project area. Future Federal actions will be subject to the consultation requirements established in section 7 of the Act and, therefore, are not considered cumulative to the proposed project. Many of the actions that are reasonably expected to occur within the vicinity of this action will be subject to formal consultation, as mandated by section 7 of the Act, because the NAWS manages surrounding lands.

Incidental Take

Section 9 of the Endangered Species Act prohibits any taking (i.e., to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of listed species without special exemption. Harm is further defined to include significant habitat modification or degradation that results in the death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Under the terms of sections 7(b)(4) and 7(o)(2) of the Act, taking that is incidental to and not a purpose of the agency action is not considered taking within the bounds of the Act, provided that such taking is in compliance with this incidental take statement. The measures described below as reasonable and prudent measures and terms and conditions are nondiscretionary, and must be undertaken by the agency or made a binding condition of any grant or permit, as appropriate.

This biological opinion anticipates the following forms of take:

1. Fifty (50) Mohave tui chubs in the form of direct mortality or injury resulting from dredging activities, increased turbidity, or stress. The Service and Navy cannot precisely anticipate the number of Mohave tui chubs that may be present in the channel during this action. Therefore, the Service is unable to estimate accurately the number of Mohave tui chubs that may be killed or injured during this action. However, the incidental take level of 50 Mohave tui chubs in the form of mortality or injury will enable the NAWS to determine whether its actions are resulting in adverse effects beyond those which it and the Service have anticipated and allow the NAWS to modify its action, if necessary, to prevent or reduce additional mortality.

2. An unknown number of Mohave tui chubs in the project area in the form of harassment through vibration, increased turbidity, and fluctuations in water level. The Service and Navy cannot precisely anticipate the number of Mohave tui chubs that may be present in the channel during this action. Therefore, the Service is unable to estimate accurately the number of Mohave tui chubs that may be harassed during this action.

This biological opinion does not authorize any form of take that is not incidental to the proposed project. If the incidental take authorized by this biological opinion is met, the NAWS shall immediately notify the Service in writing. If the incidental take authorized by this opinion is exceeded, the NAWS shall immediately cease the activity resulting in the take and shall reinitiate formal consultation with the Service.

Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize the incidental taking authorized by this biological opinion.

1. Take of Mohave tui chub, through injury or death, in the proposed project area shall be reduced by fully implementing the mitigation measures contained in the NAWS letter requesting consultation and repeated in the "Description of the Proposed Action" portion of this biological opinion.

2. Take of Owens tui chubs, through injury or death, within proposed project areas shall be reduced through establishment of well-defined operational procedures and establishment of clearly defined work areas.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the NAWS is responsible for compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. Terms and conditions are derived from the mitigation measures proposed by the NAWS with additions and modifications made herein. Terms and conditions 1 through 5 implement reasonable and prudent measure 1. Term and condition 6 implements reasonable and prudent measure 2.

1. A seine would be used to move Mohave tui chub upstream toward the Bologna Pool. The seine shall then be anchored to keep Mohave tui chub away from the dredging zone. Only biologists from the NAWS Environmental Project Office or personnel under their immediate supervision shall seine for Mohave tui chub.

2. Dredging shall be accomplished in an upstream to downstream direction to ensure that disturbance of an area occurs only once. At least one biologist or personnel under their immediate supervision shall monitor the dredging and all activities which have a potential to take Mohave tui chubs.

3. A qualified biologist shall conduct a training session for all equipment operators and other on-site project personnel prior to beginning activities at the site. At a minimum, the training shall include a description of the Mohave tui chub; the general provisions of the Endangered Species Act; the penalties associated with violating the provisions of the Act; the general measures that are being implemented to conserve Mohave tui chub as they relate to the project; and the boundaries of the project within which the work may be accomplished.

4. Removal of soil and vegetation shall be accomplished carefully and slowly to minimize water turbidity.

5. The rate of water flow and water quality parameters (total dissolved solids, dissolved oxygen, pH, and temperature) shall be monitored starting before dredging begins. Monitoring of the Mohave tui chub population shall be accomplished with a mark/recapture program that starts before the project begins and continues on an annual basis, as funding permits, following completion of the enhancement work.

6. Care shall be exercised to ensure that, when fueling or maintaining equipment, that hazardous materials do not contact the channels. When feasible, refueling of vehicles shall occur at least 50 feet from channels. Spill containment measures, such as placement of plastic sheeting under vehicles, shall be used whenever refueling occurs in or near Mohave tui chub habitat. All project-related spills of hazardous materials within or adjacent to the construction zone shall be cleaned up immediately.

Reporting Requirements

Following project completion, the NAWS shall prepare a report for the Service. The report shall document the effectiveness of the terms and conditions, the number of Mohave tui chubs killed or injured, and the circumstances that led to injury or death of Mohave tui chub. The report shall make recommendations for modifying the terms and conditions to enhance Mohave tui chub protection for future actions.

Disposition of Dead or Injured Mohave Tui Chubs

Upon locating dead or injured Mohave tui chubs, initial notification must be made in writing to the Service's Division of Law Enforcement in Torrance, California (370 Amapola Avenue, Suite 114, Torrance, California 90501) and by telephone and writing to the Ventura Fish and Wildlife Office in Ventura, California, (2493 Portola Road, Suite B, Ventura, California 93003, (805) 644-1766) within three working days of finding the animal. The report shall include the date and time the animal was found, the location where the animal was found, a photograph of the animal, cause of death, if known, and any other pertinent information.

Care shall be taken in handling dead specimens to preserve biological material in the best possible state for later analysis. The remains of intact Mohave tui chubs shall be placed with educational or research institutions holding the appropriate State and Federal permits
If the carcass is in a condition such that it would no longer be useful to educational or research institutions, the information noted above shall be obtained and the carcass properly discarded.

Arrangements regarding proper disposition of potential museum specimens shall be made with the institution by the NAWS through a biologist prior to implementation of the action.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service offers the following conservation recommendation:

DRAFT

Should the channel deepening and widening efforts prove effective for enhancing Mohave tui chub habitat and minimizing channel maintenance needs, we recommend that NAWS undertake similar efforts for the remainder of the Lark and G-1 Seep system.

The Service requests notification of the implementation of this conservation recommendation to keep us informed of actions that either minimize or avoid adverse effects or that benefit listed species or their habitats.

Conclusion

This concludes formal consultation on the NAWS's proposal to enhance habitat for Mohave tui chub near Lark Seep, Kern County, California. Reinitiation of formal consultation is required if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may adversely affect listed species or critical habitat in a manner not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by this action (50 CFR 402.16). Any expansion of activities beyond the scope proposed would be considered reason to reinitiate consultation. Any comments or questions should be directed to Kirk Waln of my staff at (805) 644-1766.

Sincerely,

for Diane K. Noda
Field Supervisor

Literature Cited

Feldmeth, C.R. 1984. A natural resource survey of the Lark seep system with special emphasis on the endangered Mohave chub. Ecological Research Services, Claremont, California.

Naval Air Weapons Station, China Lake. 1990. Letter to the Service regarding incidental take of Mohave tui chub during with channel clearing near Lark Seep.

U.S. Fish and Wildlife Service. 1983. Recovery plan for the Mohave tui chub, *Gila bicolor mohavensis*. Portland, Oregon.

SECTION 2.3.2.2.1c Reinitiation of Formal Consultation on the Removal of Aquatic Vegetation from Mohave Tui Chub Habitat on the Naval Air Weapons Station, China Lake, Kern County, California

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

12 AUG 1997

August 7, 1997

Carolyn A. Shepherd
Head, Environmental Project Office
Public Works Department
Naval Air Weapons Station
1 Administration Circle
China Lake, California 93555-6100

Subject: Reinitiation of Formal Consultation on the Removal of Aquatic Vegetation from Mohave Tui Chub Habitat on the Naval Air Weapons Station, China Lake, Kern County, California (5090 Ser 83EOOOD/1379) (1-8-97-F-39R)

Dear Ms. Shepherd:

This biological opinion responds to your request for formal consultation with the U.S. Fish and Wildlife Service (Service) pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act). Your request was dated December 17, 1996 and received in our office on January 9, 1997. At issue are the effects that the Naval Air Weapons Station's (NAWS) proposed channel clearing activities in the Lark and G1 Seep system may have on the Mohave tui chub (*Gila bicolor mohavensis*), which is federally listed as an endangered species.

This biological opinion was prepared using information from the following sources: your December 17, 1996, request for consultation regarding the proposed action; discussions between Navy and Service staff; and our files.

Biological Opinion

It is the opinion of the Service that the proposed action is not likely to jeopardize the continued existence of the Mohave tui chub. Critical habitat has not been designated for the Mohave tui chub.

Description of the Proposed Action

To maintain the water distribution capacity of a system of channels connecting Lark and G1 Seeps, the NAWS routinely excavates cattails (*Typha latifolia*) from the channel system.

Clearing is necessary because the channels in the Lark/G1 Seep system are not sufficiently deep to prevent cattails from spreading and clogging the channels. The channel clearing also benefits the Mohave tui chub because they prefer open water conditions. The proposed action, to selectively remove cattails from approximately two miles of channels, represents a significant expansion over the approximately 600 linear feet of channel cleared under the auspices of the previous biological opinion for channel clearing issued on July 24, 1990 (1-6-90-F-40).

The NAWS proposes to accomplish the proposed channel clearing by expanding the scope of past clearing activities. Further detail regarding the clearing techniques and equipment to be used is contained in the "Project Description" section of the (1-6-90-F-40) biological opinion (enclosed).

To minimize the effects of the action on the Mohave tui chub, the NAWS proposes the following:

1. To implement, with one modification, the terms and conditions from the previous biological opinion issued for channel clearing (1-6-90-F-40). The NAWS proposes to modify term and condition 1C of the 1-6-90-F-40 biological opinion to permit removal of aquatic vegetation between October 1 and January 31.

2. To better monitor population levels, distribution, and the effects of channel clearing, the NAWS proposes to implement a mark and recapture program.

   a. NAWS Environmental Project staff, or personnel under their direct supervision, would mark and recapture Mohave tui chubs over the course of two days in late spring while temperatures are moderate and dissolved oxygen levels are high.

   b. Modified minnow traps would be set and checked in the morning, afternoon, and evening. Captured fish would be placed in a bucket filled with channel water from the trap site.

   c. Tricaine methanesulfonate (Finquel), a mild anesthetic, would be applied to captured fish in the bucket to facilitate weighing and measuring the fish. Fish would be marked by clipping a section of the left pectoral fin. Following processing, fish would be transferred to a second bucket of untreated channel water for recovery from the anesthetic. The fish would be monitored closely and not returned to the channel until they are fully recovered.

3. The rate of water flow and water quality parameters (total dissolved solids, dissolved oxygen, pH, and temperature) would be monitored at an undetermined number of sites in channels and seeps. Associated with the water quality monitoring, the NAWS proposes a one time release, into an appropriate point in the seep system, of an approved, non-toxic dye to aid in determining the pattern of connection, if any, between channels and seeps.

Effects of the Proposed Action on the Listed Species

Species Account

The Mohave tui chub occurred historically in the Mojave River from the confluence of the east and west forks at the base of the San Bernardino Mountains to its terminus at Soda Dry Lake. It is the only native fish in this river system. The Mohave tui chub currently does not exist in natural habitats within its native range with the possible exception of one small spring adjacent to Soda Dry Lake. Habitat modifications, including damming of the headwaters and withdrawals of the river's underflow, and hybridization with an introduced species, the arroyo chub (*Gila orcutti*), contributed to the decline of the species. The Mohave tui chub was listed as endangered by the Service in 1970 (35 FR 16047) and by the State of California in 1971. The recovery plan for the Mohave tui chub (Service 1983), contains additional information on the life history and physiological requirements of the species.

Current information indicates that genetically pure populations of Mohave tui chub now exist only in the Lark and G1 Seep system on the Naval Air Weapons Station at China Lake, MC Spring and Lake Tuendae, along the western shore of Soda Lake, and at Camp Cady along the Mojave River channel west of Afton Canyon. All of these refugia require relatively intensive management that may include periodic excavation to maintain open water conditions.

Status of the Species in the Project Area

The Lark and G1 Seep system on the NAWS occurs because the groundwater table in the area is elevated by seepage from the City of Ridgecrest's wastewater treatment ponds. In the 1960s the NAWS excavated the current system of channels to prevent damage to facilities from rising groundwater (Feldmeth 1984). The Mohave tui chub was introduced into the channel system in 1971 as part of a transplantation effort by the California Department of Fish and Game. As water levels rose through the years, the Mohave tui chub population increased and expanded in range. Recent estimates by the NAWS place the population of Mohave tui chub at approximately 10,000 individuals.

The channels carrying water from Lark Seep to G1 Seep contain relatively more Mohave tui chub than the lagoon areas. The flowing water in these channels probably mitigates temperature and water quality problems which could occur during the summer months at the NAWS and may simulate the Mohave tui chub's natural habitat in the Mojave River. The lagoons and channels support extensive stands of cattails which periodically must be cleared to ensure water flow through the channel system and to maintain habitat for the Mohave tui chub.

Analysis of Effects

Individual Mohave tui chubs within the project area may be injured or killed as a result of activities associated with dredging and population monitoring. Increased turbidity in the channel could temporarily reduce the fitness of individual Mohave tui chubs and result in increased predation and susceptibility to disease or other environmental stresses. An unknown number of Mohave tui chubs would be harassed as a result of this project.

Measures proposed by the NAWS would minimize the likelihood for injury or death of Mohave tui chubs during implementation of this action. In combination with modifications to the channel below the "bologna pool" addressed in an earlier biological opinion (1-8-97-F-15), the proposed channel maintenance activities are desirable because they likely would result in benefits to the species through improved habitat conditions and an overall increase in available habitat.

Due to the nature of the channels and the methods used to clear vegetation, ascertaining precisely how many Mohave tui chubs are killed or injured by clearing activities will be difficult. However, in a report to the Service by the NAWS on a past clearing action, the on-site monitors observed only three dead or injured Mohave tui chubs (NAWS 1990).

The Service believes that the effects described above are not likely to jeopardize the continued existence of the Mohave tui chub. We base this conclusion on the following facts:

1. The measures proposed by the NAWS should greatly minimize the likelihood for adverse effects to individual Mohave tui chubs.

2. Similar channel clearing activities by the NAWS have been accomplished with little adverse effect on the Mohave tui chub.

3. This action would help to insure the survival of the Mohave tui chub population on the NAWS and enhance available habitat for the species.

Cumulative Effects

Cumulative effects are those impacts of future State and private actions that are reasonably certain to occur in the project area. Future Federal actions will be subject to the consultation requirements established in section 7 of the Act and, therefore, are not considered cumulative to the proposed project. Many of the actions that are reasonably expected to occur within the vicinity of this action will be subject to formal consultation, as mandated by section 7 of the Act, because the NAWS manages surrounding lands.

Incidental Take

Section 9 of the Endangered Species Act prohibits any taking (i.e., to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of listed species without special exemption. Harm is further defined to include significant habitat modification or degradation that results in the death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Under the terms of sections 7(b)(4) and 7(o)(2) of the Act, taking that is incidental to and not a purpose of the agency action is not considered taking within the bounds of the Act, provided that such taking is in compliance with this incidental take statement. The measures described below as reasonable and prudent measures and terms and conditions are nondiscretionary, and must be undertaken by the agency or made a binding condition of any grant or permit, as appropriate.

This biological opinion anticipates the following forms of take:

1. One hundred fifty (150) Mohave tui chubs in the form of direct mortality or injury resulting from dredging activities during each year dredging operations are necessary. The Service and Navy cannot precisely anticipate the number of Mohave tui chubs that may be present in the channels during dredging activities. Therefore, the Service is unable to estimate accurately the number of Mohave tui chubs that may be killed or injured during this action. However, the incidental take level of 150 Mohave tui chubs in the form of mortality or injury will enable the NAWS to determine whether its actions are resulting in adverse effects beyond those which it and the Service have anticipated and allow the NAWS to modify its action, if necessary, to prevent or reduce additional mortality.

2. An unknown number of Mohave tui chubs in the project area in the form of harassment through vibration, increased turbidity, and fluctuations in water level during dredging activities. The Service and Navy cannot precisely anticipate the number of Mohave tui chubs that may be present in the channel during this action. Therefore, the Service is unable to estimate accurately the number of Mohave tui chubs that may be harassed during this action.

3. Five (5) Mohave tui chubs per year in the form of direct mortality or injury through capture and processing of individuals of the species during population monitoring activities.

This biological opinion does not authorize any form of take that is not incidental to the proposed project. If the incidental take authorized by this biological opinion is met, the NAWS shall immediately notify the Service in writing. If the incidental take authorized by this opinion is exceeded, the NAWS shall immediately cease the activity resulting in the take and shall reinitiate formal consultation with the Service.

Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize the incidental taking authorized by this biological opinion.

1. Take of Mohave tui chubs, through injury or death, within proposed project areas shall be reduced through establishment of well-defined operational procedures.

2. Take of Mohave tui chubs, through injury or death, within proposed project areas shall be reduced through establishment of clearly defined work areas.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the NAWS is responsible for compliance with the following term and condition, which implements the reasonable and prudent measures described above.

1. The following term and condition implements reasonable and prudent measures 1 and 2:

   NAWS shall fully implement the terms and conditions of the 1-6-90-F-40 biological opinion, incorporated herein by reference. Term and condition 1C in the 1-6-90-F-40 biological opinion is modified to allow for dredging operations to occur between October 1 and January 31. NAWS shall fully implement the mitigation measures contained in the NAWS letter requesting consultation and repeated in the "Description of the Proposed Action" portion of this biological opinion.

Reporting Requirements

The NAWS shall prepare a yearly report for the Service documenting the locations and results of any dredging and population monitoring activities. The report shall document the effectiveness of the terms and conditions, the number of Mohave tui chubs killed or injured, and the circumstances that led to injury or death of Mohave tui chubs. The report shall make recommendations for modifying the terms and conditions to enhance the protection of Mohave tui chubs for future actions.

Disposition of Dead or Injured Mohave Tui Chubs

Upon locating dead or injured Mohave tui chubs, initial notification must be made in writing to the Service's Division of Law Enforcement in Torrance, California (370 Amapola Avenue, Suite 114, Torrance, California 90501) and by telephone and writing to the Ventura Fish and Wildlife Office in Ventura, California, (2493 Portola Road, Suite B, Ventura, California 93003, (805) 644-1766) within three working days of finding the animal. The report shall include the date and time the animal was found, the location where the animal was found, a photograph of the animal, cause of death, if known, and any other pertinent information.

Care shall be taken in handling dead specimens to preserve biological material in the best possible state for later analysis. The remains of intact Mohave tui chubs shall be placed with educational or research institutions holding the appropriate State and Federal permits
If the carcass is in a condition such that it would no longer be useful to educational or research institutions, the information noted above shall be obtained and the carcass properly discarded.

Arrangements regarding proper disposition of potential museum specimens shall be made with the institution by the NAWS through a biologist prior to implementation of the action.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service offers the following conservation recommendation:

> Should the experimental channel deepening and widening efforts undertaken below the "bologna pool" prove effective for enhancing Mohave tui chub habitat and minimizing channel maintenance needs, we recommend that NAWS undertake similar efforts for the remainder of the Lark and G1 Seep system.

The Service requests notification of the implementation of this conservation recommendation to keep us informed of actions that either minimize or avoid adverse effects or that benefit listed species or their habitats.

Conclusion

This concludes formal consultation on the NAWS's proposal to expand the channel maintenance activities in the Lark and G1 Seep system, Kern County, California. Reinitiation of formal consultation is required if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may adversely affect listed species or critical habitat in a manner not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by this action (50 CFR 402.16). Any expansion of activities beyond the scope proposed would be considered reason to reinitiate consultation. Any comments or questions should be directed to Kirk Waln of my staff at (805) 644-1766.

Sincerely,

Judy Holman

Diane K. Noda
acting Field Supervisor

Enclosure

Literature Cited

Feldmeth, C.R. 1984. A natural resource survey of the Lark Seep system with special emphasis on the endangered Mohave chub. Ecological Research Services, Claremont, California.

Naval Air Weapons Station, China Lake, California. 1990. Letter to the U.S. Fish and Wildlife Service regarding incidental take of Mohave tui chubs during with channel clearing near Lark Seep.

U.S. Fish and Wildlife Service. 1983. Recovery plan for the Mohave tui chub, *Gila bicolor mohavensis*. Portland, Oregon.

SECTION 2.3.2.2.2 Reinitiation of Formal Consultation for the Desert Tortoise Habitat Management Plan for the Naval Air Weapons Station, China Lake, California

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
Ventura Field Office
2493 Portola Road, Suite B
Ventura, California 93003

June 27, 1995

Carolyn A. Shepherd
Head, Environmental Project Office
Public Works Department
Department of the Navy
China Lake Naval Weapons Station
China Lake, California 93555-6001

Subject: Reinitiation of Formal Consultation for the Desert Tortoise Habitat Management Plan for the Naval Air Weapons Station, China Lake, California (5090 Ser 823EOOD C8305) (1-8-95-F-30R)

Dear Ms. Shepherd:

By letter, dated March 27, 1995, and received by us on March 30, 1995, you requested reinitiation of formal consultation with the Fish and Wildlife Service (Service), pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act), regarding the referenced Management Plan. Your request was made specifically to evaluate the impacts that the Naval Air Weapons Station's (Station) Desert Tortoise Habitat Management Plan (Management Plan) may have on critical habitat designated for the desert tortoise (*Gopherus agassizii*), a federally listed threatened species. This biological opinion supersedes the non-jeopardy biological opinion on the Management Plan issued on December 3, 1992 (Service file no. 1-6-92-F-60).

This biological opinion was prepared using information: contained in your original request for consultation to the Service in 1992; obtained during informal consultation between our staffs; and in our files.

<u>Biological Opinion</u>

It is the opinion of the Service that the proposed action is not likely to jeopardize the continued existence of the desert tortoise or adversely modify critical habitat for the desert tortoise.

Description of the Proposed Action

The Navy proposes to continue implementation of the Station's Management Plan and administration of the Desert Tortoise Management Area established following issuance of the Service's 1992 non-jeopardy opinion on the Management Plan.

The Station occupies 1,095,680 acres in two discrete units within Kern, Inyo, and San Bernardino Counties (Kiva et al. 1991) (see Service, 1992 for maps). The north ranges are located immediately north of the residential areas of China Lake and the City of Ridgecrest. The southern ranges are approximately 20 miles southeast of China Lake.

The mission of the Station is to provide, operate, and maintain base support services for both tenant and transient organizations at China Lake, California (Navy 1992). The Station is a primary site for the Navy to research, develop, test, and evaluate missile weapons systems and electronic warfare simulation (Kiva et al. 1991). Other activities include landing of planes at back-country locations, training of paratroops, and bombing of stationary targets in the Superior Valley portion of the southern ranges. The high visibility resulting from clean air, open air space free of civilian and commercial aircraft, and seclusion make the Station a suitable site for these activities.

Some activities, such as bombing at the Superior Valley range, are located at the Station on a permanent basis and occur regularly. However, the Station also hosts many Department of Defense units and private contractors from around the nation that require the temporary use of training or testing areas with the physical attributes found at China Lake. Such programs may occur for only a short period of time with little prior notice given to the Station.

In the latter case, the Station's Environmental Project Office is required to provide guidance and support in ensuring that environmental constraints are addressed during the temporary activities. In cases where the desert tortoise could be adversely affected, the short turn-around time required by the transient users conflicts with the longer time frames needed by the Service to process section 7 consultations. As a result, Environmental Project Office and Service staff developed a programmatic approach to project review that would be consistent with section 7 guidelines and at the same time could serve as a management plan to benefit desert tortoises at the Station.

The Station's Management Plan provides guidelines for project review, standard mitigation measures, and designation of approximately 200,000 acres of the southern ranges as a management area for desert tortoises. For a detailed account of the measures proposed by the Navy see the Service's 1992 biological opinion.

Effects of the Proposed Project on the Listed Species

Species Account

The desert tortoise is a large, herbivorous reptile found in portions of the California, Arizona, Nevada, and Utah deserts. It also occurs in Sonora and Sinaloa, Mexico. In California, the desert tortoise occurs primarily within the creosote, shadscale, and Joshua tree series of Mojave desertscrub, and the lower Colorado River Valley subdivision of Sonoran desertscrub. Optimal habitat has been characterized as creosote bush scrub in which precipitation ranges from two to eight inches, diversity of perennial plants is relatively high, and production of ephemerals is high (Luckenbach 1982, Turner and Brown 1982, Turner 1982, and Schamberger and Turner 1986). Soils must be friable enough for digging of burrows, but firm enough so that burrows do not collapse. In California, desert tortoises are typically associated with gravelly flats or sandy soils with some clay, but are occasionally found in windblown sand or in rocky terrain (Luckenbach 1982). Live desert tortoises have been found in the California desert from below sea level to an elevation of 7,300 feet, but the most favorable habitat occurs at elevations of about 1,000 to 3,000 feet (Luckenbach 1982, Schamberger and Turner 1986).

Desert tortoises are most active in California during the spring and early summer when annual plants are most common. Additional activity occurs during warmer fall months and occasionally after summer rain storms. Desert tortoises spend the remainder of the year in burrows, escaping the extreme conditions of the desert. Further information on the range, biology, and ecology of the desert tortoise can be found in Burge (1978), Burge and Bradley (1976), Hovik and Hardenbrook (1989), Luckenbach (1982), Weinstein et al. (1987), and U.S. Fish and Wildlife Service (1994).

On August 4, 1989, the Service published an emergency rule listing the Mojave population of the desert tortoise as endangered. In its final rule, dated April 2, 1990, the Service determined the Mojave population of the desert tortoise to be threatened. The Service designated critical habitat for the desert tortoise in portions of California, Nevada, Arizona, and Utah in a final rule, published February 8, 1994. A final recovery plan for the desert tortoise was published by the Service in June, 1994.

The recovery plan is the basis and key strategy for recovery and delisting of the desert tortoise (Service 1994). The plan divides the range of the desert tortoise into six distinct population segments or recovery units and recommends establishment of 14 desert wildlife management areas throughout the recovery units. Within each desert wildlife management area, the recovery plan recommends implementation of reserve level protection of desert tortoise populations and habitat, while maintaining and protecting other sensitive species and ecosystem functions. As part of the actions needed to accomplish recovery, land management within all desert wildlife management areas should restrict human activities that negatively affect desert tortoises (Service 1994).

A portion of the Station's Desert Tortoise Management Area lies within the Superior-Cronese Critical Habitat Unit (CHU), one of four CHUs designated in the Western Mojave Recovery Unit. CHUs and recovery units as defined in the final rule designating critical habitat for the desert tortoise were patterned after the desert wildlife management area and recovery unit concepts in the recovery plan. The Western Mojave Recovery Unit consists of approximately 4,753,000 acres, located entirely in California. Vegetation within this recovery unit is characterized by creosote bush scrub, big galleta-scrub steppe, desert needlegrass scrub-steppe, and blackbrush scrub (in higher elevations). Topography is varied, with flats, valleys, alluvial fans, washes, and rocky slopes. The Superior-Cronese CHU, covers approximately 766,900 acres in San Bernardino County, California.

Regulations found at 50 CFR § 402.02 define destruction or adverse modification of critical habitat as a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features (referred to as the primary constituent elements [50 CFR § 424.12]) that were the basis for determining the habitat to be critical. In the final rule designating desert tortoise critical habitat, the Service determined that desert tortoise habitat consists of the following primary constituent elements: (1) sufficient space to support viable populations within each of the six Recovery Units and provide for movements, dispersal, and gene flow; (2) sufficient quantity and quality of forage species and the proper soil conditions to provide for the growth of such species; (3) suitable substrates for burrowing, nesting, and overwintering; (4) burrows, caliche caves, and other sheltersites; (5) sufficient vegetation for shelter from temperature extremes and predators; and (6) habitat protected from disturbance and human-caused mortality (59 FR 5820).

Joshua tree woodland, creosote bush scrub, and saltbush scrub communities are the most common plant assemblages within the Station. The most common species found within these communities are Joshua trees (*Yucca brevifolia*), creosote bush (*Larrea tridentata*), and bursage (*Ambrosia dumosa*), and saltbush (*Atriplex* spp.), respectively. A large portion of the North Range of China Lake is at higher elevations than are generally occupied by desert tortoises. Additionally, a large playa which, because of its fine soils and absence of shrub cover does not support desert tortoises, occurs within the southern part of the North Range.

A discussion of the density and distribution of desert tortoises within the Station can be found in the original biological opinion for the Management Plan (Service 1992).

Analysis of Impacts

As noted in the original biological opinion for the Management Plan, numerous activities that the Navy undertakes at the Station have the potential to take desert tortoises through mortality, injury, or harassment and to disturb or eliminate desert tortoise habitat. These activities include construction of new facilities, testing of weapons and electronic warfare systems, use and maintenance of roads and utilities, bombing practice, and miscellaneous other activities. The Navy's Management Plan for the Station includes measures to minimize both the likelihood for take of individual desert tortoises and the effects of mission-related activities on desert tortoise habitat.

Key to implementation of the Management Plan is oversight by the Station's Environmental Project Office of a Desert Tortoise Management Area covering approximately 200,000 acres of the Station. As an incentive for project planners to minimize habitat loss or disturbance in this area, under the Management Plan, the maximum amount of disturbance associated with any given action will not exceed 2.5 acres without triggering an individual formal consultation. Cumulative impacts of the Management Plan are addressed through the stipulation that no more than five percent of the planning area could be developed or disturbed on a long-term basis without reinitiation of formal consultation.

The effectiveness of the Management Plan is exhibited by the impact of activities conducted within the planning area since its inception. In the 1993 annual report of actions within the planning area, the Station's Environmental Project Office noted that of 1200 projects reviewed, only 27 were proposed in or near desert tortoise habitat (Station 1993). The Environmental Project Office successfully sited 22 of the 27 projects in previously disturbed areas while the remaining five projects proceeded under the guidance provided in the Management Plan. For the 1993 reporting period, two acres of desert tortoise habitat were eliminated and two acres were disturbed (Station 1993).

At issuance of the original biological opinion on the Management Plan, the Station had removed almost 8,000 feral burros from its lands and installed over 11 miles of fence to exclude trespass livestock grazing from the south range. Under the Management Plan, the Station would continue these efforts and to pursue additional surveys of desert tortoise habitat, research, and educational programs on the desert tortoise and other biological resources of the desert.

The Service believes that the impacts described above resulting from implementation of the Management Plan will not jeopardize the continued existence of the desert tortoise or adversely modify its critical habitat. We present this conclusion for the following reasons:

1. The Navy's Management Plan includes mitigation measures which would reduce the take of individual desert tortoises and their habitat.

2. The impacts that would result from continued implementation of the Management Plan would generally disturb small amounts of land over a large area and would not result in fragmentation of desert tortoise habitat.

3. The establishment by the Navy of an approximately 200,000-acre area to be managed for the desert tortoise furthers recovery efforts in the western Mojave Desert.

Cumulative Effects

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

Many of the actions that are reasonably expected to occur within the vicinity of the project will be subject to section 7 consultations, because large portions of the desert consist of Federal lands. Numerous unauthorized actions on both Federal and non-Federal lands, such as collection and vandalism of desert tortoises and off-highway vehicle use, will continue to degrade desert tortoise populations and their habitat, particularly in areas that receive large amounts of recreational use.

The Service has contacted the counties of San Bernardino, Kern, Riverside, Inyo, and Los Angeles (and the incorporated areas within the desert) regarding the listing of the desert tortoise and its implications for city- and county-permitted activities. Many cities within the range of the desert tortoise in San Bernardino, Los Angeles, and Kern counties have expressed interest in obtaining a section 10(a)(1)(B) incidental take permit from the Service. Regional planning efforts, such as the West Mojave Coordinated Management Plan, could serve as model habitat conservation plans for local governments. Cumulative impacts of future State and private projects will be addressed in regional plans, such as this, and in the section 10(a)(1)(B) incidental take permit process. The measures being developed by the Bureau of Land Management and other participating agencies in the Western Mojave Coordinated Management Plan are likely to be ~~with~~ compatible with management prescriptions specified in the Station's Desert Tortoise Management Plan.

Incidental Take

Section 9 of the Act prohibits the take of listed species without special exemption. Taking is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Under the terms of sections 7(b)(4) and 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this incidental take statement. The measures described as reasonable and prudent measures and terms and conditions in this biological opinion are nondiscretionary, and must be undertaken by the agency or made a binding condition of any grant or permit, as appropriate.

This biological opinion anticipates the following forms of take which would be associated with implementation of the reasonable and prudent measures:

1. Two (2) desert tortoises per year in the form of direct mortality during implementation of the Management Plan.

2. A total of forty (40) desert tortoises in the form of direct mortality during implementation of the Management Plan.

3. Ten (10) desert tortoises per year in the form of harassment through the excavation of burrows occupied by desert tortoises and the removal of desert tortoises found above ground in project areas during work and training activities.

This biological opinion does not authorize any form of take that is not incidental to implementation of the Desert Tortoise Management Plan at the Station, China Lake. Implementation of the plan is considered to include all activities that meet the criteria as established by the Navy in its plan and the Service in this biological opinion.

If the incidental take authorized by this biological opinion is met, the Navy shall immediately notify the Service in writing. If the incidental take authorized by this biological opinion is exceeded, the Navy shall immediately cease the activity resulting in the take and shall reinitiate formal consultation with the Service.

Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize the incidental taking authorized by this biological opinion:

1. Worker education programs and well-defined operational procedures shall be implemented to avoid the take of desert tortoises and minimize loss of their habitat implementation of the Desert Tortoise Management Plan.

2. Take of desert tortoises, through injury or death due to the straying of vehicles or equipment beyond project areas, shall be reduced through establishment of clearly defined work areas.

3. Take of desert tortoises, through injury or death, found within proposed project areas shall be reduced through the removal of these animals to safe, undisturbed areas adjacent to project sites.

4. Attraction of common ravens and other potential tortoise predators to project areas shall be reduced to the maximum extent possible.

5. The Station shall continue to manage for the benefit of desert tortoises the approximately 200,000 acres within the Station as described in the original biological opinion for the Management Plan.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the Navy is responsible for compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. With the exception of updating reference to handling protocols and ensuring that wording reflects current conditions, the terms and conditions reiterate those presented in the Service's 1992 biological opinion on the Management Plan. They are included here to avoid the necessity of referring to another document and to minimize any confusion that could arise when two documents are involved.

Terms and conditions 1a, 1f, 1h, 1i, 1j, 1l, 1m, 2, 5, and 6, are established to implement reasonable and prudent measure 1. Terms and conditions 1b and 1e are established to implement reasonable and prudent measure 2. Terms and conditions 1c, 1d, 1k, and 4 are established to implement reasonable and prudent measure 3. Term and condition 3 is established to implement reasonable and prudent measure 4. Term and condition 1g is established to implement reasonable and prudent measure 5:

1.a. All proposals for new projects (and modifications to existing project sites) shall be reviewed by the Environmental Project Office (Code 823E00D). New projects include new construction or other land disturbing activities as well as significant changes in land use activities or types at established sites. Ongoing activities that may result in take of desert tortoises shall be reviewed on an annual basis. The Station-wide educational program (discussed in measure 6) shall focus on the procedures and requirements to eliminate off-site impacts and other actions that may result in inadvertent take.

1.b. The primary means to eliminate or minimize impacts to desert tortoises or their habitat shall continue to be through the use of avoidance procedures. These methods shall include the following:

i. Consultations with project proponents by Environmental Project Office (Code 823E00D) staff early in the planning process shall try to locate proposed project sites in areas that are not in desert tortoise habitat.

ii. If projects cannot be located in areas outside desert tortoise habitat, then the Environmental Project Office shall try to influence the project design such that projects are located in previously disturbed areas or so that the amount or type of disturbance is minimized.

1.c. Surveys for desert tortoises shall be accomplished for all projects which may be located in desert tortoise habitat. Surveys shall be accomplished by qualified biologists either currently employed by the Environmental Project Office (Code 823E00D) or through the use of contractor personnel. All surveys shall be accomplished in accordance with Service protocol. Modifications to the protocol to meet the requirements of specific actions shall receive prior approval from the Service.

1.d. Whenever possible, project sites shall be selected so that they are located in previously disturbed areas. Measures to minimize take shall include modifications to project size, orientation, location and construction practices. Should projects have to be located where desert tortoises are known to exist, the desert tortoises shall be relocated in accordance with procedures in Appendix A "Desert Tortoise Handling and Overwintering Procedures" (Desert Tortoise Council 1994).

1.e. Incidental take shall be minimized by taking the following measures. Actual measures shall be based on the results of site specific field surveys and shall be implemented at the discretion of Code 823E00D personnel:

i. Regular monitoring of construction operations and active project activities;

ii. Placement of signs indicating the need to reduce speeds on roadways and the necessity for all activities to be strictly confined to the project site;

iii. Clearly delineating the project site boundaries on the ground by flagging, survey lath or wooden stakes;

iv. Placement of desert tortoise-proof fences around certain projects or portions of projects where, due to the known proximity of desert tortoises to the project site, the probability of take is high;

v. Conduct project personnel briefings for all project personnel during all project phases. At a minimum the briefings shall discuss:

- the general provisions of the Endangered Species Act;
- the necessity for adhering to the provisions of the Act;
- the penalties associated with violating the provisions of the Act;
- the specific requirements (as delineated by this office) for complying with the provisions of the Act as they relate to each project;
- the exact boundaries of the project within which the project may be accomplished;
- the procedures to be accomplished by project personnel should any problem arise with respect to complying with environmental constraints;
- general behavior and ecology of the desert tortoise; and
- its sensitivity to human activities.

vi. Pre-construction site surveys to ensure the project area has remained clear of desert tortoises since the initial site surveys were accomplished. Pre-construction surveys shall be conducted within 7 days of initiation of construction activities; and

vii. Written operations plans detailing special constraints on project activities such as surveys or sweeps of project areas immediately prior to initiation of project activities for those projects which use areas on an infrequent basis.

1.f. The Station shall conduct an environmental briefing, with emphasis on threatened/endangered species management and the existence and details of the Desert Tortoise Habitat Management Plan to all Station and contractor personnel who use areas considered desert tortoise habitat. The briefing shall be conducted by Code 823E00D biologists. The briefing shall discuss the specific element of the Plan as well as general procedures detailing compliance with the Endangered Species Act.

1.g. The Station shall administer approximately 200,000 acres of land (contiguous) on the its South Range as the Desert Tortoise Management Area. This term and condition does not preclude the use of existing developments or eliminate ongoing or previously occurring activities within these areas. All personnel who use these developments or participate in such actions within these areas shall attend the educational program prior to the onset of activities. All other applicable terms and conditions of this biological opinion shall also be implemented. Existing, developed or utilized areas within the designated Desert Tortoise Management Areas shall be clearly delineated on the ground by placement of permanent markers (wooden posts). Entry points (roads) into these areas shall be delineated by signs indicating that personnel are entering a Desert Tortoise Management Area and that all activities must be strictly confined to established roadways and project sites.

1.h. The procedure for implementing this management plan shall vary depending on the location of the proposed project within or outside of the Management Area, the proposed size (acres) of the project area and the presence or absence of desert tortoises or their sign in the area. A written summary of the procedure is presented below and in the Service's previous biological opinion (Service 1992):

For: Projects outside the Management Area
Less than 50 acres in total area

With desert tortoise sign (on or near the project site):
Implement appropriate measures to preclude take
Notify Service in Annual Report

For: Projects outside the Management Area
Less than 50 acres in total area
Without desert tortoise sign (on or near the project site):
Notify Service in Annual Report

For: Projects outside the Management Area
Greater than 50 acres in total area
Without desert tortoise sign (on or near the project site):
Notify Service in Annual Report

For: Projects outside the Management Area
Greater than 50 acres in total area
With desert tortoise sign (on or near the project site):
Notify Service of project proposal with supporting documentation and request their review
Initiate section 7 consultation on request of Service

For: Projects inside the Management Area
Greater than 2.5 acres
With or without desert tortoise sign:
Notify Service of project proposal with supporting documentation and request their review
Initiate section 7 consultation on request of Service

For: Project inside the Management Area
Less than 2.5 acres
With or without desert tortoise sign:
Implement appropriate measures to preclude take
Notify Service in Annual Report

1.i. Should the cumulative acreage developed within the Management Area exceed 5 percent of the total Management Area acreage, the Station shall reinitiate formal section 7 consultation. Should small (less than 2.5 acres) project sites be established in such a fashion that they are adjacent to or near other small projects and the actual area of effect could be considered to be greater that 2.5 acres, the small projects shall each be considered to be greater than 2.5 acres and treated as described in measure 1m.

1.j. Active or usable desert tortoise burrows located adjacent to or near construction sites shall be protected by temporary desert tortoise-proof fencing placed to completely enclose the burrow at a minimum distance of 20 feet from the burrow.

1.k. Desert tortoise burrows which cannot be avoided shall be excavated by hand either by or under the direction of the authorized biologist. Desert tortoise burrow excavation and subsequent handling of any desert tortoises shall follow guidelines established in Appendix A.

The following information shall be recorded for all desert tortoises that are handled: the location where the desert tortoise was found; the location to which it was moved; the date and time of the action; any other pertinent information, including observations on the health and condition of the desert tortoise, and whether it voided its bladder upon handling; and appropriate length measurements, descriptions of unique markings, a detailed photograph of the fourth left costal scute, and photographs of at least the desert tortoise's anterior area and carapace.

1.l. Code 823E00D shall prepare and submit to the Service for its review and comment an annual report containing:

i. a general summary of all projects that have been initiated on the Station within the one year reporting period and shall include:

- a list of projects which implemented the provisions of this agreement;
- the total number of desert tortoises that were taken, through injury, mortality, or harassment;
- the total acreage of desert tortoise habitat lost or disturbed;
- a summary of the effectiveness of the take minimization measures; and
- a discussion of any problems encountered and recommendations on how to reduce or eliminate these problems.

ii. A specific summary of each project undertaken. This report shall detail:
- the project name;
- a project description;
- the project location (map);
- the total acreage of the project;
- the total number of desert tortoises that were taken, through injury, mortality, or harassment;
- the acreage of desert tortoise habitat lost and its relative condition;
- measures taken to ensure that take has been minimized or eliminated;
- follow-up data on success of impact (take) minimization efforts;
- any problems encountered with respect to implementing the provisions of the management plan; and
- the information collected on all desert tortoises as specified in term and condition 1.k of this biological opinion.

1.m. Should unforeseen problems arise or the Station propose activities that are not compatible with the continued implementation of the Desert Tortoise Management Plan, the Station shall reinitiate the formal section 7 consultation process. In addition, reinitiation of the consultation process shall be required if the criteria promulgated at 50 CFR 402.16 are met. These criteria are stated at the conclusion of this biological opinion.

2. Only qualified personnel authorized under the auspices of this biological opinion shall handle desert tortoises. Tom Campbell, Susan Williams, and Beverly Kohfield of the Station's Environmental Project Office are hereby authorized to handle desert tortoises as described in this biological opinion. If the Station wishes to use other Navy employees or outside contractors to handle desert tortoises, the names and credentials shall be supplied to the Service for its review and approval at least 15 days prior to the onset of the activities which they are being authorized to monitor.

3. All trash and food items shall be promptly contained within raven-proof containers. These containers shall be regularly removed from the project sites to reduce the attractiveness of the area to common ravens and other desert tortoise predators.

4. The authorized biologist(s) shall follow the general handling methods contained in the guidelines in Appendix A. This biological opinion does not authorize replacement of lost fluids in any desert tortoise with a syringe, the drawing of blood, or notching of the shell to mark animals. Marking of desert tortoises using the epoxy method as described in Arizona Game and Fish Department et al. (1991) is authorized.

5. Desert tortoises moved from harm's way within the vicinity of a project site shall be marked for future identification. An identification number using the acrylic paint/epoxy covering technique shall be placed on the fourth ~~left~~ costal scute (Fish and Wildlife Service 1991). 35-mm slide photographs of the carapace, plastron, and the fourth costal scute shall be taken.

6. All personnel shall check beneath their vehicles while in desert tortoise habitat prior to moving the vehicle. If a desert tortoise is found beneath the vehicle, an authorized biologist shall move the desert tortoise as described in this biological opinion or the vehicle operator shall wait until the desert tortoise has moved away from the vehicle. The authorized biologist shall ensure that any desert tortoises moved in this manner will not be exposed to temperatures that could be harmful to the desert tortoise. All personnel shall be advised of the potential for desert tortoises to take refuge under vehicles and of the proper procedures to follow in that event. This information shall be incorporated into all educational briefings on the desert tortoise.

Disposition of Dead, Injured, or Sick Desert Tortoises

Upon locating dead, injured, or sick desert tortoises, initial notification must be made within three working days of the finding to the Service's Division of Law Enforcement in Torrance, California, at (310) 297-0062. The Service's Ventura Office should also be notified at (805) 644-1766. Written notification to both offices must be made within five calendar days and include the date, time, and location of the carcass, a photograph, and any other pertinent information. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve biological material in the best possible state. The Station shall endeavor to place the remains of intact desert tortoises with educational or research institutions holding the appropriate State and Federal permits per their instructions. If such institutions are not available or the shell has been damaged, the information noted above shall be obtained and the carcass left in place. The Station should consider marking the carcass in a manner that would not be toxic to other wildlife to ensure that it would not be re-recorded in the future.

Arrangements regarding proper disposition of potential museum specimens shall be made with the institution by the Station prior to implementation of the action. Injured animals should be transported to a qualified veterinarian. Should any treated desert tortoises survive, the Service should be contacted regarding the final disposition of the animals.

Conservation Recommendations

In furtherance of the purposes of the Endangered Species Act (sections 2 c and 7(a)(1)) that mandate Federal agencies to utilize their authorities to carry out programs for the conservation of listed species, we recommend implementing the following actions:

1. The Station should instruct all personnel in the appropriate procedures to follow if a desert tortoise is encountered on a road where it may be at risk from vehicle traffic. They should also be advised that these procedures may also be followed when traveling outside of Navy lands.

2. The Station should consider cooperating with the Bureau of Land Management (Bureau) in monitoring common raven use within the Station. The Bureau's Desert District Office in Riverside may be able to provide the Station with standard raven monitoring techniques.

3. The Station should attempt to coordinate any enhancement or restoration of desert tortoise habitat that is adjacent to public lands with the Bureau to maximize the beneficial effects of both agencies' efforts.

4. The Station should investigate methods of restoring disturbed habitat to more natural conditions if it can be determined that the disturbed area is unlikely to be used for future activities. Regarding restoration efforts, the Station may wish to contact Dr. Jerry Freilich of Joshua Tree National Park at (619) 347-4528. Joshua Tree National Park has implemented restoration efforts at numerous locations with its boundaries.

The Service requests notification of the implementation of any conservation recommendations so we can be kept informed of actions that either minimize or avoid adverse effects, or that benefit listed species or their habitats.

Conclusion

This concludes the reinitiation of formal consultation on the proposed Desert Tortoise Habitat Management Plan for the Station at China Lake. Reinitiation of formal consultation is required if: 1) the amount or extent of incidental take is reached; 2) new information reveals effects of the agency action that may adversely affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion; 3) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this biological opinion; or 4) a new species is listed or critical habitat designated that may be affected by this action (50 CFR 402.16). Any questions or comments should be directed to Kirk Waln at the Ventura Field Office at (805) 644-1766.

Sincerely,

Diane K. Noda

Diane K. Noda
Field Supervisor

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SECTION 2.3.2.2.3 Inyo California Towhee Survey Methodologies

Surveys for Inyo California towhees should be conducted a minimum of every five years, especially in Mountain Springs Canyon, which has the greatest impacts and potential for conflicts with towhees. Surveys should be conducted during courtship and breeding periods. Two visits should be scheduled, one early in the breeding period (late-March through late-April) when males are more likely to be vocal and more obvious and the second visit later in the breeding period (mid-May through mid-June) when adults are likely to be feeding young. Surveys should follow the strip/belt method presented in Merkallio (1946) and reviewed by Franzreb (1977). During each survey, transects are walked parallel to riparian vegetation with periodic stops to detect birds. Surveys should occur between sunrise and five hours after sunrise. Inyo California towhees detected along a transect should be recorded and mapped. Additional data collected should include method of detection (seen or heard), number of individuals, age (adult or juvenile), time, distance from riparian vegetation, behavioral notes, and habitat use. If towhees are not detected along a transect, the observer should remain in the area for at least an additional hour to make sure the area is not occupied by towhees. Much of this additional time should be spent sitting quietly. Towhee observations should be plotted on 7.5 minute topographic maps or recorded with a GPS.

Observations of brown-headed cowbirds should be documented during the towhee survey. Cowbirds migrate onto their summer range in the southern Argus Mountains in late-April to early-May (LaBerteaux, 1994). Rates of cowbird parasitism on Inyo California towhees should also be monitored if observations of cowbirds increase. Examination of towhee nests is necessary for this evaluation; thus, a Section 10 (a)(1) permit from the USFWS is required. LaBerteaux (1989) found a 6.25% rate of parasitism (2 of 32 nests) during her research from 1984 to 1986. LaBerteaux (1994) recommended that if brood parasitism rises above 10%, consultation with USFWS for a cowbird depredation permit should be considered.

All unsurveyed towhee habitat should be surveyed following the procedures described above. Ideally, all available habitat on NAWS and BLM lands should be surveyed during a single year to best estimate the total population.

SECTION 2.3.2.3a Spiders and Scorpions of NAWS/CL

Spiders

Family	Scientific Name
Theridiidae	*Steatoda washona*
	Steatoda fulva
	Steatoda pulcher
	Steatoda sp.
	Euryopis sp.
Dictynidae	*Emblyna reticulata*
	Saltonia ? incerta
Gnaphosidae	*Gnaphosa* sp.
	Drassyllus insularis
	Callilepis gosoga
	Herpyllus hesperolus
	Gnaphoa californica
	Zelotes griswoldi
Salticidae	Undetermined
	Habronattus sp.
Pholcidae	*Physocyclus* sp. nr. *tanneri*
	Psilochorus sp.
Plectreuridae	Undetermined
Philodromidae	*Apollophanes texanus*
	Ebo californicus
Uloboridae	*Uloborus* sp.
Lycosidae	*Allocosa subparva*
	Alopecosa kochii
Linyphiidae	*Erigone* sp.
Agelenidae	*Hololena nevada*
Liocranidae	*Phrurotimpus* sp.
Thomisidae	*Misumenops importunus belkini*

Scorpions

Family	Scientific Name
Unplaced	*Anuroctonus phaiodactylus*
Iuridae	*Hadrurus arizonensis*
	Hadrurus obscurus
	Hadrurus spadix
Vaejovidae	*Paruroctonus becki*
	Paruroctonus silvestrii
	Paruroctonus boreus
	Serradigitus wupatkiensis
	Vaejovis confusus
	Paruroctonus sp.
Superstitionidae	*Superstitionia donensis*

Collections made by Gordon Pratt, Warren Savary, and Darrell Ubick. Determinations made by Darrell Ubick. Preliminary report June 8, 1997.

Comments

1. It was not possible to determine certain spiders to species because of lack of mature specimens (*Gnaphosa, Plectreuridae, Salticidae, Steatoda, Uloborus*) or a lack of adult male specimens (*Habronattus, Meioneta*) or because the taxa have never been revised and the current taxonomy is in chaos (*Erigone, Phrurotimpus, Psilochorus*).

2. A few species were tentatively identified:
Physocyclus sp. nr. *tanneri* appears to be an undescribed species. A revision of the genus would be necessary to determine its distribution and relationships).

Saltonia ? *incerta* appears to be restricted to salt-encrusted bry lakes. These specimens are most likely conspecific with the population at the Dry Lake at Zzyzyx (males are needed to confirm this) but differ in genitalic details from topotypic specimens (as described by Roth and Brown, 1975). Additional study would be needed to determine if the populations at Zzyzyx and China Lake represent a new species.

3. One species, *Hololena nevada*, represents a range extension (previously known only from Nevada and Utah).

SECTION 2.3.2.3b Invertebrate Species Background

Invertebrates are among the most diverse species on NAWS, yet the least studied. Characteristic species of Desert Scrub habitats include a variety of grasshoppers, crickets, beetles, ants, ant lions, wasps, butterflies and moths, scorpions, and spiders. Dr. Pratt expects that NAWS has as many as 10,000 species of invertebrates (letter dated Dec 6, 1996).

Giant Fairy Shrimp

Giant fairy shrimp (*Brachinecta gigas)* was under review as a species of Special Concern in 1982 (Eng, 1982). However, it is not on the CNDDB list of special animals (August, 1994). Because it was under review and because of concerns for its habitat throughout California, it has been included as a NAWS-SC.

Phyllopods are chiefly inhabitants of vernal pools and ponds which are dry during much of the year, especially during summer. Resting eggs are the only means for repopulation from one season to another. Two types of eggs can be deposited, thin-shelled summer eggs which hatch almost immediately and thick-shelled brown resting eggs which are capable of withstanding unusual heat, cold, and prolonged desiccation. In California *B. gigas* is usually associated with seasonally astatic playa lakes that obtain water from unpredictable winter and spring rains. *B. gigas* has been collected from late January to early May in 8 to 21° C water. All habitats contained highly turbid, alkaline water of high pH, moderate total dissolved solids and conductivity, and moderate to high chloride (Fajita, 1978; Eng *et al.*, 1990).

B. gigas range is through the intermontane basins of western states east of the Rocky Mountains and north into Montana, North Dakota, Alberta, and Saskatchewan. However, in California it has been found at only eight sites, seven of which are in a 100 x 31-mile area in the middle of the Mojave Desert.

Impacts to Mirror Lake, one of four sites on NAWS are numerous. It is used by NAWS for parachute testing/training and associated vehicle support. The playa is also used for recreation, such as recreational off-road vehicle use (e.g., motorcycles, dune buggies, etc.), land sailing with associated support vehicles, and horseback riding.

Eriksen *et al.* (1986) have demonstrated that compression of dry lake bed soil by vehicles destroys a significant number of entrapped anostracan eggs. The disturbance to soils may also increase surface erosion subjecting eggs close to the surface to wind displacement. Most California habitats are either within military reservations or receive frequent use by off-road vehicles, airplanes, or other use. Because of the rarity of *B. gigas* in California and because its habitats are vulnerable to degradation as a result of ongoing human activities, future survival of this species in California is uncertain (Eng *et al.*, 1990).

Constraints to NAWS activities due to the presence of giant fairy shrimp are expected to be moderate. Removal of recreational vehicle use of Mirror Lake would not impact NAWS activities, and these recreational opportunities are available on public lands adjacent to NAWS.

Argus Land Snail

The Argus land snail (*Eremariontoides argus*) is a small land snail that lives in rocky areas on north-facing slopes (Miller, 1981). Very little is known about its natural history.

This species has no specific legal status and is not listed as a special animal by CNDDB (August 1994). However, it is a species that is uncommon with a limited distribution, which includes a portion of NAWS.

Argus land snails are small, 10 to 14 mm long by 6 to 7 mm tall, with a pale brown shell, which has a narrow dark brown band above the periphery that is bordered on each side by a paler, whitish band, and 4 whorls on the shell. These snails are identified by their reproductive anatomy. Argus land snails have a reproductive anatomy characterized by the complete absence of dart apparatus and mucus glands.

Argus land snails have been collected in Revenue and Homewood canyons in the Argus Mountains and on the eastern slopes of the Slate Mountains at the southern end of Panamint Lake (Bequaert and Miller, 1973). On NAWS Argus land snails have been collected by D. Giuliani (pers. comm.) in Mountain Springs Canyon. Dr. Pratt states that the best locations for this species are north facing slopes where limestone or calcareous deposits exist. Constraints to NAWS activities due to the presence of the Argus land snail are expected to be minimal as the species appears to have a limited distribution on NAWS and its habitats are further protected by Clean Water Act regulations.

Another species of snail present on NAWS is *Fonticella micrococcus*. This species is a fairly widespread, common water snail. More information on *Fonticella micrococcus* can be found in Hershler, 1985.

Jerusalem Cricket

Dr. David Weissman indicated that the Jerusalem cricket may be an undescribed species on NAWS (pers. comm.). Thus, it should be regarded as an endemic species with a limited distribution and a potential sensitive species that may ultimately become listed. Dr. Weisman is reviewing the taxonomy of the family, and this may result in a few species being reclassified as many species. Dr. Pratt indicates that there are at least two species in China Lake. One is restricted to the higher elevations of the Argus and Coso mountains (above 5,000 feet msl) and the other is restricted to sand dune habitats below 4,000 feet msl.

Jerusalem crickets may be active during the day but are chiefly nocturnal. During the day they hide under rocks or in burrows, litter, or soft soil. Its life span is unknown. It is found from Montana and Nebraska to New Mexico and Mexico to the Pacific coast. Because the taxonomy is under review the number of species within that range is unknown. On NAWS it may be found throughout Creosote Bush Scrub but is probably most common in sandy areas such as K-2 Track area. Most of Dr. Weisman's work was in the K-2 Track area and other sandy areas around China Lake. Jerusalem crickets may also be present in riparian areas. A potentially new species was recently collected in Etcheron Valley in a Sagebrush Scrub habitat. The only known threat on NAWS is the potential for loss of habitat. Possible constraints to NAWS activities due to the presence of Jerusalem crickets are expected to be minimal as activities in the K2 Track area are generally restricted to existing facilities.

Dune Cockroaches *(Arenavaga)*

Two species of dune cockroaches have been found on NAWS by Dr. Pratt. Their species is unknown and may be undescribed. The females are wingless; thus, they cannot move great distances and are probably an endemic species or subspecies. There may be more species on NAWS (Pratt, pers. comm.).

Their distribution on NAWS is unknown. Threats to dune cockroaches are unknown as distribution and natural history attributes are not known. However, Birchum Springs is highly degraded due to feral horse and burro use, which probably has negative effects on these species. Constraints to NAWS activities from the presence of dune cockroaches are expected to be minimal as NAWS has no facilities in the vicinity of Birchum Springs.

Darwin Tiemann's Beetle (*Megacheuma brevipennis tiemannii*)

Dr. Frank Hovore indicates that he believes the Darwin Tiemann's beetle subspecies on NAWS deserves specific status. Dr. Hovore also feels that it would qualify for State and/or federal listing as threatened or possibly an endangered species due to its limited distribution. Richard Cunningham (letter dated Sept 24, 1992) stated that Josef Beierl had completed a paper raising *M. b. tiemannii* to species level. Thus, it should be regarded as an endemic species with a limited distribution and as a potential sensitive or listed species.

Adult Darwin Tiemann's beetles are active in late summer to early fall. Hovore (1979) reports finding many dead adults in early October. Kohfield and Giuliani (unpublished notes) found more than 40 live adults on October 17, 1982.

Megacheuma brevipennis is a wide ranging species known from scattered locations in the Great Basin regions of Idaho, eastern Oregon, northcentral Nevada, Utah, and recently discovered populations in Fish Lake and China Lake basins in California (Hovore, 1979). It is associated with its host plant, *Atriplex parryi*, on NAWS; thus, its distribution is limited to areas surrounding the China Lake playa and potentially Airport Lake playa, Paxton Ranch, Baker Range playas, and Magazine playa. If the species achieves specific status, then its entire known distribution will be on NAWS.

The only known threat to *M. brevipennis* is the potential for habitat degradation within its very limited distribution. Constraints to NAWS activities due to the presence of Darwin Tiemann's beetles are expected to be minimal with exception of possible new facilities in the area adjacent to the playa of China Lake.

Scarab Beetles

Information is unavailable on the scarab beetle. It is anticipated that studies designed to fill data gaps relative to scarab beetle presence, taxonomy, distribution, and management will be gathered during the next few years.

Weevils

Dune weevils (*trigonoscuta* sp.) have been collected at all dune sites visited by Derham Giuliani on NAWS. There may be more than one species present on NAWS, as species collected are undescribed. Specimens collected by Derham Giuliani are stored at the Department of Food and Agriculture in Sacramento, California and are awaiting further study by specialists in the various groups. A dune miloderes has also been found by Giuliani that seems to be restricted to two or three dune sites from Pilot Knob Valley to Wingate Dunes.

Potential impacts to these species are habitat degradation. Dune systems require a source of sand, and these sources must be maintained so dunes can continue to be replenished. Constraints to NAWS activities due to the presence of dune weevils are expected to be minimal because few activities are conducted within dune areas. Weevils also appear to be widely distributed. Some question remains as to taxonomy and number of species on NAWS.

Butterflies

Pratt and Pierce (1995) have provided a list of more than 80 species of butterflies found during a five-year survey period on NAWS. Dr. Pratt considers nine of these species as sensitive. All of the species are found on the North Range, and most are associated with small areas of habitat.

Some species exhibit superdiapause (*e.g., Euphilotes*) in the pupal stage and do not occur for a successive number of years (especially during periods of low rainfall). This behavior can last as long as six years and is an adaptation to desert conditions which allows butterflies to survive on limited plant resources through years with bad conditions. Surveys conducted over several successive years are necessary to be relatively certain of a butterfly's absence. If food plants are in relatively good condition, at least a few representatives of a particular species should be present.

Butterflies are often uniquely timed to phenology, such as flowering or bud break of their food plants. For example, *Euphilotes* emergence and activity follows the blooming phenology of their host *Eriogonum.* If their host blooms in late summer, adult butterflies associated with *Eriogonum* occur during late summer. The table below lists sensitive species of butterflies, host plants, and potential impacts at NAWS.

Species	Host Plant	NAWS Potential Impacts
Plebejulina emigdionis	*Atriplex canescens* in association with the ant *Formica pilicornis*	Near El Conejo Gate
Icaricia icarioides (new subspecies)	*Lupinus* spp. (Perennials, especially *Lupinus excubitus)*	None
Euphilotes baueri (=battiodes) vernalis	*Eriogonum kennedeyi*	None
Euphilotes pallescens	*Eriogonum baileyi*	Target sites
Satyrium silvinus	*Salix lasiolepis*	Riparian degradation by horses and cattle
Lycaena arota	*Ribes velutinum*	None
Poladryas arachne	*Pestemon speciosus*	Target sites
Cercyonis sthenele	Bunch grasses (species unknown)	Cattle and horses removing host species
Pholisora alpheus	*Atriplex canescens*	None

Although none of these species are listed by CNDDB, there are three which investigators have indicated merit special mention. *Plebejulina emigdionis* is the most rare butterfly known at NAWS. Not only is the species very rare, but the genus is monotypic. This species is restricted to about 12 locations in Kern, Inyo, San Bernardino, and Ventura counties. On NAWS it has an expansive territory south and southeast of El Conejo Gate and in Big Petroglyph Canyon. The species often occupies small areas of 1 - 5 acres of habitat which also seems to be the case at NAWS. Its larva are associated with a specific ant, *Formica pilicornis,* and they use *Atriplex canescens* as a larval host and as a specific food plant. This species of butterfly is very closely linked to this symbiotic relationship.

Euphilotes baueri vernalis may be one of the most unique butterflies on NAWS. The only area outside of NAWS where this butterfly is known to occur is Coxey Meadow in the San Bernardino Mountains in an area less than a few square miles. It may occur south of Butterbread Peak on the southeastern slopes of the Sierra Nevada. On NAWS it has been found on the eastern side of Louisiana Butte and north into the Coso Mountains near Pinon Bridge. It is also present in the mountains west of Etcheron Valley. It is found wherever its host plant *Eriogonum kennedyi* is found.

Cercyonis sthenele may compete with feral horses and burros because its host species are perennial grasses of unknown species (Pratt and Pierce, 1995). The number of individuals of this species was very low during 1994, which may be due to natural causes, such as low precipitation, or may be due to a combination of factors which includes competition with horses for grasses during a dry year. There was very little grass in open areas where *Cercyonis sthenele* occurred that had not been closely cropped by feral animals, probably horses (Pratt, pers. comm.). Pratt (1995) found *Cercyonis sthenele* in Shepherd Canyon, high elevations of the Argus and Coso mountains, and in the northern mountains of the western side of Etcheron Valley. *Cercyonis sthenele* was probably more widespread in the past and in the 1930s was abundant in Mountain Springs Canyon. No *Cercyonis sthenele* have been found there by Pratt.

Constraints to NAWS activities due to the presence of sensitive butterflies are expected to be minimal or low depending on the species of butterfly. *Euphilotes pallescens* and *Poladryas arachne* are near target sites in the Coso Mountains. As long as the target sites are not enlarged into butterfly habitat, impacts to butterflies should be minimal. *Plebejulina emigdionis* is found along the road near El Conejo Gate. This butterfly could be impacted if the road was widened or during the flight periods of the butterfly. In the latter case, butterflies could be killed by vehicles. However, vehicular use on the road is generally low, minimizing the potential impact to the species.

The following table lists butterfly food plants, the potential number of butterfly species associated with each plant, and the number of butterfly species on NAWS associated with each plant.

Food Plant	**Number of Butterflies**	
	Potential	On NAWS
Pinus monophylla	1	0
Juniperus osteospermum	1	1
Cymopterus panamintensis	1	0
Asclepias erosa	2	2
Artemesia dracunculus	1	0
Bebbia juncea	1	1

Food Plant	Number of Butterflies Potential	On NAWS
Chrysothamnus viscidiflorus	1	1
Cirsium mohavense	2	1
*Erigeron breweri**	1	0
Gnaphalium chilense	1	0
*Palafoxia linearis**	1	1
Xylorhyza tortifolia	1	1
Arabis perennans	3	2
Caulanthus cooperi	1	1
Caulanthus lasciophyllus	1	1
Stanleya pinnata	2	2
Atriplex cannescens	4	4
Chenopodium californica	1	0
Astragalus lentiginosus	3	3
Cassia armata	2	2
Lotus procumbens	1	1
Lupinus argenteus[1]	1	1
Prosopis glandulosa	2	0
Sphaeralcea ambigua	4	3
Fraxinus anomala[1]	1	0
Eriogonum baileyi	1	1
Eriogonum fasciculatum	1	1
Eriogonum heermanii	3	2
Eriogonum inflatum	1	1
Eriogonum kennedyi	1	1
Eriogonum nudum	1	1
Eriogonum pusillum	1	1
Eriogonum umbellatum (2 var.)	3	3
Eriogonum wrightii	1	0
Oxytheca perfoliata	1	1

Food Plant	**Number of Butterflies** Potential	On NAWS
Rumex salicifolius[1]	1	0
Ceanothus greggii	2	0
Cowania mexicana	1	1
Prunus andersonii[1]	1	1
Purshia glandulosa	1	1
Thamnosa montana	1	1
Salix laevigata	2	1
Salix lasiolepis	1	1
Ribes cereum	1	1
Ribes velutinum	1	1
Castelleja chromosa	1	1
Penstemon speciosus	1	1
Urtica dioica ssp. *holosericea*	3	3
Viola purpurea[1]	1	0
Arceuthobium divaricatum	1	1
Phoradendron bolleanum[1]	1	0
Yucca brevifolia	1	1
Distichlis spicata	2	0
Phragmites australis	1	1
Total	78	56

* Recorded on NAWS but not observed by Pratt and Pierce during recent survey efforts.
[1] Found on NAWS but not on list.

SECTION 2.3.2.4 Reptiles and Amphibians Background

Amphibians

Frogs and Toads

The western toad is found throughout urban areas of China Lake, Ridgecrest, and Inyokern. On NAWS ranges western toads are confirmed at Haiwee Spring (Giuliani, 1993; Michael Brandman Associates, Inc. 1988). The Pacific tree-frog is known on NAWS from one record at Haiwee Spring (19 Sept. 1980) but is also known from the southern Argus Range (Indian Joe Canyon) off the station (Woodman, pers. obs.).

Constraints to activities on NAWS due to the presence of western toads and Pacific tree-frogs are expected to be minimal. Thus, as long as development of Haiwee Spring is not planned, there will be no constraints to NAWS.

Slender Salamander

Slender salamanders (*Batrachoseps* sp.) have not been found on NAWS. However, it is assumed that they are present because they are in surrounding mountain ranges, including the Panamint, Inyo, and Sierra Nevada ranges. Slender salamanders are difficult to locate and are active only during a short period of the year. If they are present on NAWS, the possibility exists that they could be a new species.

Giuliani (1993) noted that there was the probability of slender salamanders occurring at Upper Haiwee Springs. Michael Brandman Associates, Inc. (1988) reported potential habitat at Haiwee Springs, Mountain Springs Canyon, and Coso Cold Springs with the best potential habitat at Margaret Ann Springs, but indicated the potential for them occurring at NAWS was low.

Slender salamanders are typically found on moist talus slopes or cliffs rather than in open water. They probably breed and lay eggs in moist subterranean situations. This makes them especially susceptible to impacts from large grazing ungulates that may utilize these slopes to access riparian and upland vegetation and open water.

Potential threats to this species are due to degradation of habitat by large feral ungulates. Constraints to NAWS activities due to the presence of slender salamanders are expected to be minimal due to their restrictive habitat requirements and because they are found only at springs, seeps, or riparian areas, habitat types with great value to a variety of sensitive species and already protected.

Reptiles

Chuckwalla

The chuckwalla is a CNDDB-sensitive species but not a species that warrants State-level status (Jennings and Hayes, 1994). The chuckwalla was a federal Candidate (Category 2) species until the list of candidate species was updated in 1996, and all Category 2 and 3 species were removed.

The chuckwalla is a long-lived (possibly more than 20 years) herbivore and, as such, has delayed reproduction, relatively large clutches that increase with age (and size), and does not reproduce annually (Berry, 1974). It lives among boulder piles and uses crevices for shelter, taking refuge there when disturbed and wedging itself in cracks by inflating its body (Stebbins, 1954).

Berry (1974) conducted a demographic and behavioral study on NAWS east of Lone Butte for a Ph.D. dissertation. Except for Berry's study in a limited area of NAWS, there have been no surveys or other studies of chuckwallas; therefore, distribution at NAWS is unknown. They were common on rocky portions and outcrops of Lone Butte. Potentially they could be found in all rocky areas of the Argus and Coso mountains between the elevational range of sea level to 6,000 feet.

Potential threats to this species on NAWS is loss of habitat or possibly collecting. Constraints to NAWS activities due to the presence of the chuckwalla are expected to be minimal as most facilities are not located on or adjacent to rocky hillsides or outcrops.

Panamint Alligator Lizard

The Panamint alligator lizard (*Elgaria* [=*Gerrhonotus*] *panamintina*) is a California reptile of special concern (Jennings and Hayes, 1994) because it is not well-known and has limited distribution. The Panamint alligator lizard was first collected in Surprise Canyon in the Panamint Mountains in 1954 and was described by Stebbins (1958) as *Gerrhonotus panamintinus*. Revised alligator lizard systematics later placed it in the genus *Elgaria* (Jennings and Hayes, 1994) although genetic data on the species were based on only one specimen (Good, 1988), and the genetic variation of the species across its range is unknown.

There is a lack of life history data for the Panamint alligator lizard. Stebbins (1958) reported that in captivity the closely related *E. panamintina*, *E. kingi*, and *E. multicarinata* displayed similar behavior for foraging, movement, and climbing. If *E. panamintina* is like these species, it would prefer heavy cover and not bask. They are difficult to find (Giuliani, 1993) and appear to be good climbers (Stebbins, 1958; Banta, 1963). Sexual maturity probably takes at least two years (Goldberg, 1972), and terrestrial invertebrates likely dominate the diet (Cunningham, 1956).

Panamint alligator lizards have a known distribution limited to between 2,500 and 6,800 feet in Inyo and Mono counties in the White, Nelson, Inyo, Panamint, Coso, and Argus mountains (Jennings and Hayes, 1994; Michael Brandman Associates, Inc., 1988). They are restricted to riparian areas with available open water although they may utilize adjacent upland habitat.

Potential Panamint alligator lizard habitat on NAWS is restricted to the Argus and Coso ranges in the northern and northeastern portion of the North Range within the vicinity of permanent springs or riparian habitat. Two Panamint alligator lizards have been observed on NAWS. Phillips, Brandt, and Reddick, Inc. (1983) reported a juvenile at Margaret Ann Spring, and Giuliani (1993) recorded one at Haiwee Spring. Giuliani reported that Coso Cold Spring contained good habitat for the species. Michael Brandman Associates, Inc. (1988) listed unconfirmed sightings on NAWS, including one record in the Coso Mountains (record is suspect), a sighting believed to be at LaMott Spring in the Argus Mountains, a sighting in Mountain Springs Canyon (unverified), and the Phillips, Brandt, and Reddick, Inc. (1983) observation at Margaret Ann Springs. Several areas of potential habitat include Mountain Springs Canyon, Coso Cold Springs, and a lateral spring connecting Mountain Springs Canyon to Wilson Canyon (Michael Brandman Associates, Inc., 1988).

Threats to the species on NAWS are loss and degradation of habitat. Constraints to NAWS activities due to the presence of Panamint alligator lizards are expected to be minimal due to their restrictive habitat requirements. They are found only in riparian areas which have great value to a variety of sensitive species and are thus protected.

Gilbert's Skink

Gilbert's skink was the most common species caught in pitfall traps by Michael Brandman Associates, Inc. (1988). Because Gilbert's skink is considered sensitive by BLM but only for use as an indicator species, no management prescriptions are recommended for the species.

Constraints to NAWS activities due to the presence of Gilbert's skink are minimal due to their restrictive habitat requirements and because they are found only in riparian areas which have great value to a variety of sensitive species and are thus protected.

SECTION 2.3.2.5 Birds Background

Avian Species of Concern on NAWS

Species	Habitat Type	NAWS Status	NAWS Abundance
Common loon *Gavia immer*	Wetlands	Transient	Rare
Clark's grebe *Aechmophorus clarkii*	Wetlands	Transient	Rare
Western grebe *Aechmophorus occidentalis*	Wetlands	Transient	Uncommon
American white pelican *Pelecanus erythrorhynchos*	Wetlands	Transient	Fairly Common
Brown pelican *Pelicanus occidentalis californicus*	Wetlands	Vagrant	Extremely Rare
Double-crested cormorant *Phalacrocorax auritus*	Wetlands	Transient	Uncommon
Great blue heron *Ardea herodius*	Wetlands	Transient	Fairly Common
Great egret *Casmerodius albus*	Wetlands	Transient, Winter	Uncommon
Snowy egret *Egretta thula*	Wetlands	Transient, Winter	Uncommon
Western least bittern *Ixybrochus exilis hesperus*	Wetlands	Transient	Extremely Rare
Black-crowned night heron *Nycticorax nycticorax*	Wetlands	Transient	Uncommon
White-faced ibis *Plegadis chihi*	Wetlands	Transient, Summer	Fairly Common
Fulvous whistling-duck *Dendrocygna bicolor*	Wetlands	Vagrant	Extremely Rare
Osprey *Pandion haliaetus*	Wetlands	Transient	Rare
White-tailed kite *Elanus caeruleus*	Wetlands, Rural	Transient	Extremely Rare
Golden eagle *Aquila chrysaetos*	Throughout	Resident	Uncommon
Bald eagle *Haliaeetus leucocephalus*	Wetlands	Transient	Extremely Rare
Northern harrier *Circus cyaneus*	Wetlands	Resident	Common
Sharp-shinned hawk *Accipiter striatus*	Riparian, Pinyon Forest, Urban	Winter	Uncommon
Cooper's hawk *Accipiter cooperii*	Riparian, Pinyon Forest, Urban	Resident	Uncommon

Species	Habitat Type	NAWS Status	NAWS Abundance
Northern goshawk *Accipiter gentilis*	Pinyon Forest	Winter	Extremely Rare
Swainson's hawk *Buteo swainsoni*	Throughout	Transient	Extremely Rare
Ferruginous hawk *Buteo regalis*	Throughout	Transient	Extremely Rare
American peregrine falcon *Falco peregrinus anatum*	Wetlands	Transient	Extremely Rare
Prairie falcon *Falco mexicanus*	Desert	Resident	Uncommon
Merlin *Falco columbarius*	Wetlands	Transient	Extremely Rare
Snowy plover *Charadrius alexandrius nivosus*	Wetlands	Transient, Summer	Uncommon
Long-billed curlew *Numenius americanus*	Wetlands	Transient	Rare
California gull *Larus californicus*	Wetlands	Transient, Winter, Summer	Uncommon
Forster's tern *Sterna forsteri*	Wetlands	Transient	Uncommon
Black tern *Chlidonias niger*	Wetlands	Transient	Fairly Common
Burrowing owl *Athene cunicularia*	Desert	Resident	Uncommon
Long-eared owl *Asio otus*	Riparian, Desert, Urban	Winter	Fairly Common
Short-eared owl *Asio flammeus*	Wetlands, Riparian	Transient	Extremely Rare
Vaux's swift *Chaetura vauxi*	Throughout	Migrant	Rare
Willow flycatcher *Empidonax trailii*	Riparian, Urban	Migrant	Fairly Common
Southwestern willow flycatcher *Empidonax trailii extimus*	Riparian, Urban	Migrant	Unknown
Vermillion flycatcher *Pyrcephalus rubinus*	Riparian, Urban	Summer	Extremely Rare
Purple martin *Progne subis*	Throughout	Vagrant	Extremely Rare
Bank swallow *Riparia riparia*	Throughout	Migrant	Uncommon
Western bluebird *Sialia mexicana*	Throughout	Winter	Extremely Rare
LeConte's thrasher *Toxoxtoma lecontei*	Desert	Resident	Uncommon
Loggerhead shrike *Lanius ludovicianus*	Throughout	Resident	Fairly Common

Species	Habitat Type	NAWS Status	NAWS Abundance
Least Bell's vireo *Vireo bellii pusillus*	Riparian, Urban	Migrant	Extremely Rare
Gray vireo *Vireo vicinior*	Pinyon Forest	Migrant	Extremely Rare
Yellow warbler *Dendroica petechia brewster*	Riparian	Migrant	Common
Virginia's warbler *Vermivora virginiae*	Pinyon Forest	Vagrant	Extremely Rare
Yellow-breasted chat *Icteria virens*	Riparian	Migrant	Rare
Summer tanager *Piranga rubra*	Riparian	Vagrant	Extremely Rare
Inyo California towhee *Pipilo crissalis eromophilus*	Riparian	Resident	Uncommon
Tricolored blackbird *Agelaius tricolor*	Wetlands	Summer Resident	Extremely Rare

Taken from Blue and Moore, 1998 and Blue, 1996.

Wetland and Water Dependent Bird Species

As discussed in Section 2.2.6 of the INRMP there are several types of water sources available on NAWS, including: natural perennial waters, such as springs and seeps which support natural riparian vegetation; natural ephemeral water, such as lake beds (playas), tenajas, and washes; and man-made waters, such as the evaporation/percolation ponds located at the Wastewater Treatment Facility and Lark Seep/G-1 Seep system. Each water type has specific taxa associated with it.

Open water is a scarce commodity in the desert. During migration, especially over desert areas, open water is a crucial resource for resting and foraging. Because birds use traditional flyways, they are often dependent on known water sources. When wet, playas can provide foraging opportunities for shorebirds as water triggers the hatch of invertebrate eggs. Some species are dependent on water sources for nesting and/or foraging. These resources may be especially crucial in preventing further decline of populations for bird species listed or proposed for listing.

Natural Perennial Waters

Numbers and locations of springs and seeps are discussed in Section 2.2.6 of the INRMP. Many NAWS-SC are associated with springs, seeps, and adjacent riparian vegetation. Although birds utilize open water, those found in natural perennial waters are primarily dependent on the riparian habitat associated with the springs and seeps. However, the riparian vegetation is dependent on a reliable surface or subsurface water supply. Water systems at many springs are not well understood. Prior to diversion of water, tests should be conducted to identify the source and mechanics of the hydrology. The 10 NAWS-SC birds associated with riparian habitats are discussed in Section 2.3.2.2.7 of the INRMP.

Natural Ephemeral Waters

Numbers and locations of playas are described in Section 2.2.6 of the INRMP. Playas provide habitat for a number of species. Species such as fairy shrimp have evolved so that their eggs persist during dry periods. When a playa is inundated with water, eggs hatch, and fairy shrimp become active. Shrimp provide food for birds and other wildlife that are able to utilize this intermittent food supply. When wet, playas provide water for migrating birds, they enhance their chances for successful migration. Birds most likely to use this resource are shorebirds.

Desert washes are also intermittently wet. Although surface water may not be present, there may be subsurface flow which increases vegetation that is typically representative of Mojave Desert Wash Scrub plant communities (Holland, 1986). Vegetation in washes is typically more lush with higher diversity and density of plants and animals (Brown, 1982). This provides greater protection and feeding opportunities for resident and transient birds.

Man-made Waters

Most NAWS-SC birds can only be found at NAWS during migration or under unusual circumstances. Only the western least bittern, northern harrier, and western snowy plover are known to nest near NAWS (Owen's Lake and/or Harper Lake) and could nest at NAWS. The coastal population of the western snowy plover is federally-listed threatened, and color-banded coastal birds can range widely as they have been observed in the Central Valley and potentially to NAWS. The population of western snowy plovers which nests near NAWS is the unlisted inland population. The inland population is a California species of special concern. Western snowy plovers are uncommon migrants and extremely rare summer residents on NAWS. Juvenile (flying) snowy plovers have been observed at the Waste Water Treatment Facility, but their range is unknown (Blue, pers. comm.). Flightless juveniles or nests have not been observed. No coastal plovers have been observed at NAWS.

Raptors and Owls

Cooper's hawks breed in Mojavean Pinyon Woodland, golden eagles and prairie falcons breed on cliffs in a variety of plant communities; and burrowing owls breed in Mojave Creosote Bush Scrub. Sharp-shinned hawks are a common winter resident in urban areas and probably breed in the Mojavean Pinyon Woodland on the North Range although this has not been documented (Michael Brandman Associates, 1989). Long-eared owls are a fairly common winter resident and transient. Eight raptor and one owl species are transients that are rare or extremely rare on NAWS.

Six raptors and one species of owl are typically found in wetlands and riparian areas. Of these species only northern harriers are common residents, though they apparently do not breed. The other five species are rare to extremely rare migrants. There appear to be no current threats to these species posed by activities at NAWS.

Three species most likely impacted by activities at NAWS are the golden eagle, prairie falcon, and burrowing owl. All are uncommon residents. Michael Brandman Associates (1989) found eight golden eagle and 20 prairie falcon breeding territories on NAWS in 1987 and 1988. Golden eagles and prairie falcons require rock cliffs for nest sites and adjacent habitat for foraging.

Burrowing owls nest throughout desert areas of NAWS and are probably most common around the golf course. There are fewer than 100 pairs on NAWS (Michael Brandman Associates, 1989). The availability of nest and roost sites in the form of desert tortoise, badger, coyote, and kit fox dens or burrows appears to be the principal limiting factor in their distribution and abundance. By virtue of their ground-nesting habits, burrowing owls are vulnerable to human-related disturbance.

A potential impact to raptors, primarily golden eagles but also buteos, are powerline electrocutions. Raptors use power line support structures primarily for hunting perches but also for nesting. Some power poles are preferred by eagles because they provide considerable elevation and a wide range of vision, easy takeoff, and greater attack speed when hunting. Seeking preferred poles facilitates the resolution of some electrocution problems, but in homogeneous habitats one pole would not provide an advantage over another to a hunting eagle; therefore, corrective measures must be applied more widely (Olendorrf, *et. al.*, 1981).

Most lines that electrocute raptors are smaller distribution lines or individual service lines. Higher voltage lines tend to have wider wire spacing, making it impossible for birds to contact two wires at the same time. Adequate separation of energized wires, ground wires, and other metal hardware is the most important factor in preventing raptor electrocution. The objective is a 60-inch minimum separation of conductors (Olendorrf, *et. al.*, 1981). Because of vast diversity of line designs and voltage used, generic recommendations cannot be made. However, specific problems can be addressed through design and modification of poles, crossarms, and wire placement which effects adequate separation of energized hardware. Insulation of wires and other hardware where sufficient separation cannot be achieved is also possible.

Neotropical Migrants and Riparian Habitats

Neotropical migrants are defined as those species of songbirds that winter in Latin America and nest in North America. This involves a long migration and dependence on appropriate habitat not only on the breeding areas and wintering grounds, but also along the migration route. Neotropical migrants have become an issue because of alarming declines of many species. Since these birds fill a variety of ecological roles (*e.g.*, as seed dispersers, pollinators, insect predators, and food for other species), their widespread declines signal a broad deterioration of the same ecosystems that support human life (Evans, 1995).

Migrations are energy-costly and birds require food and water sources as well as cover en route. Traditional flyways are used during migration and in desert areas certain areas are critical to the bird's survival. Usually these resources are found around water where food and protected roost sites are most abundant. These resources can be found on NAWS in wetlands and riparian areas. The primary concern is to protect these areas from degradation so food and protection is available for migrant species as well as resident breeders (Evans, 1995).

SECTION 2.3.2.6 Mammals Background

Bats

Bats are strictly nocturnal. They require roost sites to spend the day, for maternal sites, and for winter hibernation. Depending on the species, roost sites (and roost uses for one species) may have different requirements, but all typically need good air-flow and lack of disturbance. Bats require open water over which they skim to drink. Some species have communal roosts and tend to use mines, old buildings, or caverns, whereas other species tend to roost in areas with a few individuals or solitarily, tending to use cracks or crevices in rocks or tree hollows.

Pallid bats are California-listed as species of special concern. Pallid bats are found throughout the southwestern United States. On NAWS they are known from a number of sites in the Coso Mountains. Pallid bats are large, long-eared vespertilionids with big eyes, a pig-like snout, and a distinctive skunk-like odor. Maternity colonies form in spring (March-May) and stay together until October (Barbour and Davis, 1969). Roosts may be in old, new, or occupied buildings, mine tunnels, crevices in cliffs, undersides of bridges, elevator shafts, or many other shelters. Disturbance to the roost may cause them to abandon it. Most colonies number between 25 and 125 individuals. Males may leave the colony prior to partuition; thus, leaving a maternity colony. Breeding occurs in fall, and delayed fertilization occurs in spring. One or two young (usually two) are born primarily in June. Maternity colonies generally break up within two months after partuition. Pallid bats commonly feed on prey captured on the ground. Evidence of breeding or hibernating colonies of pallid bats has not been found on NAWS, although juveniles have been netted at Granite Wells and Birchum Spring. There are no winter records of this species on NAWS. Pallid bats forage on or near the ground on large arthropods, including scorpions, solpugids, beetles, grasshoppers, cicadas, katydids, and sphinx moths. Populations of pallid bats have been noted as declining in recent years in most of California. The primary threats to pallid bats are loss or disturbance to roosts and destruction of foraging habitat.

Townsend's big-eared bats are California-listed as species of special concern and proposed for threatened. Townsend's big-eared bats are found throughout the western United States (Idaho State Conservation Effort, 1995). On NAWS they are known from a number of mines and maternal roosts, including Redwing Mine, Star of the West Mine, and Josephine Mines (Brown-Berry, 1993). An estimated over 200 female Townsend's big-eared bats were roosting inside the upper shaft of Redwing Mine in spring 1992. However, in August 1993 only about 30 were observed leaving the mine. Dr. Brown-Berry believed human intrusion was the cause of the abandonment as the mine had evidence of human activity (Brown-Berry, 1994). At the Star of the West Mine more than 40 dead juveniles had apparently starved after their mothers were driven from the mine in August 1989. The mine had been used for seismic monitoring, and Dr. Brown-Berry believed repeated visits were the cause of abandonment. Townsend's big-eared bats are medium-sized with buffy brown fur distinguished by the combination of two hoseshoe-shaped lumps on the rostrum, and large, rabbit-like ears (Barbour and Davis, 1969; Kunz and Martin, 1982). Pierson (1998) summarized the natural history requirements of this species. Big-eared bats form maternity colonies in spring varying in size from a dozen to several hundred animals. Breeding takes place in fall and winter and ovulation in early spring. Birth of a single young occurs in June. Young grow rapidly, and most are able to fly by mid to late July (Hoffmeister, 1986). This species is a lepidopteran specialist, feeding primarily on medium sized moths (Dalton et al., 1986; Ross, 1967; Sample and Whitmore, 1993; Whitaker et al., 1977, 1981; Shoemaker and Lacki, 1993). Townsend's big-eared bats are known to hibernate on NAWS.

Fairly strong air flow is required for roosts and hibernacula; thus, at least two entrances are needed. Population declines have been recorded for this subspecies in many areas of California (Pierson and Rainey, 1996). The primary threat to Townsend's big-eared bats is directly linked to human activity. Intolerance to roost disturbance or destruction, the tendency to roost in highly visible clusters on open surfaces near roost entrances, and low reproductive potential and high roost fidelity increase the risks for this species.

Spotted bats are widely scattered throughout the southwestern United States. A spotted bat was detected by Dr. Pat Brown-Berry over Coso Cold Springs in August 1993 and one roosted at NAWS mainsite (Tom Campbell, pers. comm.). No roosts have been found on NAWS, nor has there been evidence of breeding. Spotted bats require rocks and cliffs for roosting, but little is known of their natural history (Hoffmeister, 1986).

Western mastiff bats are found throughout the southwestern United States. On NAWS they have been detected emerging from a canyon in the lava flows about two miles east of Coso Hot Springs (Zembal *et al.*, 1978). Brown-Berry (1993) heard a western mastiff bat at Coso Cold Spring in June 1993. Western mastiff bats are the largest member of their order with a wingspread of almost two feet. These fast, wide-ranging bats hunt for flying insects as high as 1,000 feet above the ground. Day roosts are typically in rock crevices in high, vertical cliffs. Colonies are almost always less than 100 animals. Krutzch (1955) states that many diurnal roosts may be occupied infrequently or temporarily. Pregnant females can be found any time from April until mid-June. Usually a single young is produced. Juveniles less than a week old are known from June 16 to August 10. No evidence of breeding or wintering has been observed on NAWS.

Threats to bats on NAWS are generally from intrusion of roost sites and degradation of water sources. Mines supporting two important maternity colonies of Townsend's big-eared bat (Redwing and Star of the West) have been sites for seismic monitoring or other studies, and repeated intrusion has reduced the number of animals. Numbers of Townsend's big-eared bats have steadily declined at the Redwing Mine over the past 15 years, and the abandonment of the Star of the West Mine was discussed above.

Constraints to NAWS activities due to the presence of bats are expected to be minimal as roosts tend to be in inactive mines that are generally not used by NAWS. Greater communication with EPO should be conducted prior to use of mines for any testing purposes. Mines that are bat roost sites should not be used for NAWS activities. Since abandon mines are numerous, access to and use of suitable mines not supporting roost sites should not be difficult.

Mohave Ground Squirrel

The Mohave ground squirrel (*Spermophilus mohavensis*) was declared rare in California in 1971 due to its small geographic range and loss of habitat. In 1985 California amended their ESA to match federal nomenclature, and the listing of the Mohave ground squirrel was changed to threatened. However, in 1993 the California Fish and Game Commission was petitioned to delist the species. The petition was approved; however, a number of lawsuits were filed, and the issue is still unresolved. CDFG treats ground squirrels as delisted which requires no surveys, mitigation, or compensation. USFWS determined the species to be a Candidate 2 in 1985 because of continued population decline, loss of habitat, and lack of knowledge, but it was reclassified as a Category 3 in 1994, and now is not listed since the classification system was changed.

Mohave ground squirrels prefer alluvial-filled valleys with deep, fine- to medium-textured soils with Creosote Scrub, Shadscale Scrub, or Alkali Sink Scrub. Desert pavement and eroded, shallow soils that promote rapid runoff seem to limit populations, and they generally avoid rocky or mountainous terrain and sterile playas. They occur sympatrically with antelope ground squirrels without seeming to impact each other dramatically. Southwest of NAWS, their range contacts the range of the round-tailed ground squirrel. The round-tailed ground squirrel range may be expanding at the expense of the Mohave ground squirrel.

Threats to Mohave ground squirrels on NAWS would be from habitat loss and degradation. Constraints to NAWS activities due to the presence of Mohave ground squirrels are minimal. Mohave ground squirrels use habitat that is utilized for much of NAWS facilities and infrastructure. New facilities constructed within Mohave ground squirrel habitat may lead to a loss of animals. Much of their range is sympatric with desert tortoise, thus, they are afforded protection to that extent.

Nelson's Bighorn Sheep

Nelson's Bighorn Sheep (*Ovis canadensis nelsoni*) are found in desert mountain range and are one of three races of bighorn sheep inhabiting California. Numerous bighorn petroglyphs indicate they were once common throughout the area (DeForge, 1981). Surveys by Weaver and Mensch (1970) led them to conclude that bighorn populations were transient in the Coso Mountains. They estimated the Argus Mountains and Eagle Crags populations to be 12 and 7 respectively. Weaver (1982) reported that sheep had disappeared from the Coso Mountains sometime after 1948 and from the Argus Mountains and Eagle Crags sometime after 1971.

Weaver and Mensch (1970) gave the following possible reasons for decline of bighorn sheep at NAWS:

- ***Mining activities.*** Mining camps were often by springs, and bighorns were used for food.
- ***Burros.*** Severe burro damage was noted with the least amount of damage in the Eagle Crags. Damage included vegetation cropping, waterhole damage, trailing, and general degradation.
- ***Horses.*** Horses damaged habitats in the same way as burros but proportionally less.
- ***Mule deer.*** Competition between the two species is possible although not known. Deer sign was found in areas of former sheep activity, and Navy observations suggested that mule deer numbers had increased.
- ***Military activity.*** This impact could not be evaluated, although Weaver and Mensch stated it was probably small.
- ***Predation.*** Coyotes and bobcats were prevalent, and mountain lion tracks were found. Increases in predator numbers could be due to burros and horses.
- ***Water.*** Competition for water during droughts may have limited bighorn numbers. Mesquite Spring was the only viable spring in the Eagle Crags during drought.
- ***Disease.*** Livestock introduced disease is a known cause of bighorn decline. In late 1960s a bighorn lamb in Saline Valley, north of NAWS, was diagnosed with contagious ecthyma (soremouth) (Warden Vern Burandt, CDFG files). Infected ewes do not allow nursing due to painful sores on the mouth, genitals, and teats.
- ***Inbreeding.*** Bighorn migration may be blocked by human obstruction and disturbance. However, movements of bighorns released in the 1980s would dispute this possibility.

The status of re-introductions was uncertain as of 1991. There was evidence of bighorn sheep in both areas and evidence of reproduction in the Eagle Crags. Financial constraints have hindered attempts to survey bighorn populations on NAWS. There was concern that disease had been introduced to the Eagle Crags population during the 1987 re-introduction. Bighorn sheep (adults and young) were observed in 1995 and fresh scat collected at Lead Pipe Spring in the Eagle Crags in 1997. Current herd size and health is unknown.

SECTION 2.3.2.7 Feral and Domestic Animals Background

Administrative Considerations

The Taylor Grazing Act was passed in 1934, giving the Department of Interior authority to govern and protect public lands of the United States to prevent overgrazing and soil deterioration and to provide for use and improvement of public range. NAWS (then NOTS) was created in 1943, and in 1945 Stock Operators Agreements were created with the 10 ranchers with allotments on NAWS. They could continue grazing operations with NAWS Commanding Officer approval and with waiver of all damage claims against NAWS.

In 1959 a Memorandum of Understanding was created between NAWS and BLM, whereby BLM would administer grazing on behalf of NAWS and be fully responsible for range improvements, supervision of range conditions, and grazing administration.

In 1971 the Wild Horse and Burro Act (Public Law 92-195) was passed in response to allegations of excessive commercial harvest of horses for pets, chicken feed, and limited human consumption. The Act requires that if an overpopulation exists on a given area of public land, then action is necessary to remove excess animals and that the authorized officer (BLM) shall immediately remove excess animals to achieve appropriate management levels. Appropriate management practices require that these animals, particularly horses, be in good health, have desirable color and conformation, and be maintained at a reasonable herd size which can sustain itself while not causing excessive environmental damage.

One unfortunate consequence of the Act was population explosions which resulted in significant degradation of the environment particularly with respect to destruction of water sources and forage resources due to overgrazing by horses, burros, and in some areas by cattle. By 1980 horses and burros were noted to be in very poor condition on NAWS.

In 1976 Congress passed the Federal Land Policy and Management Act (FLPMA). FLPMA recognized the Southern California Desert as a unique, complex, and sensitive ecosystem which was being subjected to conflicting and often incompatible uses of natural resources. Section 601 of FLPMA mandated designation of 25 million acres in southern California as the California Desert Conservation Area (CDCA). This law required BLM to develop a plan for public lands of the CDCA to be managed for "*...multiple use and sustained yield, and maintenance of environmental quality*". This includes economic, educational, scientific, and recreational uses which do not diminish the desert's environmental, cultural, and aesthetic values and its future productivity. This is relevant to NAWS as the Station is entirely contained within and surrounded by the CDCA, although NAWS functions as a separate land management agency.

The CDCA Resource Management Plan of 1980 established appropriate management levels for wild horse and burro populations. Estimated populations in the Centennial and Slate Management area exceeded management levels prescribed in the CDCA. The plan also acknowledged overpopulation of horses and burros and rated the Lacey-Cactus-McCloud (LCM) cattle grazing allotment as being in "fair condition".

This plan formed the basis upon which land management decisions were made for the CDCA. Because this document discusses the entirety of the CDCA and because detailed, site-specific baseline data were generally unavailable, this document dealt with many management issues in a general fashion. Emphasis was placed on future development of management plans, baseline data acquisition, field monitoring, and subsequent modifications to plan implementation.

With respect to cattle grazing, the EIS on the 1980 CDCA Plan reached the decision that upon final acceptance of the Plan, it would be implemented through development and implementation of a Rangeland Management Program Document (RMPD). The Plan also required the development of an Allotment Management Plan (AMP). Although the RMPD was never completed the AMP was completed in 1984. The LCM AMP was to be implemented after preparation of a supporting Environmental Assessment (EA). The need for an EA was to fill data gaps identified in the 1980 EIS and to specifically address impacts associated with cattle grazing on the LCM allotment. The EA has not been prepared. Implementation of the plan assumed adequate funding. However, funding has been limited, and many objectives have not been completed. Range conditions continue to show a downward trend; vegetation continues to be overutilized; and range improvements continue to degenerate and fail (BLM, 1995).

The Desert Protection Act of 1994 assigned responsibility for management of horses and burros to the Navy. The Act also allowed the Department of Interior to assign overall land use management responsibility to the Navy. This responsibility was assigned to the Navy through implementation of a Memorandum of Agreement in 1995. The BLM continues to work closely with the Navy on development of land use plans, the wild horse and burro program, and other projects of mutual interest, such as management of endangered species. BLM retained responsibility for management of LCM cattle grazing operations.

Compatibility Issues on NAWS

Distribution of Grazing Resources

The permittee operating the LCM allotment is heavily dependent on grazing resources on NAWS. Thirty of the 41 range improvements and all but three of the 20 water sources within the allotment are on NAWS. With the removal of the Coso Hot Springs, Wild Horse Mesa, Mountain Springs Canyon, and Etcherron Valley areas from the allotment, slightly over one-half of the usable portion of the allotment is now on BLM lands.

Fencing Incompatibility

In 1995 BLM noted that security fencing was interfering with cattle movements and requested that the Navy cease construction of fencing of "*dubious value*" (BLM letter, 26 Sept. 1995; pers. comm. between BLM and Navy, Sept. 1995). Security fencing interferes with cattle, horse, and burro movements. Conversely, construction of cattle pasture and drift fences interferes with horse and burro movements. Horses and burros have been injured by walking or running through fencing, particularly at night. The construction of security fencing around NAWS perimeter would successfully control cattle trespass onto NAWS when grazing is allowed only on BLM land but would present the same problem with respect to unencumbered horse movement. Cattle guards have been ruled-out as a viable means to control cattle movements because they require fencing, and cattle guards cannot be safely traversed by wild horses or heavy military equipment.

The installation of portable steel exclosure panels may present problems with respect to domestic and feral animal management. These panels are designed to preclude further degradation of springs, seeps, other water sources, and riparian areas. They are designed to provide safe access to native wildlife, such as mule deer and bighorn sheep, but preclude most access by horses, burros, and cattle. Manipulation of panel exclosures has also been used to facilitate burro trapping. Panels can be configured with one-way gates to trap burros. Domestic and feral species are still dependent on water sources and some means must be provided to ensure that water is made available outside the exclosure.

In most cases panels can be placed to allow water flow under the downslope panel away from highest value habitat areas. This passive method works well for horses which easily travel between water sources. Unfortunately, cattle tend to congregate at water sources, and since one of the major problems with the LCM allotment is distribution of water to more evenly distribute cattle, water availability must be ensured through means other than passive flow. Water catchment systems, pipelines, water storage tanks, and float-regulated drinking troughs need to be installed. These systems typically require routine maintenance. NAWS is not prepared to maintain such systems. Many existing water developments established in support of cattle grazing operations have failed or are in poor condition.

Identified Adverse Impacts

By 1980 both the BLM and National Park Service issued documents emphasizing that environmental damage associated with expanding populations of feral burros and horses were reaching a critical stage in the CDCA (BLM, 1980). In the 1980 CDCA Plan BLM proposed to manage feral burros and horses in areas on and adjacent to NAWS.

In 1981 NAWS finalized an EIS in support of the feral burro management program. This EIS was followed by an EA implementing the wild horse management program in 1982. These documents and the CDCA Plan provided the first formal, scientifically valid analysis of impacts associated with overpopulation of horses and burros as well as a limited initial assessment of impacts associated with cattle grazing operations.

Unfortunately, the EA to be prepared in support of the cattle grazing AMP implementation was never prepared. As a result, there is little quantitative data available relative to impacts specifically associated with cattle use of NAWS. It is anticipated that use of range areas by horses and burros, particularly at and near water sources, result in impacts nearly identical to those resulting from cattle grazing.

Impacts identified in the CDCA Plan and NEPA documentation of feral burro and horse management programs showed significant impacts to sensitive natural and cultural resources as well as to soils, water quality, air quality, test facilities and military operations. A summary of significant, identified, adverse impacts is as follows:

Impacts to wetlands, riparian areas, and hydrologic features include:
- direct damage to riparian vegetation,
- compaction of soil around water sources,
- increased soil erosion,
- increased water turbidity, and
- water contamination by feces and urine.

Impacts to vegetation include:
- elimination of high value vegetation such as perennial grasses and forbs,

- alteration of the vegetative composition of widespread areas,
- disappearance of vegetation caused by overgrazing by burros (BLM range specialists determined that nearly all perennial grasses had been removed from the LCM allotment in 1981),
- severely impacted areas near water with conditions persisting, and
- colonization by weedy annual species in disturbed areas.

Impacts to animal populations include;
- disruption of small mammal/rodent communities, causing reductions in density and diversity;
- loss of bighorn sheep population due to disease from domestic sheep, poor habitat conditions, lack of water, and competition with other animals (burros);
- possible increase in susceptibility to disease and decreased reproduction rates in mule deer;
- habitat damage or loss in areas supporting federal- and State-listed threatened species (Inyo California towhee, desert tortoise, and Mohave ground squirrel); and
- high likelihood of impacts to vertebrates and invertebrates restricted to water sources.

Impacts to cultural resources include:
- damage to prehistoric sites, including obsidian quarries, rock shelters, open habitations, and petroglyph sites, particularly at or near water sources (Grazing, trampling, wallowing, and watering promote alterations to sites by surface disturbance followed by subsurface damage, erosion, and deflation of archaeological deposits, which may alter the original character of artifacts. Horizontal movement of artifacts can invalidate stratigraphic interpretations. Chemical analysis of material or surrounding soils used to date sites and artifacts may be affected by chemical contamination from feces and urine);
- damage to historic sites, including structures associated with mining and ranching activities from the late 19th- through mid-20th century; and
- damage to areas listed on the National Register of Historic Places and within a National Historic Landmark.

Lack of Baseline Data

Numerous documents have identified grazing impacts to biological and cultural resources (BLM, 1980; Navy, 1981 and 1982), but there is little information for most areas being jointly utilized by horses, burros, and cattle. Few comprehensive, site-specific impact assessments have been completed, particularly in areas most heavily utilized by large herbivores, such as springs, seeps, riparian areas, and wetlands.

Little information addresses impacts to less commonly observed plants and animals. Many plant species only appear during wet years or for a short period of time. They may be diminutive in stature or may be located in small, restricted areas or microhabitats. Similarly, many animal species are only intermittently active, secretive, or very uncommon or rare. Many of these resources can only be discovered through systematic searches by trained specialists over a period of years.

The degree to which natural and cultural resources are being impacted and the significance of these impacts are largely unknown. This is a significant management concern. Discovery of new species or species previously unknown on NAWS are routinely recorded by survey teams or individual specialists, particularly when surveys are accomplished by knowledgeable botanists

and invertebrate species specialists who are most likely to note less obvious plants or animals typically missed by non-specialists.
Evidence of this is the fact that the number of plant taxa known on NAWS has increased 25 % in four years primarily due to intermittent surveys by a local botanist and a professor of entomology.

It is likely that some plant and animal species have been completely lost or locally extirpated, particularly at or adjacent to water sources where impacts are concentrated. However, impacts are not strictly confined to springs and riparian zones. In many upland areas complete or near total loss of bunch grasses has been repeatedly recorded (BLM, 1980; Navy, 1995). At least one species of butterfly is totally dependent on bunch grasses (Pratt, 1995). Unfortunately, bunch grasses are a preferred forage species of horses, burros, and cattle. Some areas on NAWS have been so heavily impacted that recovery of vegetation has not occurred even after removal of over 11,000 horses and burros. In 1995 range conditions had not improved from the "fair" rating noted by BLM in 1980 (BLM, 1995).

Compliance Issues

The lack of National Environmental Policy Act (NEPA) documentation in support of cattle grazing operations is a major management issue. When the CDCA Plan was implemented in 1980 it was based on a number of assumptions and required a number of actions be completed to support cattle grazing in the LCM allotment. The Plan acknowledged that site-specific baseline data were generally unavailable and dealt with issues such as grazing on the LCM allotment in a general fashion.

The assumptions in the CDCA Plan were overly optimistic. The Plan required completion of a number of actions and indicated that these actions would be implemented through the preparation of appropriate NEPA documentation. A review of the AMP indicates that most of the 12 goals detailed in the plan have not been met.

Since 1980 numerous documents have discussed habitat degradation and impacts to natural and cultural resources associated with horse, burro, and cattle use of the Range (BLM, 1982; NWC, 1981a; NWC, 1982; BLM, 1995a; and BLM, 1995b (letter)). BLM and Navy documentation indicate that environmental degradation continues to occur, but the significance of these impacts is not known except in a qualitative fashion.

NEPA requires that continuing activities may necessitate preparation of NEPA documentation when: there are currently occurring environmental effects which have not been previously evaluated in a NEPA document; and where there is discovery that substantial environmental degradation is occurring, or likely to occur, as a result of ongoing operations; and there is a discovery that the environmental effects of an ongoing activity are significantly different and qualitatively different or more severe than predicted in a NEPA document.

In addition to compliance with NEPA, grazing activities need to comply with numerous other statutes including the Endangered Species Act, the Clean Water Act, the National Historic Preservation Act, the Archaeological Resources Protection Act, the Federal Land Policy and Management Act, the Taylor Grazing Act, and the Wild and Free Roaming Horse and Burro Act. Compliance with these laws could be assured through the preparation of an EA in support of a revised AMP. In addition to these federal regulations, cattle grazing operations need to comply with State and County requirements, particularly where operations occur at water sources used as potable water supplies for human consumption.

Safety, Security and Mission Conflicts

The 1984 BLM AMP indicated that livestock can interfere with the military mission by their presence in test areas during tests, by damaging or disrupting sensitive equipment, and by causing safety problems by their presence on roads. The Plan also indicates that cattle grazing has resulted in Navy concerns relative to security issues due to the sensitive nature of Navy projects and the need for the permittee to regularly access the Station, and the Plan states that grazing has caused considerable negative comment when cattle access the Coso Hot Springs and petroglyph areas.

Security concerns have continued to be an issue, particularly when the permittee is afforded access to NAWS without constraints to movement. Access to test sites conducting classified operations remains a management issue. A related safety concern occurs when wranglers and cattle access areas contaminated with unexploded ordnance. The Safety and Security Department continues to provide the permittee with separate locks and keys, safety and security briefings, and annual development and renewal of an MOU.

In 1994 BLM prepared an EA in support of the 1994-1995 wild horse and burro roundups. This document indicated that in the past, personnel traveling through the range had been injured in vehicle/burro accidents as a result of uncontrolled burro activity and that equipment has been damaged, compromising safety of the NAWS mission (BLM, 1994). Similar vehicle-livestock interaction problems have been noted with respect to horses and cattle, particularly at night. Problems with horses and burros have been significantly reduced over the years as their numbers continue to be reduced.

Funding of Management Efforts

Prior to 1992 the Navy provided most funding for roundups of wild horses and feral burros on and adjacent to NAWS. The Navy estimates that it has spent between four and five million dollars to control horse and burro numbers since 1981. Additional roundup efforts in nearby areas were conducted and paid for by Death Valley National Park. Since 1993, BLM has matched funds contributed by the Navy and in 1995 paid most costs of a major wild horse capture. Jointly-funded capture efforts are anticipated to continue annually. It is possible that additional cooperative efforts and conduct of joint roundups could be arranged with Death Valley National Park. Similar efforts are being investigated with the National Training Center at Fort Irwin, which recently discovered it also has a burro problem.

With respect to grazing management, BLM is solely responsible for management of the LCM allotment. The permittee pays a minimal fee, which is collected by BLM. Unfortunately, this fee is not dedicated for expenditure on the allotment. As a result BLM is often unable to fund new range improvements or upgrades and maintenance of existing improvements, cultural and biological resource surveys, assessments of impacts to cultural and natural resources, spring/wetland/riparian area protection projects, or even annual forage utilization trend analysis.

Removal costs to maintain the horse herd at about 168 animals are anticipated to continue to increase. In addition, there will be a continued need to fund other associated projects, primarily work on springs to maintain or improve habitat conditions at these sensitive areas. Annual roundup costs of $50,000 include costs associated with burro management since horse and burro removals are conducted concurrently.

Horses

Horses (*Equis caballos*) were brought to North America with the Spanish in 1495. By the 16th or 17th centuries there were feral herds descended from escaped or released domestic livestock. By the 1800s they became such a nuisance in California that thousands were periodically slaughtered by ranchers.

The first ranchers entered the NAWS area around 1865, nearly 80 years before the establishment of the Station. Domestic horses were being grazed on what are now NAWS land by 1885, although feral herds may have been pushed there from the San Joaquin Valley by drought in 1870-72. One family alone captured 200-300 horses per year in the Coso Mountains in the early 1900s.

In 1982 it was estimated that there were 903 horses in the Coso Range and 151 horses in the Argus Range. These two herds were believed to have little intermixing. It appears that the horses remaining on NAWS are equally split between these two areas. It is unknown how much intermixing of these populations currently takes place.

Horses are rarely seen below 2,600 feet, and there is little or no seasonal movement, possibly due to mild winters and limited water sources. Horses are usually found within two miles of water and very rarely more than 5.25 miles from water. Horses typically spend less time feeding and more time drinking and resting during successively warmer months. In the Argus Range most horses were found in blackbrush/Joshua tree habitats and seemed to prefer lava mesas to forage on remnants of bunch grasses. In the Coso Mountains they typically utilize areas in openings in the pinyon-juniper plant community.

Horses are primarily grazers and are typically highly selective with respect to forage species. Grasses, particularly bunch grasses, constitute most of their diet when available. They will actively consume the short new growth of these species but will closely crop vegetation when preferred species are scarce. There appears to be a great overlap between the diet of horses, cattle, and native ungulates, such as bighorn sheep. Competition for forage between horses and cattle is most intense during plant dormancy periods or during drought (Navy, 1982). The degree of competition with bighorn sheep is considered minimal since horses are not usually found in areas inhabited by bighorns.

Horse herds consist of family groups with a dominant male, often several subordinate males, females, and young. Dominant male-female bonds are long-term. Breeding is usually seasonal. Other groups, usually less than five individuals, are made up of males driven from family groups by dominant males. Some single horses, typically old males, can be found. Most exchanges between family groups consist of young females.

First conception is usually between 2-4 years, and fecundity rises to the age of 11 then declines for the remainder of their life span. Life span is functionally estimated at over 20 years (Phillips, 1989). Many horses captured from the Centennial herd are estimated to be at least 20 years old. Horse and burro populations can increase at a rate of 15 to 25% annually. Populations can double in five years.

In temperate North America, mares generally foal between April and June. About 25% of a group is composed of mares capable of reproduction. Survivorship is high with 80-85% in the first year and probably 80-90% thereafter. Generally one foal is born each year, but not all mares reproduce each year. Unlike Phillips (1989) who found first conception to be between 2-4 years, Navy (1982) found that sexual maturity is delayed until nearly the fourth year. Reproductive success is largely controlled by physiological condition which is primarily determined by range conditions and forage/water availability (Navy, 1982).

Year	Estimated Population	Number Removed
1978	609	
1980	834	
1981	1,120	
1982	1,318	
1983	1,226	241
1984	1,090	561
1985	Unknown	691
1986	Unknown	0
1987	Unknown	507
1988	Unknown	0
1989	720	100
1990	609	347
1991	367	293
1992	509	72
1993	432	136
1994	354	126
1995	208	149
1996	229	0
1997	230	23
1998	220	41
Total		3,287

BLM Data

With significant reductions in horse numbers, competition for forage has been reduced to the point that for the last few years conditions of horse herds have noticeably improved. Their population more than doubled in number between 1978 and 1982 (from 609 to 1,318), averaging a 22% increase per year. Subsequent to passage of the Wild and Free Roaming Horse and Burro Act, horse populations were noted to increase at rates of 15 to 30 percent.

NAWS was found to have the highest concentration of feral horses in the CDCA in 1980. There were an estimated 740 in the Centennial Range in northern NAWS. At least 670 of these horses were thought to range primarily on NAWS. The Navy's interim management goal was to sustain a herd size of 375 horses. This number was reduced by BLM, based on a more thorough analysis of forage allocations between horses, burros, cattle, deer, and bighorn sheep. The BLM arrived at an appropriate management level of 168 horses. This figure remains reasonable when range conditions are taken into account.

Horse numbers appeared to have peaked at over 1,300 animals in 1982. Since then, over 3,200 horses have been removed from the Centennial and Slate Herd Management Area. The table to the left shows horse population numbers and numbers removed from 1978 thru 1998. Horse removal and subsequent adoption are through the BLM Wild Horse and Burro Adoption Program. About 220 horses are thought to inhabit NAWS and adjacent BLM land.

More than 3,280 horses have been removed from NAWS since 1983. Horse numbers have continually declined from 1,318 animals in 1982 to a low of 208 horses in 1995. The 1998 population is estimated at about 220 horses in the Centennial Herd Management Area. BLM continues to indicate that the management area is capable of supporting 168 horses.

To facilitate adoption of wild horses by the public through the BLM adoption program it is necessary to ensure that they exhibit characteristics that the public finds appealing. Horses should be young, healthy, and have good conformation and color patterns. It is also important from a biological management perspective as well as for public appeal, that the array of characteristics presently in the herd be maintained to avoid inbreeding. Because some horses occur on BLM land outside the boundaries of NAWS, it is essential that all herd management efforts be accomplished in concert with BLM management programs.

Environmental impacts associated with overpopulation of horses were assessed in the Interim Wild Horse Management Program Environmental Assessment (Navy, 1982). This document incorporated information provided by similar assessments conducted by the NPS, BLM, and the National Research Council. In general, impacts caused by horses are similar to those caused by feral burros and cattle. Detrimental impacts upon soils, native plant and animal communities, and water and cultural resources are routinely documented.

Burros

The burro (*Equus asinus*) was introduced to North America by the Spanish around 1500 and probably first entered the United States around 1600. They were used mainly in mining, by field workers, and for transportation. By the 1700s the Spanish crossed into California with burros and horses, but hostilities with Native Americans kept most non-Native Americans out of the area until the Gold Rush in the mid-1800s when thousands of Anglos and Mexicans flocked to California with pack animals. The first recorded use of burros at NAWS was for transport of charcoal to ore smelters. There are accounts of two farms in the area where burros were raised for that purpose. It was likely that burros were first released into the wild in the late 1800s, after the decline of mining and appearance of the railroad.

Burros have a relatively high reproductive rate, few natural predators, and low incidence of disease. Those that escaped or were turned loose multiplied to the point that they were outcompeting native wildlife and overgrazing rangelands. They were also significantly impacting soils, native plant and animal communities, watering sites and riparian/wetland areas, and cultural resource sites. Concern about an excessive population was expressed as early as 1958. The California Department of Agriculture issued permits for burro reductions on NAWS in 1965-66 (50 burros) and 1966-67 (150 burros), under supervision of the CDFG (Phillips Brandt Reddick, 1981a).

China Lake burros are known to have remarkably high reproductive potential. Data from the first comprehensive study conducted on NAWS revealed that almost 20 percent of the population was under one year of age and that the pregnancy rate was almost 60 percent with over 11 percent lactating, which is an indication that they have recently given birth (Navy, 1981). Burros are thought to be more territorial than horses. Males defend certain areas and mate with females that live or pass through their area. Strongest bonds are between females and their foals. Uncontrolled burro populations have a reproductive rate of up to 30 percent annually and can double their population within five years (Navy, 1981). Despite the fact that these animals were in very poor physical condition, they were maintaining a very high reproductive rate. In contrast, most native herbivores suffer marked declines in reproductive rates when range conditions are poor.

A 1976 survey by the National Park Service estimated there to be 10,000 burros inhabiting arid lands in 10 of the 12 western states. In 1980 BLM estimated about 10,000 burros within the 25 million-acre CDCA (Navy, 1981). The number of burros inhabiting NAWS appeared to have peaked in 1981 with 3,500 to 5,700 animals.

Burros were found in all habitat types of the Station and could be found from low elevations, including areas on and around the airfield to Pinyon-Juniper habitats of the highest elevations in the Coso and Argus mountains. Roundup efforts have significantly reduced the range of burros on NAWS. Most burros are found near water sources in middle elevations, avoiding the highest peaks and the much warmer low-lying areas. Despite removal of over 9,000 burros on the Station and nearby contiguous BLM land, the Navy still needs to conduct annual roundups to control these feral equines. Burros which inhabit adjacent BLM and Park Service land in the eastern Argus Mountains and southern Panamint Mountains continue to infiltrate NAWS.

Burros are browsers and selectively consume grasses which account for about 50% of their diet. Palatable forbs and other annual and perennial species constitute the remainder of their diet. Unpalatable species, such as creosote and sage brush, proliferate under conditions of overgrazing. More palatable but less desirable species become heavily utilized as conditions deteriorate ultimately leading to a disclimax or grazing climax rangeland condition. In some cases certain preferred species are ultimately eliminated from heavily utilized areas, particularly around water sources, or non-palatable and invader weedy species proliferate. Despite the severely overgrazed condition and changed species composition noted in the 1981 study, burros continued to reproduce at a high rate.

Due to differences in digestive system anatomy, burros (and horses) are capable of eating larger quantities of high fiber plants. When compared to ruminants, like deer, bighorn sheep, and cattle, burros are at a decided advantage when overgrazed conditions are present. Because of their ability and need to consume large quantities of vegetation, more damage to preferred species is realized in overgrazed areas from burros.

In 1972 burros appeared to be in poor condition and there seemed to be a die-off following drought conditions from 1970-72. Yet, in 1972-73 the State granted NAWS another permit for removal of 200 burros. The permit went unused due to pending federal legislation affecting wild burros and negative public sentiment. In the 1970s NAWS made its first burro population estimates. Although later deemed unreliable, 430 burros were estimated on NAWS in 1973, 200 burros in the Slate Range in 1973-74, and 1,000+ burros in late 1977. In the first reliable population estimates at NAWS (1980), aerial surveys indicated there were 2,225 burros at NAWS concentrated in six main herds ranging throughout the entire Station. Population growth was conservatively estimated at 20% per year. Most births occurred in spring, but some occurred year-round.

At about this same time, the BLM and the National Park Service issued documents emphasizing that environmental damage associated with expanding populations of feral burros and horses was reaching a critical stage in the CDCA (BLM, 1980). In its 1980 plan, BLM proposed to manage both feral burros and horses in areas contiguous with NAWS.

NAWS began a burro reduction program in 1980 to reduce the chance of collisions between aircraft and burros at Armitage Field (burro droppings on runways can also foul aircraft engines), vehicle and burro collisions, and crop damage by burros on agricultural fields west of NAWS. Kovac (1982) reported that between March 1980 and January 1981, 258 burros were live-captured and removed; yet, burro numbers increased. In March 1981 another 649 burros were removed by shooting which led to public outcry and a lawsuit. This resulted in animal protection groups live-capturing and removing another 606 burros between June 1981 and February 1982. All 1,513 burros came from a 275-square mile area on the NAWS North Range.

In November 1981 the final NAWS EIS for burro removal was submitted. From January through May 1982 and 1983, BLM corral-trapped, and from June through December 1982 and 1983, water traps were used. The Navy paid BLM $50 for each burro removed, and animal protection groups received the burros and took full responsibility for their care. From 1980 to 1985, a total of 6,531 burros had been removed from NAWS, and the population was believed to be about 200 (Kovac, 1985). Another 195 were removed by 1986, and annual removal efforts were continued only on a low maintenance level (Kovac, 1986). There had been 7,701 burros removed by 1991. Annual live-capture and removal now reduces the population to 100 to 150 burros, approximately equally distributed on the North and South ranges (The April 7, 1995 estimated population was 100; Allison, 1995), but burros continually migrate onto the Station.

Inventory of burro populations is usually accomplished annually by helicopter surveys or roundup efforts. The present burro population is thought to total about 50 on NAWS North Range and about 50 on South Range. An additional 150 to 200 burros are thought to exist on BLM land northeast of North Range in the Coso and Argus mountains and in the southern Panamint Mountains bordering South Range. The table below shows the number of burros (over 9,000) removed from NAWS since 1981.

Year	Estimated Population	Number Removed	Cumulative Number Removed
1966		50	50
1967		150	200
1973	430*	0	200
1974	200*	0	200
1977	1,000+	0	200
1980	2,225**	0	200
1981	3,500 - 5,700	799	999
1982		3,389	4,388
1983		1,668	6,056
1984		922	6,978
1985		415	7,393
1986		232	7,625

Year	Estimated Population	Number Removed	Cumulative Number Removed
1987		466	8,091
1988		455	8,546
1989		227	8,773
1990		162	8,935
1991		82	9,017
1992		133	9,150
1993		120	9,270
1994	400*	100	9,370
1995	350*	230	9,600
1996	100+***	0	9,600
1997	100***	45	9,645
1998	< 100***	40	9,685

* Rough estimate
** Number counted
*** Represents number on NAWS. Two to four times this number are thought to occupy nearby BLM land.

There is little doubt that the introduced ungulates are negatively impacting natural, cultural, and aesthetic values as well as diminishing the future productivity of NAWS lands. Grazing animals modify the abiotic (soil properties) and biotic (plant reproduction, density, diversity, vigor, etc.) environment. Mojave Desert habitats may take decades or even millennia to fully regain a pre-grazing state. Webb and Wilshire (198?) estimated that desert habitat in the area of an old mining town may take up to 800 years to fully recover.

Identified potential sources of disturbance on NAWS includes military activities, recreational uses, and introduced species. Military activities are highly localized and affect a small portion of NAWS, and are primarily located in areas with few sensitive or rare resources (Navy, 1981 or 1985). Similarly, recreation has a minor impact due to its restricted nature in small areas of the military range. However, there has been significant concern expressed about effects that introduced ungulates (cattle, burros, and horses) are having on the natural resources on NAWS.

Soil types at NAWS (erosional/depositional aridsols and entisols) are highly susceptible to erosion by wind or water when the surface is disturbed. Soils are deteriorating in burro-occupied areas (Navy, 1981). Burros develop extensive trail systems for grazing and moving to and from water. A grazing exclosure in Etcherron Valley illustrates a decrease in trails where burros and other grazing animals have been excluded for several years. Terracing effects of burros are evident in photos of the Hidden Springs area. Trailing increases soil erosion and compaction, leading to increased water runoff and less water availability for plants. There is a significant inverse relationship between moisture infiltration (thus, groundwater recharge) and grazing intensity. This effect is especially apparent in a xeric environment. In addition, soil crusts have been found to disappear from areas grazed by burros. These crusts help prevent soil erosion, retain soil moisture, and provide a seed bed.

Burro-caused soil compaction influences plant root contact with water sources which may be responsible for the reduction of vegetation canopy, which result in increased evaporation and erosion rates (Navy, 1981 and 1985). Some NAWS springs flow at less than a gallon per hour or per day. Burros in the desert drink 3-5 gallons of water per day. The 2,225 burros at NAWS (1980 population estimate) would have therefore consumed at least 267,000 gallons, at four gallons daily, of water per month, making that amount of water unavailable to native species. Additionally, two water sources were found unfit for human consumption due to high fecal coliform and fecal streptococci levels.

Norment and Douglas (1977) showed that in southeastern California, eight of 12 plant species exposed to grazing by burros were impacted to the point where their chance of survival, and reproductive potential were reduced. Where exposed to heavy burro grazing, perennial grasses can disappear quickly and be locally extirpated. Forbs and herbaceous perennials are likewise quickly extirpated.

The effect of burros on water sources and riparian areas may be the most dramatic. There are 100+ sources of surface water on the North Range, 21 of which are wildlife guzzlers, and 40 sources on the South Range. Most are perennial. Some contain ponded water during the winter (*e.g.* China Lake playa). Burros concentrate activity around water sources during summer, and as burro populations increase damage to water sources becomes more severe. Phillips, Brandt, Reddick, Inc. (1981b) found that burro grazing and trampling results in decreased vegetative cover and species richness as disturbance increased near water and that exotic plant species unpalatable to native wildlife were replacing native vegetation. Burro grazing and trampling were also altering the structure of vegetative and small mammal communities, especially in the vicinity of riparian areas. Impacts are most notable near water sources, but trailing and impacts to adjacent upland habitats are apparent at considerable distances. Predators dependent on small mammals are, in turn, affected. Birds, reptiles, amphibians, invertebrates, and possibly some rare plants are affected by the general destruction of habitat.

Burros may affect native ungulates. Although there are many reasons attributed to the decline in desert bighorn sheep at NAWS, their range overlaps with burros. Mule deer prefer different foods than burros, but as general range quality declines, burros should dominate as they are more capable of utilizing low quality habitat.

Cultural resources can be affected by burro activity. These resources are often concentrated near water sources. Cultural artifacts can be chipped and broken by impact and moved vertically and horizontally in the substrate, invalidating stratification and position analysis. Burro urine and feces potentially alter chemical analysis of artifacts.

Feral burros have a negative impact on NAWS recreation by trailing and water source degradation, destruction of cultural resources, and general degradation of aesthetic qualities of the native desert. Burros seem to have limited effect on the surrounding socioeconomic environment. It is apparent that an unchecked population of burros have and continue to have a serious negative effect on NAWS natural and cultural resources.

Cattle

NAWS has been grazed by cattle and sheep since the 1860s with reports of up to 10,000 cattle and large numbers of sheep run in the area (BLM, 1982). The Pilot Knob allotment (no longer in existence) on Mojave B South and adjacent BLM land was the only livestock allotment on the South Range. This allotment had been grazed for over 100 years by cattle and to a lesser extent by sheep. Originally the ranch headquarters (PK Ranch) and part of the allotment were on NAWS. With establishment of a bombing range in the late 1970s, grazing was barred from the NAWS portion of the allotment in 1982, reducing the acreage of the allotment from 97,920 to 48,000 acres. However, the NAWS boundary remained unfenced until 1991, resulting in extensive cattle trespass onto NAWS. Since livestock on this allotment were dependent on water sources on NAWS, pipelines were laid to transport water to tanks off-Station. The Desert Tortoise Preserve Committee, along with other conservation groups, purchased the grazing entitlement on the remaining BLM portion of the allotment in 1995.

On and near the North Range there were originally the following allotments: Tunawee Common, Cactus Flat, McCloud Flat, Darwin, and Lacey. The Tunawee Common allotment included about 13,500 acres on NAWS near the Coso Known Geothermal Resource Area on which grazing was permitted for only one and one half months annually. It was originally a sheep allotment but was changed to cattle in 1985. Grazing rights were subsequently purchased and retired by the prime geothermal developer as part of wildlife mitigation for development. In 1968 the remaining allotments (excluding Darwin) were combined into one allotment as a result of purchase of the John Lacey rights by Cabin Bar Ranch (BLM, 1984), which is currently owned by the Anheuser-Busch Corporation.

The Lacey-Cactus-McCloud (LCM) grazing allotment encompasses the northern third of the North Range and nearby BLM-managed land to the north and west. It originally included 233,535 acres on NAWS with another 187,637 acres on BLM-administered land. The table below shows acreages and status of the LCM allotment. Due to grazing restrictions on additional areas on the NAWS portion of the allotment, most of the active portion of the allotment is now located on BLM land. The LCM allotment is presently the only allotment on NAWS.

Lacey-Cactus-McCloud Allotment Acreage		
Pasture Name	Acres	Status
Junction Ranch/Etcherron Valley	26,196	Inactive*
Wild Horse Mesa/Petroglyph Canyon/Coso Hot Springs**	65,643	Inactive***
Remaining NAWS	141,696	Active
NAWS Total	233,535	
BLM Total	187,637	Active
Total Active	329,333	
Total Active and Inactive	421,172	

* Still receives use
** Includes Mountain Springs Canyon area
*** Receives very light/infrequent use

In 1981 an MOU signed by NAWS, BLM, and Cabin Bar Ranch suspended cattle grazing on NAWS during burro reduction efforts. The MOU was for a period of two years or until an AMP was approved (BLM, 1984). Concerns relative to grazing at NAWS were identified in the MOU and included:

- interference with the NAWS mission by the physical presence of livestock; negative public comment due to cattle use of public areas (*e.g.* Coso Hot Springs and petroglyph areas);
- needed range improvements important to wildlife and feral horses, which need routine maintenance;
- near total dependence of livestock on NAWS water sources, as there are few sources off-station; and
- conflicting needs of feral horse and livestock management, such as competition for forage and water.

The BLM uses a quantitative indicator known as Animal Use Month (AUM) to fairly represent actual forage consumption comparisons. An AUM is defined in 43 CFR 4100.0-5 as the amount of forage necessary for sustenance of one cow or its equivalent for one month. A single horse or cow grazing for one month is equal to one AUM. A burro or mule deer grazing for one month would account for 0.7 AUMs, and a bighorn sheep would account for 0.2 AUMs. The LCM allotment is a cow/calf operation, and a cow/calf pair grazing for one month would account for one AUM.

The 1982 LCM and Darwin allotments management plan submitted by BLM defined management objectives and protocols to attain those objectives. A rest and rotation grazing strategy was emphasized. Cattle numbers were not to exceed 520 cattle, or 3,655 AUMs (75% of the preferred 4,873 AUMS for the allotment until range conditions improved to "good"). The entire allotment was estimated to produce about 35,500 AUMs, although about 12,000 AUMs are considered to be unavailable due to steep terrain or lack of nearby water.

The 1986-1995 grazing evaluation for the allotment indicates that of the 4,873 preferred AUMs, 1,737 AUMs had been suspended, leaving 3,136 AUMs for active use on the allotment. It was recommended that the active AUMs be left at this level with continued monitoring and re-evaluation following one grazing cycle after implementation of the revised AMP.

In a typical year cattle are trailed into the LCM allotment in early November. When available, forage utilization and associated range condition information is used to determine how many cattle are turned-out in specific areas within the allotment. The allotment is located on and around the northern half of the Station's North Range. Movements are minimally monitored, and cattle that wonder in areas permanently or temporarily closed to grazing are moved by the permittee. Livestock normally are removed from the allotment on or around Memorial Day.

Due to lack of a Station boundary and internal pasture fencing, cattle are capable of moving anywhere in or around the allotment at any time. Even when cattle are turned-out off-Station, they are able to, and routinely do, access NAWS and traverse the North Range, appearing on the eastern edge of the allotment near Junction Ranch within as little as 36 hours.

Numbers of cattle turned-out in a given year are dependent upon forage condition which is affected by drought and past forage use. The 1984 Allotment Management Plan indicates that stocking rates could be as high as 600 head from 1 November through 28 February and 703 head from 1 March through the Memorial Day weekend. Due to excessively high numbers of horses and burros and consequent damage to the range as well as severely deteriorated forage conditions, the maximum stocking level was reduced to 448 cows. The actual stocking rate for the 1981-1982 season was 430 head of cattle (BLM, 1984). Actual numbers for 1987 thru 1997 are shown in the table below. The 10 year average was 261 cows accounting for an average 1,829 AUMs. During the 1997-1998 season the permittee has indicated that the maximum number of cattle allowed (520 head, 3,655 AUMs) will be turned-out on the allotment for the entire grazing period.

The 421,172-acre allotment (35,502 available AUMs) is not entirely available for cattle. Approximately 3,433 of the available AUMs are inaccessible due to steep terrain, and an additional 8,625 AUMs are too far from water and are not considered available for livestock use (BLM, 1984). Lack of water and steep terrain significantly limit the movements of cattle. They typically can be found in close proximity to water were they congregate and loiter. Damage to springs and seeps is severe and made worse by horse and burro use.

Recent Cattle Grazing Use Intensity and Cost

Year	Number of Cattle*	Actual Use (AUMs)	Grazing Fee**
1987	107	748	1.35
1988	440	3,083	1.54
1989	232	1,625	1.86
1990	173	1,210	1.81
1991	202	1,415	1.75

Recent Cattle Grazing Use Intensity and Cost			
1992	241	1,689	1.92
1993	398	2,788	1.86
1994	327	2,292	1.98
1995	135	947	1.61
1996	357	2,498	1.35
1997	520	3,655	1.35
1998	520	3,655	1.35
Average	304	2,134	1.70

* Average over seven month grazing period
** Fee is dollars per AUM

Cattle selectively utilize perennial grasses, desert bitterbrush, and 4-winged saltbrush. Their diet can significantly overlap that of horses, burros, and native wildlife. Control of cattle movements and utilization of key forage species is particularly important during spring growing months. The AMP proposed resting these areas during spring months and constructing six pastures with barrier fences. Cattle continue to use all areas within the allotment as well as adjacent areas due to lack of pasture and adequate drift fencing.

Cattle Grazing Intensity and Trends

Since 1987 as many as 440 (3,083 AUMs) and as few as 107 (748 AUMs) cattle have been turned-out on the LCM allotment (See table to the right). The lowest use for a full calendar year (1/1 to 5/31 and 11/1 to 12/31) was 1,210 AUMs (39% of preference) in 1990 (1987 and 1995 where not full calendar years). The average AUM use during the 1987 to 1996 period was 1,829.

Implementation of the CDCA Plan (BLM, 1980) was based on a number of assumptions. These assumptions were detailed so that an accurate analysis of environmental impacts could be made.

- Licensed use would not result in overuse of vegetation, particularly in concentration areas, such as watering troughs, bedding rounds, or holding areas.
- An Allotment Management Plan would be prepared and would be fully implemented within five years after development.
- Range improvements would be required to properly manage cattle grazing in the allotments.

In 1982 BLM released their LCM Allotment Management Plan (AMP). The three assumptions made at the time the CDCA Plan was implemented have proven to be optimistic. Vegetation is still being overutilized, the AMP has never been fully implemented or supported by the required environmental documentation, and range improvements continue to fail and degrade.

The AMP identified six primary management concerns associated with cattle grazing. They include;

- interference with the Navy mission,
- safety and security concerns,
- cattle use in public areas on-Station,
- maintenance of range improvements,
- the near total dependence of cattle on water developments almost exclusively located on NAWS, and
- potential conflicts with horse herds including competition for water and forage, movement restrictions due to cattle fencing, and extensive overgrazing, which is intensified by animals congregating in areas with water.

An assessment of habitat and cultural resources within the LCM allotment was provided in the AMP by BLM and indicated that.

- The habitat is in a very deteriorated condition.
- Lands which comprise these allotments have not been adequately surveyed for cultural resources.
- Systematic cultural surveys should reveal a large number of unrecorded sites, and construction of range improvements (water developments) and over-grazing pose the greatest threats to cultural resources.

BLM identified 12 management goals in the AMP to rectify shortfalls in the management program. These objectives were designed to manage site-specific problems and to ensure sustained-yield forage production. In addition, 10 specific actions designed to meet these 12 goals were detailed in the AMP. In accordance with requirements of the CDCA Plan, the AMP was to be fully implemented within five years after development.

The CDCA Plan established only baseline range conditions and means to correct identified deficiencies. The primary corrective measure was assumed to be full implementation of the AMP, after a comprehensive evaluation of impacts and documentation in an EA.

The Grazing Evaluation 1986-1995 for the LCM allotment (BLM, 1995) provides the most current analysis of range conditions within the LCM allotment. This evaluation indicates that excessive numbers of horses and burros contribute to utilization above proper use levels, particularly apparent in areas where animals congregate, such as wildlife water sites (springs and riparian areas) and critical habitat (cattle do not currently graze in critical habitat). However, it is not known what data BLM are using to support this assessment since all BLM allotment study plots on NAWS are located away from water sources.

Observations by the NAWS EPO staff and other biologists (Pratt, 1996; Silverman, 1996) support the contention that grazing ungulates significantly degrade riparian areas. It is not known if shortterm, high intensity use by cattle is a more significant source of impact than intermittent, year-round use by horses and burros.

The grazing system is a deferred rotational system. The 1995 evaluation indicates that this system has yet to be followed as designed. This system is dependent on pasture fences. Many (not all) of the fences have been constructed but have been damaged and not repaired. It has been speculated that cattle fences are regularly damaged by horses, particularly when horses are active at night. Neither BLM nor the permittee records or reports movements of cattle from one pasture to another.

The evaluation provides a plant species list and proper use factors for each species. There are 21 trend monitoring study sites in the allotment. These sites are in key areas, areas associated with cattle, horse, burro, and wildlife grazing. None, however, are in or adjacent to riparian areas or springs which are the most heavily impacted areas (BLM, 1982; Phillips, Brandt, and Reddick, Inc. 1981a; 1981b; and 1982). The condition of areas in and adjacent to springs, seeps, and riparian areas were rated as poor (BLM, 1980).

Twenty of the 21 vegetation study sites show a downward trend and indicate a history of utilization above the proper use level. Observations by BLM personnel note that communities between key areas appear to exhibit the same use and trend. BLM correspondence (BLM, 1994 - Sept. 18 letter) to the permittee indicated that key forage species were being utilized at or above the utilization threshold dictated in the AMP. The overutilization was attributed to a combination of drought, use by cattle and wild horses above the proper use level, and improper distribution of cattle.

In addition to determining trend and utilization, the 1995 evaluation (BLM, 1995) assessed the condition of 53 of the 59 range improvements (cattle guards, water pipelines from springs, water troughs, and fencing). Thirteen have failed; one is in poor condition; 10 are in fair condition; and 28 are in good condition. Many failures are due to lack of maintenance. Only three water sources used by the LCM permittee are located off-Station on BLM land.

The 1982 AMP prescribed 12 objectives that needed to be completed to correct problems on the LCM allotment. These objectives were required by the 1980 BLM Environmental Impact Statement to be fully implemented within five years of adoption of the plan (by 1987). The 1995 evaluation indicated that seven of the 12 objectives were incomplete with the other five objectives completed. A more conservative analysis of the objectives indicates that two additional objectives are incomplete (Tom Campbell, pers. comm.).

The AMP lists ten specific management actions to meet the 12 objectives. Seven of these actions have not been completed. One management action, adjusting stocking levels based on forage utilization, is accomplished intermittently. Despite the negative findings and identified adverse impacts, the allocation recommendation of BLM was to maintain current allocation of 3,136 AUMs (448 cows (not counting calves) for seven months) and to continue monitoring.

Even with dramatically reduced numbers of horses and burros within the LCM allotment, range conditions are still considered fair. Cattle grazing may presently equal or exceed use by horses and burros. The AMP indicates that even with reduction in horse numbers to 168 animals and the elimination of burros, it is unlikely that overall ecological condition of the area will return to pre-grazing conditions.

The AMP indicates that the integrity of cultural resource sites ranges from good to poor. The plan indicates that most damage was being caused by feral burros and over-grazing and states that the greatest threat to cultural resource integrity is overgrazing and the construction of range improvements. The plan also states that cultural resource sites have not been adequately surveyed.

Use Intensity Comparison

In 1981 it was estimated that cattle were responsible for about 10% of the forage use. The remaining forage was primarily consumed by feral horses and burros (Navy, 1985). Since this time the Navy has removed over 3,000 horses and 9,000 burros from NAWS and adjacent land. Horse numbers have been reduced from over 1,000 in 1982 to approximately 230 animals (management goal is 168 animals). Burro numbers are estimated at about 100 animals evenly distributed between the North and South ranges.

Within the active portion of the LCM allotment there are 100 - 120 horses and 20 - 40 burros. Numbers of horses and burros have steadily declined since 1982. Over the past 10 years the number of cattle grazed on the LCM allotment has varied from 107 cows to 440 cows (not counting calves). The average number of cattle grazed on the allotment during the last 10 years was 261 head.

To compare use intensity, numbers of animals need to be converted to AUMs since AUMs more accurately reflect actual forage consumption. This analysis shows that horse use within the LCM allotment accounted for 1,200 (110 x 1.0 x 12 months) AUMs, burro use accounted for 252 (30 x 0.7 x 12 months) AUMs, and cattle use accounted for 1,829 (261 x 1.0 x 7 months) AUMs. This analysis shows that cattle use percentage now accounts for over 50 percent of the forage utilized within the active portion of the LCM allotment.

Cattle represent the single largest source of forage consumption in the LCM allotment area. This area covers approximately one-third of NAWS North Range. With continued efforts to reduce horse and burro numbers to management levels, cattle use percentage will continue to exceed, and become more skewed over time, forage use from horse and burro grazing. Cows tend to loiter in riparian zones and are much harder on these areas than horses (Dave Silverman, pers. comm.).

With respect to adverse impacts to natural and cultural resources, cattle grazing may now account for the single largest source of such impacts. Impacts associated with horse, burro, and cattle use are well known and summarized above. Cattle are regularly observed congregating in and around riparian zones (Bob Parker, BLM in 1997 *Daily Independent* article; Pratt, 1986; and Silverman, 1987) where biological and cultural resources are most commonly encountered. In addition to potentially rare, endemic, and possibly yet to be discovered plant and animal species that may occur at springs and riparian sites, there is probably not a single spring that does not contain cultural resource values. Continued degradation of these sites and resources is a major management concern.

SECTION 3.2.2.2.5 Birds Management

Partners in Flight

In 1990, in response to declines of many migratory landbirds, federal, state, and private organizations formed Partners In Flight (PIF) to protect migratory birds in North America, Latin America, and the Caribbean. CDFG sponsors PIF with input from experts in the field. By 1995 more than a dozen federal agencies, many state agencies, and over 40 non-governmental conservation groups, universities, and private groups had joined forces under PIF to develop and implement a coordinated plan to reverse historic declines of neotropical landbirds. PIF seeks to protect a wide array of avian species from habitat loss and fragmentation, changes in forest composition, human-related increases in predation and parasitism, environmental contamination, as well as other factors. PIF is an effort to protect a broad group of species from diverse threats prior to any single species being federally-listed threatened or endangered (Evans, 1995).

Riparian Habitat Joint Venture

Riparian habitats are the richest terrestrial habitats for flora and fauna in western United States. In most cases, during the breeding season riparian habitats have species totals and total individuals of greater number than surrounding uplands. Desert riparian habitats have many endemic species and subspecies, known as riparian obligate species. Riparian habitats remaining in California are estimated to range from 2 to 5% for the Central Valley and desert area (Ohmart and Anderson, 1986) to up to 15% for north coastal streams. In addition to its loss, much remaining fragments of habitat are highly degraded, caused by grazing, water diversions, and exotic plants, such as giant reed and salt cedar (Laymon, 1995).

Riparian habitats contain more endangered bird species than any other habitat type in California (Ohmart and Anderson, 1986). These species are primarily impacted by two factors: 1) habitat loss and degradation, and 2) brown-headed cowbird parasitism. These factors are linked in that cowbirds benefit from conversion of riparian habitats to agricultural lands because more foraging habitat is created. The effects of cowbird parasitism are greater because habitat reduction, fragmentation, and degradation enable cowbirds to find a larger proportion of host nests (Laymon, 1995).

On September 6, 1994, 11 federal, state, and private organizations signed a cooperative agreement, the Riparian Habitat Joint Venture (RHJV) to protect and enhance habitats for native landbirds throughout California. Agencies and organizations that initiated the RHJV include; CDFG, The Resources Agency, Wildlife Conservation Board, Ducks Unlimited, National Audubon Society, Kern River Research Center, Point Reyes Bird Observatory, BLM, Bureau of Reclamation, USFS, and USFWS. The RHJV is modeled after the highly successful Joint Venture projects of the North American Waterfowl Plan. It reinforces other collaborative efforts to protect biodiversity and enhance natural resources and the human and economic values they represent (Evans, 1995).

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