Lower Colorado River
National Wildlife Refuges

Comprehensive Management Plan

1994-2014

FINAL

Havasu National Wildlife Refuge
Bill Williams River National Wildlife Refuge
Cibola National Wildlife Refuge
Imperial National Wildlife Refuge

U.S. Fish and Wildlife Service
Region 2
Albuquerque, New Mexico

U.S. Bureau of Reclamation
Lower Colorado Region
Boulder City, Nevada

COMPREHENSIVE MANAGEMENT PLAN APPROVAL
for the
Lower Colorado River National Wildlife Refuges:
Havasu NWR
Bill Williams River NWR
Cibola NWR
Imperial NWR

The attached Comprehensive Management Plan for the Lower Colorado River National Wildlife Refuges has been reviewed and approved as submitted by the managers of the aforementioned national wildlife refuges.

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The U.S. Bureau of Reclamation, Lower Colorado Region, has participated in this planning effort as a full Cooperator and hereby approves this Comprehensive Management Plan's treatment of issues pertaining to the Bureau's management responsibilities of lower Colorado River resources.

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Lower Colorado River National Wildlife Refuges
Comprehensive Management Plan 1994-2014

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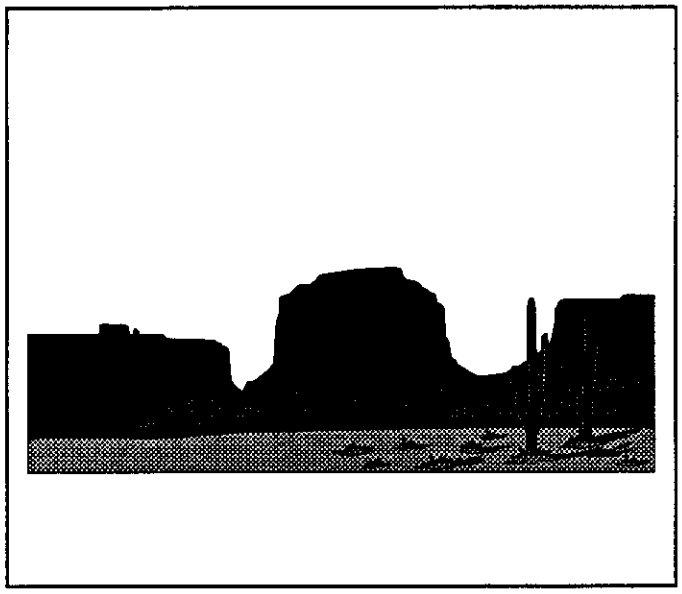


PREFACE

The U.S. Fish and Wildlife Service and The U.S. Bureau of Reclamation: Cooperators on the Colorado River

The Bureau of Reclamation (BR) and the U.S. Fish and Wildlife Service (Service) have overlapping jurisdictions on segments of the lower Colorado River associated with the Service's four national wildlife refuges. Since the BR's authorized activities on the lower Colorado River interact with the refuges, the BR is a full cooperator with the Service in the planning and implementation of this comprehensive management plan.

Under authority of the Colorado River Front Work and Levee System Act, as amended, the BR is responsible for operating and maintaining the channel of the lower Colorado River that passes through Havasu, Cibola, and Imperial National Wildlife Refuges (NWRs). While under the Colorado River Basin Project Act, the BR is responsible for the Central Arizona Project facilities located within the boundary of the Bill Williams River NWR.

Since the 1930s, the BR has assisted the Service with various projects at each of the lower Colorado River national wildlife refuges. Much of those cooperative efforts are outlined in this document. Through their respective authorities, the Service and the BR will continue to cooperate in a close partnership for the benefit of the resources involved. This comprehensive management plan is one means of effecting such benefits.

The Special Roles of the Arizona Game and Fish Department (AGFD) and the California Department of Fish and Game (CDFG): Cooperative Leadership in Wildlife Management

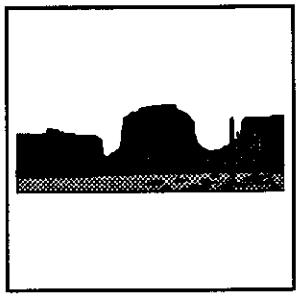
The AGFD and the CDFG have important cooperative roles in the management of fish and wildlife species on all national wildlife refuges in Arizona and California. Close coordination is essential in ensuring that the missions of the Service, the AGFD, and the CDFG are accomplished for the lower Colorado River national wildlife refuges.

PART I: INVENTORY

UNIT 1 -- INTRODUCTION, DEFINITION OF PLANNING APPROACH, AND REGIONAL HISTORY AND SETTING

1. AREA OF ECOLOGICAL CONCERN

Introduction



This comprehensive management plan is primarily concerned with the four national wildlife refuges located along the lower Colorado River (River) in western Arizona and eastern California. These refuge stations include Havasu, Bill Williams, Cibola, and Imperial NWRs. The refuge stations share various natural resource characteristics even though they possess unique values of their own. Because of the location, juxtaposition, and similar nature of each of the refuges, they are considered to be major elements of a larger Area of Ecological Concern.[1]

As demonstrated throughout history, the lower Colorado River basin has clearly played, and continues to play, a defining and central role for desert and riparian ecosystems in western Arizona and eastern California.[2] This is true even though modern technological development has altered the River basin's natural flows, which in turn affects the associated wildlife who glean sustenance and protection from this oasis in the desert. Dam building for flood control, navigation and river regulation, water storage and conservation, and power generation, has produced a set of outcomes that are problematic to both wildlife and human ecology. Ecologists and wildlife managers concede that what remains unknown is how much of the Area of Ecological Concern can be managed to restore and/or optimize natural diversity. It is known, however, that continuing to plan and manage individual elements of the Area of Ecological Concern without respect for the remainder, will result in great resource value losses.

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[1]An Area of Ecological Concern can be defined as: "An essentially complete ecosystem (or set of interrelated ecosystems) of which one part cannot be discussed without considering the remainder." [Malheur, *National Wildlife Refuge Master Plan and Environmental Assessment*, 1985, p. 7] For purposes of the lower Colorado River national wildlife refuge master plan, the entire region between Davis Dam and the Colorado River/Gulf of California (Mexico) delta is considered the Area of Ecological Concern. This area is large enough to encompass several ecosystems, including perennial riparian, intermittent riparian, lacustrine, and desert uplands. The two major riparian systems are the lower Colorado River and the Bill Williams River. Two major desert regions are the Mojave and the Sonoran.

[2]The ecosystem, according to Eugene Odum in his classic work *The Fundamentals of Ecology*, is "the largest functional unit in ecology." An ecosystem includes organisms (biotic communities) and inorganic structures such as geological formations and the weather (abiotic environment). Each of these elements influence the properties of the other, and all are "necessary for maintenance of life as we have it on the earth." [Odum, *The Fundamentals of Ecology*, (W.B. Saunders Company, Philadelphia: 1954)]

Area of Ecological Concern General Make-up

From the biological perspective, the Area of Ecological Concern consists of several ecosystems comprised of a variety of desert biomes, riparian biomes, and habitat types, each in varying states of ecological health.[3] The extent of ecosystem health and naturalness depends on the habitats' relationship with the larger environmental influences.[4] The Colorado River, with its varying water levels and flows, is perhaps the single most influential of the environmental factors. This Area of Ecological Concern, with its delicate mosaic of desert and riparian ecosystems, has been poetically described by author Aubrey S. Johnson as a "thin green line" surrounded by a world in which drought is the rule rather than the exception.[5] Overlain upon this fragile set of interlocking pieces of the biological puzzle are artificial boundaries defined by politics, economics, and sociology.

Much of the land surrounding the thin green line is under the jurisdictional control of governmental agencies having natural resource-oriented directives. Chief among these agencies are the Service, the Bureau of Land Management (BLM), the BR, Arizona State Parks Department, AGFD, and CDFG. Also of great importance are the large land areas under the control of various Native American tribes, who have had a long history of recognizing the value of protecting natural resources.

Area of Ecological Concern Core Habitats [6]

The lower Colorado River national wildlife refuges, and certain other lands and waters interspersed between the refuges along the River, are considered vital elements to the Area of Ecological Concern. These habitats are unique in their potential or current ecological health, in that they warrant objectives congruent with the refuges' objectives. These special areas, including the refuges, are called Core Habitats.

Core Habitat boundaries are based more upon vegetative community mixes and wildlife use qualities than administrative judgment, jurisdiction, or ownership. In some cases, certain

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[3]Reference *Lower Colorado River Vegetation Management Study*, Phase I, U.S. Bureau of Reclamation, June 1990, p. 8, for a list of vegetation communities and criteria used in classification. (Younker and Anderson 1986)

[4]According to Odum, "The concept of the ecosystem is and should be a broad one, its main function in ecological thought being to emphasize obligatory relationships, interdependence, and causal relationships." [Odum, *The Fundamentals of Ecology* (W.B. Saunders Company, Philadelphia: 1954)]

[5]"The Thin Green Line" by Aubrey Stephen Johnson treats desert riparian ecosystems, especially in Arizona and New Mexico, as the premier biological resource in the entire arid Southwest. This article is printed in *Preserving Communities and Corridors* (Defenders of Wildlife, Washington, D.C.: 1989).

[6]A Core Habitat can be defined as habitats that: (1) Carry or potentially carry a naturally diverse wildlife mix by virtue of the structure and health of the vegetation communities that thrive there, and the availability of resources to maintain and enhance these communities; (2) without which the remainder of the ecosystem(s) is considerably diminished; and (3) closely represent in character the quintessence of the Area of Ecological Concern as it existed prior to modern technological influences upon the natural landscape (i.e., natural mixes of vegetation and wildlife as would be provided by natural cycles of succession and predation).

important vegetation mixes overlap jurisdictional boundaries. Understood collectively, Core Habitats, including the refuges, provide the basis for the habitat enhancement and protection of the entire Area of Ecological Concern.

This comprehensive management planning effort sets objectives only for the four national wildlife refuges, but identifies other Core Habitats interspersed between the refuges. The process prompts the future development of natural resource objectives for all Core Habitats in the Area of Ecological Concern. The Service would like other jurisdictions to view this refuge comprehensive management planning effort as a vehicle for initiating cooperative natural resource ventures in the Area of Ecological Concern. Such ventures would lead toward the achievement of refuge and other jurisdiction objectives, which will contribute to effective wildlife habitat management and biological diversity within the Area of Ecological Concern.[7] Interjurisdictional efforts could, and probably should, lead to cooperative management agreements with other agencies and landowners, especially Federal and State governments.

This plan has developed refuge objectives in consideration of the role they play relative to other Core Habitats within the Area of Ecological Concern. Nine Area of Ecological Concern Core Habitats have been identified on Map #1 (see the previous page).

Refuges and Their Management Units

Refuges -- The lower Colorado River national wildlife refuges are key components of the overall ecological mosaic. All four refuges are the main constituents of the series of Core Habitats discussed above. Each of the refuges has its own stated purpose; however, combining the refuges has the potential to contribute more to the Area of Ecological Concern than if each one were treated separately. Conversely, persisting to manage and plan for the refuges separately from the larger ecological context could contribute to continuing degradation of the associated ecosystems.

Management Units, Subunits, and Special Project Activities -- Within national wildlife refuges throughout the United States, units and subunits have been geographically defined by virtue of the general natural resource mixes and profiles and the general nature of ongoing management activities. These areas have been called refuge management units and subunits. An example of a refuge management unit is Havasu NWR's Topock Marsh Management Unit, which geographically consists of all refuge land, water, and wildlife resources from the northern border of the Refuge to Interstate 40 on the southern end of Topock Marsh. An example of a subunit is the Pintail Slough Moist Soil Management Subunit located within the northern end of the Topock Marsh Management Unit. While Topock Marsh Management Unit has several natural resource features and various habitat types, the management subunit is characterized by the specific activity that takes place there, namely moist soil management. This planning project

[7]Biological diversity is the variety of life and its processes. It includes the assortment of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur. [*Biological Diversity on Federal Lands, Report of a Keystone Policy Dialogue*, The Keystone Center, April 1991]. Also see PART I, Unit 2, Section 6 in this document for a brief summary of the report.

involved the consideration of the management units as the primary focus of annual work planning. In addition, two types of areas were mapped within the various refuge management units and subunits:

Special Project Areas -- Special Project Areas are areas in need of site work or rehabilitation beyond that provided by regular refuge program management. The rehabilitation areas form the basis for special activity planning, funding, and development over the 20-year planning period. For example, revegetation is a site-specific activity or project that requires focused strategic planning. Revegetation is expected to be of short duration, even though the desired effects are long term. In contrast, farming is considered to be part of a refuge's normal year-to-year management program and usually takes place on the same location.

Special Protection Areas -- Special Protection Areas are sites within the refuges with vegetation and wildlife characteristics in need of enhanced protection efforts. For example, there are highly sensitive areas subject to a higher degree of such threats as recreational use, fire, and salt cedar infestation, among others. Even though habitat protection is part of a refuge's year-to-year management program, these special areas warrant additional protectionary strategies.

In summary, refuge management units and subunits provide the framework for ongoing refuge management and special activities over the next 20 years.

Planning Perspectives

The comprehensive management planning effort will integrate three perspectives to produce holistic management approaches for the national wildlife refuges, and ultimately the Area of Ecological Concern, over the next 20 years. The plan includes the following:

A. A broad perspective for Area of Ecological Concern issues (e.g., contaminants, revegetation, endangered species, biological diversity, recreational use, water quality, inter-jurisdictional cooperation, etc.).

B. A more narrow perspective for national wildlife refuge-related policy issues that affect all four lower Colorado River refuges (e.g., water rights, compatibility, water management, etc.).

C. A focused perspective for individual refuge management-related activities and strategies affecting defined management units and subunits (e.g., moist soil management, farming, hunting and fishing management, special project activities for rehabilitation and protection, etc.).

An understanding of these three perspectives and the relationships between them leads to the formulation of an integral set of refuge goals and objectives for the next 20 years.

The comprehensive management plan goals and objectives for the lower Colorado River national wildlife refuges form the practical basis for realistic and justifiable budgetary requests.[8] The acquisition of the necessary funding and resources is expected to drive the implementation of management programs at every level.

The Issues

During the course of the planning effort, a series of formal and informal meetings were held to determine the most important issues relative to the lower Colorado River national wildlife refuges and the Area of Ecological Concern. Meetings with other Federal agencies, state agencies, representatives of Native American governments, and members of the public, assisted the Service in identifying most of the natural and public use resource issues.[9]

The following is a list of major issues that surfaced in the various meetings and discussions. PART II, Analysis of this document considers these issues within the context of the perspectives described above. PART III, Synthesis of this document outlines goals and objectives in an attempt to address these issues[10]:

Biological Diversity and Habitat Management
Endangered Species Management
Fisheries Enhancement and Management
Migratory Waterfowl Management
Wetlands Protection
Water Rights
Water Management
Revegetation
Water Quality and Contaminants
Refuge Allowable Use Compatibility
Land Status and Jurisdiction
Nonwildlife-Oriented Recreation and Law Enforcement
Environmental Education and Public Outreach
Refuge Recreation Management
Interagency Coordination
Relationship to Native American Tribes
Staffing, Funding, and Coordination

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[8]PART III, Unit 1, contains goals and objectives as they relate to the major issues present for the lower Colorado River national wildlife refuges and the Area of Ecological Concern.

[9]The record of correspondence and transcripts of the various meetings are part of the project file and may be accessed upon request to the U.S. Fish and Wildlife Service, Region 2, Refuges and Wildlife, in Albuquerque, New Mexico. Copies are also kept on file at each of the lower Colorado River national wildlife refuges.

[10]The list of issues and corresponding goals in Part III of this document are not in any order of priority except to indicate that natural resource issues and goals take precedence by virtue of the ordering of the goals of the National Wildlife Refuge System. (*Refuge Manual* 2 RM 1-4)

2. NEED FOR ACTION

The Service Refuge Manual states that the purpose of comprehensive management planning is to "provide long-range guidance for the management of national wildlife refuges." **[4 RM 1.1, Planning]** Because of the potential cumulative impacts on the ecosystem, there is a great need to coordinate major natural resource decision-making of individual refuges.

Without a comprehensive management plan, decision-making on any of the refuges within the Area of Ecological Concern will potentially impact on the natural resources, on other non-refuge elements, as well as on each other. The Service's approach will be to consistently plan for the lower Colorado River refuges, with ecologically desirable outcomes for the entire Area of Ecological Concern.

3. EXPECTED PLANNING OUTCOMES

The following objectives were designed to be consistent with the Refuge Manual comprehensive management planning objectives.

A. The planning effort will ensure that legal mandates and national policy direction are incorporated in the management of the lower Colorado River refuges.

B. The planning effort should determine the capability of the lower Colorado River refuges to further Service and Refuge System goals, objectives, and long-range plans; and to provide a means of evaluating accomplishments.

C. The planning effort should provide a systematic process for making and documenting refuge decisions.

D. The planning effort should establish broad management strategies that are, to the degree possible, consistent with the ecosystem perspective of the Colorado River.

E. The planning effort should provide continuity in the management of the lower Colorado River refuges.

F. The planning effort should provide a practical basis for budgeting requests to implement management programs leading to the achievement of refuge objectives.

G. The planning effort should achieve an optimum level of public acceptance and/or support for the management strategies adopted through effective involvement in the planning process.

H. The planning effort should facilitate and encourage cooperative, coordinated, and integrated resource conservation planning and management throughout the Area of Ecological Concern.

4. AREA OF ECOLOGICAL CONCERN HISTORY AND REGIONAL SETTING[11]

The Colorado River originates in the Rocky Mountains of Colorado and extends approximately 1,700 miles before emptying into the Gulf of California[12]. The River and its major tributaries travel through the states of Colorado, Wyoming, New Mexico, Utah, Nevada, Arizona, and California. The *lower* Colorado River, located below the Grand Canyon's narrow rugged valleys, flows through a series of comparatively level and rather broad valleys interspersed with spectacular deep gorges and scenic granitic rock formations. Historically, the lower Colorado River valley consisted of many alluvial silt beds, marshes, and riparian forests.

Geology

Natural events shaped the lower Colorado River floodplain, and these events need to be examined in order to understand the type of vegetation that existed along the River. According to Ohmart and Anderson, two factors affected floodplain formation.[13] First, the River carried a large sediment load that contributed to the erosive action of the current. The current eroded the river bank along the outside of each meander, and new soils were deposited on the inside bank. The creation of a stream bank was continual; so was the stream bank's destruction.

Secondly, fluctuating water levels of the River affected the floodplain formation. Between mid-May and the first of July flood levels reached their peak. The size of the yearly snowpack in the Rocky Mountains and the rapidity of the spring snowmelt largely determined the flooding.

Monthly Colorado River flows ranged from 2,000 to 100,000 cubic feet per second, and changing bank formation, along with the variation in flood stages from year-to-year, created terraced bottoms along the River. Annual inundation replenished and sometimes leveled the lowermost terrace; inundation on the higher terraces was more intermittent, allowing a slower building-destruction cycle.

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[11]Scientists specializing in the lower Colorado River area have studied and documented much of the natural and environmental history of this ecological region. The primary research and description of natural events that shaped the lower Colorado River basin was done by Drs. Bertin W. Anderson and Robert D. Ohmart, Arizona State University, Center for Environmental Studies, acting as consultants to the BR. Their work is the basis for most of the research which followed during the 1970s and 1980s. A book detailing the history of vegetation, entitled *Birds of the Lower Colorado River Valley* by Kenneth V. Rosenberg, Robert Ohmart, Bertin Anderson, and William Hunter, (University of Arizona Press, 1991) confirms the vignette offered above.

[12]The headwaters of the Colorado River begin in central Colorado; however, the headwaters of the Green River, the dominant tributary, begin in Wyoming and flow into the Colorado River north of Glen Canyon Dam in Southeastern Utah.

[13]Ohmart, R.D., B.W. Anderson, and W.C. Hunter. 1988. *The Ecology of the lower Colorado River from Davis Dam to the Mexico-United States International Boundary: a community profile.* Final Report for the U.S. Fish and Wildlife Service. Biological Report No. 85 (7.19). 296 pp.

Table I Vegetative Communities and Criteria Used in Classification in 1986 Mapping of Lower Colorado River (AAA Engineering, Inc.). Based on Ohmart-Anderson Data.

VEGETATIVE COMMUNITIES AND CRITERIA
USED IN CLASSIFICATION
LOWER COLORADO RIVER, 1986

Community and Criteria

Cottonwood-willow (CW) *Populus fremontii* and *Salix gooddingii* constituting 10 percent of total mix, a very rare mix.

Salt cedar (SC) *Tamarix chinensis,* making up 80 to 100 percent of tree mix.

Salt cedar-honey mesquite (SH) *Prosopis glandulosa,* making up 10 percent of total trees; rarely found to make up greater than 40 percent of mix.

Salt cedar-screwbean mesquite (SM) *Prosopis pubescens,* making up at least 20 percent of the total tree mix.

Honey mesquite (HM) *Prosopis glandulosa,* making up 90 to 100 percent of tree mix.

Arrowweed (AW) *Tessaria sericea,* making up 90 to 100 percent of total vegetation mix.

Atriplex (quailbush) *Atriplex lentiformis, A. canescens,* and/or *A. polycarpa,* making up 90 to 100 percent of vegetation mix.

Vegetation

Few plants are uniquely adapted to the floodplain of seasonally fluctuating streams. Those that are adapted exist where their roots are in the capillary fringe of the water table. The plant roots then extend only as far from the channel as the stream exerts its influence through the water table. More often then not, the floodplain of the River gets its visual definition from this strip of vegetation. (See Table I)

Historically, belts of vegetation have existed along the River, and cottonwood and willow were the dominant riparian forest species. These occurred primarily on the "first bottom" terrace and on the braided channels. As an adaptation to a frequently flooded environment, these plants were fast-growing and relatively short-lived. Once the River was "controlled," there was little or no regeneration; thereby subjecting existing native vegetation to wildfire and succession by exotics. The shrub arrowweed often formed dense monotypical belts along the drier sites adjacent to the willow and cottonwood stands. Screwbean mesquite grew in association with willows where the floodplain of the first bottom escaped inundation for a number of years.

On the second bottom a very different type of riparian vegetation occurred than that which existed next to the River. Honey mesquite, which formed relatively sparse monotypical woodlands, was the dominant species in the second bottom. In addition to the honey mesquite, several shrubs grew locally in dense clumps on the second terrace, with salt bush being the most prevalent. Where the first and second bottoms abutted, quailbush occurred locally as a narrow belt. In areas of denser, saline, or alkaline soils, inkweed or pickleweed was found.[14] Cottonwood and willow riparian communities were a dominant feature along the River. Historical documents indicate that Father Eusebio Kino's expedition in 1699 reported dense groves of cottonwood and willow communities at the junction of the Gila and Colorado Rivers. Some of the groves are described as being as much as 3 miles wide. Soldiers and scientists began working in the area of the lower Colorado River in the late 1840s and left records of cottonwood distribution, abundance, and size. In 1846, a member of Lieutentant Emory's engineering party observed that the land near the Colorado-Gila junction was overgrown with impenetrable thickets of willow, mesquite, and cottonwood. John Bartlett, one of the commissioners of the boundary survey, also mentioned the dense forest of willow, cottonwood, and mesquite that filled the River's bottomland in 1852.

The soldiers and scientists also discovered the River was navigable, and this discovery resulted in steamboat travel. From 1855 to 1890, steamboat use, and the resulting need for fuel, caused widespread reduction of the cottonwood communities located along the River. The trees were readily accessible in the early years, but were later so reduced that steamers planning long trips upriver had to take on wood from the delta to ensure an adequate fuel supply. Cottonwood forests on the Bill Williams River, on the other hand, remained relatively intact until recent times.

Cottonwood communities began returning with the end of the steamboat era, but floods in 1905 and 1907 caused a temporary setback in their recovery. The floods did, however, provide necessary habitat for cottonwood seed germination and for accelerating the reforestation process.

Dam Building

Agricultural activities were also starting along the River in the late 1800s. The flooding events, which provided for the return of the cottonwood-willow communities, devastated farming efforts. Public pressure for control of the River for human use followed the agricultural devastation. Water users wanted the Reclamation Service, established in 1902, to assume responsibility for power generation, water storage, and flood control; it was concluded that all these needs could be met by damming the River.

Built in 1907, Laguna Dam was the first water management structure built on the River. In 1922, another large flood occurred and River users and their representatives lobbied Washington decision-makers to authorize Hoover Dam. Hoover Dam was completed in 1935; the stage was set for other River management activities. A number of lesser dams, including Parker and

[14] Please refer to Table I in this Section.

Imperial, were operational by 1938; Davis Dam by 1951. Following construction of these dams, management activities began to control, and permanently changed, the once wild and unpredictable flows of the River.

The cycle of annual flooding that had shaped the valley over geological time had ended; floods could now be controlled and irrigation water was readily available. Large stands of natural habitat in the floodplain areas of the River were rapidly converted to agricultural uses. Wide portions of the floodplain near Yuma, Blythe, Parker, and Needles were cleared during the 1940s and 1950s. The only large tracts of natural terrestrial vegetation remaining on the lower Colorado River are now on the five Indian reservations and the four national wildlife refuges.

It is also important to note that Alamo Dam was constructed by the Corps of Engineers to control the Bill Williams River flooding and to provide recreational opportunities. As in the case of dam structures on the mainstem Colorado River, the Alamo Dam negated the natural cycle of annual flooding and scouring so important to the regeneration of native riparian plants. Consequently, native habitat has been extremely vulnerable to the infestation of the persistent exotic salt cedar.

Flood Control and the Infiltration of Salt Cedar

The demise, and possibly the eventual disappearance, of the cottonwood and willow forests along the lower Colorado River were dictated by two major events.[15] First, by 1936 Hoover Dam had essentially stopped all threats of floods, except when heavy runoff from local rains brought water from larger tributaries such as the Bill Williams River. With the cessation of flood threats, farming of the rich alluvial soils increased and new seedbeds were no longer formed. Consequently, the life cycle of the cottonwoods and willows was irreversibly changed. The damming that followed inundated thousands of acres of riparian habitat.

Around 1920, the second major event took place. An exotic woody species, salt cedar, spread into the lower Colorado River Valley from the Gila River. Salt cedar found optimal ecological conditions as it spread and eventually dominated the floodplain. Mearns estimated that in 1894 there were 400,000 to 450,000 acres of native riparian vegetation in the Colorado River floodplain.[16] As of 1986, total native riparian vegetation was about 100,000 acres.[17]

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[15]Ibid., Ohmart et al., 1988.

[16]Mearns, E.A., 1907. *Mammals of the Mexican boundary of the United States.* A descriptive catalogue of the species of mammals occurring in that region; with a general summary of the natural history and a list of trees. U.S. National Museum Bulletin. No. 56. 530 pp.

[17]Anderson, B.W., R.D. Ohmart. 1984. *Vegetation Management Study for the Enhancement of Wildlife Along the Lower Colorado River.* Final Report. U.S. Bureau of Reclamation, Lower Colorado River Region, Boulder City, NV. 529 pp.

According to BR studies, ". . . roughly 40 percent of the remaining area in 1986 was covered in pure salt cedar stands, an additional 43 percent consisted of native plants mixed with salt cedar, and only 0.7 percent could be considered mature cottonwood or willow habitats."[18]

Initially, salt cedar became established in areas where native vegetation had been cleared and the land left fallow.[19] Salt cedar has a high rate of seed production; the plant produces as many as 600,000 seeds per plant from April through October. This long period of seed production allows salt cedar to germinate well into fall, which is when most native trees are no longer producing viable seeds. These factors, along with river channelization and river-flow management (designed to meet agricultural and hydroelectric needs), have resulted in very little native plant regeneration. Soil and water salinity levels have risen as irrigation practices in the Colorado River Basin have increased. With the exception of salt and quail bush, native plants exhibit a low tolerance to saline soils, while salt cedar thrives.

Salt cedar is deciduous, and without floods, large amounts of leaf litter accumulate. Therefore, the possibility of a stand igniting increases, especially during the dry summer months. After such fires, salt cedar and arrowweed quickly regenerate, while cottonwoods and quail bush usually fail to return. In stands of mixed vegetation, salt cedar will be the first to regenerate, and, through successive fires, eventually displaces most native species.

As salt cedar displaced native riparian vegetation, wildlife experienced a changed habitat, which required adaptation or relocation. Salt cedar is dense, produces little useful food and nesting cover for wildlife, and harbors few insects. Most wildlife found the new habitat to be less than optimal, and many species have been adversely impacted by the change.

Area of Ecological Concern Socioeconomic Features

In the past, the economics of this area were dominated by mining and agriculture, and social attitudes were highly influenced by developments and decisions related to these industries. Recently, the lower Colorado River Valley has "come of age" as a recreation mecca. The discovery of the River by tourists and recreationers, primarily from the metropolitan centers of Southern California and Phoenix, Arizona, is amply documented in the pyramiding use occurring along the entire River, from Lake Mead to the International Boundary.[20]

Improved highways, increased leisure time, the advent of the pickup camper, and the general increase in affluence of society have contributed to the boom. Gold rushes have been replaced

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[18]U.S. Bureau of Reclamation, *Lower Colorado River Vegetation Management Study*, Phase I, 1992.

[19]Ohmart, R.D., W.O. Deason and C. Burke. 1977. *A Riparian Case History: The Colorado River.* Pages 35-47 in R.R. Johnson and D.A. Jones. Importance, preservation and management of riparian habitat: a symposium, Tucson, Arizona. U.S. Forest Service General Technical Report RM-43. 217 pp.

[20]*Arizona Statewide Comprehensive Recreation Plan (SCORP)*, State of Arizona, Arizona State Parks Department, 1989.

by "holiday rushes." With them have come changes in economics and, though more slowly, changes in the social attitudes of the local citizenry.

Recreational use of various lakes and areas along the lower Colorado River has grown in a rapid, though haphazard, manner, and projections indicate continued growth.[21] There is little doubt that outdoor- and water-oriented recreation will continue to predominate the area in future years.

If visitor use from all the lower Colorado River refuges were combined, it can be shown that the majority of visitors come to the area to enjoy water-oriented activities. This is more true for Havasu and Imperial and less true for Cibola and Bill Williams. People have also discovered the Colorado River as a place to live, at least for part of the year. Thousands of people, especially retirees, spend the winter along the River and adjacent areas. Virtually all communities along the River are experiencing rapid growth.

Population Growth -- Between 1980 and 1990, Yuma, La Paz, and Mohave counties in Arizona grew an average of 21 percent, and growth for the three counties between 1990 and 2000 is expected to surpass an average of 20 percent. Populations in Yuma County alone are expected to surpass 150,000 by the year 2000. The largest community at the southern end of the lower Colorado River, Yuma had a 1990 resident population of 50,000, and with an influx of visitors, the wintertime population is approximately 95,000.[22]

Lake Havasu City, located in Mohave County between Havasu and Bill Williams River NWRs, is one of the fastest growing communities along the River. Prior to 1964, only uninhabited desert prevailed. Mohave County's growth from a countywide population of 25,857 in 1970 to a 1990 population of more than 100,000, is due in large part to the rapid growth of Lake Havasu City. There have also been significant increases in populations in the Bullhead City area because of its proximity to the new gambling resort community of Laughlin, Nevada, located across the River. Projected population estimates for the next 20 years for the Mohave Valley; Riviera; Bullhead City, Arizona; and Laughlin, Nevada, areas (9 to 22 miles north of Needles, California) are for 200,000.

Projected growth for the Cibola Valley (near Cibola NWR) in Arizona and the Palo Verde Valley in California is slight by comparison. However, the valleys are equidistant from the metropolitan areas of Los Angeles to the west and Phoenix to the east along Interstate 10. The major community on the California side of the river is Blythe with a population of 10,000. The population of both valleys is approximately 25,000.

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[21] For a description of modern day social and economic demands stressing the Colorado River, please refer to an article in the June 1991 issue of *National Geographic* entitled "The Colorado– A River Drained Dry" by Jim Carrier.

[22] Ibid., Arizona SCORP.

Income Trends -- The 1984 per capita income for Mohave, La Paz, and Yuma counties averaged a little more than $10,000 per year. Since then, there have been no significant changes in the employment bases for these counties. This average is well below the 1985 Arizona statewide per capita figure of almost $30,000 per year. The employment base for this area has been primarily government employment and agriculture. Mining activities have dwindled to a point where that industry is negligible. Colorado River recreation opportunities, however, are projected to shift the income base to a service-oriented economy to meet the needs of recreational users and the growing number of retirees relocating to communities situated along the River.[23]

Economic Development Pressures -- The five basic economic development pressures on the natural resources along the River are: agricultural, hydroelectric, residential, recreational, and gambling.

The hydroelectric demands of the Southern California metropolitan areas and the agricultural demands of both California and Arizona have been the fundamental forces driving River water storage and release policies since the construction of Hoover Dam in the 1930s.[24] As the BR manages the River to meet the interests of all affected entities, these demands are both ever-present and ever-growing.

Likewise, residential and recreational demands such as sport fishing and watercraft sporting, place additional pressures on the BR to manage water in ways that will satisfy the respective needs. Throughout the mid 1960s the growing demand for recreational opportunities along the River influenced increasing calls for conveyance of public lands for private development.[25] Private land developers were becoming increasingly attuned to the recreation- and outdoor-oriented lifestyles desired by newcomers to the arid Southwest. During this time period, these developers increasingly used this theme in their marketing materials and made more serious attempts to obtain private development rights within or directly bordering prime natural environments. Growing concern that this demand would develop into a land use crisis prompted the Department of the Interior to produce an overall lower Colorado River land use plan.[26]

Lands with existing water features are experiencing particularly intense development pressures. Studies of the effects of a water feature on property values also help to explain private developer interest. Analysis by the Department of the Interior found the estimated value per acre of

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[23]Ibid. Arizona SCORP, Bureau of Economic Analysis

[24]The Colorado River Compact, an agreement between seven Colorado River Basin states, was approved by the Boulder Canyon Project Act of 1928. The Compact states: "Subject to the provisions of this compact, water of the Colorado River may be impounded and used for generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes."

[25]Udall, Stewart, U.S. Department of the Interior, *Lower Colorado River Land Use Plan*, A Report of the Lower Colorado River Land Use Advisory Committee, 1964., pp. 17-25.

[26]Also see Part I, Unit 2, Section 6 (I) of this document for a general description of the *Lower Colorado River Land Use Plan of 1964.*

recreational land having direct access to water was about $1,370 nationally in 1965. At the same time, the value of recreational lands without access to water was only $530.[27]

The Arizona SCORP states: "An unforeseen side effect of increasingly severe groundwater use restrictions (in Southwestern States) has been a shift of development pressure towards areas containing existing water features. Thus, we are seeing tremendous development pressure along the Colorado River, as one example."[28]

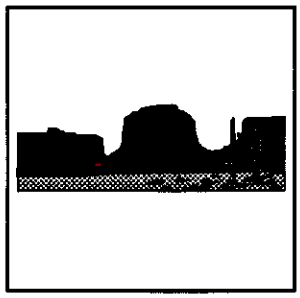
One of the fastest growing pressures on the natural resources in the Area of Ecological Concern are those caused by the desire to increase gambling as a source of income at Laughlin, Nevada, and on Native American tribal lands. The Fort Mojave Indians have expressed a desire to implement gambling on the reservation in order to draw tourists and outside dollars to the economy. Laughlin is already established as a gambling center alternative to Las Vegas, which lies about 100 miles to the north. This desire to implement gambling as a means to improve economic development and standards of living in the area also has costs associated with it, including the creation of human waste, air pollution, and other environmental contamination challenges. It should also be mentioned that population growth in Mohave County, Arizona, and Clark County, Nevada, is generating additional pressures on the environment, especially related to air pollution, water pollution, and solid waste disposal. This is causing great concerns by down-river jurisdictions. Native American tribes have expressed their desire to see better water quality monitoring techniques employed throughout the River because of potential hazardous and toxic waste problems caused by the ever-increasing populations.

[27]U.S. Department of the Interior, Study Committee, *Recreation Land Price Escalation*, 1967.

[28]Chapter 5 SCORP, "Trends Influencing Outdoor Recreation" and which pertain to recreational use trends of water resources, pp. 119 through 220, are hereby incorporated by reference.

UNIT 2 -- LEGAL, POLICY, AND ADMINISTRATIVE GUIDELINES AND OTHER SPECIAL CONSIDERATIONS

1. INTRODUCTION



This Unit outlines current legal, administrative, and policy guidelines for the management of national wildlife refuges, as well as those that provide guidance to the BR relative to management of the River. The Unit begins with the more general considerations, such as laws and executive orders for both the Service and BR, then moves toward those guidelines that specifically apply to the Service and national wildlife refuges.

This Unit does not include a section on water rights. For the lower Colorado River, water rights are more than a legal consideration. There are few significant bodies of water in this Area of Ecological Concern that are not tied to allocated rights. Basically, if there is no allocated water right, there is no water to use. Water is not treated separately from the "right" to use it. The very scarcity of water in the arid Southwest elevates a water right to the status of a resource; thus, water rights are considered as part of the natural resource inventory discussed in Unit 3.

This Unit also includes sections dealing with specially designated sites such as Research Natural Areas, Wilderness Designations, and historic and archeological sites, all of which carry specific direction by law and/or policy. In addition, consideration is given to guidance prompted by other formal and informal natural resource planning and research efforts.

All of the legal, administrative, policy, and planning guidelines provide the framework within which management activities are proposed and developed. This guidance also provides the basis for a continued and improved partnership between the BR and the Service and other natural resource agencies.

2. LEGAL MANDATES

Administration of the refuges is ultimately guided by bills passed by the United States Congress and signed into law by the President of the United States. These statutes are considered to be the law of the land, as are Executive Orders promulgated by the President. The following is a list of most of the pertinent statutes establishing legal parameters and policy direction to the National Wildlife Refuge System. Included are those statutes and mandates that pertain to the management of the lower Colorado River and define the role of the BR.

For those laws that provide special guidance and have strong implications relevant to the Service and the lower Colorado River refuges, legal summaries are offered below. Many of the

summaries have been taken from *The Evolution of National Wildlife Law* by Michael J. Bean.[29]

For the bulk of applicable laws and other mandates, legal summaries are available as part of an Appendix to this document.

Summary of Congressional Acts, Treaties, and other Legal Acts Relating to Administration of the National Wildlife Refuge System

1. Lacey Act of 1900, as amended (16 U.S.C. 701).

2. Antiquities Act of 1906 (16 U.S.C. 431).

3. Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-711).
   Migratory Bird Treaty Act of 1978 (40 Stat. 755).

4. Migratory Bird Conservation Act (1929), as amended (16 U.S.C. 715-715s).

5. Migratory Bird Hunting Stamp Act of 1934 (U.S.C 718-718h).

6. Fish and Wildlife Coordination Act (1934), as amended (16 U.S.C. 661-666).

   This Act was "the first major Federal wildlife statute to employ the strategy of compelling consideration of wildlife impacts. The act authorized 'investigations to determine the effects of domestic sewage, trade wastes, and other polluting substances on wildlife, encouraged the development of a program for the maintenance of an adequate supply of wildlife on the public domain' and other Federally owned lands, and called for state and Federal cooperation in developing a nationwide program of wildlife conservation and rehabilitation."[30]

7. Historic Sites Act of 1935 (16 U.S.C. 461).

8. Convention Between the United States of America and the Mexican States for the Protection of Migratory Birds and Game Mammals (1936) (50 Sta. 1311).

9. Convention of Nature Protection and Wildlife Preservation in the Western Hemisphere 1940 (56 Stat. 1354).

10. Fish and Wildlife Act of 1956, as amended (16 U.S.C. 742-742j).

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[29]Bean, Michael J., *The Evolution of National Wildlife Law*, (Praeger Publishers: New York, 1983).

[30]Ibid., p. 181.

11. Refuge Recreation Act, as amended (Public Law 87-714,76 Sta. 653; 16 U.S.C. 460k) September 28, 1962.

This Act authorizes the Secretary of the Interior "to administer areas of the System 'for public recreation when in his judgement public recreation can be an appropriate incidental or secondary use; provided, that such public recreation use shall be permitted only to the extent that it is practicable and not inconsistent with the primary objectives for which each particular area is established.' Recreational uses 'not directly related to the primary purposes and functions of the individual areas' of the System may also be permitted, but only on an express determination by the Secretary that they 'will not interfere with the primary purposes' of the refuges and that funds are available for their development, operation, and maintenance."[31] This legislation is the basis for establishment of the refuge allowable use compatibility process. A revised draft compatibility process not only invokes consistency with refuge purposes, but also National Wildlife Refuge System goals.[32] The draft will be made final as soon as the review process is completed.

12. Refuge Revenue Sharing Act of 1964 (16 U.S.C. 715s), as amended (P.L. 95-469, approved 10-17-78).

This Act provides "that the net receipt from the sale or other disposition of animals, timber, hay, grass, or other products of the soil, minerals, shells, sand, or gravel, from other privileges, or from leases for public accommodations or facilities in connection with the operation and management' . . . of areas of the National Wildlife Refuge System shall be paid into a special fund. The monies from the fund are then to be used to make payments for public schools and roads to the counties in which refuges having such revenue producing activities are located."[33]

13. Wilderness Act of 1964 (16 U.S.C. 1131-1136).

14. Land and Water Conservation Fund Act of 1965, as amended (16 U.S.C. 460L-4 to 460L-11), and as amended through 1987.

15. National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd- 668ee).

This Act, derived from sections 4 and 5 of Public Law 89-669, "consolidated 'game ranges', 'wildlife ranges', 'wildlife management areas', 'waterfowl production areas', and 'wildlife refuges', into a single 'National Wildlife Refuge System.' It placed restrictions on the transfer, exchange, or other disposal of lands within the System; clarified the

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[31]Ibid., pp. 125-126.

[32]See Part I, Unit 2, Section 4 (Refuge Purpose Statements) for further reference. Also refer to Part II, Unit 1, Section 9 (Compatibility, Refuge Programs and Allowable Uses) for a discussion of the implications of this policy.

[33]Ibid., p. 126.

Secretary's authority to accept donations of money to be used for land acquisition; and, most importantly, authorized the Secretary, under regulations, to 'permit the use of any area within the System for any purpose, including, but not limited to, hunting, fishing, public recreation and accommodations, and access whenever he determines that such uses are compatible with the major purposes for which such areas were established."[34]

16. National Historic Preservation Act of 1966 (16 U.S.C. 470).

17. National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321-4347).

18. Protection and Enhancement of Environmental Quality Executive Order of 1970 (Executive Order 11514, dated March 5, 1970).

19. Environmental Education Act of 1975 (20 U.S.C. 1531-1536).

20. Use of Off-Road Vehicles on the Public Lands Executive Order of 1972, as amended (Executive Order 11644, dated February 8, 1972, as amended by Executive Order 11989, dated May 24, 1977).

21. Endangered Species Act of 1973 (16 U.S.C. 1531-1543 87 Stat. 884) P.L. 93-205). The Endangered Species Act as amended by Public Law 97-304, The Endangered Species Act Amendments of 1982, dated February 1983.

    According to Bean, the 1973 Act "builds its program of protection on three fundamental units. These include two classifications of species--those that are 'endangered' and those that are 'threatened'--and a third classification of geographic areas denominated 'critical habitats.'"[35]

    This Act: (1) Authorizes the determination and listing of species as endangered and threatened, and the ranges in which such conditions exist; (2) Prohibits unauthorized taking, possession, sale, and transport of endangered species; (3) Provides authority to acquire land for the conservation of listed species, using land and water conservation funds; (4) Authorizes establishment of cooperative agreements and grants-in-aid to states that establish and maintain active and adequate programs for endangered and threatened wildlife; and; (5) Authorizes the assessment of civil and criminal penalties for violating the Act or regulations.

    Section 7 of the Endangered Species Act requires Federal agencies to ensure that any action authorized, funded, or carried out by them does not jeopardize the continued existence of listed species or modify their critical habitat.

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[34]Ibid., p. 125.

[35]Ibid., p. 331.

22. Floodplain Management Executive Order of 1977 (Executive Order 11988, dated May 24, 1977).

23. Wetlands Preservation Executive Order of 1977 (Executive Order 11990, dated May 24, 1977).

24. The Archeological Resource Protection Act of 1979 (P.L. 96-95, 93 Sta. 721, dated October 1979) (16 U.S.C. 470aa - 47011).

25. Fish and Wildlife Conservation Act of 1980 (P.L. 96-366, dated September 29, 1980). ("Nongame Act") (16 U.S.C. 2901-2911; 94 Stat. 1322).

    Approved in September 1980, this Act authorized grants for development and implementation of comprehensive state nongame fish and wildlife plans and for administration of the Act. It also required the Service to study potential mechanisms for funding these activities and report to Congress by March 1984.

    According to Bean, this Act "strives to encourage comprehensive conservation planning, encompassing both nongame and other wildlife. . . . The impetus for the enactment of this legislation was the perception that animals not ordinarily valued for sport hunting or commercial purposes receive insufficient attention and funds from state wildlife management programs."[36]

    Public Law 100-653 (102 Stat. 3825), approved November 14, 1988, amended the Act to require the Service to monitor and assess nongame migratory birds, identify those likely to be candidates for endangered species listing, identify appropriate actions, and report to Congress one year from enactment. It also requires the Service to report at 5-year intervals on actions taken.

26. Administrative Procedures Act (5 U.S.C. 551-559, 701-706, 1305, 3105, 3344, 4301, 5362, 7521; 60 Stat. 237), as amended (P.L. 79-404, as amended).

27. Bald Eagle Protection Act of 1940 (16 U.S.C. 668-668d; 54 Stat., as amended).

28. Canadian United States Migratory Bird Treaty (Convention Between the United States and Great Britain for Canada for the Protection of Migratory Birds. (39 Stat. 1702; TS 628), as amended.

29. Clean Air Act (42 U.S.C. 1857-1857f; 69 Stat. 322), as amended.

30. Colorado River Basin Project Act (43 U.S.C. 616aa-, 620, 620a, 620a-1, 620a-2 620c-1, 620d, 620k, 620hh, 1501-1556; 82 Stat. 886).

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[36]Ibid., p. 227.

This Act provided a program for the comprehensive development of the water resources of the Colorado River Basin, and directed the Secretary of the Interior to develop, after consultation with affected states and appropriate Federal agencies, a regional water plan to serve as the framework under which projects in the Colorado River basin may be coordinated and constructed.

31. Colorado River Storage Project Act, Section 8 (43 U.S.C. 620-620o, except certain sections classified to the Colorado River Basin Project Act; 70 Stat. 105), as amended.

    This Act authorized the Secretary of the Interior to construct a variety of dams, power plants, reservoirs, and related works. This Act also authorized and directed the Secretary, in connection with the development of the Colorado River Storage Project and participating projects, to investigate, plan, construct, and operate facilities to mitigate losses of, and improve conditions for, fish and wildlife and public recreational facilities. This Act provided authority to acquire lands and to lease or convey lands and facilities to state and other agencies.

32. Convention on Wetlands of International Importance Especially as Waterfowl Habitats (I.L.M. 11:963-976, September 1972).

33. Cooperative Research and Training Units Act (16 U.S.C. 753a-753b, 74 Stat. 733), as amended. P.L. 86-686).

34. Federal Aid in Fish Restoration Act (16 U.S.C. 777-777k, 64 Stat. 430).

35. Federal Aid in Wildlife Restoration Act (16 U.S.C. 669-669i; 50 Stat. 917), as amended.

36. Federal Environmental Pesticide Control Act of 1972 (7 U.S.C. 136-136y; 86 Stat. 975), as amended.

37. Federal Land Policy Management Act of 1976 (43 U.S.C. 1701-1771, and other U.S.C. sections; 90 Stat. 2743). Public Law 94-579, October 1976.

38. Federal Power Act (16 U.S.C. 791a 825r; 41 Stat. 1063), as amended.

39. Federal Property and Administrative Services Act of 1949 (40 U.S.C. 471-535, and other U.S.C. sections; 63 Stat. 378), as amended.

40. Federal Water Pollution Control Act Amendments of 1972 (33 U.S.C. 1251-1265, 1281-1292, 1311-1328, 1341-1345, 1361-1376, and other U.S.C. titles; 86 Stat. 816), as amended.

41. Federal Water Project Recreation Act (16 U.S.C. 4601-12-4601-21;79 Stat. 213), as amended P.L. 89-72, approved July 1985.

42. Fish and Wildlife Improvement Act of 1978 (16 U.S.C. 7421; 92 Stat. 3110) P.L. 95-616, November 1978.

43. Flood Control Act of 1944 (16 U.S.C. 460d, 825s and various sections of title 33 and 43 U.S.C.; 58 Stat. 887), as amended and supplemented.

44. Freedom of Information Act (5 U.S.C. 552; 88 Stat. 1561.

45. Refuge Trespass Act (18 U.S.C. 41; Stat 686).

46. Rivers and Harbors Act of 1899 (33 U.S.C. 401 et seq.; 30 Stat. 1151, as amended and supplemented.

47. Transfer of Certain Real Property for Wildlife Conservation Purposes Act of May 1948, (16 U.S.C. 667b-667d; 62 Stat. 240), as amended.

48. Water Resources Planning Act (42 U.S.C., 1962-1962a-3; 79 Stat. 244), as amended.

49. Waterfowl Depredations Prevention Act (7 U.S.C. 442-445; 70Stat. 492), as amended.

50. Clean Water Act of 1972, Section 404.

    Under this Act, permits are required to be obtained for discharges of dredged and fill materials into all waters, including wetlands. Implementation of the 404 program involves three other Federal agencies in addition to limited state involvement. The Environmental Protection Agency (EPA), the National Marine Fisheries Service, and the Service review permit applications and provide comments and recommendations on whether permits should be issued by the Corps. The EPA has veto authority over permits involving disposal sites if impacts are considered unacceptable, and also develops criteria for discharges and state assumption of the 404 program. Due to a national lawsuit, Section 404 regulations were changed in 1984, and now apply to tributaries of navigable waters, isolated wetlands, and waters where interstate commerce is involved. With the new regulations, all washes, drainage, and tributaries of navigable waters, including ephemeral and perennial streams, are included under the 404 program in Arizona.

51. The Food Security Act of 1985 (Farm Bill).

Bureau of Reclamation Mandates

1. Colorado River Basin Project Act, Sept. 30, 1968, Public Law 90-537, 82 Stat. 885.

2. Colorado River Basin Salinity Control Act, June 24, 1974, Public Law 93-320, 88 Stat. 266.

3. Reclamation Act of 1902, 32 Stat. 388, 43 U.S.C. 391.

4. Protection of Property Along the Colorado River, June 25, 1910, Pub. Res. 43, 36 Stat. 883.

5. Colorado River Front Work and Levee System Act, March 23, 1925, 43 Stat. 1186, Public Law 585, as amended.

   Under this mandate, the BR is charged with controlling the River for water delivery for irrigation, municipal and industrial use, navigation, and other purposes. The BR is also charged with providing flood control and property protection. These activities include scheduling water releases from the reservoirs and river stabilization activities, such as dredging, channelizing, levee construction, and bankline stabilization.

6. Boulder Canyon Project Act, December 21, 1928, 45 Stat. 1057, as amended.

7. Conservation of Wildlife, Fish and Game, March 10, 1934, 48 Stat. 401.

8. Parker-Davis Project, Public Law 373, May 28, 1954, 68 Stat. 143.

9. Coordination of Recreation Programs, Public Law 88-29, May 28, 1963, 77 Stat. 49.

State of Arizona Statutes

The following are pertinent sections of Arizona law which help clarify the role of AGFD in wildlife management activities and the administration and regulation of watercraft on national wildlife refuges.

1. Arizona Revised Statutes, Title 17, Sec. 102

   Section 102 states: "Wildlife, both resident and migratory, native or introduced, found in this state except fish and bullfrogs impounded in private ponds or tanks or wildlife and birds reared or held in captivity under permit from the commission, are property of the state and may be taken at such times, in such places, in such manner and with such devices as provided by law or rule of the commission."

2. Arizona Revised Statutes, Title 17, Sec. 201

   Section 201 states: "The laws of the state relating to wildlife shall be administered by the game and fish department."

3. Arizona Revised Statutes, Title 5, Sec. 302

Section 302 states: "The provisions of this chapter apply to all watercraft operating on all of the waterways of this state, including that part of waters common to interstate boundaries which is within the boundaries of this state, excluding vessels owned by agencies of the federal government in performance of their official duties."

4. Arizona Revised Statutes, Title 5, Sec. 311 A.7

Section 311 A.7 states: "The commission may administer the law enforcement and boating safety program on the state level, and accept federal grants for the purpose of boating safety and related enforcement."

3. AGENCY WIDE POLICY DIRECTIONS

Fish and Wildlife Service Agency Mission

While the Service mission and purpose has been evolving since the early 1900s, it has always held on to a fundamental national commitment to threatened wildlife. The earliest national wildlife refuges and preserves are examples of this. Pelican Island, the first refuge, was established in 1903 for the protection of colonial nesting birds such as the snowy egret and the endangered brown pelican. The National Bison Range was instituted for the endangered bison in 1906, and Malheur NWR was established in Oregon in 1908 to benefit all migratory birds, with emphasis on colonial nesting species on Malheur Lake. It was not until the 1930s that the focus of refuge programs began to shift toward protection of migratory waterfowl (i.e., ducks and geese). As a result of drought conditions in the 1930s, waterfowl populations became severely depleted. During the next several decades, the special emphasis of the Service, then the Bureau of Wildlife and Sport Fisheries, became the restoration of critically depleted migratory waterfowl populations.

The passage of the Endangered Species Act of 1973 refocused the activities of the Service and other government agencies. This Act mandated the conservation of threatened and endangered species of fish, wildlife, and plants both through Federal action and by encouraging the establishment of state programs. In the late 1970s, the Bureau of Wildlife and Sport Fisheries was renamed the U.S. Fish and Wildlife Service, and its scope of wildlife conservation responsibilities was broadened to include endangered species and both game and nongame species. A myriad of other conservation oriented laws followed, including the Fish and Wildlife Conservation Act of 1980, which emphasized the conservation of nongame species.

The Service has no "organic" act on which to focus for the purposes of generating an agency mission. The agency mission has always been derived in consideration of the multitude of laws (as listed in Section 2 of this Unit) and treaties that collectively outlined public policy concerning wildlife conservation. The Department of the Interior Departmental Manual states:

> "The U.S. Fish and Wildlife Service is responsible for conserving, enhancing, and protecting fish and wildlife and their habitats for the continuing benefit of people through Federal programs relating to wild birds, endangered species, certain marine mammals, inland sport fisheries, and specific fishery and wildlife research activities."[37]

The New Vision -- Over the last century, the objectives of reversing national and worldwide trends of species extinctions, declining populations of fish and wildlife, habitat destruction, and negative human impacts on the natural environment has become an increasingly "monumental task." It was apparent to policy-makers the task would require new approaches based on an

[37]Department Manual, 2 AM 2, Organization, 142 DM 1.1

expanded mission. The product of this new thinking is the *Vision for the Future: A Total Quality Management Plan.*[38] The *Vision* document defines the following new mission:

> "Provide leadership toward achieving a national net gain of fish and wildlife and the natural systems which support them."

Although more general, the new mission statement incorporates a shift in roles for the Service from one of manager and steward, to one of "leader."

The new vision proposes goals and objectives that call for an abundance and diversity of fish and wildlife and their habitats. This abundance and diversity must:

a. Maintain the basic web of life that sustains all living things;

b. Provide for the enjoyment of natural values;

c. Promote free-ranging and naturally sustaining populations of native species; and

d. Sustain reasonable levels of public use and economic benefits.[39]

Bureau of Reclamation Mission and Strategic Plan

Like the Service, the BR had its roots in President Theodore Roosevelt's legacy of conservation. Roosevelt stated: "The reclamation and settlement of arid lands will enrich every portion of our country and our people as a whole will profit." Since 1902, a key element toward accommodating the growth and development of the West was the construction of a system of irrigation works for the storage, diversion, and development of water. This was envisioned as a means of establishing an agricultural base from which economic diversity could occur. Congress agreed, and through the Reclamation Act of 1902, the Reclamation Service, since renamed the Bureau of Reclamation, was created.

In addition to his legacy of using reclamation to help develop the West, President Roosevelt insisted that: "As a people we have the right and duty. . . to protect ourselves and our children against the wasteful development of our natural resources." The growing West, and the rest of the nation, still requires the development of additional water supplies and hydropower resources, but such development must be environmentally responsive and economically justified. Changing societal values, greater environmental knowledge and awareness, increased competition for a

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[38] *Vision for the Future: A Total Quality Management Plan* (1991), is the fundamental broad policy document for purposes of this master plan.

[39] In pursuit of these ends, *Vision for the Future* has outlined the following overall principles necessary for goal achievement: Partnerships, Integrations of Ecological and Economic Considerations, Biological Diversity, Public Use Opportunity, Public Outreach and Education, Habitat Restoration, Scientific Management, Law Enforcement, and Total Quality Management.

scarce and finite resource, and Federal budgetary constraints have dictated the improved management and protection of existing facilities and our natural resources.

In 1987, the BR examined the direction of its programs. That examination, *Assessment 87*, recognized the need for increased emphasis on the improved management of projects and the protection of environmental values. As an integral part of that assessment, the BR reviewed its organizational structure and programs to determine whether adjustments were necessary to more effectively meet its responsibilities. In 1988, a significant reorganization of the BR was implemented to create a more efficient and cost-effective agency. Following this assessment, the BR initiated development of the Strategic Plan in 1990. This plan sets forth a broad, long-term framework for resource management, development, and protection with specific goals and strategies for the 21st century. The plan continues the BR's role in providing for sustained economic growth, an improved environment, and an enhanced quality of life in the West.

As a result of the BR's reassessment, their mission has been defined as follows:

> "The mission of the BR is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public."[40]

The Policy Role of the Arizona Game and Fish Department

In response to concerns over a decline in the state's resources, the Arizona Territorial Legislature created the Arizona Fish Commission in 1881, with responsibility to enforce existing conservation laws. By 1897, the original 3-person staff had grown to 15, with responsibility for enforcement of all wildlife-oriented laws. At the time, hunting seasons were controlled by the Legislature.

In 1929, citizens desiring a more scientific approach to wildlife management passed a ballot initiative which created the Arizona Game and Fish Commission (Commission). Under this system the three-member Commission regulated hunting and fishing and appointed a State Game Warden. This system is still in effect today, although the State Game Warden is now the Director of the AGFD, who serves as secretary to the now five-member Commission.

Under the provisions of Arizona Revised Statutes Title 17 and Title 231, the Commission establishes policy for the management, preservation, and harvest of Arizona's wildlife. The Commission makes rules and orders for these purposes and for the safe and regulated operation of watercraft for the benefit of citizens of the State of Arizona. In support of the Commission's obligations, the mission of AGFD is to conserve, enhance, and restore Arizona's diverse wildlife resources and habitats through aggressive protection and management programs, and to provide

[40]The BR's document, *Reclamation's Strategic Plan*, is similar to the Service's *Vision* document. The BR's plan consists of 25 separate program elements grouped into 5 sections: Managing and Developing Resources, Protecting the Environment, Safeguarding the Investment, Building Partnerships, and Fostering Quality Management.

wildlife resources and safe watercraft recreation for the enjoyment, appreciation, and use of present and future generations.

National Wildlife Refuge System: Mission and Goals

The National Wildlife Refuge System (System) is the only existing system of Federally owned lands managed chiefly for the conservation of wildlife. The following System mission is a derivative of the Service mission:

> "To provide, preserve, restore, and manage a national network of lands and waters sufficient in size, diversity, and location to meet society's needs for areas where the widest possible spectrum of benefits associated with wildlife and wild lands is enhanced, and made available."[41]

The broad goals of the System describe a level of responsibility and concern for the nation's wildlife resources for the ultimate benefit of the people.

a. To preserve, restore, and enhance in their natural ecosystems (when practical) all species of animals and plants that are endangered or threatened with becoming endangered.

b. To perpetuate the migratory bird resource.

c. To preserve the natural diversity and abundance of fauna and flora on refuge lands.

d. To provide understanding and appreciation of fish and wildlife ecology and man's role in his environment, and to provide visitors with high quality, safe, wholesome, and enjoyable recreational experiences oriented towards wildlife, to the extent these activities are compatible with the purposes for which the refuge was established.[42]

Currently, the Refuge System is undergoing its own formalized assessment of the prevailing issues in an effort to determine the best strategies for achieving its goals and objectives. This formal process has been called *Refuges 2003 - a Plan for the Future of the National Wildlife Refuge System*. The *Refuges 2003* process has identified 20 issues and 9 management alternatives designed to deal with those concerns. At the writing of this document, a draft Environmental Impact Statement has been released to the public.

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[41]Refuge Manual: 2 RM 1.4

[42]A use may be determined to be compatible if it will not have a detrimental effect upon fulfillment of the purposes of the refuge unit and the refuge system.

Refuge Manual

The Refuge Manual (Manual) serves as the primary direction for refuge managers with respect to the application of Service wide and System wide policies and procedures.

The purpose of the Manual is:

> "To provide a central source of U.S. Fish and Wildlife Service policy, operating guidelines, and technical references for the management of the National Wildlife Refuge System."[43]

The Manual outlines administrative policies with respect to issues such as pollution abatement, minerals and mining, cultural resources, water rights, specific types of habitat management, specific types of wildlife populations management, and public use and recreation management.

4. REFUGE PURPOSE STATEMENTS

Refuge Purpose Statements are primary to the management of each refuge within the System. The Purpose Statement is the basis on which primary management activities are determined. Additionally, these statements are the foundation from which "allowed" uses of refuges are determined through a defined "compatibility process."[44] Sometimes Purpose Statements are given in the form of statute, but in many cases refuges were established by Executive Order. This is the case for the four refuges along the lower Colorado River.

Havasu NWR

Havasu NWR was established by Executive Order 8647 on January 22, 1941, ". . . as a refuge and breeding ground for migratory birds and other wildlife."[45]

Bill Williams River NWR

Bill Williams River NWR was originally established, concurrently with establishment of Havasu NWR, by Executive Order 8647.[46] Subsequently, a larger portion of the Bill Williams River NWR was acquired from The Nature Conservancy (TNC) in 1977. Taking into account the

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[43]Ibid., Refuge Manual 1 RM 1.1.

[44]Please refer to PART II, Unit 1, Section 9 for a discussion with respect to the revised compatibility policy.

[45]Appendix B, Purposes of National Wildlife Refuges, 1992 Update.: Havasu National Wildlife Refuge.

[46]From 1941 until 1992 the Bill Williams River NWR was a management unit of the Havasu NWR. The Service decided to designate the unit as a separate national wildlife refuge after assessing that hydrological and natural resource concerns required a focus separate and different than those related to Havasu NWR. At the request of the Southwest Regional Director, the Director of the Service officially designated the Bill Williams Unit of Havasu NWR as the Bill Williams River NWR on June 9, 1993.

original establishment, along with Havasu NWR and the 1977 acquisition from TNC, the refuge purpose is defined as a ". . . refuge and breeding ground for migratory birds and other wildlife . . ." (Executive Order 8647), and is suitable ". . . for incidental fish and wildlife oriented recreational developments, the protection of natural resources, and conservation of endangered species or threatened species." **[Refuge Recreation Act, as amended, (Public Law 87-714)]**

Cibola NWR

Cibola NWR was established on August 21, 1964, by Public Land Order 3442. It was ". . . reserved for use of the. . . United States Fish and Wildlife Service, as the Cibola National Wildlife Refuge " and ". . . subject to their use for reclamation or wildlife refuge purposes."[47]

Imperial NWR

Imperial NWR was established February 14, 1941, by Executive Order 8685, ". . . as a refuge and breeding ground for migratory birds and other wildlife." The Refuge "is subject to their use for the purposes of the Colorado River Storage Project."[48]

5. LAND, JURISDICTIONAL, AND SPECIAL DESIGNATION CONSIDERATIONS[49]

General

The four types of governmental land jurisdictions are: exclusive, concurrent, partial, and proprietary.

According to the Manual, the majority of Service land is controlled under proprietary jurisdiction. State civil and criminal laws apply fully except where they might conflict with Federal law. Under proprietary jurisdiction, the Service owns and controls lands in the same manner as a private citizen. Concurrent and partial jurisdiction are similar to proprietary jurisdiction, in that state civil and criminal laws apply.[50]

The Service's jurisdictional rights on the lower Colorado River refuges, including the Bill Williams River NWR, are proprietary. Some of the lands owned by the Service were purchased

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[47]Federal Register, August 28, 1964, Title 43, Public Land Order 3442.

[48]Appendix B, Ibid., Imperial NWR.

[49]Please refer to PART II, Unit 1, Section 3 for a discussion of the problems related to land status and jurisdictional problems and questions.

[50]Ibid., Refuge Manual, 1 RM, 5.8

"fee simple." [51] The real property interest that the Service owns or controls in these cases is characterized by all the rights conveyed by Warranty Deed, unless excepted explicitly in the deed (e.g., water rights, mineral rights, right of ingress and egress, etc.).[52] The majority of lands comprising the lower Colorado River national wildlife refuges were conveyed to the Service by Public Land Order after these lands had either been withdrawn from Public Domain or had been obtained by the United States Government through condemnation proceedings. The jurisdiction in these cases becomes much more complex and is usually defined or delineated in the Public Land Order conveying the property. With the exception of much of the existing Bill Williams River NWR, the lower Colorado River refuges were established and overlain on lands withdrawn for control and management of the River by the BR and on lands sold to the BR by private owners either voluntarily or by condemnation proceedings. The authorization of the conveyance was through several Public Land Orders published in the Federal Register.

Some lands, as in the case of an addition to the Bill Williams River NWR, were purchased from The Nature Conservancy.[53] While the refuge lands are considered to be under primary jurisdiction of the Service, most of the River itself is considered to be under primary jurisdiction of the BR.[54] The Service is considered to have secondary jurisdiction of the River where it passes through refuge lands. The Service does, however, have authority to manage the River as part of the refuge program.

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[51]Fee Simple Title is that ownership which is without limitation to any class of heirs or restrictions on transfer of ownership. Fee Simple ownership is conveyed by Warranty Deed which is merchantable, clear of any unknown or undisclosed encumbrances, and is usually insurable against any undisclosed "clouds" or encumbrances. All exceptions, limitations, and encumbrances are disclosed on the deed and are fully known at the time of acquisition or disposal.

[52]Water rights are legal entities in the purest sense. The ownership of such rights allows the owner consumptive use of the resource whether for hydroelectric, agricultural, drinking, or other legal purposes. Nevertheless, because of the nature of desert ecosystems, these rights are considered an essential part of the overall refuge natural resource inventory covered in PART I, Unit 3 of this document. The constraints that water rights, or the lack there of, place upon the lower Colorado River refuges are treated in PART II, Unit 1, Section 4 of this document.

[53]Public Land Orders (PLO), deeds and other documentation pertaining to the acquisition of each of the refuge lands by the United States for wildlife refuge purposes delineate that the water management activities of the BR are authorized by the Colorado River Storage Act, Colorado River Basin Project Act, and other related legislation. These laws grant primary jurisdiction and management of the Colorado River waters to the Secretary of the Interior. The BR acts as the Secretary's agent in water storage and management matters. However, the PLO authorize that waters may be managed for refuge purposes by the Service. The BR and the Service both act as cooperative managers as called for by the Fish and Wildlife Coordination Act. (Please refer to Legal Mandates section of Part I, Unit 2, Legal, Policy and Administrative Guidelines and Other Special Considerations.) Copies of PLO, deeds, and other legal records are available in the Realty Division, Region 2, U.S. Fish and Wildlife Service offices in Albuquerque, New Mexico.

[54]The BR's jurisdiction over the Colorado River waters are by virtue of the Reclamation Act of 1902; the Colorado River Compact of 1922; the Colorado River Front Work and Levee System Act of 1925; the Boulder Canyon Project Act of 1928; the Parker-Davis Project Act of 1954; the Colorado River Basin Project Act of 1968; Colorado River Storage Project Act; and the Colorado River Basin Salinity Control Act of 1974. This jurisdiction supersedes ownership rights granted by Public Land Orders that overlay the BR's area of jurisdiction. Service ownership of lands that overlay the BR's jurisdictional areas (i.e., certain refuge lands along the lower Colorado River) is proprietary. However, the jurisdiction of the Service relative to the management of the Colorado River waters and management of the Colorado River front and levee system is secondary to the BR, not withstanding other statutory mandates (i.e., the BR is subject to provisions of the Endangered Species Act, NEPA, Fish and Wildlife Coordination Act, and the Coordination of Recreation Programs Act of 1963, etc.). The Service does, however, manage the water distribution and use on the Refuges.

Land Status

Havasu NWR -- The Service owns most of the land within the defined boundaries of Havasu NWR, as a result of Public Land Orders that overlaid the Refuge on BR-acquired lands. The Refuge adjoins acreage belonging to the Fort Mojave Indian Tribe, the BLM, and the Chemehuevi Indian Tribe.

The Refuge (excluding the Bill Williams River NWR acreage) as established encompassed 41,252 acres and was enlarged to 44,013 acres in 1949.[55] With the founding of Lake Havasu City in 1964, the Refuge was reduced to 20,259 acres under the Lower Colorado River Land Use Plan. In 1968, the Needles Peaks area was added to the Refuge, bringing the total acreage to 39,747. In 1974, 420 acres were deleted and returned to the Chemehuevi Indian Tribe.

In 1991, an extensive land exchange took place between the BLM and the Service, with involvement from the State of Arizona. The exchange allowed the Service to acquire previously leased lands at the Buenos Aires NWR, southwest of Tucson, Arizona. As a result of the transaction, the Havasu NWR relinquished 900 acres. The transaction was part of the Fort McDowell Indian Water Rights Settlement and the Santa Rita exchange. Refuge boundaries were affected on the north and east; much of the acreage to the east of State Highway 95 is now owned by the State of Arizona. As a result of the newest transaction, Havasu NWR now has 38,427 total acres.

One concession exists at Five Mile Landing, which is adjacent to the Topock Marsh. The concession operates under a 20 year lease. This concession is privately operated and provides temporary trailer spaces, camping, tackle, boat rental, docks, and grocery items. The lease terminates on July 31, 2006. During the term of this lease, the area described by the lease is zoned for use as a concession. Uses are limited to those specified in the lease agreement and allow for overnight camping and the parking of campers and trailers meeting the standards as described in the lease agreement. There are 74 trailer sites, most of which are filled by trailer or mobile homes. Funds collected by the Service for the operation of the concession go directly to the BR. The domestic water use for this concession is lower Colorado River water supplied from Golden Shores Water Conservation District, subject to its Reclamation water delivery contract.

During 1994, the Service and the BR began researching evidence of which agency actually has jurisdiction over this area. Both agencies have been operating as if the Service had primary jurisdiction, but there is some question about how the property was conveyed to the Service. Regardless, the concessionaire has a legal leasehold right until expiration.

There is one slight encroachment of the Refuge by the Golden Shores Marina operation at the south end of the Topock Marsh Management Unit. It encompasses several hundred square feet

[55]The Bill Williams River NWR was formerly the Bill Williams Unit of the Havasu NWR.

where boats have been allowed to moor for the marina. In lieu of a formal lease agreement, this activity has been addressed by "special use permit" over the past several decades.

Bill Williams River NWR -- The land noted as part of the Bill Williams River NWR is owned by the Service fee simple and by withdrawal from the Public Domain.

The Bill Williams River NWR is currently comprised of 6,105 acres. The Refuge originally consisted of 1,748 acres in and around the River delta and lake. In October 1977, 1,575 acres were purchased from the Arizona Ranch and Metals Company through TNC as an addition to the Bill Williams River NWR. An additional 2,781 acres of desert upland and wash, located adjacent to and up-slope from the River bottomlands and lake, were withdrawn from the BLM in 1981.

The Service is currently interested in developing a water management strategy involving the existing Bill Williams River NWR and an 8,400-acre area commonly known as the Planet Ranch. The Planet Ranch has been under the ownership of the City of Scottsdale, Arizona. It is hoped the strategies contemplated will lessen the depletion in groundwater levels currently occurring from extensive agricultural pumping.

A slight encroachment by the Hillcrest View Mobile Home Park is handled by a special use permit. Easements on the refuge include two power lines, a telephone line, and a county road which is maintained by La Paz County.

Cibola NWR -- Land within the Cibola NWR boundary was acquired by both fee simple and through withdrawal from the Public Domain (i.e., BLM lands). The Refuge consists of approximately 16,667 acres. There are 297 acres leased from the State of California for a 49-year period, ending July 31, 2031.

Efforts have been made to add to the existing land in Arizona and California. A limiting factor in California is the lack of water rights and the complicated measures of moving the water to appropriate habitat areas. Areas identified for acquisition have been integrated into the planning process. It should also be noted that a Federal Court order determined that the lands beneath the Old River Channel of the River were not part of the original Federal acquisition of lands for mitigation and that they are currently owned by the States of California and Arizona.

The Cibola NWR Annual Narrative for 1989 indicates that the Continental Telephone Company of California maintains two easements across Refuge land. One is in California and the other is along the eastern boundary of the Refuge in Arizona. Two adjacent farms maintain irrigation easements across Refuge land; the easements were granted by the BR during the acquisition of private land for establishment of the Refuge.

Imperial NWR -- The Service owns all land within the defined boundaries of Imperial NWR by withdrawal from the Public Domain. Originally, the Refuge encompassed 46,792 acres. Withdrawals in 1963 of 3,410 acres for Picacho State Park, in 1968 of 17,617 acres by

Executive Order 4367, and in 1982 of 640 acres to the BLM reduced the Refuge to 25,765 acres. The Santa Rita land exchange affected a reduction of 640 acres on the southern end of the Refuge, which reduced the total acreage to 25,125 acres.

Adjacent Land Use

Generally speaking, land uses surrounding the four national wildlife refuges in the Area of Ecological Concern are owned either by Indian tribes or other Federal and State agencies. A majority of the lands belonging to the Federal government are currently managed by either the BLM, the BR, or the Department of Defense.

Along the River's riparian corridor are segments belonging to the States of Arizona and California. Some of these lands are used for state recreation areas. There are few private lands directly adjacent to the lower Colorado River national wildlife refuges. Most of the private holdings are used primarily for agriculture in the Cibola and Palo Verde Valleys. The Lake Havasu City limits adjoin the southern end of the Topock Gorge Unit of Havasu NWR. Depending on land use and resource planning by the municipality, land use could affect the Refuge. The refuge manager maintains close contact with the policy makers of the city, however, and will have input concerning land use changes in the areas that might affect the Refuge. A similar situation exists with the village of Martinez Lake, Arizona, although on a much smaller scale. The largest single possibility of urban growth directly affecting any of the refuges is the Needles and Lake Havasu City area. Bullhead City, Arizona, and Laughlin, Nevada, are about 20 miles to the north of the Refuge, and as these two communities grow, economic and environmental pressures will increase on the Refuge. [56]

Special Considerations: Designated Sites

Cultural Resources -- The archeological sites recorded to date on the four refuges typify the archeology of the lower Colorado River. Rock art sites, ground images known as geoglyphs, rock alignments and clearings, dance patterns, cairns, trails, and sparse scatters of lithic material and pottery shards, are the primary archeological occurrence. Collectively, these sites are found in great number, and it is estimated that at least 2,000 such sites remain unrecorded on the four national wildlife refuges alone.

Almost totally lacking, however, are the habitation/village sites and stratified sites resulting from very long-term occupation, which would normally be expected in an area with a record of continuous occupation of at least a thousand years. The scarcity of deep sites and village sites is a consequence of indigenous settlement patterns, where seasonally occupied farm village sites were located on the flood plain. Annual flooding and movements of the River resulted in destruction of the evidence of this long-term habitation. That which was not destroyed by the floods is deeply buried by river silts, while hundreds more sites were inundated by the Parker and Imperial dams. But for a handful of deep sites and habitation sites, most of what remains

[56]Please refer to PART II, Unit 1, Section 4 for a discussion of water rights problems and recommendations.

are the limited use localities of the uplands and river terraces, as well as the short-term wild resource harvest sites located at great distance from the River. The result is a poorly defined chronology for the region, and very limited information on key aspects of prehistoric River culture. Indeed, more than any other region of the Southwest, the native tradition of the lower Colorado River is defined almost entirely through modern ethnography and historic accounts, rather than by evidence of prehistoric archeology.

In gross terms, conventional measures of archeological significance do not apply here. The significance of the archeology does not stem from the material richness or depositional complexity of the sites themselves. More relevant in defining the value of the cultural resources on these refuges is the recognition that a cultural continuum exists between the prehistoric and modern Native American presence on the River.[57] Although the millennia-old systems of subsistence and settlement no longer exist, it is important to note that many traditional practices survived quite late into the historic era, and that Native American communities on the River continue to regard refuge lands with a profound reverence for religious and ancestral values.

Archeologists have applied the term "Patayan" to the prehistoric occupation on the River. It refers to the era after about A.D. 700 when pottery and agriculture were introduced to the River bottomland. The Patayan culture is largely defined by the lower Colorado Buffware ceramic tradition, but information on prehistoric architecture, burial practices, and material culture is limited. The available archeological data points to a number of traits, including flood water farming supplemented by fishing and seasonal gathering, small and widely separated "rancheria" settlements, free standing (non-contiguous) earth lodges, temporary ramada structures, roasting pits and sealed vessels for storage, rock and mud mortar surface structures, timber-lined pithouses, paddle-and-anvil pottery, and cremation as the most common mortuary practice. Added to this list are the upland sites listed above for which the region is best known. Among the most spectacular of all archeological phenomena in North America are the ground images called "geoglyphs," sometimes very large figures in geometric, anthropomorphic, zoomorphic, and other symbolic representations that are found chiefly on the River terraces and elevated platforms of desert pavement.

The Patayan archeological tradition is widely believed to be ancestral to the Yuman people of the flood plains who, along with the later arriving Chemeheuvi, have historically lived on the River and whose reservations lie directly above and below the national wildlife refuges today. At the time of the Spanish entry into the region, the principal Yuman-speaking groups living along the River were the Mojave in the north, the Yuma (Quechan) in the lower River, the Cocopah in the delta, and the Maricopa/Halchidhoma on the Gila River and also in the middle valley between the Mojave and the Quechan.

The Shoshonean-speaking Chemehuevi entered the Colorado valley later in historic times. The modern reservations are the Cocopah, Fort Yuma, Colorado River (shared with other, non-Yuman tribes), Chemehuevi, and Fort Mojave. Many residents of these communities continue

[57]Please refer to PART II, Unit 1, Section 2 for a discussion regarding Native American policy issues.

to regard certain places on the River with a high degree of religious and ancestral significance. Knowledge about these places and their meanings is entirely proprietary. There are locations on the four lower Colorado River refuges, however, with which the tribes maintain a special relationship. Some are still in use and regularly visited by tribal members.

Research Natural Areas -- Research Natural Areas (RNA) on national wildlife refuges are part of a national network of reserved areas under various ownerships. This network is the result of a designation system recognized by other Federal land administering agencies and the Federal Committee on Ecological Reserves. They are administratively established by the participating agency. RNAs are intended to represent the full array of North American ecosystems; biological communities, habitats, and phenomena; and geological and hydrological formation and conditions, all intended for research purposes. They are areas where natural processes are allowed to predominate without human intervention. Under certain circumstances, however, deliberate manipulation is used to maintain unique features that the RNA was established to protect.[58]

There is one RNA within the Area of Ecological Concern at the Bill Williams River NWR. In this case, deliberate actions have taken place, such as extensive tree planting, in an effort to enhance and protect the remaining native vegetation along the Bill Williams River riparian area. Because of the Service's lack of control over the release of water from Alamo Dam and the associated watershed, protecting the natural processes has been difficult.

Wilderness -- There are a total of 75 designated Wilderness areas (units), comprising nearly 20.7 million acres, on lands controlled by the Service. This includes 74 areas on national wildlife refuges and one area on a national fish hatchery. Passage of the Arizona Refuge Wilderness Act, P.L. 101-628, November 28, 1990, added more than 1.3 million acres of national wildlife refuge lands to the wilderness system.

Both Havasu and Imperial NWRs were affected by this recent congressional designation. A total of 14,606 acres from Havasu NWR and 9,220 acres from Imperial NWR were added. All of the designated lands in both refuges are primarily upland desert lands. Proposals are now being considered to add an additional 5,836 acres on the California side of the Imperial NWR and 3,195 acres on the California side of Havasu NWR as part of the California Desert Protection Act. As noted earlier, Wilderness designation is expected to contribute significantly to the protection already afforded remote and roadless areas integral to the desert upland habitat resources in each of the refuges.

Wilderness Management Planning -- The areas designated as Wilderness in both Havasu and Imperial NWRs are, for the most part, upland desert ecosystems containing sparse desert vegetation. Planning for these areas will be based on the principles fostered by the Wilderness Act of 1964. There is very little, if any, active management of these desert areas. The

[58]Ibid., Refuge Manual, 8 RM 10.

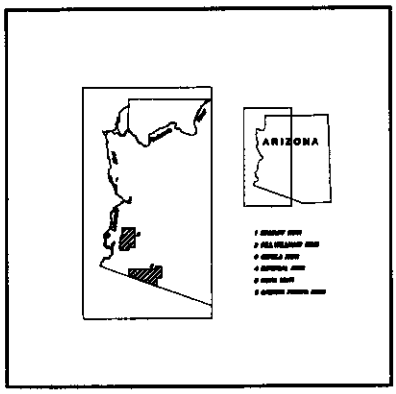

Figure 4 Wilderness areas were designated in Arizona at Havasu, Imperial, Kofa, and Cabeza NWRs. Kofa and Cabeza Prieta represent the richness of the desert diversity surrounding the "Thin Green Line."

inventory of wildlife use is not complete; however, vegetation communities include desert grasses, creosote, mesquite, and cactus communities. Additional work is necessary to inventory both vegetation communities and associated wildlife use. It is expected there is a dynamic relationship between the non-wilderness lower Colorado River riparian corridor and the decidedly dry landscapes of the desert wilderness.

There is very little public use of the designated Wilderness areas on Havasu and Imperial NWRs since there is no vehicular accessibility. Any permitted public uses must meet both the legal mandates in the Wilderness Act and compatibility criteria.

6. RELATIONSHIP TO OTHER PLANS

The following is an outline of the most prominent of existing planning efforts and documents that influence the future management of the lower Colorado River refuges as well as the Area of Ecological Concern.

Bureau of Reclamation Activities

Colorado River Front Work and Levee System -- Under the authority of the Colorado River Frontwork and Levee System, the BR is charged with maintaining the front work and levee system of the lower Colorado River for flood control, water delivery, navigation, and power production. These activities directly affect the lower Colorado River national wildlife refuges, and the BR and the refuges work closely together. This involves providing engineering support and construction and maintenance activities on the refuges.

This ground level planning and cooperation between the BR and the refuges has resulted in dredge work and dike construction at Havasu NWR in order to ensure stable water levels, as well as provide an inlet structure for the marsh. A new dike was constructed in the mid-1980s to protect the Topock Marsh from high river flows. Cibola NWR was created as mitigation for river modification activities in the Blythe, California, area. Activities on this refuge have included dredging Cibola Lake and providing inlet and outlet structures for the lake. The BR has also worked at Imperial NWR by opening channels in the marsh north of the refuge headquarters and raising farmland using dredged material.

Some of the projected goals, objectives, and strategies of this comprehensive management plan will be accomplished with the cooperation of the BR through the Front Work and Levee System planning and management mechanisms currently in place.

Water Delivery: Annual Operating Plan -- The BR is responsible for management of Colorado River flows, and, as such, schedules and controls the delivery of water throughout the River. Each year the Secretary approves and publishes the Colorado River Annual Operating Plan. The lower Colorado River national wildlife refuges are some of the many entities the BR serves with planning and scheduling of water deliveries in accordance with legal mandates. The BR has invited the Service, along with other governmental agencies, to offer input relative to the development of each year's operating plan. Through cooperation with the BR, water delivery will be optimized as much as possible for the benefit of the River's natural environment.

Vegetation Management Plan -- This study is examining the feasibility of a long-range plan for replacing salt cedar along the River with native riparian plants. The objectives for this plan are to reduce water uptake by plants and restore native habitat for wildlife. The study is being conducted in two phases.

Phase I (issued September 1992):

(1) Determined the distribution of salt cedar along the River.
(2) Reviewed water-uptake estimates for salt cedar and native riparian plants.
(3) Compared the wildlife habitat value of salt cedar and native riparian plant communities.
(4) Compared different methods of salt cedar removal.
(5) Summarized previous revegetation projects.
(6) Compared several revegetation alternatives.

Phase II (scheduled to be completed September 1994) is:

(1) Improving estimates of water uptake by salt cedar and native plant communities along the River.
(2) Predicting the suitability of potential revegetation sites for different native riparian species.
(3) Estimating the potential water savings.
(4) Developing an integrated approach for managing salt cedar that employs chemical, cultural, and biological methods.
(5) Developing a management and funding framework for a long-range revegetation program.
(6) Identifying additional research needs and environmental compliance strategy for implementing a long-range revegetation plan.

The revegetation plan developed by the Vegetation Management Study is integral to the Service's comprehensive management planning and management activities. By replacing salt cedar with native plants that consume less water, it may be possible to use a portion of the water saved to initially irrigate revegetation sites. Restoring native vegetation will increase the diversity of plant and animal communities and improve habitat for a variety of wildlife.

Fish and Wildlife Service Activities

Endangered Species Recovery Plans -- These plans spell out steps that must be taken to recover a species and remove it from the endangered and threatened list. The following represents a summary of the recovery plans affecting species found on the lower Colorado River national wildlife refuges and other areas within the Area of Ecological Concern.

(1) Yuma Clapper Rail Recovery Plans -- The Yuma clapper rail has been a highlighted endangered species for the lower Colorado River. The implications of the clapper rail's recovery on other marsh and waterbird species are important to the establishment of refuge habitat management objectives. Significant progress has been made toward rehabilitating the clapper rail, and this will have positive affects on other rail subspecies of special concern in the Area of Ecological Concern. Such subspecies like the California black rail and the Virginia rail

are not Federally endangered at this time. However, both the States of Arizona and California view them as threatened.

The recovery plan's primary objective is:

> "To assure the continued survival of a total breeding population of 700-1000 Yuma clapper rails in the United States."[59]

A study funded by both the BR and the Service was conducted on the biology of the species, and a report entitled *Biology of the Yuma Clapper Rail in the Southwestern U.S. and Northwestern Mexico* was published in July 1989.[60]

The study recommended the following:

1. Preparation and implementation of management plans on Federal and State management areas.
2. Creation and management of wetlands.
3. New research on captive birds to clarify nesting biology, vocalizations, design of call counts, and reproductive problems associated with selenium contamination.
4. Standardization and continuation of call counts.
5. Cooperative efforts with Mexico to preserve habitat in the Colorado River Delta.
6. Continued listing of the species as endangered until habitat is stabilized and reproductive effects of selenium are clarified.
7. Retention of an Interagency Team to oversee all counts.
8. No net loss in habitat areas.
9. More oversight on projects conducted within or adjacent to marsh habitats.

The study states that "Future recovery efforts for Yuma clapper rails should emphasize implementation and evaluation of management recommendations rather than large scale additional basic research."[61] The lower Colorado River national wildlife refuges comprehensive management plan has adopted the recommendations as listed above.

(2) **Peregrine Falcon Recovery Plan** -- There are recovery plans for different populations of the peregrine falcon. The general goal is to restore a new self-sustaining population of peregrine falcons in the western United States. The lower Colorado River national wildlife refuges play a small but important role by preserving wintering and migratory habitats, by protecting peregrine falcons through refuge law enforcement efforts, and by promoting public support and understanding through education.

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[59]U.S. Fish and Wildlife Service. 1983. *Yuma Clapper Rail Recovery Plan*, Albuquerque, New Mexico, 51 pp.

[60]Eddleman, Wm. R., *Biology of the Yuma Clapper Rail in the Southwestern U.S. and Northwestern Mexico*, Wyoming Cooperative Research Unit, 1989.

[61]Ibid., Eddleman.

(3) **Bald Eagle Recovery Plans** -- Southern bald eagles are known to winter and are thought to nest along the Area of Ecological Concern. The number of sightings vary from year-to-year on the lower Colorado River national wildlife refuges. Eagles once nested along the Area of Ecological Concern prior to the decline of the tall cottonwoods. There were reports of a pair of bald eagles attempting to nest at Topock (Havasu NWR) from 1975-1977.

As recently as 1987, a pair of bald eagles was found breeding along the Bill Williams River near Alamo Dam.[62] In 1989, an unconfirmed sighting was made east of Cibola Lake (Cibola NWR) near the Trigo Mountains. Seven bald eagles were observed in 1989 near the Old River Channel and Cibola Lake (Cibola NWR), although most of them were immature.

The lower Colorado River national wildlife refuges play a critical role by ensuring that bald eagle habitats are protected and enhanced for the maintenance and production of these endangered creatures. In addition to preserving wintering and migratory habitats, the refuges protect the eagles through law enforcement efforts and by promoting public support and understanding through education.

(4) **Endangered Colorado River Fish Recovery Plans**[63] -- There are four native species of Colorado River fishes currently listed as endangered by the Service. Critical Habitat designation has been proposed for the entire area encompassing the four refuge locations for the razorback sucker and the bonytail chub. The Native Fishes Work Group, the Service, and the AGFD are involved in ongoing recovery efforts for these species along the lower Colorado River.[64] In particular, recovery efforts are being planned for Lake Havasu. This issue is discussed further in Part II, Unit 2, Section 3 of this document.

Razorback Sucker -- The razorback sucker was listed as endangered in 1992 by the Service. As yet, there is no recovery plan for this species, and the Service is in the process of identifying critical habitat. It is thought the lower Colorado River national wildlife refuges could be prime candidates as possible critical habitat areas for this species. No recovery plan has been drafted at the writing of this comprehensive management plan.

Colorado Squawfish -- The Colorado squawfish was listed by the Service as endangered in 1973. In the late 1970s, the Service experimented with releases of this species in the mainstem channel of the lower Colorado River. Even as recently as 1992, an incidental take has occurred from time to time. Most of the population released in the River has been extirpated.

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[62]Alamo Dam is not immediately adjacent to the Bill Williams NWR; however, the refuge water resources, including those affected by releases from Alamo Dam, and other natural resource considerations heavily influence wildlife use on the refuge lands.

[63]See PART II, Unit 1, Section 8C and PART II, Unit 2, Section 2 for discussion regarding endangered or threatened Colorado River fishes.

[64]The Native Fishes Work Group includes BR, the Service, Arizona Game and Fish Department, Nevada Department of Wildlife, and Arizona State University.

The original recovery plan for this species, drafted in March of 1978, sets out the necessary criteria and actions thought to result in species recovery. Although most of the recovery activity for this species is taking place in the Upper Basin of the Colorado River, the plan calls for the Service to reintroduce the Colorado squawfish into its historic range, which includes the Lower Basin. The revised plan states:

> "Colorado squawfish are now being reintroduced into unoccupied habitat areas in the lower Basin with highest recovery potential (i.e., the Salt River, the Verde River, and the lower Colorado River)."[65]

It is clear the refuges within the Area of Ecological Concern will play a role in the recovery of this species.

Humpback Chub -- The humpback chub was listed as an endangered species in March of 1967. The original recovery plan was approved in August of 1979, revised in May of 1984 and again in September of 1990. The goal of this recovery plan is the protection or restoration of five viable, self-sustaining populations of this species within the Colorado River Basin and the protection of the habitat utilized by these populations.

Most of the recovery plan activity is situated in Upper Basin areas. Nevertheless, the plan calls for the development of a coordinated recovery program for the Lower Basin; it is estimated that humpback chub recovery activities planned for the Lower Basin will total at least $10 million by the year 2003.

The humpback chub is being recovered in concert with the bonytail chub, Colorado squawfish, and the razorback sucker.

Bonytail Chub -- The bonytail chub was listed as an endangered species on April 23, 1980. The original recovery plan was approved in May of 1984 and revised September 4, 1990. The recovery goal in the short-term is to prevent extinction of the bonytail chub. In the long term, once the immediate threat of extinction is removed, quantitative goals for downlisting and delisting will be addressed.

According to the recovery plan, development of a Lower Basin bonytail chub reintroduction program has been planned and costs have yet to be determined.

Biological Diversity on Federal Lands: Report of a Keystone Policy Dialogue

Representatives from the Service, as well as other Federal agencies, Congressional committees, environmental organizations, commodity interests, professional associations, and academia, were

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[65] *Colorado Squawfish Recovery Plan*, U.S. Fish and Wildlife Service, Regions 2 and 6, 1978. The recovery plan for this species was prepared by the Colorado Fishes Recovery Team of the U.S. Fish and Wildlife Service in Denver, Colorado, and originally published in March of 1978. A revision was published and approved in August of 1991.

active participants in a multi-agency dialogue attempting to address conservation of biological diversity on Federal lands. Efforts focused on formulating consensus recommendations for conserving biological diversity on lands managed by the major Federal land management agencies (Service, BLM, U.S. Forest Service, National Park Service, and Department of Defense).

The dialogues produced a document that recommended the development of a national goal to conserve, protect, and restore biological diversity on Federal lands. The participants determined that, because of its intrinsic value, biological diversity is important to sustain the health of ecological systems and to provide for human well-being. Though the conclusions of the report are only recommendations, the Service is considering implementation.[66]

Region 2 Biological Diversity Plan

In 1991, the Southwest Region initiated an effort to formally establish a regionwide plan and program for biological diversity. The effort is ongoing for the region and a final draft is forthcoming.

The draft plan set out a purpose of identifying "goals, objectives and strategies for the conservation of the natural biological diversity of the Southwest Region, with emphasis on those species and habitats which the Fish and Wildlife Service has primary statutory jurisdiction. This group includes Federally listed threatened and endangered species, migratory birds and anadromous or inter-jurisdictional fishes. On national wildlife refuges and fish hatcheries, Service management authority extends to all fish and wildlife species and their habitats, in coordination with respective State governments."[67]

The plan proposes the following objectives:

Monitoring: Identify and monitor the status of nongame fish and wildlife species of concern, biological communities, and other elements of biological diversity.

Research: Identify and evaluate the factors contributing to the decline of biological diversity and the management strategies necessary to reverse that decline.

Management: Identify and implement actions promoting conservation of biological diversity.

Education: Enhance public awareness and appreciation of the values of natural biological diversity.

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[66]Keystone Center, *Final Consensus Report of the Keystone Policy Dialogue on Biological Diversity on Federal Lands*, Keystone, Colorado, 1991.

[67]Region 2 Biological Diversity Draft Plan, July 23, 1991

Training: Enhance technical capability of Service employees relating to the conservation of biological diversity.

Partnerships: Enhance coordination and partnerships between Federal, State, academic, and private landowners or organizations with shared responsibility for the conservation of biological diversity.

International Cooperation: Enhance conservation of biodiversity in the Caribbean and Latin America through research, education, and technical assistance.

Part II: Analysis, Unit 1, Section 7 of this document discusses and makes recommendations concerning the Southwest Region biological diversity plan as it relates to the lower Colorado River national wildlife refuges and the Area of Ecological Concern.

Partners in Flight: Neotropical Migratory Bird Conservation Program

This document was prepared by participants at the Neotropical Migratory Bird Workshop in Atlanta, Georgia, in December of 1990. The document outlines strategies to reverse the documented population decline of passerine birds that breed in North America and winter in the Caribbean and Latin America. The goal of the program is to focus the combined resources of agencies, academia, and private organizations on the improvement of monitoring, research, management, and education programs relating to neotropical migratory birds. Implicit in the strategy document is the need to identify, protect, manage, and restore essential habitats.

North American Waterfowl Management Plan (NAWMP)

The NAWMP guidelines were published in May 1986. The plan is a broad framework describing the overall scope of the requirements for management of migratory waterfowl in Canada and the United States. The purpose of the plan is to promote a coordinated international response to a crisis in North American waterfowl populations. The plan is a partnership effort based on the joint venture concept, including private, state/provincial, and Federal interests. The plan also focuses on the many ongoing and planned continent-wide waterfowl management efforts and stimulates new endeavors.

Implementation of this plan requires these nations to convert international objectives into operational plans. The plan will be updated every 5 years from its first revision in 1990.

The lower Colorado River national wildlife refuges and the Area of Ecological Concern are important to the NAWMP and can contribute significantly to its goals. The refuges serve as wintering habitats and stopover points for several waterfowl species within the Pacific Flyway. Each of the refuges along the River meets the NAWMP's goal for maintaining waterfowl habitats of acceptable quality and with minimal exposure to contaminants.

National Wetlands Priority Conservation Plan (NWPCP) and National Wetlands Inventory (NWI)

The NWPCP was completed in compliance with the provisions of the Emergency Wetlands Resources Act of 1986. The purpose of the Act was to promote, in concert with other Federal and state statutes and programs, the conservation of the wetlands of the nation in order to maintain the public benefits they provide. The Act provides for wetlands acquisition and gives equal consideration to acquisition involving the purchase of wetlands with Land and Water Conservation Fund (LWCF) monies. While acquisition of wetlands for public outdoor recreation has always been eligible for LWCF assistance, they are now specifically highlighted under the Emergency Wetlands Resources Act.

The NWI has been conducted by the Service across the nation. The NWI conducted in Arizona undertook the task of inventorying and classifying the state's wetlands. The plan describes the majority of the State's wetlands as being directly related or indirectly associated with streams and their drainages. It has been the concern of some natural resource experts that the NWI did not include a majority of floodplain vegetation communities, only the vegetated islands within a stream channel. These riparian communities of old growth cottonwood-willow galleries and mature mesquite bosques growing on the terraces above the actual channel, are just as dependent upon the existing aquifer for their survival as the more traditionally accepted wetlands vegetation. The riverine riparian areas in Arizona that were identified in the NWI were nearly all classified as palustrine forested.

Arizona Wetlands Priority Plan

This plan was prepared to comply with the Emergency Wetlands Resources Act of 1986. The purpose is to promote, in concert with other Federal and state statutes and programs, the conservation of the wetlands of Arizona in order to maintain their public benefits.

The Arizona plan was prepared as an Addendum to the Arizona Statewide Comprehensive Outdoor Recreation Plan.

Lower Colorado River Land Use Plan (January 1964)

Not since the early 1960s has a large-scale planning effort taken place along the Colorado River. The *Lower Colorado River Land Use Plan* was published in 1964 by the Department of the Interior as a cooperative planning effort to foster coordinated economic and recreational uses of the River.

The land use plan concerned the area along the River from the southern boundary of the Lake Mead National Recreation Area on the north to the International Boundary with Mexico on the south. The plan included the study of the resources that extend back from the River on both sides for varying distances. The plan did not consider "supplies" of water or allocated consumptive use rights since the Supreme Court, at that date, had not rendered a decision in the

case of *Arizona v. California*, et al.[68] This dispute was based on the state's rights to allocate tributary water to the various state participants of the Colorado River Compact of 1922.[69]

The plan suggested land uses that typified the respective and different missions of each of the agencies.[70] The *Land Use Plan*, however, was designed to be a general outline of possible land uses along the River. The plan states:

> "It is emphasized that the Land Use Plan does not embody a set of directives or definite commitments to be put into immediate operation. Rather it is an outline of objectives for a long-range program of land use and zoning along the lower Colorado."[71]

The land use planning effort was "initiated to correct the problem of illegal occupancy of Federal lands along the river and to provide a recreation oriented Land Use Plan."[72]

While considering resolution of this problem, Secretary of the Interior Stewart L. Udall realized the Federal lands along the River offered "outstanding opportunities to salvage major recreation and scenic assets of far reaching influence."[73] The Secretary requested these lands be evaluated for their highest and best uses. Four primary land use needs were outlined: areas suitable for national recreational development, areas suitable for national wildlife refuges, areas suitable for state parks and recreational uses, and areas that should be established or retained as state game and fish refuges.

Subsequent to the publication of the land use plan, some of its objectives were met. The Cibola NWR was established for wintering of migratory birds, while substantial portions of lands at both Havasu and Imperial NWRs were relinquished back to the Public Domain. Some of those lands were subsequently withdrawn from the Public Domain for the establishment of state parks and recreation areas in both California and Arizona.

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[68]Refer to *Arizona v. California*, a landmark Supreme Court decision that rendered control of Colorado River tributary waters to the states. This decision allowed Arizona to allocate and control water rights from the Gila River and other tributaries of the Colorado River (including the Bill Williams River) while prompting the development of the Central Arizona project, where waters from the main Colorado River channel could be diverted to meet the Colorado River Compact allotment for Arizona.

[69]As a result of the Compact, the lower Basin states were allocated 7.5 million acre-feet available per year: Arizona 2.8 million, California 4.4 million, and Nevada 300,000 acre-feet.

[70]According to the *Land Use Plan:* (1) the BR responsibilities included river control, the conservation of water, and the regulation and delivery of water; (2) the Bureau of Sport Fisheries and Wildlife (U.S. Fish and Wildlife Service) responsibilities included the preservation and development of migratory bird habitat for feeding and nesting (in line with international agreements with Canada and Mexico). This would prompt the need for establishment of wildlife refuges; and, (3) the BLM responsibilities included the administration of grazing leases and mining claims on public domain and Reclamation withdrawn lands. In addition, the BLM would be concerned with cooperation with the States and counties in the execution of their proposed programs for the establishment of planned urbanized areas and National Cooperative Land and Wildlife Management Areas on Public Domain. [*Lower Colorado River Land Use Plan*, pp. 1 and 2].

[71]Lower Colorado River Land Use Advisory Committee, *Lower Colorado River Land Use Plan*, 1964. U.S. Department of the Interior.

[72]Ibid., Land Use Plan.

[73]Ibid., Land Use Plan.

It should be noted that preparation of this land use plan occurred prior to the passage of the National Environmental Policy Act of 1969, the Endangered Species Act of 1973, and the Fish and Wildlife Conservation Act of 1980, among others. Up until that time, there was no national mandate for agencies to consider impacts of proposals on endangered species, fish and wildlife resources, or cumulative impacts on environmental resources (e.g., air, water, archeological, cultural, etc.).

Previous Comprehensive Plans, Imperial and Havasu NWRs

Both Havasu and Imperial NWRs have undergone major long-range planning efforts. Imperial's plan was published in 1969 and Havasu's in 1971. The documents produced for each planning effort contained long-range objectives; proposed development and management; and estimated costs, including preliminary project construction.

Though much has changed in the past 20 years, these planning documents contain descriptions of needs and goals still applicable for the current planning period. Inventories of natural resources for Imperial and Havasu have changed to some degree, including the relative health of the native vegetation communities in each. Floods and drought in the 1980s have affected water levels and the ability of the refuges to manage their wetlands for the benefit of wildlife resources. At the time these plans were published, NEPA had not yet been passed, nor had the Yuma clapper rail been listed as an endangered species.

Nevertheless, the old plans call for certain kinds of improvements that appear to be applicable for the current planning period. For instance, Havasu and Imperial call for major site development work to improve marsh areas. In the case of Imperial, the plan called for a major dredging project to connect backwater marshes. That project was started, but first ran out of money then was determined to be infeasible when the dredge operator hit rock. In the case of Havasu, site development work to improve the Topock Marsh was listed as a major project, including dike work at Goose Lake, Willow Lake, and Beal Lake. A significant amount of dike and dredge work was accomplished between 1966 and 1979. The need remains, however, to make improvements to the Topock Marsh area as a whole.[74]

The Imperial plan called for the construction of a new visitor's facility in the City of Yuma where the refuge headquarters were once housed. In the early 1980s, Administrative and Visitor Center complexes were constructed on the Refuge near the Village of Martinez Lake, Arizona, 30 miles north of Yuma. The Havasu plan called for the construction of a new visitor's facility on the Refuge. This project was never approved or funded and continues to be a critical need of the Refuge.

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[74]The BR has conducted extensive work in the Topock Marsh Management Unit for improvement, all precedent to the old plans. A significant amount of dike work was completed in 1966. In addition, in 1973 the Service requested that the BR use its 12-inch dredge to enhance wildlife habitat in Topock Marsh. The marsh was dredged from February 1, 1974, through March 1, 1975, and April 12, 1978, through April 1, 1979. The work provided 6.2 miles of diking to improve water management and 7.4 miles of channel to improve water circulation patterns to preclude or substantially reduce adverse affects of water quality. Excess dredged material was used to construct 2.1 miles of low-profile islands. The channel and the islands were designed by the Service.

As this comprehensive management plan document is "stepped down" in a management planning and site development planning effort for Management Units and Special Project Areas, the two previous documents will need to be consulted for basic information. Therefore, the two previous plans are included as part of the planning file.

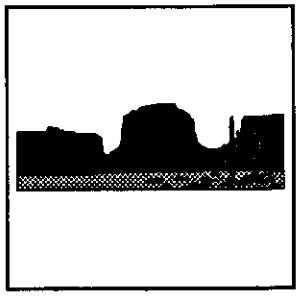
California and Arizona State Comprehensive Outdoor Recreation Plans (SCORP)

The major purpose of the SCORPs are to provide a comprehensive framework for the orderly planning, acquisition, development, and administration of Arizona and California's outdoor recreation resources. The 1983 SCORPs identified recreation needs and implementation strategies. The need for natural resources conservation was one of the major issues identified and many activities in the plans are aimed at this issue. Priorities relative to wetlands acquisition and protection were included in the Arizona statewide priorities for 1983.

Bureau of Land Management (BLM) Resource Management Planning

The BLM is a sister agency in the Department of the Interior and is responsible for the management of public lands throughout the Western United States. Lands on both the Arizona and California sides of the Colorado River are managed by various BLM Area Resource and District Offices from both States. Each of the BLM land areas is managed in accordance with the agency's Resource Management Planning process as dictated by the Federal Land Policy Management Act. Both the Service and the BLM are engaged in general land management planning and planning for designated wilderness areas.

UNIT 3 -- NATURAL RESOURCE INVENTORY



This unit outlines in detail the extensive natural resources currently present on the lower Colorado River national wildlife refuges. Included are current geological, soil, biological, and water rights resource values.

As mentioned in Unit 2, water is not treated separately from the right to use it. The water, together with the right to use it, is considered the most critical of natural resources affecting the management of the national wildlife refuges in the Area of Ecological Concern. Therefore, the water rights inventory for the lower Colorado River refuges is treated in this Unit.[75]

Cultural resource values and other special resource value designations (i.e., research natural areas and wilderness resources) are normally considered to be part of the natural resource inventory. Although these are natural resources in the broad sense, they are, for the most part, policy considerations that are taken into account as both planning and management takes place. These resources are treated in full in Unit 2, Legal, Policy Guidelines, and Administrative and Special Considerations.

1. GEOLOGIC RESOURCES

According to geomorphologists, the River and its gigantic canyon has existed only since the Miocene Age. The Colorado, like the Nile, is an exceptional example insofar as contrasts are concerned. Most desert regions are of internal drainage. Not so with the Colorado, for here is a stream flowing through a region of high aridity that has its origins in tributaries beginning at 10,000 feet or more in the Rockies, and terminating at base level in the Gulf of California.

The River bisects all of the refuge stations, with the exception of Bill Williams River NWR, and forms an important alluvial feature of an external drainage system. The physiographic features of the area were influenced primarily by the Tertiary period to recent times, with a great number of features being of the Quaternary. The area has many predominant features of early, undivided Pre-Cambrian granitic rocks, especially in the Chemehuevi Mountain region. There is evidence of mineral deposition having occurred on the Arizona side of the River, while much of the Needles Peaks area shows granites of highly weathered varieties.

2. SOIL RESOURCES

The soils within the national wildlife refuges and the Area of Ecological Concern can be separated into three broad categories.

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[75]Water Rights as a larger Service policy issue is also treated in the Part II, Analysis, Unit 1, Section 1, Water Rights Policy.

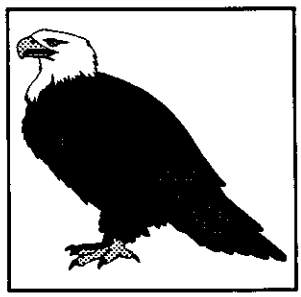
Soil Group #1 -- The soils in this association are well drained, moderately coarse textured, and shallow to weathered granite or closely related rock. They are formed on moderately steep and steep hills and mountains in this desert area. The surface is gravelly, cobbly, stony, or rocky. The dominant soil is formed on granite or closely related rocks. Small areas of shallow and moderately deep soils with a clay subsoil are in some of the more level areas. Moderately coarse and coarse-textured recent alluvial soils are in the drainage ways. Rock outcroppings are common throughout and are dominant in some areas, especially on Havasu and Imperial NWRs.

Soil Group #2 -- These are well drained, shallow and very shallow, gravelly, cobbly, stony, or rocky, loamy soils. They are formed on moderately steep and steep basalt, andesite, or rhyolite hills and mountains. The dominant soil is very shallow loamy soil that is gravelly, cobbly, stony, or rocky. Basalt rock outcrops and rockland areas are common throughout. Included are small bodies of a shallow clayey soil that occurs on the less steeply sloping areas. Also included are narrow bodies of moderately fine textured recent alluvial soils in the drainage ways.

Soil Group #3 -- These are deep, gravelly, sandy loam, and moderately deep loamy soils formed on alluvial materials from mixed sources. The surface is gravelly. These soils are on alluvial fans and flood plains with slopes that range from nearly level to strongly sloping. The dominant soils are deep gravelly, sandy loams and may or may not be calcareous. These soils are on nearly level flood plains or gently to strongly sloping alluvial fans. Some of the soils on the fans may have zones of lime accumulation. Another major component of the association is a gravelly loam soil that is moderately deep over gravel. This soil is on gently sloping areas on the fan tops. Many of these soils have a vesicular crust on the surface that inhibits water penetration. Included are coarse textured soil in the drainage ways.

For crop production, soil amendments must be added and extreme care taken to prevent soil loss from wind erosion. Soils surrounding the Cibola NWR have been intensively farmed over the past several decades and have the necessary soil characteristics necessary to make the Cibola and Palo Verde Valleys some of the region's most productive agricultural areas.

3. WILDLIFE AND HABITAT RESOURCES



The following section describes the existing habitat and wildlife resources of each of the four lower Colorado River national wildlife refuges. An analysis of biological use and resource capabilities, along with recommended actions, is offered in PART II, Unit 2 of this comprehensive management plan document. Full lists of refuge species are offered in the Appendix to this document and are available on request.

As described in PART I, Unit 1, Section 1, each of the refuges are divided into refuge management units and management subunits. These management units represent ongoing program activities within distinct geographically defined parts of the respective

refuges. The following narrative attempts to incorporate the wildlife and habitat values within the context of these administratively determined divisions.

Havasu NWR Habitat and Wildlife

Havasu NWR consists of two management units: the Topock Marsh and the Topock Gorge Management Units. Havasu NWR includes marsh, lake, and riverine habitat comprised of native and non-native vegetation community mixes, all surrounded by a xeric desert landscape with its own set of ecological values. Included in this desert landscape is the designation of 14,606 acres as Wilderness.

As has been described for the Area of Ecological Concern, the areas forested with native cottonwood and willows are now seriously infested with overpowering salt cedar. This tenacious species is not judged to have the wildlife values associated with the native cottonwood-willow community. Salt cedar also presents itself as a problem because of its resistance to fire, flooding, and any reasonable control methods. Where monotypical stands predominate, a fire hazard exists--the excess build up of dry biomass beneath it is extremely flammable.

Salt cedar encroachment on managed lands results in considerable time spent on maintenance. The natural stands of mesquite, willow, and cottonwood lose ground to salt cedar after each disturbance unless intensive and expensive effort is given to re-establish the area.

Other kinds of habitat include marshes and wetland areas, which are of great importance to the migratory birds frequenting the Refuge. Marsh areas offer sanctuary to nesting Yuma clapper rails, a Federally listed endangered species, and the California black rail, which is a species of concern for this ecosystem.

HABITAT

<u>Marshes</u> -- The Topock Marsh Management Unit consists of Topock Marsh and Pintail Slough Subunits; the Topock Gorge Management Unit contains Crystal Beach Marsh Subunit.

> *Topock Marsh Subunit* -- This is a 4,000-acre marsh fed by a 4-mile inlet canal that extends from the main channel of the Colorado River. Submergent vegetation here is sago pondweed and an abundance of spiny naiad. Water management is complicated because the river fluctuates in a tide-like manner, due in part to changing hydroelectric power demands in metropolitan areas 300 miles away. In the evenings the demand is greatest so more turbine generators are used. The peak flow in the inlet canal is around midnight and the low flow around 1 p.m. The daily fluctuation in river elevation can be as much as 6 feet.
>
> *Pintail Slough Management Subunit* -- Located to the north of the Topock Marsh, this moist soil area is composed of five slough impoundments managed for moist soil plants.

This management subunit produces an abundance of alkali bulrush, barnyard grass, sprangeltop, and smart weed. Flooding is used as a control for cocklebur.

Crystal Beach Marsh Subunit -- Annual surveys for endangered Yuma clapper rails indicate this area contains the highest abundance of clapper rails within the Area of Ecological Concern. These backwater marshes are currently designated as no-wake zones and are off-limits to water skiing and jet skiing. Additional funding and personell needs to enforce these regulations are a major management concern.

Open Water Lakes -- Lake habitat at Havasu NWR is located in both the Topock Marsh and Topock Gorge Management Units. No Name and Beal Lakes are in the Topock Marsh Management Subunit. These lakes contain marsh vegetation such as cattail and bulrush emergents which characterize marshes. These shallow water lakes have open water and provide roosting areas for wintering geese, ducks, and migratory marsh birds.

These lakes are also habitat for various species of sport fish. The deep water lake areas are in the Topock Gorge Management Unit, located just as the Colorado River enters Lake Havasu at the southern extreme of the Refuge. These extensive waters are open and are used by sport fishermen, boaters, and water skiers. The shorelines consist of backwater marshes that provide nesting areas for grebes, Yuma clapper rails, and other marsh and waterbirds.

Riverine -- The Topock Gorge Management Unit at Havasu NWR contains stretches of a large section of the Colorado River that is unchannelized along with associated riparian habitats. The Colorado River dry cut adjoining the Topock Marsh Management Unit is approximately 10 miles in length, from the northern boundary to the Golden Shores Marina at Interstate 40. Habitat along the dry cut is of poor quality for wildlife, with dense groves of monotypical salt cedar and arrowweed along the riprapped banks of the River and the levee road.

In contrast, the Topock Gorge Management Unit includes approximately 20 miles of the River and represents one of the last remaining natural stretches along this portion of the River. The riparian zone is used by a variety of songbirds and marsh and wading birds, including the endangered Yuma clapper rail. The emergent vegetation in the backwaters provides nesting habitat, as well as nursery areas, for largemouth bass, crappie, and channel catfish. Since it is an unchannelized portion of the River, certain backwater coves may be potential habitat for the endangered bonytail chub and razorback sucker.

Vegetation associated with the lower Colorado River has been a topic of increasing discussion among State and Federal agencies each year. A variety of activities, beginning with dam construction and including woodcutting, dredging, flooding, and agricultural developments have destroyed virtually all the naturally occurring cottonwoods in the vicinity of the Topock Marsh.

In 1986 cottonwoods were planted high along the new south dike in the Topock Marsh. The trees have continued to grow well, with an 80 percent survival rate. Some of the trees planted on the bank of the dike have not survived in the long term. For reasons unknown, about 15

additional cottonwoods planted there in 1988 by the BR died. Cattail beds at the north end of Lake Havasu have continued to extend and become established.

Backwater areas adjoining the river channel are designated as no-wake zones and are closed to jet skis. Water skiing is prohibited along the full length of the Topock Gorge Management Unit. Boat traffic above a 5 mile per hour speed will create wakes in the water causing disturbance to marsh and waterbird nesting areas. Potentially, wakes can cause damage to Federally endangered Yuma clapper rail habitats.

Unconsolidated Streambed and Dry Washes -- Several dry washes that drain into the Colorado River flow onto the Refuge. These washes support significantly more vegetation than the surrounding drier desert upland. Ironwood, palo verde, and smoketree are indicators of available water. As with other areas in the arid desert, the availability of water is the determining factor controlling the distribution of plant species at Havasu NWR.

Forest -- Most of the forested lands on Havasu NWR consist of monotypical growths of salt cedar. The more valued habitats are mixes of salt cedar and mesquite communities and some of the remaining communities of cottonwood and willow trees. These vegetation mixes are primarily in the areas surrounding the Topock Marsh within the Topock Marsh Management Unit. A 600-acre tract with the potential for enhancement of migratory, resident, and wintering avian species has been identified for a future revegetation project in the Topock Marsh Management Unit. According to Rosenberg, Ohmart, Anderson, and Hunter, until the 1970s this area was used by such riparian-obligate species as summer tanagers and willow flycatchers.[76] Also of note are forested areas in the Pintail Slough Management Subunit in the northern part of the Refuge, which also have the potential to be enhanced to benefit migratory, resident, and wintering avian species.

Croplands -- Refuge croplands include 130 acres of fields in the Pintail Slough Management Subunit and 90 acres of bermuda grass in the Bermuda Pasture Management Subunit, located near the Refuge maintenance shop. These fields are primarily used by geese for browse. Ducks use the Pintail Slough farm fields for short durations after irrigation or fall/winter rains. The nearest potential cooperative farmer withdrew in 1986, indicating conflicts with the Refuge's wheat planting schedule, wheat prices, and the potential for losing a crop. The surrounding area is intensively farmed in cotton, alfalfa, and January-planted wheat. There is little interest in cooperative farming in anything other than these crops. In 1989 a study was conducted to determine if moist soil management was a viable alternative to the traditional farming activities in these fields. The conclusion of the study was that moist soil management in the farm fields is not feasible due to the inability to hold water on the fields for effective control of undesirable plants. Also, fields drain off quickly making food unavailable to ducks.

[76]Ibid., Rosenberg et al.

Moist soil management does take place in the 60-acre area adjacent to the traditional fields. The combination traditional farm program and the moist soil area benefit the Refuge's field feeding ducks.

Desert -- The Refuge is located in the southern portion of the Mohave desert, and approximately half of the habitat is in this category. A sizeable portion of this habitat on the Arizona side of the Refuge is now designated wilderness. This upland portion of the desert is now named the Wilderness Management Subunit of the Topock Gorge Management Unit. Each year, as the human population of the area increases, the threat of trespass damage does likewise. Off-road vehicles, trash dumping, and vandalism to fences and gates, damage desert soils, and vegetation and are aesthetic problems.

WILDLIFE

The Colorado River and Topock Marsh, lying adjacent to the desert, account for an interesting array of wildlife. Over 300 species of birds, 42 species of mammals, and 38 species of reptiles have been recorded at Havasu NWR, including the following:

Endangered Species -- Federally listed endangered species associated with Havasu NWR include the Yuma clapper rail, bald eagle, peregrine falcon, and two Colorado River native fishes-- the razorback sucker, and the bonytail chub. Although present historically, the Colorado squawfish has been extirpated from the lower Colorado River. The endangered Mohave desert tortoise may be present on the Refuge. Occasionally, California brown pelicans are seen in the area. The Refuge is also within the range of the lowland leopard frog, Federally listed as a candidate species.

State-Listed Species -- The California black rail is listed by California as threatened and by Arizona as endangered. It is also a Federal candidate species. The Southwestern willow flycatcher is listed endangered in California and Arizona, and is proposed for Federal listing. In cooperation with the State of Arizona, surveys of appropriate habitat to determine locations of breeding pairs of willow flycatchers were conducted on the Refuge in 1993. No birds were detected at that time. The Arizona Bell's vireo occurs on the Refuge and is listed by California as endangered. Snowy egrets are listed in Arizona as threatened and great egrets have endangered status in Arizona. Both of these egrets are abundant on the Refuge. Once common along the River in large stands of cottonwood and willow, the yellow-billed cuckoo is now listed as endangered in California and threatened in Arizona. It is doubtful that enough habitat exists currently on the Refuge to support a population of yellow-billed cuckoos, but habitat restoration projects should improve the situation for this species.

Waterfowl -- Havasu NWR supports snow geese, Canada geese, mallard, gadwall, northern pintail, green-winged teal, cinnamon teal, American wigeon, northern shoveler, redhead, ring-necked duck, lesser scaup, bufflehead, and the ruddy duck.

Marsh, Water and Wading Birds -- Yuma clapper rail, California black rail, Clark's grebe, western grebe, double-crested cormorants, least bittern, American bittern, great egret, snowy egret, herons, and common loons utilize the Refuge wetlands.

Shorebirds (Gulls, Terns, and Allied Species) -- Species of this group found on the Refuge include American avocet, black-necked stilt, dowitchers, sandpipers, yellowlegs, willet, long-billed curlew, godwits, ring-billed gulls, black tern, Forster's tern, and Caspian tern.

Raptors -- In addition to the bald eagle and peregrine falcon, red-tailed hawks, great-horned owls, and northern harriers are common. Others sighted on the Refuge have been osprey, kestrel, golden eagle, prairie falcon, barn owl, short-eared owl, Cooper's hawk, and sharp-shinned hawk.

Other Migrant, Resident, and Wintering Avian Species -- Blue grosbeak, common yellowthroat, yellow-breasted chat, black phoebe, phainopepla, western kingbird, and marsh wren are common breeding birds on the Refuge. Phainopepla are present year-round and ruby-crowned kinglets are abundant in winter. Many others species either breed here, migrate through, or use the Refuge during winter. Athel tamarisk galleries support breeding Lucy's warblers and summer tanagers. Gambel's quail are abundant throughout the Refuge. White-winged and mourning dove populations are particularly common in the Pintail Slough Management Subunit.

Mammals -- The most notable mammals in this area are the bighorn sheep populations. Other mammals include mule deer, mountain lion, cottontail rabbit, and black-tailed jackrabbit.

Fish -- Surveys of Topock Marsh and Topock Gorge indicate that largemouth bass and black crappie have had good reproductive success in recent years. Although native Colorado River squawfish have been extirpated from the lower Colorado River, this was part of their historic range. Bonytail chub and razorback suckers are still present in small numbers, and re-introductions of these fish to the lower Colorado River are being coordinated by the Parker Fisheries Resource Office.

Reptiles and Amphibians -- Two state (Arizona) species of concern on the Refuge are the lowland leopard frog, which is at the edge of its range on the lower Colorado River, and the Sonoran desert tortoise. Spiny soft shelled turtle, desert iguana, desert collared lizard, western whiptail, chuckwalla, and coachwhip are other species present. Four species of rattlesnakes: western diamondback, speckled, Mohave, and the sidewinder can also be found on the Refuge.

Bill Williams River NWR Habitat and Wildlife

The Bill Williams River NWR consists of three management units: Delta Management Unit at the confluence of the Bill Williams River and Lake Havasu; the Bill Williams River Riparian Management Unit; and the Bill Williams River Uplands Management Unit.

The Bill Williams River basin is recognized statewide in Arizona for its wildlife species diversity. The presence of 250 species of birds, 48 mammal species, and 34 reptile and amphibian species has been documented in the basin. It was this very diversity that prompted the Service to acquire the present-day Bill Williams River NWR.

Because of a new national focus on neotropical birds, innovative perspectives and considerations in the annual funding picture for the Bill Williams River NWR will likely result.

HABITAT

Marshes -- Wetlands at the Bill Williams River NWR are associated with the Bill Williams River, Lake Havasu and the interacting water table in the river bottoms. The dominant wetland feature is the 285-acre cattail marsh at the delta. This nutrient-rich area supports a productive food chain that includes many species of fish and wildlife, including the endangered Yuma clapper rail. Two other types of wetlands are found in the river bottoms in modest proportions.

Four shallow ponds exist on the Refuge. Two of these ponds are 5 and 10 acres, respectively, and are semi-permanent, being dependent on high water table levels. Both support significant emergent vegetation but normally go completely dry from June through December. The other two ponds are about 4 and 2 acres in size, respectively, and seem to be permanent. Both of these ponds lack a shallow shoreline and have little in the way of emergent marsh vegetation. Other marsh wetlands found throughout the Bill Williams River bottoms consist of scattered pockets of cattail, sedge, smartweed, watercress, and other wetland plant species where the existence of eddies, backwaters, depressions, and beaver ponds allow their development. Although these types of wetlands are common throughout the riverine system where surface water is present, their existence is dynamic. Too little flow can cause portions of the River to go subsurface, drying up these wetlands. On the other hand, too much flow can destroy these wetlands through erosion and siltation.

Open Water Lakes -- A 500-acre portion of Lake Havasu is within the boundary of the Refuge. This is an area of plentiful submergent aquatic plants, and fish, freshwater clams, and crawfish attract a variety and abundance of wildlife. Very little vegetation, except some salt cedar and arrowweed, exists along the rock margin of the lake.

The portion of the lake included in the Refuge, all of the adjoining delta, and the navigable lowermost 2 miles of the Bill Williams River, are designated as a "no-wake/skiing/fires/camping" zone delineated by 18 regulatory buoys at the Refuge boundary in the lake. The speed restriction is enforced to maintain compatibility between boating use and refuge objectives.

Bill Williams River Channel -- The Bill Williams River flows are influenced by groundwater pumping at Planet Ranch (immediately east of the Refuge), releases from Alamo Dam, and Colorado River water levels. The marsh area in the delta provides habitat for marsh and water birds and roosting areas for ducks and geese. These areas of the Bill Williams River are subject

to no-wake zones to protect nesting areas for these birds as well as the endangered Yuma clapper rail. The river also provides habitat for various native and non-native species of fish and many mammals depend on the river for water.

Unconsolidated Streambed and Dry Washes Though a good portion of the Bill Williams River is a perennial stream, some of it is periodically dry. As in any river system, this type of habitat is subject to change in response to erosion and deposition, and the river bed itself shifts each year, depending upon flows.

Several dry washes on the Refuge support significantly more vegetation than the surrounding drier desert upland. Some authorities debate whether or not well-vegetated washes and brushland habitat should be classified as types of wetland habitat. As with other areas in the arid desert, the availability of water is the determining factor controlling the distribution of plant species at the Bill Williams River NWR. These washes are especially important in formulating hydrology and groundwater models that are currently being conducted for the Refuge.

Forests -- For wildlife, the riparian vegetation bordering the Bill Williams River is the most important feature of the Refuge. Prior to 1980, the Bill Williams River bottoms contained perhaps 1,500 acres of closed canopy cottonwood-willow gallery forest. Additional land was acquired in 1977 and 1981 so that additional native forest habitat could be included in the Refuge for protection and management. Sudden, catastrophic events in the past, such as fires, have been responsible for much of the loss of forest along the Bill Williams River. However, a slow, steady decline of native cottonwood and willow has been occurring since Alamo Dam was built in 1968. This loss has been due to a lack of water, prolonged inundation of the vegetation, and flood releases at the wrong time. The overall result is a lack of native vegetation regeneration and ensuing salt cedar invasion. This problem is compounded by excessive groundwater pumping at Planet Ranch.

Destabilization of stream courses by flash flooding is required for significant reproduction and recruitment in Fremont cottonwood. Large releases from Alamo Dam should be timed to occur just before and during the first part of seed dispersal of cottonwood and willow, with enough flow following dispersal to allow seedlings time to establish roots that reach the water table. Historically, cottonwoods begin seed dispersal around March of each year. If these conditions are not met, opportunities for the invasion of salt cedar increase, and the opportunities for cottonwood-willow recruitment may be lost (at that site) forever.

Although cottonwood and willow are dependent upon flash-flooding for successful reproduction, prolonged inundation during the growing season can be detrimental, as roots of riparian trees are unable to draw in soil nutrients or oxygen when inundated for a period of months. There is a shortage of information on exact lengths of time that cottonwood and willow can be inundated before mortality actually occurs, but many sources (published and professional consultations) mention a period of 1 or 2 months as a limit that should be adhered to in making mangement decisions.

Prolonged flooding from 1978 through 1980, caused by sustained large releases, killed most of the cottonwoods and many willows in the broadest remaining belt of native vegetation on the Refuge. Avian community structural changes occur in a mature floodplain forest after extensive flooding. Refuge records indicate that 99 percent of cottonwood and willow trees within a 120 *ha* plot died due to prolonged flooding during that time period. In addition to the loss of trees, the removal of the forest canopy acted as a catalyst for encroachment by salt cedar. Other areas which were flooded are now cattail marshes.

In addition to flooding, lightning-started fires have also destroyed much of the cottonwood and willow on the Refuge. These fires are largely fueled by a buildup of salt cedar debris, which periodic flooding would help eliminate.

Recently developed infrared photographs of acreage estimates for habitat types include 406 acres of mixed cottonwood-willow-salt cedar, 535 acres of mixed willow-salt cedar, and 570 acres choked with salt cedar. These estimates suggest that as much as 1,500 acres of cottonwood-willow habitat may have existed prior to flooding. Of course, the majority of the woody habitat itemized above could be characterized as brushland rather than riparian forest in its current state.

Good potential exists for a variety of salt cedar control and revegetation projects both in the river bottoms and in portions of fallow croplands. Existing obstacles include personnel and equipment shortages and the need to develop an effective means of irrigating seedlings or pole plantings. Water table monitoring and an effective soil analysis should also be undertaken prior to planting.

The survival of any revegetation as well as the remaining native vegetation is dependent on summer water releases from Alamo Dam adequate enough to maintain any native riparian vegetation that might be re-established. Periodic flooding is a critical factor in preventing fires from accumulated salt cedar. Flooding is needed to create new soil banks for seedling establishment, in addition to adequate summer releases for their survival.

Desert -- The driest habitat type is the desert upland. Scant rainfall combined with well-drained, sometimes steep slopes, puts the availability of moisture at a real premium for plants. Plant species able to grow in the desert upland must have special strategies, including a highly seasonal growth cycle, specialized root systems, and leaves to deal with hot weather and rainfall patterns that one ecologist described as "a perpetual drought mitigated by occasional periods of precipitation."

There are numerous plant species typical of the Sonoran and Mohave desert upland including honey and screwbean mesquite, palo verde, brittlebrush, creosote bush and ocotillo. Cacti, including saguaro, barrel, prickly pear, two species of cholla, and pincushion are common. The Refuge is the approximate northern range of saguaro cacti. Management priorities for this habitat include protection from the impacts of off-road vehicles. Cable and railroad rails are being used to barricade trails, and signs are being placed in strategic locations. Restoration of abused areas are planned in the future.

WILDLIFE

The presence of water and the large amount of wetland and riparian habitats make the Bill Williams River NWR an oasis within the surrounding desert environment. The Bill Williams River NWR wildlife inventory includes:

Endangered Species -- Federally listed endangered bird species associated with the Bill Williams River NWR include the bald eagle, Yuma clapper rail, peregrine falcon, and California brown pelican. Surveys for Yuma clapper rails are conducted annually. At least 15 birds were present in 1993. Populations of peregrine falcons elsewhere are now increasing following a nationwide decline in the early 1950s, and in the future, this species should again begin nesting on the cliffs along the lower Colorado River. Bald eagles have nested at Alamo Lake since 1987 and an immature was seen on the Refuge in the spring of 1993. Brown pelicans frequently show up in the area in the late summer and early fall and are usually immatures. The black rail is a Federal candidate species and has been recorded in the Bill Williams Delta, as have western least bitterns, a Federal candidate species. The southwestern subspecies of the willow flycatcher is proposed for Federal listing and has been sighted on the Refuge during migration.

There are still small, remnant populations of bonytail chub and razorback suckers in Lake Havasu. In February of 1993, 853 approximately 12-inch razorback suckers were released into the Bill Williams delta and there are plans to introduce more in the future. The fish are not released into the lake until they grow to a length which excludes them from predation by game fish. Netted off growout areas will be located in coves in Lake Havasu and the delta. There is currently one cove on the island in Lake Havasu City which has razorback suckers and the cove just to the north of the Refuge headquarters will soon be a growout area. Although the delta area is in the historical range of the Colorado squawfish, this species has been extirpated from the lower Colorado River.

State-Listed Species -- The California black rail is listed by California as threatened and by Arizona as endangered. The Southwestern willow flycatcher is listed endangered in California and Arizona. The Arizona Bell's vireo is listed by California as endangered and it was one of the most abundant birds to breed on the Refuge in 1993. Snowy egrets are listed in Arizona as threatened and great egrets have endangered status in Arizona. Both of these egrets are found on the Refuge. Once common along the river in large stands of cottonwood and willow, the yellow-billed cuckoo is now listed as endangered in California and threatened in Arizona. A 1989 survey indicated that more than 70 percent of the remaining population in the lower Colorado River Valley is found on the Bill Williams River NWR.

Waterfowl Species -- Canada geese in the area typically feed and loaf in the Planet Ranch, where the City of Scottsdale currently farms 2,300 acres of alfalfa. Most of these geese fly to the Bill Williams River Delta to roost for the night. Migrating flocks of mallards, gadwalls, northern pintails, green-winged teal, cinnamon/blue-winged teal, American widgeons, and northern shovelers are seen sporadically in the Delta and occasionally further up the river. Other ducks such as redheads, ring-necked ducks, lesser scaup, buffleheads, common goldeneye,

ruddys, and common mergansers frequent the Bill Williams River in greater numbers and are seen in the deeper parts of the Delta, Lake Havasu, and below Parker Dam.

Marsh and Waterbirds -- This variety of birds includes common loon, Clark's grebe, western grebe, pied-billed grebe, double crested cormorants, white pelicans, Yuma clapper rail, black rail, black-crowned night heron, Virginia and Sora rail, green-backed heron, great egret, snowy egret, white-faced ibis, common moorhen, and both the least and American bitterns.

Shorebirds (Gulls, Terns, and Allied Species) -- Species common to the area include ring-billed gull, Forster's, caspian and black terns, common snipe, killdeer, spotted sandpiper, long billed curlews, willets, American avocets, marbled godwit, lesser yellowlegs, dunlin, and western sandpiper.

Raptors -- In addition to the bald eagle and peregrine falcon, the Bill Williams/Planet Ranch basin is utilized by red-tailed, Cooper's, and sharp-shinned hawks, turkey vultures, great-horned, western screech, elf, and barn owls.

Other Migrant, Resident, and Wintering Avian Species -- Blue grosbeak, common yellowthroat, yellow-breasted chat, black phoebe, phainopepla, western kingbird, marsh wren, summer tanager, Lucy's warbler, yellow warbler, song sparrow, ash-throated flycatcher, brown-crested flycatcher and black-throated sparrow are known to breed on the Refuge. Many other species, such as northern (gilded) flicker, Gila and ladder-backed woodpecker, Townsend's and black-throated gray warbler, ruby-crowned kinglet, canyon, cactus, and rock wrens, and black-tailed gnatcatchers either breed here, migrate through or use the Refuge during winter. In 1989, an estimated 2,000 pairs of mourning doves and 250 pairs of white-winged doves were present during the nesting season, with an estimated 100 mourning doves over-wintering in the area, primarily at the Planet Ranch. Gambel's quail are very common on the Refuge and are found in uplands as well as riparian vegetation. A few Inca doves also occur throughout the year.

Mammals -- The most notable of the mammals in this area are beaver, mule deer, javelina, bighorn sheep, coyote, mountain lion, bobcat, black-tailed jackrabbit, cottontail rabbit, and raccoon. Several species of bats and rodents occur on the Refuge; many of them have Federal categories 1 and 2 listing status.

Fish -- Past surveys of the rivers and creeks above Alamo Lake (Santa Maria, Little Sandy and Burro Creek) determined that several native fish species were present. It is safe to assume that these fish occured historically in the lower reaches of the Bill Williams River as well. These include the speckled dace, desert sucker, flannelmouth sucker, longfin dace, and Gila sucker. The roundtail chub, longfin dace, and desert sucker have recently been reintroduced onto the Refuge with the hope that populations of them will become established.

Amphibians and Reptiles -- Typical of deserts, this is a numerous and diverse group of organisms. The presence of wetland areas provides a more varied habitat which increases the

species list even more. The lowland leopard frog (listed as a Federal candidate species) is on the edge of its range in the lower Colorado River valley. The Refuge is within the range of the Sonoran desert tortoise, spiny soft-shelled turtle, desert iguana, desert collared lizard, western whiptail, chuckwalla, and coachwhip. Four species of rattlesnakes, western diamondback, speckled, Mohave, and sidewinder can also be found on the Refuge.

Cibola NWR Habitat and Wildlife

Cibola NWR consists of five integrated Management Units: Arizona North, Hart Mine, Island, California, and the Cibola Lake Management Units.

Cibola NWR is the only Refuge on the lower Colorado River designated as having the fundamental purpose of mitigating the negative impacts of channelizing the Colorado River below Parker Dam in the Blythe, California, area. Its establishment was encouraged and recommended by the Lower Colorado River Land Use Plan in 1964.

Despite its recent establishment, the Cibola NWR has played an extremely important role as a test area for researchers, and a significant body of empirical scientific research has been conducted on or near the Refuge. The Cibola NWR habitat inventory contains a major revegetation site, which was part of an overall research project conducted by Robert Ohmart and Bertin Anderson. A second site, while not being on Refuge property, is very near the boundary.

These revegetated areas continue to offer researchers "a unique opportunity" to test predictions about which bird species should occur and what densities they should attain, based on habitat data.[77] The conclusions of this and future research will ultimately influence the achievement of a healthy and diverse ecosystem in the longterm.

HABITAT

Marshes -- Located within Hart Mine Management Unit, the Hart Mine Marsh Subunit is actually an extension of Cibola Lake, which lies to the south. At the time of channelization of the Colorado River, a levee was constructed between the main portion of Cibola Lake, thereby cutting off water for the upper portion. As a result, this area was left as a sump that would catch runoff from the mountains and drainage water from the nearby farm fields. The Hart Mine Marsh has proven to be important for egret and heron species. Mallard, cinammon and blue-winged teal, and wood ducks have been sighted in the flooded mesquite thickets.

Open Water Lakes -- Located within Cibola Lake Management Unit, Cibola Lake encompasses approximately 600 surface acres of water when it is held at its operation level of 212 msl. It, like so much of the Refuge, is manmade and has been negatively affected by channelization. Nevertheless, it serves as the Refuge's chief impoundment and can ideally support a variety of wildlife.

[77]Ibid., Rosenberg et al.

Although served by an electrical pump, water levels within the lake have been very difficult to maintain when the Colorado River is at its lowest elevation, which occurs during the November through January period when there are no downstream demands for irrigation water. During low water conditions, additional shoreline is exposed and shallow areas are provided for shorebird and dabbling duck species. On the other hand, fish and roosting Canada geese populations may suffer from increaseed predation since cover would be reduced and access to the roosting area increased.

Despite limited perches in the area, eagle and osprey occur on the lake. The Yuma clapper rail census typically indicates that many nesting birds use the lake.

An important resource for the Refuge is the Three Fingers Lake, located at the extreme south end of the California Management Unit. This approximately 145 acre natural depression will hold water through rainy periods but is dry most of the year. The BR has agreed to assist the Refuge in restoring the Three Fingers Lake which dried up after the Colorado River was channelized. Should the lake be completely restored, more than 300 acres of surrounding lands will be more capable of supporting cottonwood and willow revegetation efforts. An Environmental Assessment is currently being drafted regarding this project.

River Channel -- The Old River Channel lies between the Island and the California Management Units. The approximately 10-mile channel is a portion of the Colorado River left undisturbed after channelization was completed within Cibola and Palo Verde Valleys. The first mile of the channel is termed "Pretty Water," which refers to the clarity and stillness of the water. This is due to a sill across both ends which prevents direct mixing, thereby eliminating a great deal of sediment movement. The Palo Verde Irrigation District Outfall Drain enters the Refuge below Pretty Water and probably attributed to the development of the sill at that point. When the downstream demand for water declines, water levels declined throughout, making certain areas of the Old River Channel impassable to boats with motors. This is a benefit to all aquatic life.

The Old River Channel is considered the most important backwater within Cibola NWR. It is used by a large variety of wildlife species throughout the year. During the spring, the Pretty Water section and the Palo Verde Irrigation District Outfall Drain/Pretty Water junction serve as nesting sites for the endangered Yuma clapper rail. Other areas along the Old River Channel serve as nesting sites for herons, grebes, and some waterfowl. It also serves as a year-round fishing lake for ospreys, who manage to perch on the limited snags remaining along the channel. During the winter, its use is incomparable. Low water conditions provide excellent feeding and loafing sites for many species of marsh and waterbirds, shorebirds, and waterfowl. The low water levels increase movement flexibility of many mammalian species, especially mule deer.

The Colorado River Dry Cut channel also runs through the Refuge, and although it is primarily riprapped throughout, it does provide good habitat for sport fish.

Unconsolidated Streambed and Dry Washes -- Several washes meander onto the Refuge, and they support significantly more vegetation than the surrounding drier desert upland. Some authorities debate whether or not well-vegetated washes and brushland habitat should be classified as types of wetland habitat. As with other areas in the arid desert, the availability of water is the determining factor controlling the distribution of plant species at Cibola NWR.

Forests -- The Refuge forest consists of five major vegetation types: cottonwood-willow, honey mesquite, salt cedar, salt cedar-honey mesquite, and screw bean mesquite-salt cedar. From 1980 to 1990, the Refuge and the Palo Verde Valley experienced a noticeable reduction in cottonwood-willow habitat, and a corresponding explosion of monotypical salt cedar. As a result, notable migratory and resident bird species such as Arizona Bell's vireo, summer tanager, yellow-billed cuckoo, and nesting raptors such as red-tailed hawk and Harris' hawk have significantly declined.

In 1989, approximately 300 acres were cleared of salt cedar, which sprouted following two wildfires in 1986 and 1987. The work was done in conjunction with the soil analysis study conducted by the Revegetation and Wildlife Management Center. Plans entailed revegetating the area with native cottonwood and willow.

Croplands -- Cibola NWR has the following primary farm management subunits:

Farm Subunit One: Located in the Arizona North Management Unit near the headquarters and is approximately 1,200 acres in size. This subunit consists of approximately 960 acres of alfalfa and 200 acres of corn, milo, and rye. With the exception of the Canada Goose Drive, it is closed to entry.

Farm Subunit Two: Located in the Hart Mine Management Unit near the center of the Refuge, this subunit has suffered from severe alkalinity problems, and consists of bermuda grass. The area once contained non-native vegetation until high water tables inundated and destroyed these trees. Most of the salt cedar trees remaining after 1988 were cleared by the cooperative farmer. This subunit is open to the public and is used primarily for decoy goose hunting. Its locality provides maximum prey accessibility and is, strategically, one of the best Canada goose hunting areas within the western United States.

Farm Subunit Three: This subunit originally consisted of approximately 500 acres. After the floods of 1983, all farming ceased because of high water and high alkaline conditions. Recently, approximately 160 acres were reclaimed and are being farmed with milo, rye, and winter wheat. Located within the Island Management Unit of the Refuge, this subunit is not under a cooperative agreement.

WILDLIFE

Cibola NWR continues to play a central role in efforts to enhance and protect native resident, migratory, and wintering avian species. Surveys for resident and migratory avian species have been conducted for the past 3 years on the Refuge, and the area is famous for its abundant winter waterfowl and sandhill crane populations. Until very recently, yellow-billed cuckoos and summer tanagers frequented and bred in small cottonwood-willow stands on the Refuge. Nevertheless, a variety of amphibian, reptilian, avian, and mammalian species still thrive on the Refuge. The Cibola NWR wildlife inventory includes the following.

Endangered Species -- Six Federally listed endangered species are associated with the Cibola NWR: Brown pelican, bald eagle, Yuma clapper rail, peregrine falcon, and the Colorado River native fishes which include the razorback sucker and the bonytail chub. The Colorado squawfish has been extirpated from the lower Colorado River, but the Refuge is in its historical range.

State-Listed Avian Species -- A number of State-listed species are also found on the Refuge. The California black rail and the Southwestern willow flycatcher are listed by both the AGFD and the CDFG as endangered, and both are present in the Cibola and Palo Verde Valleys. The yellow-billed cuckoo is listed as endangered by the State of California and threatened by the State of Arizona. Until recently, this species was sighted frequently on Cibola NWR. Leading lower Colorado River riparian habitat authorities have used the attractability of this species as a gauge for revegetation success or failure. The Arizona Bell's vireo is listed by California as endangered. Snowy egrets are listed in Arizona as threatened and great egrets have endangered status in Arizona. Both of these egrets are common on the Refuge.

Waterfowl Species -- Since its establishment, Cibola NWR has become an important wintering area for Canada geese, northern pintail, mallard, American wigeon, green-winged teal, and gadwall. It should be noted that the Canada goose population peaks in December and January, which accounts for most of the Refuge's public use days during that time period. For example, the 1989 Annual Narrative indicates that in January of 1989, the population peaked at 24,500 and accounted for approximately 1,600,000 public use days.

Marsh, Water, and Wading Birds -- Cibola NWR supports a variety of marsh and water birds throughout the calendar year. The most abundant species occurred within the Old River Channel. This category includes: greater sandhill crane, white pelican, double crested cormorants, California black rail, Virginia rail, and Yuma clapper rail.

Shorebirds (Gulls, Terns, and Allied Species) -- Numerous shorebirds use the plowed agriculture fields, marsh, sandbars and, shoreline during migration. These include black-necked stilt, American avocet, willet, killdeer, long-billed dowitcher, and western and least sandpiper.

Raptors -- In addition to the bald eagle, the following raptors are part of the Cibola NWR wildlife inventory: osprey, northern harrier, Cooper's hawk, sharp-shinned hawk, Harris' hawk,

red-tailed hawk, American kestrel, elf owl, western screech-owl, turkey vulture, and western burrowing owl.

Other Migrant, Resident, and Wintering Avian Species -- The Southwestern willow flycatcher and the yellow-billed cuckoo represent two of the many migratory birds native to the Colorado River ecosystem. Migratory and resident birds in general are severely threatened by dwindling Arizona riparian habitat. Because these birds are associated with native cottonwood and willow forests, revegetation efforts at Cibola NWR are of extreme importance.

Other species found on the Refuge include gray flycatcher, vermillion flycatcher, summer tanager, Arizona Bell's vireo, black-tailed gnatcatcher, black phoebe, black-throated sparrow, and song sparrow. Mourning and white-winged dove, amid declining numbers, are two of the Refuge's most numerous species. Gambel's quail are also numerous on the Refuge.

Mammals -- There is a variety of mammals within or adjacent to the Refuge, including: Yuma puma, bobcat, ringtail cat, desert cottontail rabbit, black-tailed jackrabbit, several rodent species, and coyote.

Reptiles and Amphibians -- Not much is known of this category of species as no significant studies have been conducted. The Refuge does have populations of bullfrogs and toads, and it is speculated that the Sonoran desert tortoise may thrive in upland areas adjacent to the Refuge.

Imperial NWR Habitat and Wildlife

Imperial NWR consists of five management units: Martinez Lake and Riverbank, Martinez Marsh/Upland, Ferguson Lake and Shore, Backwater Riveredge, and Wilderness. The Refuge lies within the northern portion of the Sonoran Desert, and is very mountainous. It is bisected by 30 miles of the Colorado River. This section is one of the few remaining major unchannelized reaches of the River in the lower Colorado River Valley.

The Colorado River floodplain contains stratified vegetation communities. Open water areas within river backwaters support stands of sago pondweed and spiny naiad. Water edges are dominated by cattail, bulrush, and giant cane, while rushes and sedges can be found on slightly dries sites. Still higher, up to the limit of the River's influence, salt cedar, arrowweed, and mesquite dominate. A distinct line separates the river bottom vegetation from the upland desert. The only noticeable species crossing this line are arrowweed, salt bush, and mesquite, and even these penetrate the uplands only a short distance.

The upland desert vegetation on the Refuge is similar to that prevailing on surrounding terrain. In general, it is sparse in ground cover and variety. This is understandable since rainfall in the refuge area, 3 inches annually, is well below average for the Sonoran Desert. Creosote bush, bursage, brittle bush, palo verde, and ocotillo are the dominate plants of the low hills. Staghorn cholla and barrel cactus are present, but cacti do not occur in significant stands anywhere on the Refuge.

The uplands are cut by numerous washes. These washes are intermittent drainage channels varying in width from a few feet to several hundred yards. Some are shallow, while others are deep and steep-sided. Most are marked by an increase in size and variety of plants. Species such as catclaw, mesquite, ironwood, and smoke tree are almost totally restricted to the wash bottoms.

HABITAT

With the exception of the Wilderness Management Unit, all the management units at Imperial NWR contain various wetlands including shallow marshes, deep marshes, Martinez Lake, an extensive system of backwater lakes, the Colorado River channel, and various unconsolidated streambeds and seasonally flooded basins. Water levels in most wetlands on Imperial NWR fluctuate widely throughout the year, and are primarily dependent on Colorado River flows. Water management is regulated by the BR at the Parker Dam for releases and at Imperial Dam for diversion.

Maintenance and enhancement of wetland habitats on Imperial NWR is of critical importance to the goal of maintaining and enhancing biodiversity in the Area of Ecological Concern. Increasing salinity in wetlands no longer receiving direct Colorado River flows, due to high rates of evaporative water loss, has compromised productivity and decreased the functional value of these wetlands. In addition, the process of sedimentation and detrital accumulation followed by plant encroachment has and continues to convert wetland habitats to stands of non-native upland vegetation. Conversely, levels of selenium contamination in sediments, plants, and invertebrates have been found to be lower in backwater wetlands no longer receiving direct Colorado flows, as compared to wetlands directly connected to the River. Research aimed at developing water management strategies necessary to protect and restore wetlands and enhance wetland productivity without increasing contaminant loads is urgently needed.

The dominant vegetation type within the floodplain of the Colorado River is presently salt cedar. Native riparian gallery forests have been reduced to small remnant cottonwood and willow stands. Similar to the other lower Colorado River refuges, restoration of native riparian gallery forests following systematic site suitability analyses within the Colorado River floodplain is of critical importance to reverse the downward population trends of several wildlife species on Imperial NWR.

A major threat to existing native habitats and wildlife resources on Imperial NWR are human-caused wildfires, originating primarily from recreational activities on and along the Colorado River. Encroachment of non-native plants, which provide few benefits for wildlife, follows these wildfires. Additional threats to resources associated with nonwildlife-oriented public use on and along the Colorado River and adjacent desert uplands include disturbance, bank erosion from watercraft wakes and vegetation trampling, desert habitat destruction from off-road vehicle activity, and littering and human waste disposal.

Marshes -- The shallow marsh areas total 1,000 acres and are situated within the Martinez Marsh/Upland Management Unit and the Ferguson Lake and Shore Management Unit. The areas are found in association with deep marshes and open water areas in the backwater portion of the river system. These marsh areas are dominated by bulrush, cattail, and giant cane. The endangered Yuma clapper rail and the California black rail use the shallow marsh areas for nesting and foraging. Waterfowl, wading birds, and shorebirds also use the shallow marsh areas extensively during the migration and wintering periods. The shallow marsh areas are actively protected through seasonal closures to public use. The 160-acre West Farm Moist Soil Management Subunit adjacent to the refuge headquarters (Martinez Lake and Riverbank Management Unit) is included in this category. Portions of this area have recently been managed using prescribed fire, mechanical manipulation, and water management to control salt cedar and giant cane and encourage native moist soil plants. Yuma clapper rails, California black rails, shorebirds including long-billed dowitchers, American avocets and black-necked stilts, and several species of wading birds and wintering migrating waterfowl have benefitted from these management activities.

Deep marshes are located primarily within the Backwater Riveredge Management Unit. Ferguson Lake and Shore Management Unit and the Martinez Lake and Riverbank Management Unit. The marshes are dominated by cattail and giant bulrush. Several species of marsh and waterbird utilize this habitat type including the Yuma clapper rail. Eared and pied-billed grebes, American coot, great blue heron, great egret, white pelican, double-crested cormorant, ruddy duck, and bufflehead also utilize this habitat type.

Open Water Lakes -- The habitat type includes the major backwater lakes along the River: Martinez Lake, Ferguson Lake, Clear Lake, Island Lake, Adobe Lake, and Draper Lake. With the exception of Martinez and Ferguson Lake all others are located within the Backwater Riveredge Management Unit of the Refuge. Aquatic plants found in the lakes include members of the following families: *Najas*, *Potamogeton*, *Scirpus*, *Ceratophyllum*, *Utricularia*, and *Myrophyllum*. Most marsh and waterbird species found on Imperial NWR utilize this habitat type, including Yuma clapper rails and California black rails. Unique to the open water lakes are western grebes, and several diving duck species including redhead, canvasbacks, and lesser scaup. Open water lakes are important foraging areas for osprey and bald eagle. All backwater lakes on Imperial NWR are designated no wake zones.

River Channel -- A total of 2,010 acres is found in the main channel of the Colorado River, primarily within the Backwater Riveredge Management Unit. The river channel is naturally contained within low level banks of current deposited silt and sand. During flood conditions, the river flows over the banks, freshening backwater lakes and marshes. During low flows the River recedes, exposing numerous sandbars which are extensively utilized by waterfowl, marsh and waterbirds, shorebirds, and wintering bald eagles.

Unconsolidated Streambeds and Dry Washes -- Approximately 1,800 acres of wetlands fall into this category. These areas are actively protected. The areas remain dry but seasonal flood conditions generally occur during late May through mid-September. The seasonally flooded

areas are dominated by stands of salt cedar and arrowweed. Wildlife use these areas more so than the drier upland deserts.

Forest -- There are 4,300 acres of this habitat on Imperial NWR. The areas consist of wooded wash bottoms and drainage ways and remnant stands of riparian forest. The washes provide both local and regional drainage during periods of high or sudden rainfall. Tree species found in the washes are microphyllous and include honey mesquite, ironwood, palo verde, and smoketree. Other plant species occupying the washes are cat claw acacia, burrobush, desertbloom, desert willow, chuparosa, and desert honeysuckle. As the washes approach the river edge, salt cedar and arrowweed begin to dominate. These riparian areas are the most diverse in the lower Colorado River Sonoran Zone. Gambel's quail, mule deer, fox, coyote, bobcat, jackrabbits, and cottontail rabbits are residents. Feral burros and horses also use the washes for food and cover. Management conducted in the washes consists of active habitat protection through a prohibition of off-road vehicle use.

Small remnant stands of Gooding's willow and Fremont cottonwood exist throughout the Colorado River floodplain on Imperial NWR. A wide variety of passerine species use these areas year round and during migrations.

Desert -- Sonoran desert habitat comprises 17,850 acres on Imperial NWR. The dominant vegetation is defined as desert scrub and is contained within the lower Colorado River Valley Subdivision of the Sonoran Desert. Approximately 9,220 acres in Arizona became designated Wilderness under the Arizona Wilderness Act of 1990. In California, two units totalling 5,836 acres of desert upland are proposed Wilderness. This area is currently being considered by Congress for Wilderness designation under the California Desert Protection Act. All upland desert habitat on the Refuge will be managed as the Wilderness Management Unit.

The dominant plant association in the desert uplands is creosote bush-white bursage. Other plant species found in the desert are numerous ephemerals, eight species of cacti, and ocotillo. Management conducted on the desert areas consists of protection of desert habitat, primarily through a prohibition of off-road vehicle use.

WILDLIFE

The diversity of avian species on the Imperial NWR is greatest in the spring and fall when both water and land bird migrants are present. Two hundred and five bird species have been recorded on the Refuge since 1942. Resident wildlife indigenous to the Refuge include 29 mammalian species and 47 reptilian and amphibian species.

Endangered Species -- Four Federally endangered avian species are associated with Imperial NWR: brown pelican, Yuma clapper rail, bald eagle, and peregrine falcon. The Southwestern willow flycatcher has been proposed for listing as endangered. Three endangered Colorado River native fishes, the razorback sucker, the bonytail chub, and the Colorado squawfish, are believed extirpated within the Refuge portion of the Colorado River. That portion of the

Colorado River on Imperial NWR has recently been included in a proposal of critical habitat designation for the razorback sucker. In addition, several mammalian, avian, reptilian, and amphibian species are currently listed as Federal candidate species.

State-Listed Species -- Several State-listed avian species are found on Imperial NWR, including but not limited to the following: 1) the California black rail is listed by both the AGFD and the CDFG as endangered; 2) the Arizona Bell's vireo is listed by California as endangered; 3) snowy egrets are listed in Arizona as threatened; and 4) great egrets have endangered status in Arizona. In addition, several mammalian, reptilian, and amphibian species occurring on the Refuge are State-listed as endangered, threatened, or species of special concern.

Waterfowl -- Imperial NWR serves the Area of Ecological Concern as a wintering area and migrational habitat for Canada geese, snow geese, white-fronted geese, northern pintail, mallard, American wigeon, cinnamon and green-wing teal, gadwall, northern shoveler, common goldeneye, bufflehead, ruddy duck, redhead, lesser scaup and canvasback.

Marsh and Waterbirds -- The significant number of backwater wetlands at Imperial NWR support a variety of marsh and waterbirds throughout the year. This category includes: greater sandhill crane; double-crested cormorant; white pelican; California black, Virginia, and Yuma clapper rail; great and snowy egret; great blue, black-crowned night, and green-backed heron; American and least bittern; and western, pied-billed, and eared grebes.

Shorebirds (Gulls, Terns, and Allied Species) -- These groupings include killdeer, long-billed dowitcher, long-billed curlew, white-faced ibis, wood stork, ring-billed gull, Caspian tern, Forster's tern, American avocet, black-necked stilt, willet, western sandpiper, and least sandpiper.

Raptors -- In addition to the bald eagle and peregrine falcon, the following raptors are part of the Imperial NWR wildlife inventory: osprey, northern harrier, Cooper's hawk, sharp-shinned hawk, Harris' hawk, red-tailed hawk, prairie falcon, American kestrel, elf owl, western screech-owl, turkey vulture, and burrowing owl.

Other Migrant, Resident, and Wintering Avian Species - As with the other lower Colorado River Refuges, migratory and resident avian species are a critical element to the wildlife inventory at Imperial NWR. These species include: yellow-billed cuckoo, northern gilded flicker, Gila woodpecker, Sonoran yellow warbler, brown-crested, vermillion, and ash-throated flycatcher, black phoebe, summer tanager, yellow-breasted chat, blue grosbeak and Abert's towhee. Gambel's quail are very abundant and mourning and white-winged dove, amid declining numbers, remain plentiful at Imperial NWR.

Mammals -- There is a variety of mammals within or adjacent to the Refuge including desert bighorn sheep, mule deer, Yuma puma, bobcat, ringtail cat, desert cottontail rabbit, beaver, muskrat, feral burro and horse, and coyote.

Fish -- Waters of the Colorado River and associated backwaters support a variety of warmwater fish. Twenty-three introduced species occur in the River or in adjacent backwater lakes. There are no known extant populations of razorback suckers, Colorado River squawfish, or bonytail chub on the Imperial NWR.

Reptiles and Amphibians -- Typical of deserts, this is a numerous and diverse group of organisms on the Refuge. The presence of wetlands provides more habitat diversity and adds to the species list for this group. The lowland leopard frog, a Federal Candidate Category 2 species, is on the edge of its range in the lower Colorado River Valley. The Refuge is within the range of the Sonoran desert tortoise, spiny softshelled turtle, desert iguana, desert collared lizard, western whiptail, chuckwalla, rosy boa, and coachwhip. Four species of rattlesnakes are also found on the Refuge: western diamondback, speckled, and Mohave rattlesnakes and sidewinder.

4. WATER RIGHTS INVENTORY

The following is an inventory of the current water rights situation at each national wildlife refuge within the Area of Ecological Concern.

Water rights for use of Colorado River water were granted in the 1964 Supreme Court Decree in *Arizona v. California* (Decree), and by Secretarial reservation. These waters are regulated and managed by the BR. In the case of the Bill Williams River, which is a tributary of the Colorado River, water rights are granted by the State of Arizona.[78]

Havasu NWR

Havasu NWR has an entitlement in annual quantities reasonably necessary to fulfill the purposes of the Refuge, not to exceed 41,839 acre-feet of water diverted from the mainstream or 37,339 acre-feet of consumptive use of mainstream water, whichever is less. The priority date for this entitlement is January 22, 1941, for lands reserved by the Executive Order 8647, and a priority date of February 11, 1949, for lands reserved by Public Land Order 559.

Bill Williams River NWR

The Service currently holds three Certificates of Water Rights at the Bill Williams River NWR, allotting a total of 1,110 acre-feet per year. These certificates are allotted by the State of Arizona. Releases from Alamo Dam are regulated and scheduled by the Army Corps of Engineers in consultation with the Service.

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[78] The *Colorado River Compact* apportions water between the Upper and Lower Basins. The apportionment among the Lower Basin States was addressed in the Boulder Canyon Project Act, and confirmed by the *Arizona v. California* decree. A Supreme Court decision, the decree also rendered control of River tributary waters to the states. This decision allowed Arizona to allocate and control water rights from the Gila River and other tributaries of the Colorado River while prompting the development of the Central Arizona Project where waters from the River channel could be diverted to meet the *Colorado River Compact* allotment for Arizona.

Cibola NWR

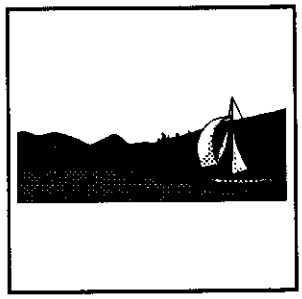
The water entitlement for Cibola was established by a Secretarial reservation in the Federal Register on December 8, 1982, as follows: "Consistent with the February 9, 1944, contract between the United States and the State of Arizona, notice is given that the following amount of Colorado River water is reserved for the United States for use on the Cibola National Wildlife Refuge in Arizona: (1) The diversion of 27,000 acre-feet annually from the mainstream or the consumptive use of 16,793 acre-feet annually from the mainstream, which ever is less, with a priority date of August 21, 1964."

Imperial NWR

The Imperial NWR has an entitlement in annual quantities reasonably necessary to fulfill the purposes of the Refuge not to exceed 28,000 acre-feet of water diverted from the mainstream or 23,000 acre-feet consumptive use of mainstream water, whichever is less, with a priority date of February 14, 1941.

UNIT 4 -- PUBLIC USE INVENTORY

The following inventories detail the baseline activities of the Service regarding public and allowable uses of the national wildlife refuges within the Area of Ecological Concern. The base year of activities used for this plan was 1989.



1. HAVASU NWR

General

The pattern of public visits to the Refuge has been consistent throughout its history. Winter visitors come to the area from October to March to escape the cold winters of other areas in the United States and Canada. During the summer, vacationers and weekenders come for fun on the Colorado River. Both seasonal public use and resident population of the area is expected to increase well into the planning horizon.

According to records, estimates indicated there were 566,354 visitors to the Refuge area in 1989, and approximately 2,029,860 activity hours were involved in various public uses over that year. More recent years show an upward trend line in the number of activity hours on the Refuge. It is acknowledged, however, that a vast majority of those visiting the Colorado River area are interested in water-based recreation on the River.

Interpretation

Wildlife Trails -- Havasu NWR has no wildlife trails.

Wildlife Tour Routes -- Private contractors conduct Colorado River canoe tours through the Topock Gorge. Interpretive materials are provided in advance at the Refuge headquarters in Needles, California. Leaflet dispensers located at entry points on the Refuge also provide a source for interpretive materials.

In addition, under special use permit, private contractors offer land tours within the northern portion of the designated wilderness area. Tour guides reach the wilderness area using four wheel drive vehicles, but travel only on existing backroads outside the designated wilderness. Within the wilderness area, guides continue on foot.

Visitor Center -- Havasu NWR has no visitor center on site.

Visitor Contact Station -- Havasu NWR has no visitor contact station.

Staff-Conducted Activities -- Presentations, talks, slide shows, and tours are given to groups on request.

Educational Services

Havasu NWR has been accessible to teachers of local school districts for the provision of wildlife educational tours.

Wildlife-Oriented Recreation

Hunting --

Migratory Birds -- The waterfowl hunting program at Havasu NWR consists of open hunting on Topock Marsh and limited reservation hunting in the Pintail Slough Management Subunit. Typically, the duck and goose hunting reservations at Pintail Sough fill quickly.

In 1988, a new regulation was implemented by the Department of the Interior because of declining duck populations across North America. The rule called for a change in shooting hours and the purpose was to reduce hunting pressure.

Other Game -- Hunting for dove, quail, and rabbit occurs on the Refuge and adjacent lands to the north of Lake Havasu City.

Fishing/Warm Water -- The demand on Havasu NWR by fishermen has been considerable; between 1989 and 1992 anglers averaged approximately 500,000 hours. Catfish, largemouth bass, and crappie fishing in Topock Marsh accounted for about one third of the total use, while striped bass, catfish, largemouth bass, and trout fishing in the Colorado River accounted for two thirds. More recent years indicate slight drops in fishing use at Topock Marsh because of water quality difficulties in the Topock Marsh Management Unit. Anglers also complain that sport boating and jet skiing conflicts with sport fishing in the main channel.

In addition, many bass tournaments are held on Havasu NWR. Most are administered from marinas on Lake Havasu just south of the Refuge boundary, and the Arizona Department of Game and Fish requires and issues permits for all fishing tournaments. Many of the tournament fishermen use the Topock Gorge Management Unit as their primary fishing ground.

Wildlife Observation -- The Refuge does provide observation tower/platforms, and will allow vehicle access on some parts of the Refuge by permit only. Other observational uses include photography and special activities such as retriever field trials.

Nonwildlife Oriented Recreation

Camping -- Camping is only permitted at the Five Mile Landing Concession. This concession is operating on a lease agreement with the Service. The lease terminates on July 31, 2006. During the term of this lease, the area described by the lease is zoned for use as a concession. Uses are limited to those specified in the lease agreement and allow for overnight camping and

the parking of campers and trailers meeting the standards as described in the lease agreement. The use by the concessionaire is monitored to ensure that uses are as provided in the contract and that no such uses are in conflict with the Refuge's operational programs.[79]

Swimming/Boating/Water Skiing -- Thousands of vacationers and weekenders come to recreate on the Refuge during the summer. Popular activities include swimming, speed boating, water skiing, jet skiing, canoeing, tubing, and sun bathing.

This kind of use is intensive during the summer weekdays, increases dramatically on the weekends, and skyrockets over the major holiday weekends, especially Memorial and Labor Day weekends. Since 1989, almost 1 million activity hours have been tabulated annually for this type of recreation. Of special concern is the fact that several species of marsh and waterbirds nest at this time of the year, including the endangered Yuma clapper rail. No-wake restrictions have been imposed in Topock Gorge backwaters to protect these species. Jet skis are specifically prohibited from entering into the Topock Gorge backwaters. Water skiing is prohibited on the full length of the Topock Gorge Management Unit.

Off-Road Vehicles -- Off-road vehicle travel is not permitted on the Refuge; however, this activity, as an illegal trespass, is reported to be a considerable problem for Refuge management. Most desert washes show evidence of vehicle travel. Repairs to fences and cable barriers are expensive and time consuming. Enforcement of off-road regulations is difficult due to the assignment of limited resources to other priorities set by the Refuge manager.

Tour Boats -- Commercial tour boat services are available to shuttle passengers from Lake Havasu City through the Refuge to the casinos in Laughlin, Nevada.

Law Enforcement

Havasu NWR receives a large amount of public use year round and as a result, requires a significant level of law enforcement. Because a large portion of the public use is nonwildlife-oriented, the mission to protect wildlife resources is complicated. Law enforcement patrols are conducted frequently but within the limitations of budget, staffing, and other priorities. The most dramatic increase in numbers of citations issued occurred between the years 1988 and 1989 without increases in enforcement efforts. Prior years showed a more stable trend of only slight year-to-year increases.

[79]Please refer to page 33 for description of land status.

2. BILL WILLIAMS RIVER NWR

General

Public use and recreation of the Bill Williams River NWR consists of two basic types: boating visits at the lake and delta and vehicular visits on Planet Ranch Road. A small amount of pedestrian visits also occur with access via Planet Ranch Road and Arizona Highway 95. Additionally since 1989, an average of 6,000 people use the portion of Highway 95 that crosses the Refuge.

The delta and adjoining lake is delineated as a "No Wake, No Skiing, No Fires, No Camping" zone to protect the considerable wildlife values there.

Interpretation

Wildlife Trails -- There are no formally established wildlife trails on the Refuge.

Wildlife Tour Routes -- Privately contracted land tours are offered under special use permit.

Visitor Center -- There is no visitor center on the Refuge. Visitors seeking information about the Bill Williams River NWR can contact staff at the office on Highway 95 near Parker Dam.

Visitor Contact Station -- A visitor contact station exists adjacent to Highway 95 near Parker Dam. This station also serves as a Service Fisheries Assistance Office.

Staff Conducted Activities -- Presentations, talks, slide shows, and tours are given by Refuge staff to groups on request.

Educational Services

The Bill Williams River NWR has been accessible to teachers of local school districts for the provision of wildlife educational tours.

Wildlife-Oriented Recreation

Hunting -- Hunting at the Bill Williams includes dove, quail, and cottontail rabbit by shotgun only. Non-toxic shot is the only legal ammunition allowed.

The Bill Williams River NWR has the largest remaining breeding population of western yellow-billed cuckoos along the lower Colorado River. In addition, it is home to Bell's vireo and willow flycatcher--two other species in decline in the western United States. During the breeding and nesting period (March through August), this riparian area needs to be protected from disturbance; therefore, the cottontail rabbit hunting season is closed during this period.

Cottontail rabbit hunting is held in conjunction with the dove and quail hunting seasons (September through mid-February).

The Refuge consists of a narrow corridor of riparian habitat along the Bill Williams River, which is crucial to the survival of several neotropical migratory bird species that are disappearing throughout the lower Colorado River area. Protection from disturbance and habitat degradation is a primary concern on the Refuge. Vegetation along the River is thick and almost impenetrable at times, which makes it difficult to hunt and retrieve game without the aid of a dog. There is no legal vehicular access on the north side of the River. In view of these conditions, hunting is confined to the south side of the road to the south boundary of the Refuge. Administratively, this will provide a more efficient means of enforcement of refuge regulations and will afford some protection for habitat and wildlife.

Fishing/Warm Water -- Fishing is a very popular pastime on the lake and at the delta. Anglers fish for largemouth and striped bass, as well as channel and flathead catfish. Due to insufficient water depth and lack of navigability, almost no fishing takes place above the delta in the river.

Fishing and other types of boat-based recreation at the delta and adjoining lake can present conflicts with wildlife objectives. The sheer volume of boats in the area can displace wildlife, especially migratory birds, despite the no-wake status of the area.

Wildlife Observation -- The Bill Williams River NWR is visited by a few bird watching groups throughout the year and by some residents from Parker and Havasu and winter visitors who venture out onto the Refuge to experience wildlife and take in the scenic wildlands. Other observational uses include photography and special wildlife and habitat research.

Nonwildlife-Oriented Recreation

Swimming/Boating/Waterskiing -- While swimming and boating occur in the delta, the Refuge has established a no-wake zone to prohibit disturbance of the nesting areas for the marsh and waterbird species. Water skiing and jet skiing are not allowed.

Off-Road Vehicles -- Off-road vehicle travel is not allowed on the Bill Williams River NWR. This kind of activity, frequently in combination with vandalism, has been a persistent problem. Signing and barricading do not appear to deter many of the more determined violators who are seldom caught due to the large land area involved.

3. CIBOLA NWR

General

Cibola NWR has had the most complex migratory waterfowl recreational hunting and fishing programs of all the lower Colorado River national wildlife refuges. The Refuge has an approved "hunt plan" for waterfowl species in cooperation with the CDFG for the California side of the Refuge and the AGFD for the Arizona side of the Refuge. In addition, the Refuge has a notable amount of use by sport fishermen.

Interpretation

Wildlife Trails -- Cibola NWR has no wildlife foot trails.

Wildlife Tour Routes -- The Canada Goose Drive is the only tour loop on Cibola NWR. Constructed in a restricted area of the Refuge, it allows visitors to view large concentrations of birds within a small area. Visitors must check in at the Refuge headquarters before using the tour loop. According to the records, the Thanksgiving and Christmas holidays have traditionally represented the peak visitation period.

Visitor Center -- Cibola NWR has a headquarters office and small interpretive center on-site. This office center was enhanced in 1993 to include a new interpretive wing. The interpretive area has several areas designed for interpretive displays and exhibits.

Visitor Contact Station -- Cibola NWR's headquarters on the Refuge serves as a contact station for the issuance of permits and for the distribution of information and leaflets. The headquarters has an exhibit and interpretive area. Plans are currently being developed to expand the existing building to accomodate an interpretive area and visitor information area.

Staff Conducted Activities -- Cibola NWR conducts presentations to school groups, organizations and other government agencies upon request.

Educational Services

Cibola NWR has been accessible to local teachers and local school districts for the provision of wildlife educational tours.

Wildlife Oriented Recreation

Hunting -- The hunting of geese is permitted under Federal guidelines. The "decoy only" fields include the Old River Channel, Pretty Water, and open woodland areas. Hunting has been permitted by a lottery system in the decoy fields (Farm Unit 2).

The trend over ten years indicates a sharp increase in the number of hunting visits for geese.

Duck hunting has been confined to the Old River Channel and wetlands within the Island Management Unit. Hunting is permitted on a first-come basis with no advance registration. Refuge officers and hunt coordinators record hunter numbers and harvest data. The trend over 10 years indicates a general decrease in the number of visits for ducks. This decrease should not infer changes in hunter preference. Although the cause of these trends has not been studied formally, it is speculated that changes in Colorado River flows affect resource availability.

In September of each year, dove hunting season opens. With no large fields of grain, the hunting has been somewhat limited. From 1980 through 1983, the Refuge experienced a dramatic drop in the number of visits for doves. From 1983 through 1992, the number of visits leveled off. Adjacent fields off-refuge provide most of the recreation for dove hunting.

Fishing/Warm Water -- Refuge records indicate overall declines in the angler days on the Refuge. The water level within the Colorado River has been fluctuating at such a pace that it has been virtually impossible to maintain adequate water levels within critical fishery habitat areas including Cibola Lake and the Old River Channel.

The Refuge has provided for a growing interest in fishery opportunities for the general public. This interest has led to a series of fishing tournaments sponsored throughout the Colorado River with the Old River Channel receiving more than its share of heavy traffic.

Cibola Lake serves as one of the Refuge's chief fishing areas for largemouth bass. The lake opens annually at sunrise on March 15 and closes the day following Labor Day. This closure is necessary for the protection of migratory birds.

Wildlife Observation -- A lack of tall trees limits use by passerine species, which in turn affects the amount of Refuge wildlife observation.

Nonwildlife-Oriented Recreation

Swimming/Boating/Water skiing -- The Refuge experiences modest use of the channelized portion of the Colorado River for water skiing, boating, and canoeing.

Off-Road Vehicles -- Cibola NWR is closed to off-road vehicles at all times.

Law Enforcement

Cibola NWR's law enforcement is directed toward the protection and safety of the natural resources and Refuge visitors.

Some type of law enforcement has been necessary on a year-round basis because of the variety of activities along the lower Colorado River. The area receiving the most attention in law enforcement has been hunting. Enforcement has been performed within the guidelines established by Service policy.

4. IMPERIAL NWR

General

Imperial NWR is similar to Havasu NWR in its public recreational visit profile. As in the case of Havasu NWR, temporary residents of the southwest region are present from October through March to escape the cold winters in the northern climates. Nonwildlife-oriented recreational use is extremely high, as in the case of Havasu NWR.

Interpretation

Wildlife Trails -- The Refuge has one maintained trail, "The Painted Desert Trail," which is interpreted by a brochure that corresponds to numbered posts along the trail. The majority of the trail use occurs during the cooler winter months.

Wildlife Tour Routes -- Automobile road access is available to Refuge backwater lakes and marshes for fishing access and to the Painted Desert Trail. However, there is no true auto-tour route on the Refuge.

Visitor Center -- Imperial NWR has a Visitor Center and Headquarters Complex which were constructed in the early 1980s. The facility has more than adequate room for larger groups of visitors; however, exhibitry in the Center is minimal.

Visitor Contact Station -- Information is available on hunting, fishing, access, and other visitor-related materials at the Visitor Center and Headquarters Complex.

Staff-Conducted Activities -- Staff conducts tours and special presentations upon request. The Refuge participates regularly in cooperative presentations with other government and sometimes nongovernment agencies.

Educational Services

Refuge management frequently gives presentations to local school groups. Since 1991, Student Conservation Association (SCA) Resource Assistants have provided additional interpretive and educational capabilities at Imperial NWR. Visits by school groups for interpretive tours and presentations and classroom outreach activities have increased significantly. SCA Resource Assistants are added to the staff from October through April.

Wildlife-Oriented Recreation

Hunting -- Over 75 percent of Imperial NWR is open to hunting of quail, waterfowl, dove, deer, and rabbit. Only about 10 percent of the Refuge is accessible by road, and the only other access is on foot or by boat. The Refuge experiences modest numbers of hunters, with the

majority pursuing waterfowl, dove, and quail. With Refuge concurrence, the AGFD issues permits for the hunting of deer and bighorn sheep in a larger State game management area which includes Imperial NWR.

Fishing/Warm Water -- Fishing is second only to recreational boating as the most popular activity on the Refuge and occurs during every month of the year. Species pursued are largemouth bass, catfish, striped bass, black crappie, and sunfish. A local fishing club, the Bass Masters of Yuma, Arizona, sponsors several bass tournaments in the area during the year. The tournaments in the area are normally catch and release.

Wildlife Observation -- Visits to Imperial NWR by bird enthusiasts continue to increase.

Nonwildlife-Oriented Recreation

Camping -- Camping is prohibited on the entire Refuge, and violations are a problem, especially on the high use holiday weekends. The Refuge has placed locally printed signs erected on wooden stakes on sandbars and beaches. According to Refuge staff, the posting of these inexpensively produced signs has been effective and most of the signs have lasted longer than expected.

Picnicking -- Picnicking generally occurs due to the fact that most boaters spend the entire day on the River. The Refuge does provide three tables at Meers Point and two tables at the headquarters, which receive a limited amount of use.

Swimming/Boating/Waterskiing -- Jet skis are becoming more common along the River. The machines are covered by boating laws (Arizona and California) though there are still some areas in need of consideration. Jet skis are generally operated by minors with no training and can be very dangerous, evidenced by fatalities that have occurred. Water skiing is prohibited in most of the main river channel. All backwater lakes and those portions of Martinez Lake and Ferguson Lake on the Refuge are designated no-wake zones.

Off-Road Vehicles -- Use of off-road vehicles is prohibited. Nevertheless, off-road vehicle use, including encroachment into designated Wilderness, continues to negatively impact fragile upland desert habitats.

Other Nonwildlife Oriented Recreation -- Non-motorized float trips occur on the main river channel. This low impact boating takes place throughout the year, with most activity occurring from September through December when conflicts with power boat use are less and weather is most favorable. Six to eight groups usually travel the River each month. Most of the trips begin at Walter's Camp and end at Martinez Lake or Imperial Oasis.

Law Enforcement

The major part of the refuge law enforcement effort occurs during the April through September high use season and mainly on the Colorado River. Special refuge regulations have been established for the Colorado River, and are enforced in conformance to both Arizona and California boating and fishing laws. The center of the river channel is also the boundary between the states. The enforcement effort on Imperial is supported by cooperation with the Yuma County Sheriff's Office from Arizona, the Imperial County Sheriff's Office from California, the AGFD, and the CDFG. Significant law enforcement efforts are also directed towards implementing non-toxic shot requirements for small game and waterfowl hunting during fall seasons and to reduce off-road vehicle activity yearround.

UNIT 5 -- ADMINISTRATION, PERSONNEL, AND FUNDING RESOURCES

This section seeks to briefly summarize the current administrative, staffing, and funding resources available to the lower Colorado River national wildlife refuges prior to any proposed organizational changes being completed.

Neither this comprehensive management plan document nor this section attempts to do a comparative or a trend analysis of funding and staffing since the Service has already recognized the refuges' inadequacies in these areas. Although cursory budget and staffing histories indicate that where budgets have risen and staffs have dropped, costs have also risen, resulting in little to no net gains over the previous year's budgeted allocation.

It should be noted that PART II, Unit 1, Section 11 describes the action the Service is implementing to set the stage for the lower Colorado River refuges to compete more strongly for Regional and national funding.

General Funding and Budget Allocations

Each of the lower Colorado River national wildlife refuges submits separate annual budget requests to the Regional Office, based on ongoing informal needs assessments relative to refuge programs. The Region begins preparation of budget submittals to Washington 3 years in advance. This is a complex process consisting of formal and informal dialogue between the Regional Office and the refuge managers. This communication results in several revisions of the proposed budgets throughout the 3-year budget planning cycle. For example, during Fiscal Year (FY) 1992, the budget for FY 1994 was in the first stages of being developed.

Only in recent years has the Service competed favorably for scarce government dollars on the national scale. Basic programs have seen modest increases, with 1992 having a 15 percent overall budgetary increase, the highest percentage increase in the Service's history. Nevertheless, after taking into account cost increases in operations, that percentage translates into nominal dollars and the net effect is minimal. Each of the nine regions compete for the dollars allocated to the Service that are not already earmarked for special purposes. Ultimately, it is the final annual allocation of dollars that influences staffing, operations, maintenance, and special projects.

Region 2 currently allocates refuge budgets into 3 basic line item categories: Refuge Operations and Maintenance, Law Enforcement Operations, and Migratory Bird Management. In addition to these there are several wide-scale programs, such as Fire Management and Contaminants, with a separate general funding allocation. Fire Management and Contaminants funding is eventually integrated into the Refuge Operations and Maintenance category. It should also be noted that special funding categories impacting refuges are the Land Acquisition and Migratory Bird Conservation Act line items.

It is the mix of these annual allocations which catalyze the day-to-day management of refuge programs. For instance, lack of a kind of tractor might hamper accomplishment of a set of tasks. Lack of a refuge biologist might hamper a refuge's attempt to improve habitat for wildlife. In the past, refuges have had to improvise to get the ultimate job done, sometimes with great success and sometimes with minimal success.

Recent administrative technical innovations are expected to improve the budgeting process through the use of financial information and need assessment data bases. Projects like the Refuge Operations Needs System (RONS), Refuge Management Information System (RMIS), and Maintenance Management System (MMS) have been designed to ultimately simplify the budget request process and allow the Service to better prioritize allocations.

Lower Colorado River Refuge Administrative Resources

Havasu NWR

Havasu NWR's staffing consists of: Refuge Manager, Assistant Refuge Manager, Office Assistant, Engineering Equipment Operator, and two Maintenance Workers. In 1980, the staff consisted of eleven. This count included an Assistant Refuge Manager at the former Bill Williams Unit which has since been redesignated as a national wildlife refuge. By 1989, the staff had decreased to eight Full-Time Equivalent staff.

Public input through correspondence and public meetings indicates that staffing and funding resources have not adequately addressed law enforcement, public outreach, and habitat enhancement problems.

Bill Williams River NWR

Bill Williams River NWR was formerly the Bill Williams Unit of Havasu NWR. Through 1994 the Refuge staff consists of one Assistant Refuge Manager. Staff presently consists of a refuge manager, wildlife biologist, and an office assistant.

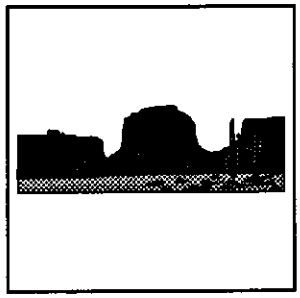
Cibola NWR

Cibola NWR's staffing includes: Refuge Manager, Assistant Refuge Manager, Park Ranger, Office Assistant, Engineering Equipment Operator, and Maintenance Worker. Since 1985, staffing has only increased by one position, the Park Ranger, who is assigned to staff the Refuge hunting and fishing programs. Recent Refuge Program Reviews have indicated that Cibola is in great need of equipment repair and replacement. These needs have been identified in the Refuge's MMS requests.

Imperial NWR

Imperial NWR's staff consists of: Refuge Manager, Assistant Refuge Manager, Refuge Biologist, Office Assistant, Equipment Maintenance Operator, and Maintenance Worker. Also detailed on a part time basis are four Fire Suppression Technicians. The Refuge Manager has utilized, for a nominal fee, trustees from the Yuma County Jail for maintenance projects as needed.

PART II: ANALYSIS



Havasu, Bill Williams River, Cibola, and Imperial NWRs each make individual, unique, and significant contributions to the Area of Ecological Concern by perpetuating natural resource values.

The effectiveness of these individual refuge contributions is strengthened through coordinated and consistent management action. In order to manage resources consistently and efficiently, both the scientific elements of the resource (i.e., biological/natural resource factors) and the policy elements of managing the resource (i.e., overall policy concerns) must be considered in the planning process. Consideration of both results in coordinated management of the refuges, assuring a mix of natural resource gains for wildlife and plant communities throughout the Area of Ecological Concern.

This part of the lower Colorado River national wildlife refuges planning process analyzes the existing information base including Service policy issues, management direction, wildlife and habitat resource data, and public use or recreational resource data. Unit 1 discusses 11 of the most important policy concerns while Unit 2 details informal analyses of the primary refuge endangered species, in addition to analyses of population trends for the major groupings of avian species that use the refuges. The combination of topics from both units of this document addresses the 17 issues delineated in Part I. Arising out of these analyses is the set of refuge objectives detailed in Part III.

Refuge-specific scientific data was scarce in the case of wildlife and habitat information, except in the case of waterfowl and Yuma clapper rail data. In most cases, the inventory of wildlife and habitat resources was the refuge manager's best estimate of the current status. As a result, objectives have been developed in this plan which call for the determination of scientific research data needs related to land and aquatic ecosystems for each of the lower Colorado River refuges.[80]

The policy and issues analysis is informal and is intended to describe the basic circumstances. These circumstances were considered relative to their relationship to the current and future management of the lower Colorado River national wildlife refuges.

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[80]See Issue/Goal #1: Biological Diversity and Habitat Management, Objectives 1-3.

UNIT 1 -- MANAGEMENT DIRECTION, AND POLICY ISSUES

Several major policy issues and concerns have surfaced as a result of this comprehensive management planning process. These concerns are common to all four refuges and other jurisdictions in the Area of Ecological Concern. Although the following are not policy analyses in the strictest sense, they attempt to summarize the policy concerns and associated problems, and to suggest possible avenues for resolution. The goals and objectives delineated in Part III of this document are an attempt to address the problems and opportunities addressed in this informal analysis. Resolution of these problems will determine the long-term impact of this comprehensive management planning approach, as well as its effectiveness in actual implementation of this comprehensive management plan.

The policy concerns addressed in this section include:

(1) Coordination of Activities Within the Area of Ecological Concern
(2) Native American Governments
(3) Land Ownership and Jurisdictions
(4) Water Rights
(5) Water Management
(6) Water Quality, Contaminants, and Human Waste
(7) Wetlands Policy Issues
(8) Biological Diversity
(9) Compatibility, Refuge Programs, and Allowable Uses
(10) Public Outreach and Education
(11) Organizational Structure and Administration

1. COORDINATION OF ACTIVITIES WITHIN THE AREA OF ECOLOGICAL CONCERN

Currently there are numerous agencies and jurisdictions with natural resource management responsibilities along the lower Colorado River. These agencies and jurisdictions have effected numerous working relationships, both formal and informal, to accomplish their individual and joint responsibilities and missions. Since 1930, there have been a multitude of activities in the Area of Ecological Concern, which represents individual governmental jurisdictions' respective attempts to lessen conflicting actions affecting the River and their missions. Coordination of these activities by agencies is proposed and approached on an activity-by-activity basis. The resulting web of government sponsored activities along the River has not been addressed in a cumulative sense since the publication of the *Lower Colorado River Land Use Plan of 1964.* Even the extensively coordinated efforts by these agencies have been for the most part related to specific projects.

Recognizing this, the Regional Directors of the Federal agencies on the lower Colorado River designated an interagency working group in 1991. The Directors saw a need to review present coordination efforts and existing opportunities for improving the working relationships, while taking into account the varied array of agency missions and purposes. The Regional Directors also recognized that this need applies to non-Federal jurisdictions such as the AGFD, the CDFG, and the Native American tribes. The wide array of land ownership and jurisdiction along the Area of Ecological Concern presents the continuing probability that a lack of coordination would produce the kind of decisions that could be harmful to the natural resources. This prospect prompts all the jurisdictions to consider improving working relationships in general.[81] The Service's policy will be to attempt to play a significant role in changing the approach by being a strong advocate of coordinated natural resource decision-making. This document will serve as a starting point for the attainment of improved coordination if only between agencies of the Federal government.[82]

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[81]Major jurisdictions include the following: Federal Agencies. The Service; BR; BLM; Department of Defense (including Army Corps of Engineers). State Agencies. State of Nevada; Arizona State Land Department; AGFD; Arizona State Parks Department; State of California; CDFG; California Department of Parks and Recreation. Indian Tribal Governments. Fort Mojave Indian Tribe; Cocopah Indian Tribe; Colorado River Indian Tribe; Chemehuevi Indian Tribe. Counties and Cities. Clark County, Nevada; Mohave County, Arizona; La Paz County, Arizona; Yuma County, Arizona; San Bernardino County, California; Riverside County, California; Imperial County, California; City of Laughlin, Nevada; Bullhead City, Arizona; Lake Havasu City, Arizona; Village of Parker, Arizona; City of Yuma, Arizona; City of Blythe, California; City of Needles, California. Irrigation Districts. Cibola Valley Irrigation District, Arizona; Palo Verde Irrigation District, California; Imperial Irrigation District, California; California Metropolitan Water District; Mohave Valley Irrigation and Drainage District. Private Land Owners.

[82]It should be noted that in 1971, the Lower Colorado River Management Program Coordinating Committee was formed. This group is a Federal-State coordinating committee for matters related to the River Management Program. It is comprised of the heads of the Colorado River Board of California, CDFG, California Department of Water Resources, the Arizona State Water Engineer, AGFD, the Regional Director of the lower Colorado Region of the BR, Colorado River Commission of Nevada, and the Directors of the BLM, the Bureau of Indian Affairs, and the Service. This committee handles policy matters and final decisions on involved matters. The bulk of the coordinating work is handled by staff representatives of the member agencies who comprise the Lower Colorado River Work Group. The work group meets three times a year, and is convened at other times if necessary. This work group is the central locus for coordination. As presently constituted, only Federal and State agencies qualify for membership on the coordinating committee and its work group. Provisions are made for representation by local government entities by temporary memberships in the Work Group, while matters of interest to those local agencies are under discussion.

2. POLICY OF NATIVE AMERICAN GOVERNMENTS

Five Native American governments exist within the Area of Ecological Concern. They include: the Chemehuevi, the Cocopah, the Colorado River Indian Tribe, the Ft. Mojave, and the Quechan. As described in PART I, Unit 2, Section 5D, Cultural Resources, the many members of these governments regard certain places within the Area of Ecological Concern with a high degree of ancestral and religious reverence. There are locations on the four lower Colorado River national wildlife refuges which these tribes consider sacred and with which a special relationship is maintained.

In the past, the Service and the national wildlife refuges have worked with these Native American tribes in ways that support their ceremonial activities and great respect for the natural resources. The ceremonial willow gathering from the Bill Williams River NWR by the Colorado Indian Tribe, under permit for basket weaving, is an example of the closeness these ancient peoples have with nature. The coming together of the various tribes along with the Service, to dedicate and interpret a special petroglyph site on Havasu NWR is an example of the level of cohesiveness that is possible between these sovereign nations. These examples provide a clear indication that the Native American tribes are a strong supportive element of the Service and the National Wildlife Refuge System goal of "maintaining the basic web of life that sustains all living things."[83]

The Service recently drafted a proposed *Policy On Native American Governments.* As prescribed by the proposed policy, the four national wildlife refuges along the lower Colorado River will attempt to maintain a government-to-government relationship with the tribal governments. The Service and the refuges will respect the Native American right to self-determination and self-government. It is essential that the Service and the refuges work directly with the Native American governments on a one-to-one basis. The Service and refuges will consider Native American legislative mandates, treaty rights, trust responsibilities, and cultural values when planning and implementing refuge programs. Further, the Service and the refuges will recognize Native American governments as the primary parties for making fish and wildlife resource management policy and for managing fish and wildlife resources on Native American lands. Service expertise and assistance should be offered and be available when requested by the Native American governments. As one of the major landowners in the Area of Ecological Concern, the Native American nations will undoubtedly be faced with all the present and future natural resource challenges. These include water quality, endangered species, wetlands protection, and regulation of public use.

3. LAND STATUS AND JURISDICTION

PART I, Unit 2, Section 5 narrates the current understanding of the Service's lower Colorado River refuge land ownership and the rights attributed by law and title.

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[83]This is one of four goals spelled out in *Vision*, U.S. Fish and Wildlife Service, A Total Quality Management Plan, 1991.

In so far as general ownership of the lands provides for proprietary jurisdictional rights, questions remain regarding rights that may be excepted by law and policy. An example of this concerns the Service's rights pertaining to public use regulation and law enforcement in a navigable waterway.[84]

Questions arising out of the chain-of-title prior to acquisition by the BR from private owners and State governments need to be answered. However, current impacts of certain recreational uses make it imperative that the Service assert long-term land use regulatory policies based upon legal mandates calling for the protection of refuge resources.

Some lands acquired by the BR were withheld by the BLM for the Colorado River Project and subsequently deeded to the Service. In most cases, the Federal executive action and congressional mandate to transfer the land to the Service is subject to valid existing rights. The valid existing rights should be researched to identify specifically what those rights are to clarify which agency retains primary or secondary jurisdiction. This is the case for the management of Havasu NWR as it relates to the Parker Dam project and the relative jurisdictions of the Service and BR.

The relationship between the BR's and the Service's jurisdictional priorities remains complex and easily misunderstood for some of the lands which comprise the lower Colorado River national wildlife refuges. This is further complicated by the fact that the lands submerged beneath the River are considered lands belonging to Arizona and California. Decisions regarding the regulation of activities on the River and other associated bodies of water have not been easily forthcoming. However, based upon public and agency input regarding the harmful effects of certain uses on refuge lands, the Service is ready to implement the necessary regulatory changes resulting in more effective protection of refuge resources. The improvement of the Service's legal understanding of its standing on this land status and jurisdictional issues, as well as the improvement in its working relationship with other agencies with joint or shared jurisdiction, are extremely important in the Service's efforts to protect refuge fish and wildlife resources. The Service is currently taking steps to improve that legal understanding in addition to working more closely with the other agencies affected with shared jurisdiction, especially Arizona, California, and the BR.

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[84] The lower Colorado River has been determined to be a navigable waterway and such navigation is legally under the control of the United States Coast Guard under authority of the Navigable Waterways Act. On May 28, 1970, the Regional Solicitor for the Department of the Interior opined that the BR, has primary jurisdiction over the lands and the Colorado River within the refuges for reclamation purposes, and the Service has jurisdiction on that part of the River within the refuge to control water necessary to preserve wildlife and properly administer fish and wildlife values in the Refuge. The Solicitor states: "This office has been of the opinion that your Bureau (the Service) has the authority to regulate and control recreational water surface use on the Refuge, subject to the primary jurisdiction of the Bureau of Reclamation to control the area in conformity with the Parker-Davis and Boulder Canyon Projects and the decree of the U.S. Supreme Court in *Arizona v. California.* Accordingly, our view is consistent with that expressed by the Los Angeles' Regional Solicitor. You will recall that some time ago we obtained an expression from legal counsel to the Coast Guard to the effect that it did not claim or exercise water surface recreational use jurisdiction on the Colorado River within the Refuge, notwithstanding the fact that the River is a navigable stream." [**Authority to Regulate Recreational Activities within the Havasu National Wildlife Refuge, Letter from Office of The Solicitor to Bureau of Sport Fisheries and Wildlife, May 2 , 1970].**

4. WATER RIGHTS POLICY

Introduction

The BR, Lower Colorado River Region, is charged with the administration and accounting of Colorado River water utilization in the lower Colorado River basin.

Beginning in 1922, the Colorado River Compact began riverwide regulation of the Colorado River. The compact divided seven western states (Utah, Wyoming, Colorado, New Mexico, Arizona, California, and Nevada) into upper and lower basins. The lower basin states have a total basic apportionment of 7.5 million acre-feet per year, which is comprised of Arizona's 2.8 million, California's 4.4 million, and Nevada's 300,000 acre-feet. As noted earlier, the River's annual flow has averaged only 14 million acre-feet since 1930. Two million acre-feet of that flow is lost to evaporation each year. In spite of this, the River is committed to deliver 16.5 million acre-feet.[85]

The Benefits of Additional Water Rights in General

The benefits of additional water rights will be:

More Effective Marsh Management. Additional waters will allow for freshening of marsh areas, and impoundments where aquatics are the food source for migratory birds including the endangered Yuma clapper rail and the Arizona and California listed black rail.

More Efficient and Effective Revegetation. Additional waters would assist in the planting of native cottonwood and willow trees where salt cedar has been removed or to replace native plants which have been destroyed by fire. Water levels when coupled with soil types are key factors in success in revegetation. Where success at revegetation with cottonwoods and willows has been attained, increases in key avian species has resulted.

More Efficient and Effective Crop and Moist Soil Management. Water use is the key ingredient in managing crops on the refuges. These crops and moist soil management areas are important for all migratory bird use especially waterfowl and sandhill cranes.

The Need for Instream Flow Rights

Nationally, it is recognized that instream flow rights are necessary for the conservation of biological values. The States of Arizona and California allow appropriation of any part of stream flow within any segment of a stream in order to protect an existing natural environment. A water right granted in support of that kind of appropriation is an instream flow right. Both States have implemented regulations for the granting of permits for minimum instream flow rights that would apply to both sides of Havasu, Cibola, and Imperial NWRs. Colorado River

[85]Please refer to water rights inventory PART I, Unit 3, Section 4 for a delineation of the allocated waters to the refuges.

water rights are governed by Federal law, which takes precedence over State law in cases of conflict.

The allocation of flow rights will be a factor in solving some of the water quality issues on the refuges as well as the productivity of the marsh for wildlife in general. An example is Havasu NWR's Topock Marsh, where lack of sufficient flows affects fisheries as well as the eventual contaminant loads (i.e,. selenium), which then affect the endangered Yuma clapper rail. Other areas that could benefit from appropriate flow rights are: Cibola NWR's Hart Mine Marsh and Cibola Lake and Imperial NWR's Ferguson Lake. All these areas are in great need of instream rights more so for the freshening flows and subsequent oxygenation of the waters than for consumptive use benefits. Any additional flows to those areas on the Arizona side of the Refuges may not need additional consumptive use rights provided that additional flows do not cause water surface acreages to increase. Any waters diverted on the California side of the refuges (i.e., Ferguson Lake) would require a new allocation to California's total appropriation and a diversionary right for the Refuges. This is an extremely complex legal issue which requires further study and the strengthening of the Service's relationship with the lower basin States and the Bureau of Reclamation.

There is a serious problem with respect to the general hydrology of the Bill Williams River, which flows through Bill Williams River NWR. The natural hydrologic regime of the river on the Refuge has been altered by: (1) the installation and operation of Alamo reservoir; and (2) groundwater pumping at Planet Ranch. Alamo Dam, which is 18 river miles upstream of the Refuge, began operations in 1970. Planet Ranch pumping began in 1985. The operation of Alamo affects the nature of flood flows on the refuge and, to a lesser extent, base flows. The pumping of the Planet Ranch Aquifer has reduced base flows on the refuge. Both nature-mimicking flood and base flows are essential for the vitality of cottonwood-willow riparian habitats. The base flow reduction caused by Planet Ranch pumping is potentially (during normal and drought years) very threatening to the sustainability of the riparian habitat of the Refuge. A computer model developed by the Service shows that the base flow approaches 0 cfs on the Refuge in 16 years, assuming average climatic conditions and pumping rates equivalent to the present day.

Water rights issues associated with the Bill Williams River NWR are complex and enigmatic. Acquiring an instream flow right through the State of Arizona would give the Service a priority date of August 1993 (date of filing; the most junior on the River), and only allow us to claim the water available in the modern regime. The modern hydrologic regime, as discussed above, is not sufficient to maintain the ecologic needs on the Refuge. Additionally, recent rulings by the State of Arizona do not recognize the connection between ground water and surface water, allowing the Planet Ranch to pump as they are allotted regardless of the impact on the Service's would-be right.

Current strategies to resolve this hydrologic dilemma involve pursuing negotiations with the Corps through the Bill Williams Technical Committee, and negotiations with Scottsdale. In addition, it is ultimately hoped that the long-term disposition of the Planet Ranch is such that its

lands can be managed keeping in mind the need to protect the surface-ground water relationship. Federal ownership of Planet Ranch is one option leading to such protection.

The Need for Additional Water Rights On California Side

Havasu, Cibola, and Imperial NWRs all have considerable amounts of land on the California side of the River. However, because water rights for these lands have not been allocated by the Colorado River Compact, habitat management is minimized. Only when river flows are high do natural depressions contain water sufficient for use by wildlife populations in the area. Until consumptive use water rights are obtained for the California side of the refuges, only limited activity can take place. The severely impacted areas with significant wetland habitat potentials are Cibola NWR's Three Fingers Lake and Imperial NWR's Ferguson Lake.[86]

In the course of time, water and land may become available for purchase in both Arizona and California sides of the Colorado River. Potential water marketing in the lower basin may have either a positive or negative effect on the refuges, depending on the particular situation. The Metropolitan Water District of California has a 2-year land fallowing test program in place near Cibola NWR on the California side of the River. This program saves approximately 93,000 acre-feet of Colorado River water for the Metropolitan Water District to use at a later time.

Effects from this activity are undetermined at the drafting of this document. Also, there have not been any massive water rights exchanges on the Arizona side of the River in the Cibola Valley. However, the cumulative effect of transfers on both the California side and the Arizona side of the refuges is expected to cause long-term water depletion. These activities need to be monitored over the long-term.[87]

5. WATER MANAGEMENT AND REVEGETATION

Water management and revegetation are two issues that are directly and maybe even causally related. While the BR is the primary water manager as applied to the Colorado River channel, each refuge has a fundamental responsibility to manage the water allocated to it. In addition, the BR views revegetation as an important part of its water management program.[88] The BR

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[86]Cibola NWR is currently designing a proposal in conjunction with the BR to restore the Three Fingers Lake wetlands on the California side of the Refuge. A site specific Environmental Assessment will be prepared for this project.

[87]Regarding the effect of water transfers on the flows of the Colorado River, the BR is addressing the effects of all known and potential transfers in the All American Canal Environmental Impact Statement which will be finalized in 1993. This is an analysis of the effect on fish and wildlife as a result of the implementation of these transfers.

[88]This discussion is not meant to oversimplify the findings of the ongoing BR Vegetation Management Study. The BR recognizes that salt cedar provides nesting habitat and has other wildlife values which in some cases outweigh replacement with native stands of non water-using brush such as quail bush. An increase in wildlife values is influenced not so much by the species type but rather the vegetation community mixes, their relative densities and height. (Ibid., Anderson and Ohmart, 1984).

has concluded that removal of non-native salt cedar and subsequent revegetation with other species of plants, will result in less water loss through evapotranspiration.[89]

Water Management

With the exception of Bill Williams River NWR, each of the lower Colorado River national wildlife refuges must deal with the larger difficulties related to having no water allocated for use on the California side. That problem must be overcome in the long term in order to foster the kinds of projects necessary to enhance habitat through revegetation. That issue is dealt with in Section 4 of this unit.

Regarding the allocated water rights for the Arizona side of the refuges, each refuge has particular challenges with respect to appropriate delivery of water to the various management units and special activity and project areas. Without the ability to properly deliver water, habitat enhancement (including backwater marsh areas), farming programs, and native revegetation would be difficult.

Havasu Water Management Issues -- The inlet canal that delivers water into the Topock Marsh Management Unit has been the focus of attention. Because of topographical and hydrological factors, the inlet has been unable to efficiently deliver water into the unit, especially during low flows. As explained in PART I, Unit 3, Section 2, the inlet canal feeds water into the Topock Marsh when water levels in the River are high enough. When the River is low, water drains out through the inlet canal. The ultimate outcome is that the Topock Marsh does not receive freshening flows. The BR has been working with the Service in developing a plan of action which will improve how water is fed into the marsh and how the marsh retains water. Work has been completed on cleaning out the inlet canal, and the installation of flap gates will control the back flow of water out of the marsh.

Biologically, it is not known what effects the lack of freshening flows may have on the marsh areas, though it is conjectured that the lack of flows does not foster ideal fish and wildlife habitat. More importantly, the lack of flows is thought to contribute to above-average selenium contaminant loads in Topock Marsh. These are all factors which must be weighed prior to setting goals and objectives for Havasu NWR. The dynamics and possible effects of manipulating the water levels and increasing instream flows is currently under investigation by Service and BR biologists and hydrologists. The conclusions of further study will have a profound effect upon future management practices for this management unit.

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[89]Evapotranspiration is the process during which there is a loss of water from the soil both by evaporation and by transpiration from the plants growing thereon. Plants associated with this process are known as phreatophytes, deep-rooted plants that obtain water from the water table or the layer of soil just above it. The non-native salt cedar is a phreatophyte, as are the native cottonwood and willow trees, the desired revegetation plant of the Service. The dilemma presented by revegetation with cottonwoods and willows is that water savings will be unlikely.

Bill Williams River NWR Water Management Issues

A far different problem exists at Bill Williams River NWR. The combination of the releases from Alamo Dam by the Army Corps of Engineers and the pumping of water from the deep aquifer at the Planet Ranch presents a serious hydrological dilemma. Prolonged high releases of water from the dam at inappropriate times have in the past drowned mature cottonwood and willow vegetation communities. On the other hand, extensive pumping from the deep water aquifer at Planet Ranch combined with the generally insufficient releases from Alamo Dam, depletes water flows into the Bill Williams River NWR. Consequently, the cottonwood habitat throughout the Refuge cannot survive flows insufficient to meet the needs of the native vegetation root systems.

Extensive flooding of riparian habitat along the Bill Williams River has occurred because of high releases from Alamo Dam. The flooding that occurred in the early 1980s damaged much of the existing cottonwood and willow galleries along the River. However, periodic flooding is also needed to wash away accumulated salt cedar debris to prevent fires. As noted earlier, flooding is necessary for the creation of new soil banks and to establish seedlings. Without a more suitable flow regime that includes periodic short duration, high intensity flooding, the remaining native riparian habitat on the Bill Williams River NWR is in danger of being completely lost.

This water management challenge has prompted improved communication, cooperation, and planning with the AGFD, City of Scottsdale, the Army Corps of Engineers and other Federal and State agencies relative to the Bill Williams River. A specific Bill Williams River Technical Committee was formed for this purpose.

Cibola NWR Water Management Issues

Cibola NWR has extensive habitat management capabilities if it could better deliver allocated water to its farm fields, Island, Hart Mine, and Cibola Lake Management Units. The Refuge has been determined to have great potential for revegetation with native cottonwoods and willows, and has been the subject of a number of revegetation projects. The old canal systems, once used for farm irrigation prior to the establishment of the Refuge, are now deteriorated and clogged with emergents that hinder water delivery. In addition to this, pumps on the channelized portion of the Colorado River were constructed too high, and when the River is very low, no water can be pumped into the Cibola Lake or Hart Mine Marsh areas. The Old River Channel, which receives flows from the Palo Verde Irrigation District Outfall Drain, has a water level dependent on adjacent farm irrigation drainage as well as ground water levels. The main Colorado River channel no longer feeds into the Old River Channel and is blocked by a dry cut levee.[90] Based on circumstances not under the control of refuge management, fluctuating water levels do create dynamic habitat situations. The effect here is the same as at the Topock Marsh (Havasu NWR). The shallow water may engender habitat for marsh species and native fish.

[90]The Old River Channel is connected to the Cibola Dry Cut at the Downstream end. For this reason, the water surface elevation is not likely to be higher than the elevation in the main channel at the juncture.

Current research now indicates that lack of freshening flows at Cibola NWR may be the cause of selenium contaminant loads in excess of the average, thus impacting the Yuma clapper rails and other marsh and waterbirds.[91]

Imperial NWR Water Management Issues

Imperial NWR has an instream flow dilemma at the Ferguson Lake Management Unit on the California side and on the Refuge's backwater lakes and marshes. Acquisition of instream-flow rights for Ferguson Lake might help solve the potential contaminant buildup and salinity problems. The greater water management issue at Imperial, however, appears to be backwater marsh and lake areas. Past planning efforts determined the need for water delivery to the Martinez Marsh and Uplands Management Unit in the southern part of the Refuge. This Unit consists of a series of unconnected backwater lakes and marshes. Water delivery to these isolated areas would theoretically freshen them, improving aquatic and invertebrate populations that are food for Yuma clapper rails and other marsh bird species. Recent studies of the effects of selenium loading in Colorado River backwater marshes have cautioned the Service not to link the backwater lakes until additional studies determine the risk of selenium contamination from Colorado River flows. Preliminary studies indicate that the isolated backwater marsh/lake areas did not contain any above average selenium loads in spite of the high rates of evaporation. These studies theorize that surface flows from the main Colorado River channel would increase risk of selenium contamination.[92] Adding further to the complexity of protecting wetland values and associated resources is the in-fill of wetlands via sedimentation and/or detrital accumulation. This in-filling is followed by plant encroachment and natural succession. All river bottom wetlands on the Refuge are potentially being affected. A management approach that considers both selenium contamination and wetland loss will be required to address this dilemma.

Revegetation

The BR and the Service have agreed on native revegetation as one of the major issues to consider in planning for the future. The Service is interested in the wildlife benefits of this kind of activity; the BR is interested in both wildlife enhancement and saving water. The BR is concerned that salt cedar, which has infested large portions of the Area of Ecological Concern, uses a large amount of water.[93] The Service is concerned that the monotypical nature of the

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[91]For additional discussion relative to water quality, please refer to Part II, Unit 1, Section 6, Water Quality, Contaminants and Human Waste Policy; and Part II, Unit 2, Section 1, Analysis of Population Trends of Yuma Clapper Rails and Section 3, Analysis of Population Trends of Refuge Marsh and Waterbirds.

[92]Three separate research projects sponsored by the University of Arizona Cooperative Research Unit have studied selenium contamination in various locations along the lower Colorado River. Conclusions of each of the studies indicate a risk to fish and avian species because of selenium found in aquatic plants and invertebrates. Isolated lakes and marshes are concluded to be low risk areas for selenium contamination.

[93]Please refer to Part I, Unit 2, Section 6 of this document for an outline of the Bureau of Reclamation Vegetation Management Study.

salt cedar stands do not contribute to wildlife diversity and richness.[94] Each of the refuges has its fair share of salt cedar infestation. According to researchers, the four Colorado River refuges contain 37 percent of all the salt cedar mapped within the Area of Ecological Concern. Because of water management difficulties and fires along the Colorado and Bill Williams Rivers, the percentage is increasing on a year-to-year basis. Because of this situation, it will take a strong cooperative approach to reduce the levels of salt cedar and to revegetate with mixes of native vegetation.[95]

Fire Management -- The Service cannot over emphasize the importance of fire management throughout the Area of Ecological Concern. Management should include the combination of fire protection, pre-suppression and suppression strategies. These activities are integral to an overall revegetation program and to efforts to restore and enhance biological diversity. The fire program on the lower Colorado River refuges is unique within the Service because of prevention and suppression emphases. Given the negative effects of wildfire on native vegetation communities, the refuges must calculate fire into the development of revegetation plans. When viewed from an ecosystem management perspective, protection of restored habitats and existing stands of native plants throughout the Area of Ecological Concern calls for active participation by the Service in interagency fire community activities including fire management planning, fire prevention educational efforts, and suppression on and off the refuges. In considering prescribed burning for resource enhancement, especially in the riparian areas on the refuges, managers must consider the extreme volatility of fuels in these habitats,the danger of fires escaping refuge boundaries, and negative effects on native plant communities.

6. WATER QUALITY, CONTAMINANTS, AND HUMAN WASTE POLICY ISSUES

General

The water quality and contaminant issues presently affecting the four refuges are directly generated by the growth of human populations, the management of water flows, and the effects of intensive agricultural irrigation in the lower Colorado River watershed.[96] According to the Arizona Department of Environmental Quality, Office of Water Quality, segments of the

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[94]Both agencies recognize that mature salt cedar stands can emulate microclimatic conditions suitable for nesting of some species, including Bell's vireo. These stands also have value as dove nesting habitat.

[95]*Analyses of the Structure and Function of Lower Colorado River Riparian Plant Communities* (University of Nevada, Las Vegas: May 1992) by David E. Busch, confirms that the invasion of the ecosystem by salt cedar "potentially alters competitive (plant community) hierarchies and disturbance regimes..." Busch's study confirms that salt cedar is salt tolerant and actually uses salts to adjust to drought conditions. In addition, salt cedar leaf litter accumulation contributes to fires. Salt cedar colonizes quickly following fires because of its ability to use salt to adjust to lack of moisture, and its ability to use existing moisture more efficiently. Native cottonwoods and willows are not salt tolerant, and they need consistent root moisture to survive. Following fire, native vegetation does not colonize efficiently because of high salt and moisture stresses. Busch states: "A high proportion of senescent [old] *Populus* [cottonwoods] in Colorado River riparian vegetation plots provided an indication that this species is approaching local extinction in this ecosystem."

[96]Agricultural flooding techniques cause high evaporation rates. Contaminants coagulate as the evaporation takes place leaving residue on the soils. This residue is then leached back into the subsurface water regimes and eventually flushed into a moving stream. It is suspected this takes place along the lower Colorado River.

Colorado River and the Bill Williams River have occasionally failed to meet water quality standards relative to temperature, sediment, selenium, nitrates, phosphates, and dissolved oxygen.[97] Populations of invertebrates and other food chain organisms take in (bioaccumulate) these contaminants especially during periods when the water quality in the River does not meet State standards.

Because the National Wildlife Refuge System and the Service does not control the flow of water into, through, and out of the refuges along the lower Colorado River, there is the potential that various types of environmental pollutants could contaminate refuge resources. Water quality directly affects the food chain of the habitat resources in the Area of Ecological Concern.[98]

Population Growth

Population growth figures for all municipal and county-wide jurisdictions clearly indicate that human wastes, treated effluent, and solid waste problems will be faced by the natural resources up and down the lower Colorado River. In 1990, the City of Laughlin, Nevada, requested a permit from the Environmental Protection Agency (EPA) to increase effluent discharge volumes into the lower Colorado River below Davis Dam. Population increases are surpassing a 15 percent per annum growth rate and the solid waste and sewage treatment demands of such a growth rate are going to severely impact downriver water quality unless EPA standards are appropriately monitored.

The negative cumulative impacts are considered to be more pronounced in the more southern reaches of the River. Coliform counts have been found to be high on portions of Lake Havasu, near Lake Havasu City. It is expected that if these counts are not monitored, along with the projected human population increases in urban areas along the River, the degradation of water quality will mar the fishing experience and other recreational appreciation of the waters involved. Ironically, there is also a real threat of human disease if water quality is not monitored and regulated.

The refuges have an additional challenge ahead as they attempt to plan public use objectives compatible with the purposes, goals, and objectives of the refuges, while keeping in mind the effects of human use and human wastes. It is clear that each of the refuges that continue to allow for large amounts of public access for any reason must at some point develop human waste management minimum standards or requirements for refuge visitors.

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[97] 1988, 1990, 1992, Nonpoint Source Assessment Reports; and Surface Water Assessment Colorado Main Stem River Basin; HUC 15030101-011 - 006, 15030104-011 - 002; Arizona Department of Environmental Quality, Office of Water Quality, Nonpoint Source Unit.

[98] The Service is currently developing a detailed monitoring program to address water quality issues and environmental contaminants on refuge lands and trust resources. These initiatives will be incorporated in the Biomonitoring of Environmental Status and Trends (BEST) program under the direction of the Service (Regional) Environmental Contaminants Program.

Effects of Contaminants on Endangered Species

If pollution sources and trace elements are not monitored and remediated along the River, endangered species, including fish and avian species, could be adversely affected.

Human pollution, as discussed above, is only one of the major challenges of the future. Another significant problem in the lower Colorado River is that of selenium contamination.[99] Though selenium is an essential trace element, high levels of dietary selenium are known to have adverse effects in birds and fish. It is suspected that a variety of situations along the Colorado River result in the presence of toxic levels of selenium. Significant concentrations in the soils throughout the arid West are known to be common, due to high evaporation rates that leave the mineral deposits on dried soils. Selenium has become a critical problem in the lower Colorado River region since the Colorado River itself passes through major "rock source formations" in Wyoming, Utah, and Arizona. The River flushes the mineral into lake formations where high rates of evaporation occur. Bontamination of wildlife can take place through direct ingestion of water with high selenium concentrations or by ingesting invertebrates and plant life with selenium concentrations.

Another factor accelerating high concentrations of selenium, especially in the Blythe, California, and Yuma, Arizona, area is the presence of agricultural flooding techniques. The water used for farming eventually drains into the lower Colorado River basin, which already contains selenium. Although the concern is for wildlife in general, special consideration is given to the rail species that feed on invertebrates.

In 1989, the Service proposed to reclassify the Yuma clapper rail from endangered to threatened. Even though populations of this endangered species have remained stable and Recovery Plan population goals have been achieved, habitat continues to be degraded. These habitat losses, in addition to the possible negative effects of selenium, caused the Service to further investigate these issues prior to considering down listing the species. The result of the investigation was a study published under Service contract by the University of Arizona.[100]

The study concluded that, with the exception of selenium, trace elements in birds from the lower Colorado River are not elevated above normal; that selenium does concentrate in the backwaters

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[99]It should be noted that selenium poisoning incidents have been documented since the 1930s. The most publicized incident of selenium toxicity in the United States occurred at Kesterson National Wildlife Refuge in the San Joaquin Valley, California. High concentrations of selenium in evaporation ponds killed and deformed resident birds. This incident in and of itself provided the impetus for the Service to contract for definitive study of the contaminant problem in the lower Colorado River basin and specifically as the contamination might affect the endangered Yuma clapper rail.

[100]Kirsten-Rusk, Monica, *Selenium Risk to Yuma Clapper Rails and Other Marsh Birds of the Lower Colorado River*, Masters Thesis, University of Arizona, 1992. The study delineates six objectives: (1) Determine if backwater areas of the lower Colorado River contain higher concentrations of selenium than the main channel; (2) Determine if selenium is distributed uniformly among lower Colorado River backwaters; (3) Evaluate the level of trace elements in lower Colorado River birds; (4) Determine the biomagnification rate of selenium through the Yuma Clapper Rail food chain; (5) Determine the relative accumulation of selenium in waterbird species inhabiting the lower Colorado River; and, (6) evaluate tissue levels of selenium in lower Colorado River birds according to contrasting hypotheses of selenium toxicity.

of the River; and that based on both liver selenium levels and the liver:kidney selenium ratios, marsh birds in the River are at low risk of adult mortality, but at high risk of embryonic deformity. In addition, other contaminant studies are underway to evaluate the extent and magnitude of contamination on refuge lands and trust resources.

Other Contaminant Issues

Each of the refuges also attempts to be mindful of the unpredictable incidence of point source pollution such as petroleum product leakages from underground storage. Studies are now underway to determine the extent of contamination to the water table, if any. Secretarial Orders and Congressional Mandates have required that we remove underground storage tanks and be in compliance by 1998. Leakages have been found at the Five Mile Landing area in the Topock Marsh Management Unit of Havasu NWR. The Service has engaged in a comprehensive program to remove all tanks on refuges along the lower Colorado River and to remedy for any contamination that has already taken place.

Nevertheless, there is always a possibility that an accident, such as a gasoline truck spill on the Interstate 40 bridge which bisects the Havasu NWR, or Interstate 10 bridges above Cibola NWR, could take place on the River. The Service Office of Environmental Affairs has prepared a comprehensive contingency plan to deal with accidental spills along the lower Colorado River. These plans are available at each refuge.

7. WETLANDS POLICY

Wetlands Determinations

Nationwide, jurisdictional wetland determinations are made under Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act and the "Swampbuster" provisions of the Food Security Act of 1985 (Federal Interagency Committee for Wetland Delineation 1989). These decisions are made after review by several Federal agencies to determine whether or not a particular area of land meets the criteria established for such determinations. A permit is either denied or granted by the Army Corps of Engineers (Corps) based upon this review process.

Under the Clean Water Act, permits are required for discharges of dredged and fill materials into all waters, including wetlands. Implementation of the 404 program involves three other Federal agencies in addition to state involvement.[101]

[101]The EPA, the National Marine Fisheries Service (NMFS), and the Service review permit applications and provide comments and recommendations on whether permits should be issued by the Corps. EPA has veto authority over permits involving disposal sites if impacts are considered unacceptable. EPA also develops criteria for discharges and state assumption of the 404 program. Regulations were changed in 1984 due to a national lawsuit and 404 jurisdictions now apply to tributaries of navigable waters and isolated wetlands and waters if interstate commerce is involved. With the new regulations, all washes, drainages, and tributaries of navigable waters, including ephemeral and perennial streams, are included under the 404 program in Arizona. This applies directly to such waterways as the Colorado River, a navigable waterway, and its tributary, the Bill Williams River.

Under Section 404, states have authority to veto applications for permits. Each state must certify that a permit issued by the Corps will not violate water quality standards, and the Corps cannot issue a permit if the certification is denied. In Arizona, the Department of Environmental Quality (DEQ) and the AGFD has responsibility for reviewing 404 permits. Likewise, the State of California also plays a role in reviewing 404 permits for the lower Colorado River and subsequent water quality certification.

The Benefits

There is a new level of awareness by the public of the inherent ecological values in wetlands and riparian areas. This strengthened awareness creates a need for a more comprehensive approach to evaluating water-related resources before allowing activities, projects, and developments in wetlands and riparian areas.

Cooperation among agencies, organizations, user groups, and landowners has resulted in the implementation of strategies for protecting fish, migratory bird, and waterfowl habitat. For example, the State of Arizona, along with commercial industries and organizations, is initiating programs and activities designed to protect the remaining wetlands and riparian systems. The State of Arizona produced an addendum to its SCORP entitled Arizona Rivers, Streams and Wetlands Study in 1989. Video programs and educational booklets on desert riparian systems have been published by the University of Arizona Cooperative Extension Service. The Arizona Nature Conservancy has begun an ambitious fundraising campaign, Streams of Life, to protect and acquire sensitive riparian habitats throughout the state.

The recently enacted North American Wetlands Conservation Act establishes a clear wetland policy direction. This policy directs natural resource agencies to focus on migratory bird and waterfowl habitat conservation and the provision of broad benefits for fish, wildlife, soil, and water conservation. This is the present policy direction being supported and fostered by the Service. The comprehensive management planning effort for the national wildlife refuges along the lower Colorado River is one of the Service's contributions toward the purpose of protecting wetland values in the lower Colorado River Area of Ecological Concern.

8. BIOLOGICAL DIVERSITY, ENDANGERED SPECIES, FISHERIES, AND MIGRATORY BIRD MANAGEMENT

Biological Diversity

Since the passage of the Endangered Species Act, State and Federal wildlife and natural resource agencies have attempted to focus on turning around downward slides of specific wildlife populations, including fishes and plant species determined to be on the brink of extinction. Although the Service has attempted to balance its efforts with programs to benefit both nongame and game species, the focus has historically been on a relatively small minority of species, particularly game species. Statistics in 1990 indicate that only 17 percent of the estimated 3,700 vertebrate species native to the continental United States and its coastal waters are game species.

Nongame species have benefitted from agency programs only indirectly or, more recently, as a result of fragmented and marginally funded programs specifically directed at a small fraction of the long list of nongame species.

Nationwide, endangered species listing and recovery efforts by State and Federal agencies have met with only limited success, due to the high costs involved and the lack of pertinent biological data on which to base management actions. The number of species under consideration for listing continues to grow while scarce agency resources have been directed to a very small proportion of those species already listed.

Many nongame species, including several migratory bird species, have experienced substantial population declines, as evidenced by repetitive survey data. Among those with documented declines are nearly a quarter of the more than 200 species of perching birds that breed in the continental United States and winter in the Caribbean, Mexico, and Latin America in general. Habitat loss and fragmentation in both nesting and wintering grounds contribute to the population declines in these migrants. Migratory shorebirds and other waterbirds have been similarly affected by conversion and degradation of habitat. In many respects, the evidence of population declines is only symptomatic of a much more complex problem -- the accelerating loss of worldwide biological diversity.

The same can be said with respect to the increasing degradation of aquatic ecosystems. In the past 100 years, at least 3 genera, 27 species, and 13 subspecies of North American fishes have become extinct, primarily as a result of habitat loss or alteration. Nearly 100 other species/populations are now listed as threatened or endangered. Declines of fish populations have resulted in significant financial losses for the commercial and recreational fishing industries.[102] In addition, this impacts upon the economic value of recreational fishing.[103]

Biological Diversity in the Area Of Ecological Concern

The lower Colorado River mosaic of land and aquatic ecosystems and biomes suffer the same symptoms. As has been described in other sections of this document, riverine development for non-ecologically based hydrological management goals and objectives has produced definitive changes to the natural environment.

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[102]The decline of Atlantic Coast striped bass populations was estimated to cost 7,500 jobs and $220 million in lost economic activity between the years 1974 and 1980. Likewise, the decline of Pacific salmon stocks has resulted in lost economic benefits. Commercial harvest of Pacific salmon was valued at $200 million in 1980; the value in 1990 was only $120 million.

[103]Preliminary findings identified in the Service's 1991 Survey of Fishing, Hunting, and Wildlife Associated Recreation indicate that 32.1 million freshwater anglers spent 434 million days fishing in the nation's ponds, lakes, and streams during that year alone. In addition, 8.7 million anglers spent 74 million days saltwater fishing. The already diminished economic value of recreational fishing, estimated at $25.8 billion annually, is falling rapidly.

Consequently, biologists representing various jurisdictions along the River are unanimous in their diagnosis that losses in habitat resources, in species of both nongame and game categories, are indicative of a declining ecosystem health.

Wildlife analyses for the four national wildlife refuges on the River only give us a "tip of the iceberg" perspective of natural resource value losses in the lower Colorado River Area of Ecological Concern. Past funding mechanisms have not been effective in servicing the biological data needs of the refuges. Enough observational data and experience exists, however, to have enabled refuge biologists and other natural resource experts to suggest the necessary actions which could turn the resource value decline trends around. Rather than treat the situation on a species-by-species or habitat-by-habitat basis, ecologists prescribe attacking the problem of value losses by setting goals and objectives with ecosystem benefits. A diversity of species, including game and nongame, will benefit by this more inclusive approach.

Nevertheless, one of the key difficulties continues to be the lack of formal research and information on issues that affect overall biological diversity in the Area of Ecological Concern. These issues include water management, marsh management, public uses, fire management, and contaminants management, and how these affect all fish and wildlife resources.

Endangered Species Management[104]

While developing a program of managing for biological diversity, the first responsibility of the Service and the National Wildlife Refuge System is to "preserve, restore, and enhance in their natural ecosystems (when practical) all species of animals and plants that are endangered or threatened with becoming endangered." [Refuge Manual, 2 RM 1.4]

Endangered Yuma Clapper Rail -- As noted in Part I, Unit 2, Section 6A of this document, the lower Colorado River refuges have been playing a significant role in maintaining suitable habitat for the endangered Yuma clapper rail. In Part II, Unit 2, Biological Program Analysis, the current status and future prospect of this endangered species is discussed. The Service has followed through with most of the recommended actions of the Yuma Clapper Rail Recovery Plan. Nevertheless, a number of problem areas remain. These problem areas include the effects of water management, public recreation, fire, and water quality on the long-term survivability of the species. Chief among these are the effects of selenium contamination on the Yuma clapper rail as discussed in Section 5 of this Unit.

Endangered and Threatened Colorado River Native Fishes -- Recently, the refuges have become more involved in efforts to recover the native fishes of the River. Included are the Colorado squawfish, the humpback chub, the bonytail chub, and, more recently, the razorback sucker. For example, Cibola NWR has created a razorback sucker refugium in one of its ponds. All activities related to these species have been carried out by the Service's Fish and Wildlife

[104]Please refer to Part II, Unit II for a cursory analysis of the status of the Yuma clapper rail and the threatened and endangered Colorado native fishes. Summaries of species recovery plans are in PART I, Unit 2, Section 6A.

Enhancement Division, the Native Fishes Work Group, all in coordination with the Colorado Fishes Recovery Team.

The level of concern is now elevated as a result of this planning effort and the recent listing of the razorback sucker as an endangered species. Critical habitat has been proposed for the entire area encompassing the four refuge locations. The refuges will have to plan how they will fulfill a role in the recovery of endangered and threatened native fishes while attempting to prudently manage other resources.

Other Endangered Species -- The southern bald eagle and the peregrine falcon occur on the Colorado River refuges, and each of these has been monitored as to the number of occurrences. The southern bald eagle is known to nest in the Bill Williams River Basin, and immature eagles are frequently sited at Cibola and Imperial NWRs.

The challenges that lie ahead for the refuges are those of properly managing the kinds of habitat these species need. Continued enhancement of cottonwood and willow habitat will positively affect these raptor species by allowing them to have the kind of perches they need. By fostering a policy of managing for biological diversity, endangered species should eventually have an optimum range of habitat and food sources needed for survival and recovery.

Interjurisdictional Fisheries

As noted above, attempting to curb the losses in the native fish populations along the lower Colorado River is among the highest priorities. It is imperative, however, that programs be developed to address continuing aquatic habitat degradation and to prevent the need to list additional species. One of the difficulties in effectively addressing new development issues and responding to management needs is the lack of efficient access to information on aquatic resources. While the AGFD data is available to the Refuges, much more study is required in order to understand the relationships between the factors influencing species composition. Additional biological research activities on the River will increase the availability and accessibility of relevant databases for Service biologists. This in turn will assist in endangered fish recovery efforts. In addition, a good informational base would allow managers to quickly evaluate potential effects of changes in water management, increases in water use, demands for increases in sport fishing, proposals for introduction of native fishes, or increases in non-native sport fish, and water quality issues.

The presence of the Service's Fishery Resource Office (FRO) at Parker, Arizona, allows for a stronger partnership between the refuges and the FRO in understanding the dynamics of the aquatic ecosystems along the Area of Ecological Concern. The refuges, along with the FRO, are currently improving their abilities to provide management assistance for fishery resources among other jurisdictions along the lower Colorado River. In addition, the refuges and the FRO are working toward fostering additional research in understanding the effects of public use, water

quality, and water management on aquatic ecosystems in the lower Colorado River. Perhaps this could lead toward the prevention of future Federal listings.[105]

New Opportunities to Protect Neotropical Migratory Bird Species

In May of 1989, the Secretary of the Interior agreed to participate in an international effort to halt the decline of neotropical migratory birds that breed in the North American Continent and winter south of the United States. Neotropical migrant birds include such species as the summer tanager, scarlet tanager, Bell's vireo, and several hummingbird species.

By December of 1990 the Neotropical Migratory Bird Conservation Program published a strategy entitled *Partners in Flight*.[106] In 1991, seven Federal agencies, including the Service, signed an agreement to promote conservation of neotropical migratory birds. The program objectives are to improve surveys and monitoring of bird populations, conduct research on habitat needs and causes of species declines, identify essential habitat areas, and develop conservation and management techniques.

Many western neotropical migratory birds use riparian habitats, such as the lower Colorado River, and deciduous forests in canyonlands as nest sites and migratory corridors. These habitats are under increasing pressure from development, agriculture, and exotic plant species invasion. Only remnants of the former extensive riparian habitats along the lower Colorado River exist today, the largest being along the Bill Williams River.

The national and international focus on neotropical species will serve as an impetus for planned rehabilitation of core habitat areas (including those that encompass the refuges) throughout the Area of Ecological Concern.

9. COMPATIBILITY AND REFUGE PROGRAMS

Compatibility of Uses

Law and policy allow a variety of uses on national wildlife refuges. An allowed use is defined as a use over which the Service has jurisdiction, including Service-initiated uses. Accordingly, these are uses on which the Service may make determinations of compatibility.[107]

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[105]Also please refer to discussions concerning Water Management and Revegetation, Part II, Unit 1, Section 5, Water Quality, Contaminants and Human Waste Policy, Part II, Unit 1, Section 6, Analysis of Population Trends of Colorado River Fishes, Part II, Unit 2, Section 3, and Wildlife-Oriented Recreation, Part II, Unit 3, Section 3.

[106]See Part I, Inventory, Unit 2, Section 6 of this master plan document for a brief description of the *Partners in Flight* program.

[107]The authorities that mandate the requirement for determination of compatibility of uses are found in the Refuge Recreation Act and the National Wildlife Refuge Administration Act. See Part I, Unit 2, Section 2, No's 11 and 15.

Within this framework, Service policy provides that an allowable use may be determined to be compatible if it will not materially interfere with or detract from the purpose(s) for which the refuge was established, and the goals of the National Wildlife Refuge System.[108] Before a proposed use can be reviewed for compatibility, it must first be determined to be in compliance with applicable laws, Departmental and Service policies, and regulations. Finally, there are other considerations that affect the allowance of a particular use, aside from the compatibility determination process. These considerations include the associated costs, timing of the proposed use, enforcement requirements, and conflicts with other uses. In these circumstances, a use may be denied even if it is compatible.

Allowability of Public Uses on National Wildlife Refuges

With regard to guidance concerning allowing public uses on national wildlife refuges, the fourth goal of the National Wildlife Refuge System provides the following:

> "To provide an understanding and appreciation of fish and wildlife ecology and man's role in his environment, and to provide refuge visitors with high quality, safe, wholesome, and enjoyable recreational experiences oriented toward wildlife to the extent these activities are compatible with the purposes for which the refuge was established."[109]

As a matter of policy, the Service and the four national wildlife refuges along the lower Colorado River have provided wildlife-oriented public use opportunities, including wildlife interpretation and education, and wildlife-oriented recreation such as the traditional hunting and fishing programs. The Service discourages all public use activities that are nonwildlife-oriented unless it is precluded from doing so by law. Formal compatibility determinations have also been completed for each of these allowable public uses. Service policy requires that the refuge manager must annually re-certify all allowed uses for compatibility.

Activities that take place under a special use permit or lease agreement should also undergo strict evaluations with respect to compatibility long in advance of lease or permit renewal. For example, although the concession at Five Mile Landing at the Havasu NWR does not expire until 2006, the Refuge Manager should make a determination of the compatibility of the current use and propose options for renewal, termination, and changes in scope should a lease be renewed. In addition, it is imperative that the manager closely monitor the concession's performance relative to the stipulations of the lease, and ensure that the uses are not going beyond the bounds of provisions of the lease agreement.[110]

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[108]The goals of the National Wildlife Refuge System are delineated in the Refuge Manual 2 RM 1.1-1.4. They have been listed in this document in Part I, Unit 2, Section 3C. The refuge objectives are the result of this planning process and are outlined in Part III, Synthesis, of this document.

[109]Refuge Manual 2 RM 1.4

[110]Please see page 33 for description of Five Mile Landing Lease.

The final decisions regarding allowable public uses for each of the four refuges should take place in cooperation with other agencies and jurisdictions within the Area of Ecological Concern. Those decisions related to hunting and fishing activities must be done in full coordination with the various state game and fish agencies. Hopefully, an optimum mix of public uses could be provided that recognizes the contributions of other individual agencies and jurisdictions in meeting public use needs and opportunities. Ideally these planned uses should be tailored to the missions and purposes of the individual agencies.

The Problem of Nonwildlife-Oriented Public Recreational Uses on Refuges

The largest public recreational use issue on the lower Colorado River has been and will continue to be that of nonwildlife-oriented recreation (i.e., off-road vehicle use, water skiing, jet skiing, and speed boating). The chief cause of concern is the suspicion that these activities negatively impact habitat and wildlife health. The refuge manager has been able to obtain photographic evidence of the kinds of nest destruction which takes place as a result of jet ski activities in refuge backwater areas. In addition, the increased number of citations issued since 1986 at Havasu NWR is indicative of the growing threats.[111] The Office of the Solicitor opined in 1970 that the Service has the necessary jurisdictional rights on the portion of the Colorado River within the refuge boundaries to ". . .control water surface recreational uses insofar as such controls are necessary to preserve wildlife and properly administer fish and wildlife values in the Refuge."[112]

The Service discovered, as a result of public involvement in this planning process, that recreational abuses on refuges are a problem much larger than the Service is capable of solving alone. The traditional approach would be to attempt to solve the public use problems with more law enforcement. In the past, this approach has drained resources from the refuge system's primary programs such as habitat/wildlife management and biology. A concentration of additional dollars in singularly supplementing current law enforcement resources on the lower Colorado River could not possibly address a problem that transcends the refuges' boundaries within the Area of Ecological Concern. Input from agencies and the public is indicative of the need for the formation of a multi-jurisdictional management, enforcement, and educational work group. In the case of nonwildlife-oriented recreational activities that occur on the mainstem navigable River, the refuges must work more closely with the AGFD to develop a cooperative law enforcement policy and program.[113]

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[111]The increases in citations at Havasu NWR between the years 1986 to 1990 occurred even though refuge staffing and law enforcement efforts remained the same each year. Please refer to Figure 11 in Part II, Unit 3, Section 4 of this document for a graph depicting this increase.

[112]Please refer to letter from the Department of the Interior, Office of the Solicitor, to Acting Regional Director, Bureau of Sport Fisheries and Wildlife (the Service) dated May 28, 1970, regarding Authority to Regulate Recreational Activities within the Havasu National Wildlife Refuge.

[113]The AGFD currently regulates watercraft activities in accordance witih Arizona Revised Statutes Title 5 as well as 33 U.S.C. pertaining to uniform navigational marking of waters. The CDFG also has a set of similar standards. Any zoning of areas affecting mainstem waters should be done in coordination with AGFD and CDFG. The Refuges must agree to abide by the appropriate waterway

10. PUBLIC OUTREACH AND ENVIRONMENTAL EDUCATION

Public outreach and education have been identified as important elements and principles within the context of the four goals of the Service's new *Vision*, and the fourth defined goal of the National Wildlife Refuge System. The lower Colorado River Area of Ecological Concern presents an ideal opportunity to fulfill the goals represented in the *Vision* document as well as the Refuge System goal of providing "understanding and appreciation of fish and wildlife ecology and man's role in his environment."[114]

Until recently, each of the national wildlife refuges on the lower Colorado River has attempted to engage in public outreach and education activities in a fashion limited by monetary resources and personnel. Consequently, the level of cumulative public outreach and educational activity along the River has been minimal, if not negligible.

This master planning effort has identified the need for extensive coordination among the refuges with regard to all programs, including those that would foster true public appreciation of our natural and wildlife resources. A new organizational structure has been designed so the cumulative and synergistic natural resource values can be understood as integral parts of the lower Colorado River mosaic. With the new organizational structure, coordination of all refuge and Service activities will be paramount, thus providing an opportunity for much improved service and outreach to the public and other jurisdictions within the Area of Ecological Concern.

An important aspect that should not be overlooked, is the link between the immediate River and surrounding desert landscapes. As is true with biospheric perspectives on a global scale, even the Area of Ecological Concern is not an island unto itself. Therefore, it is equally important to view the Area of Ecological Concern within the context of the larger desert biomes and ecosystems outside the immediate surroundings of the refuges and the Colorado River riparian area. The recent designation of Wilderness Areas at Havasu and Imperial NWRs calls to mind the larger desert mosaic, including Wilderness designations on BLM lands, military lands, and Kofa and Cabeza Prieta NWRs. The Area of Ecological Concern and the surrounding expanse of desert is full and rich with wildlife and habitat values yet to be inventoried. Future public outreach and environmental education should be designed while keeping in mind the contributions of the desert-riparian relationship. This relationship calls to mind the simple beauty of the contrast between the "thin green line" of the lower Colorado River and its connection with the desert.[115]

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marking standards for both mainstem and backwater areas along the River.

[114]Ibid., Refuge Manual

[115]Again, this refers to Aubrey Stephen Johnson's treatment of desert riparian ecosystems in Arizona and New Mexico in his article "The Thin Green Line." *Preserving Communities and Corridors* (Defenders of Wildlife, Washington, D.C.: 1989).

11. ORGANIZATIONAL STRUCTURE AND ADMINISTRATION OF THE THE LOWER COLORADO RIVER NATIONAL WILDLIFE REFUGES

By establishing the national wildlife refuges along the lower Colorado River, the United States government attempted to curb wildlife and habitat losses occurring as a result of damming and channelizing the Colorado River.

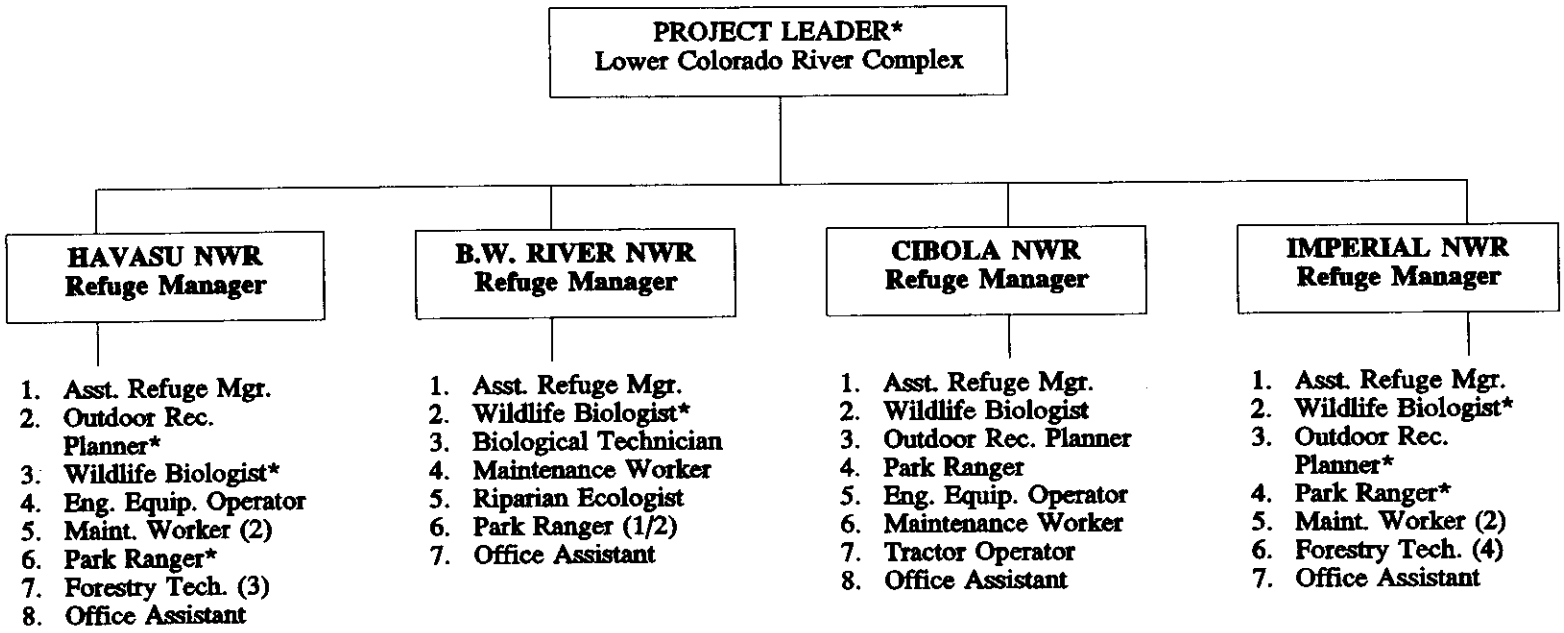
A succession of refuge managers at Havasu, Bill Williams River, Cibola, and Imperial NWRs have attempted to meet the challenge of protecting resources and curbing wildlife value losses on their respective refuges. Although the refuge managers share resources, each refuge competes with the others both regionally and nationally for scarce dollars. This situation presents a dilemma as each manager attempts to fulfill responsibilities for their respective refuges. The outcome of this competitive relationship is the inability to meet the demand for high levels of coordination between the refuges and a myriad of other agencies and jurisdictions. The net effect for the refuges individually and collectively is that they receive resources inadequate to the complicated task intended by the government when the refuges were established.

As has been described earlier in this document, the refuges are located in geographical proximity, and are all components of the Area of Ecological Concern. The refuge lands as a whole represent the largest remaining segment of the lower Colorado River managed primarily for wildlife purposes.

Prior to the completion of the comprehensive management planning process, it was clear to the Service that a new administrative and organizational perspective was necessary. Because of the high degree of interagency and intergovernmental coordination and communication required to describe and represent the cumulative needs of the refuges, the Service initiated action resulting in a reorganization of the lower Colorado River refuges. The reorganization provided for the establishment of a Refuges complex manager with the Complex headquarters located in Yuma, Arizona. This site was chosen because of the presence of AGFD, BLM, and BR officials. The location of a Complex headquarters near these other agencies facilitates higher levels of interagency coordination and cooperation.

Each of the individual refuges will continue to be managed in accordance with their original purposes, and the goals of the refuge system. The goals and objectives set through this planning process will stem primarily from the refuge purposes and refuge system goals.

Organizational Chart
5-Year Plan
COMPLEX OFFICE LOCATION: YUMA, ARIZONA



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UNIT 2 -- BIOLOGICAL USE PROGRAM ANALYSIS

1. INTRODUCTION

This Unit attempts to analyze existing data and information regarding population trends for the major classifications of avian wildlife, including the endangered Yuma clapper rail, on the four lower Colorado River national wildlife refuges.[116] This Unit also addresses the population trends of the endangered Colorado River fishes. Baseline inventories for all other species need to be conducted. Goals and Objectives detailed in Part III of this plan were designed to address the problems and opportunities characterized in this section of the document.

The following informal analyses are offered:

1. Analysis of Population Trends of the Yuma Clapper Rail
2. Analysis of Population Trends of the Endangered Colorado River Fishes
3. Analysis of Refuge Population Trends for Marsh and Waterbirds
4. Analysis of Refuge Population Trends for Migratory and Resident Songbirds and Raptors
5. Analysis of Refuge Waterfowl and Flyway Trends

2. ANALYSIS OF POPULATION TRENDS OF YUMA CLAPPER RAILS

The following is a cursory analysis of the populations and habitat status relative to the endangered Yuma clapper rail. The problems relative to this species are similar to those discussed for the larger classification of birds of which the clapper rail is a member, namely, marsh and water bird species. That analysis is offered in Section 4 of this Unit.

Historical Data

The Yuma clapper rail was declared endangered pursuant to the Endangered Species Act of 1966, a precursor to the 1973 Federal law.[117] Surveys between 1969 and 1981, produced a

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[116]Experts in the study of habitat and wildlife suggest that the health of the avian species communities is a gauge for determining the health of mammalian, amphibian, insect, and reptilian species communities. The relationship between avian habitat depletion and extirpation of these species is considered to be direct. Likewise, as avian species disappear, a domino effect begins to take place up through the food chain. Anderson and Ohmart state: ". . .as our knowledge of the ecosystem increased it became quite apparent that birds and the vegetation would be the major data set with small mammals and herps playing lesser roles. Our revegetation efforts supported this assumption in that by fulfilling the habitat requirements of a large number of species of birds the needs of numerous species of small mammals, deer, coyotes, rabbits, and herps were also addressed; they were present on the revegetated areas in high numbers (Anderson and Ohmart 1982, pers obs.)." [Anderson, Bertin W., and Ohmart, Robert D., *Vegetation Management Study for the Enhancement of Wildlife Along the Lower Colorado River*, Center for Environmental Studies, 1984.]

[117]The California Fish and Game Commission, under authority of the California Endangered Species Act of 1970, included the Yuma clapper rail on the state's listing of endangered and rare fish and wildlife. [Leach, H.R., and L.O. Fisk, *At The Crossroads - A Report On California's Endangered and Rare Fish and Wildlife*, California Department of Fish and Game, 1972, pp. 99]. Arizona classified the Yuma clapper rail under group 3, which is similar to the Federal threatened status; those species whose status is threatened or considered to be in jeopardy in the foreseeable future. This was taken by the Arizona Game and Fish Commission under their authority to list threatened and unique wildlife of Arizona. [Arizona Game and Fish Department, *Threatened Native Wildlife in Arizona*, Arizona Game and Fish Department Publication, Phoenix, Arizona, 10988, 32 pp.]

body of knowledge on breeding distribution and habitat of the Yuma clapper rail in the United States. Surveys in that time period were also conducted on the delta in Baja California and Sonora, Mexico. These surveys indicate that the population of Yuma clapper rails in the delta is about equal to that in the United States. Results of the surveys from 1969 through 1981 in the United States and Colorado River delta of Mexico indicate that the population was fairly stable at about 1,700 to 2,000 birds. The body of knowledge was sufficient enough for the drafting of the *Yuma Clapper Rail Recovery Plan* in 1983, which recommends goals and objectives for the recovery of the species. PART I, Unit 2, Section 6 of this document outlines these goals and objectives.[118]

Current Survey Conclusions

Since the early 1980s, the Service, in concert with the Yuma clapper rail recovery team, has conducted annual surveys. Current surveys indicate that the numerical goals are being met.[119] The 1991 Yuma Clapper Rail Survey reports a total of 843 birds, compared to the 673 recorded in 1990. It is important to note the 1991 Survey's observation that clapper rail ". . .habitat areas which deteriorated during the 1983 through 1986 flood have improved and the populations of clapper rails may further increase, especially if habitat conditions continue to improve."[120]

Refuge Contributions

Unlike the aggregate data, the survey as it applies to the national wildlife refuges indicates slight drops in the clapper rail populations between 1990 and 1991. No conclusions have been drawn, although it should be stated that the refuges' habitat areas for this sensitive species are in need of improved protection and in some cases enhancement. Water quality difficulties plague the backwater areas at Havasu, Cibola, and Imperial NWRs.[121] Control of public recreation on the River, including some backwater areas, also continues to be a problem. Though no data exists to confirm that such use is directly impacting the clapper rail, photographic evidence shows that unregulated jet skiing and high speed boating is harmful to other marsh birds like the Western and Clark's grebes.[122]

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[118]Please refer to *Yuma Clapper Rail Recovery Plan*, Anderson, Stanley H., Wyoming Cooperative Research Unit, Laramie, Wyoming, 1983.

[119]The Yuma Clapper rail recovery plan indicates that in order to assure survival of the species, 700 to 1000 clapper rails need to be maintained in the United States.

[120]U.S. Fish and Wildlife Service, *Yuma Clapper Rail Census Summary*, 1991.

[121]Please refer to PART II, Unit 1, Section 6 of this document for a discussion of water quality, contaminants, and human waste issues as they affect endangered species.

[122]Please refer to PART II, Unit 3, Public Use Program Analysis, of this document for an analysis of public recreational use, PART II, Unit 1, Section 9 for a discussion of allowable uses and compatibility, and PART II, Unit 1, Section 3 for a discussion regarding jurisdiction of the Service.

Havasu NWR -- Between 1987 and 1991, the data shows reasonably stable counts with slight downward fluctuations in 1988, a large increase in 1990, and a slight drop for 1991. The Crystal Beach Subunit of the Topock Gorge Management Unit continues to be the area with the highest counts along the River. The percentage growth in population between 1987 and 1991 was approximately 56 percent.

Bill Williams River NWR -- The Bill Williams River NWR has traditionally registered small numbers of the clapper rail, with populations fluctuating downward in 1989 and 1990, but with a significant increase in 1991. Overall, the populations have increased since 1987, with a percentage growth of two percent. The 1991 population was an increase of nine rails over the previous year.

Cibola NWR -- Cibola NWR's counts at Cibola Lake were not recorded in 1988 and 1989. Data exists only for 1987, 1990, and 1991. The 1990 count of 52 birds was the peak, far surpassing 1987's count of 23 and the most recent 1991 count of 39.

Imperial NWR -- Like Havasu and Cibola NWRs, the 1991 census at Imperial NWR (24 birds), indicates a drop from 38 birds in 1990.

Summary -- It is difficult to come to any conclusions about the current conditions of the Yuma clapper rail habitat and carrying capacities on each of the national wildlife refuges. The 5-year data points are not enough to come to any scientific conclusions about long-term growth trends on the refuges. Throughout the Area of Ecological Concern, the data indicates that overall populations are stable and that the recovery plan numerical population goal is being met.

Nevertheless, recent drops in refuge Yuma clapper rail populations should be cause for concern regarding habitat conditions. Recent study findings concerning selenium contamination of backwater marsh areas, although not definitive, indicate that a significant risk factor exists for these species. Public recreation near sensitive areas presents another possible risk to both habitat and species.

3. ANALYSIS: RECOVERY AND MAINTENANCE OF NATIVE POPULATIONS OF COLORADO RIVER FISHES AND THE ROLE OF THE COLORADO RIVER NATIONAL WILDLIFE REFUGES

The following analysis concerns the recovery and maintenance of big fishes native to the lower Colorado River. The status of existing populations and gross actions needed for their survival, recovery, and maintenance are discussed. Four species of fish native to the lower Colorado basin are now listed by the Federal government as being in danger of extinction.[123] All four

[123]Please refer to PART I, Unit 2, Section 6 of this document for a discussion regarding Recovery Plans for these species.

species--the bonytail chub, Colorado squawfish, humpback chub, and razorback sucker--were once abundant in the River.[124]

A variety of factors led to the demise of lower basin native fish populations, including the modification of free flowing streams and riverine habitats altered by dams. Free flowing warm and turbid streams became clear impoundments that blocked migration and modified the food chain. Non-native fish better equipped to a lotic environment were introduced and rapidly occupied the newly-created reservoirs. Native fish were not competitive in the changed environment and decreased in abundance while the introduced fish prospered. Additionally, success of the introduced fish was ensured by resource managers who managed the non-native fish to provide a growing sport fishery. With the additional burden of water withdrawals, contaminants, interrupted stream flows, etc., all four species have declined in numbers and have reached an all-time low in the lower basin.

Current Survey Conclusions

All four species are listed as endangered by the Federal government.[125] The major threats to their continued survival are loss of habitat, especially modification of the riverine system to which these species are adapted, and competition and predation by non-native fish species.

Colorado Squawfish -- Except for experimental nonessential populations introduced into the Verde and Salt River sub-basins, Colorado squawfish have been extirpated from the wild in the lower basin. Although the eventual success of these recovery efforts is unknown, current population numbers in both sub-basins are small and are being supplemented with larger (> 12 inch) hatchery-produced fish as they become available.

Colorado squawfish are "relatively" abundant in the Green River (upper Colorado River basin). They are migratory, traveling considerable distances to spawn. Spawning apparently occurs in flowing water on selected boulder or boulder/gravel riffles or runs upstream of deep pools.

Humpback Chub -- Humpback chub populations in the lower sections of the Little Colorado River, its confluence with the Colorado River mainstem, and the mainstem per se, contain several thousand fish. This population seems to be dependent on the Little Colorado River for spawning and nursery habitat. A major chemical spill or other disaster could drastically reduce

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[124]Historians tell of catching Colorado squawfish (locally known as the white salmon of the Southwest) that grew to 6 feet in length and weights of more than 80 pounds. Razorback suckers were so abundant in portions of the Gila River that horsemen had to be careful that their mounts were not spooked when crossing streams on horseback. Although less notoriety was given to the humpback and bonytail chub, there is evidence that they too were very abundant in the lower Colorado River basin. Although the total number of species was sparse, the number of individuals occurring within each species was large. Native fish were so abundant in the Colorado River that western settlers used them as fertilizer to enhance crop production in the lower basin. Yet within a century, the numbers of the four listed species dropped so low that their continued existence remains in doubt.

[125]The Colorado squawfish and humpback chub were listed in 1973, the bonytail chub in 1980, and the razorback sucker in 1991. Please refer to PART I, Unit 2, Section 6 of this document.

this population or possibly destroy humpback chub populations in the lower Colorado River Basin. Again, spawning in the wild is stream-dependent, occurring in flowing water.

Bonytail chub -- A residual population of bonytail chub still occurs in Lake Mohave. The size of this endemic population is unknown, but believed to be small, and there appears to be little natural recruitment to the population.[126] Pressures from non-native fish populations and a reservoir environment are constant threats to this species survival. Almost nothing is known of spawning activity or location in Lake Mohave.

Razorback Sucker -- Razorback sucker populations occur sporadically in much of the lower Colorado River mainstem. By far the largest known population, approximately 60,000 fish, occurs in Lake Mohave. Fish surveys in the Grand Canyon, Lake Mead, Lake Mohave, and canals on the Colorado River Indian Reservation have all produced razorback suckers. For the most part, however, samples contain old adult fish. The sparse to nonexistent recruitment recorded to date will not sustain existing populations. Spawning occurs in Mohave where adult fish congregate over water-covered gravel bars in relatively shallow water. Spawning activity has been recorded on numerous occasions and fry have been collected. But recruitment to adult is apparently nil to nonexistent.

Current Efforts of the Native Fish Work Group

The Native Fish Work Group is involved with the "nuts and bolts" activities of constructing barriers for grow-out coves, and basic fish culture to produce the fish for stocking in the grow-out coves. The majority of the work at present is to replace the aged population of razorback suckers and bonytail chub in Lake Mohave with a young population that has enough genetic diversity to maintain them. This is to provide time for the scientific community to determine the exact causes of the apparent 100 percent recruitment failure for thos species in the wild.

At this time, the Work Group's efforts are primarily concentrated on ensuring a genetically diverse population of the razorback sucker and chub survives in Lake Mohave. As part of the Lake Havasu Fishery Improvement Program, the Service, in cooperation with BR, BLM, Angler's United, Metropolitan Water District of California, and AGFD, is following the same protocol as above for ensuring a young population of razorback sucker and bonytail chub with good genetic diversity is established in Lake Havasu.

Possible Refuge Contributions

There appear to be opportunities for management of at least three Colorado River native fish species (bonytail chub, Colorado squawfish, and razorback sucker) on one or more of the lower Colorado River refuges. Due to their apparent need for riverine habitat during the reproductive process, the "natural" river conditions on the four refuges appear especially important for the

[126]Recruitment is a term referring to increases in populations of sexually viable fish. Even though spawning may occur, numbers are not considered to be "recruited" until they have reached adult sizes and can reproduce.

recovery of these three species. The humpback chub is in less immediate danger than the bonytail chub and, since there is always a chance of hybridization if the two genus *Gila* species were introduced in the same area, short-term efforts dictate work be done with bonytail rather than humpback chub.

All four species evolved in riverine habitats, and flowing water is a valuable asset, if not a requirement, in the recovery of these fish. In the nearterm, Havasu, Bill Williams River, Cibola, and Imperial NWRs could all provide refugia for these long-lived (30 plus years) species of fish.[127] Both refuges have areas that have been traditionally determined to be off-limits to public use and/or are inaccessible to humans.

Refugia at each of the refuges may be provided in coves that are blocked to prevent both the escape of the native fish stocked in the cove and entry of non-native predators and competitors into the protected area. Ponds or marshes of sufficient depth (>8 feet) are needed to provide safe habitat. Additionally, if these impoundments do not contain predatory fish, other than the target species stocked, some natural reproduction can be expected.

Summary

The importance of refugia can not be overemphasized. With fish populations containing primarily old fish that are not recruiting in sufficient numbers to maintain existing populations, the species will be extirpated from the wild unless existing populations can be supplemented with stocks produced in captivity and/or barriers to natural recruitment are solved.[128] Time is needed to produce fish to maintain these species and solve problems associated with recruitment. Lower Colorado River refuges will be instrumental in providing refugia and possibly producing fish to augment existing populations. As management of the endangered fish becomes an added purpose of the refuges, their needs can be addressed without compromising the other refuge purposes.

Short-term management strategies should be to provide refugia for these fish. Mid-term management strategies should be to reintroduce fish into available habitat believed conducive to the recovery of the fish. Long-term management strategies should be to manage and protect habitat and the species to ensure each species survival.

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[127]Refugia refers to existing or created areas to be inhabited by species in danger of extinction or extirpation. These areas are typically under extensive protection from a dynamic environment which surround them and act as centers from which a new dispersion and speciation may take place.

[128]Captivity includes any refugium where natural reproduction and survival can occur to that desired for release into waters targeted for recovery or maintenance of existing populations.

4. ANALYSIS OF REFUGE MARSH AND WATERBIRD TRENDS

General

Since the beginning of the 20th century, Colorado River development projects have done more than changed the course of the River itself. In some cases, development has had catastrophic effects upon habitat and wildlife in general. This is particularly true for both migratory and resident species, including cranes, rails, egrets, grebes, bitterns, herons, and cormorants.

Channelization of the River is speculated to have detrimental effects, particularly on rail species such as the endangered Yuma clapper rail and the Arizona and California-listed California black rail. Rail species breed and feed in shallow marshy areas where the population of cray fish and other aquatic animals and vegetation thrive. Certain types of recreational uses of the lower Colorado River when unregulated are suspected of being harmful to riparian habitat and wildlife populations in general. Specifically, previously unregulated jet ski access and use of riparian backwater areas has been suspected to directly harm Yuma clapper rail nesting areas. This kind of high intensity use of these areas is documented to have affected grebe and cormorant nesting areas.

Additionally, fluctuating water levels due to releases at the various dams along the Colorado River, are thought to affect the viability of native vegetation survival, as in the case of cottonwood and willow galleries. The disappearance of this kind of native vegetation may not have a direct effect on marsh and waterbirds, but probably influences shorebird, raptor, and migratory and resident songbird use. These are all thought to be important pieces in the biological diversity mosaic along the River.[129]

Another described threat to all species, especially marsh and waterbirds, in the Area of Ecological Concern is selenium contamination, which is known to cause species mutations, sickness, and death.[130] With the exception of Yuma clapper rail surveys, there are no riverine-wide surveys for this classification of birds that look at regional populations. This analysis is based on a refuge-by-refuge estimation of populations.

Refuge Trends

Havasu NWR -- Populations of marsh and waterbirds remain stable, but informal surveys have shown that water-based recreational activities continue to impact water-nesting birds. The annual Western/Clark's Grebe Nesting Survey conducted in August indicates gradual drops in the

[129]River channelization and controlled releases from various dams have caused the river levels to fluctuate, thus affecting the viability of native vegetation survival along the shores. Ironically, it should be pointed out there is more marsh on the lower Colorado River now than in historic times. This is primarily due to the marshes forming at the upper ends of reservoirs, and those such as Topock Marsh (Havasu NWR), which were a result of river stabilization.

[130]Please refer to PART II, Unit 1, Section 6 for further discussion regarding the effects of high concentrations of selenium on marsh and waterbird species, including the Yuma clapper rail.

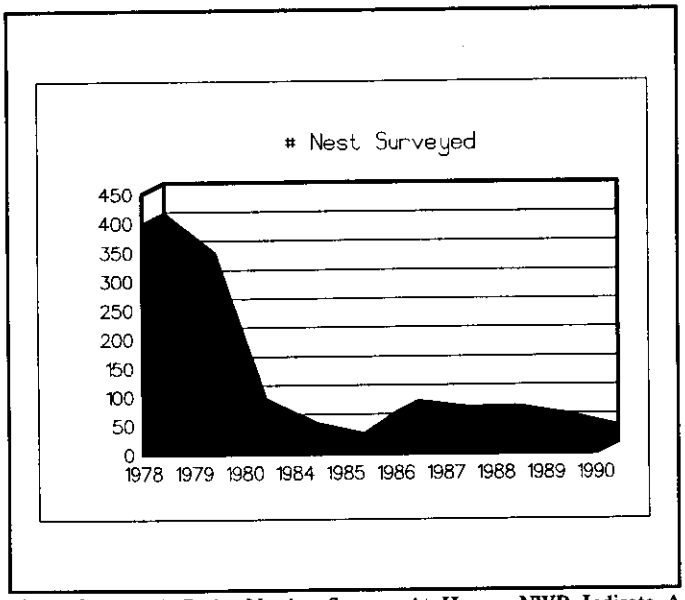

Figure 9 Annual Grebe Nesting Surveys At Havasu NWR Indicate A Significant Population Decline Since 1978.

number of nests counted in the Refuge's marsh areas. The purpose of this survey is to determine grebe nesting response to decreased boat traffic in no-wake backwaters. It should be noted that Havasu has the highest concentration of Yuma clapper rails in the Topock Gorge backwater marshes, specifically in the Crystal Beach Subunit of the Topock Gorge Management Unit. (See Figure 9)

There are over 5,000 acres of marsh suitable for marsh and waterbirds in both the Topock Marsh and the Topock Gorge Management Units. These marshes have concentrations of potomogeton, spiny naiad, and invertebrates such as crayfish, the preferred diet of the rail species.

Bill Williams River NWR -- Observations of marsh and waterbirds at the Bill Williams River NWR indicate a stable population trend. The Refuge's role to protect the Colorado River-Bill Williams River delta ensures stable populations.

The inventory includes Clark's, pie-billed and western grebe, double-crested cormorant, white pelican, American bittern, great and snowy egrets, white-faced ibis, black-crowned night heron, green-backed heron, and various rail species (black, Virginia, sora, and Yuma clapper rails). The annual Western/Clark's Grebe Nesting Survey trends indicate moderate increases.

The concentration of acreage for marsh and waterbirds at the Bill Williams River NWR is in the delta area. The addition of Planet Ranch should affect populations by enhancing ecosystem biological diversity in general. The acreage for marsh and waterbird species at the Bill Williams River NWR is estimated at a little more than 100 acres.

Cibola NWR -- A large bank of data exists for the Cibola NWR populations of marsh and waterbirds including the greater sandhill crane and the double-crested cormorant.

The Refuge plays a specific role in the maintenance of sandhill cranes, as called for in the *Pacific Flyway Management Plan, Lower Colorado River Population of Greater Sandhill Cranes*, as revised in 1989. The plan calls for the Refuge to winter 500 to 1000 cranes, and since 1985, it has exceeded the goal. Wintering populations along the Colorado River as a whole are estimated between 1500 and 2500. Cormorant surveys also show a stabilized population with year-to-year slight increases since 1988.

Unlike Havasu and Imperial NWRs, Cibola's backwater marsh areas are concentrated, rather than spread out over long distances. Cibola's capability to manage for these species lies in Cibola Lake, in the Cibola Lake Management Unit, Hart Mine Marsh in the Hart Mine Management Unit, and along the Old River Channel. Sandhill crane areas include Farm Subunit 1 of the Arizona North Management Unit, Farm Subunit 2 of Hart Mine Management Unit and Farm Subunit 3 of the Island Management Unit. Cibola's total acreage suitable for marsh and waterbirds including sandhill cranes is estimated at more than 4000 acres.

Imperial NWR -- There are no formal surveys, other than those for the Yuma clapper rail, to denote population trends at Imperial NWR. It is management's estimation that because of the Refuge's basic role of protecting backwater habitats, most populations of this classification of birds are stable.

The Imperial NWR 1989 Annual Narrative indicates stable populations of great blue heron, great egret, snowy egret, and black-crowned night heron. Of concern to the Refuge is the drop in production of western grebe; the estimated number of birds sighted on Martinez Lake is 200.

The Refuge's total acreage suitable for marsh and waterbirds is difficult to estimate because much of the backwater areas suitable to marsh species are along inaccessible portions of the River. The areas containing manageable habitats include Martinez Lake and Riverbank, Ferguson Lake and Shore, and Martinez Marsh and Upland Management Units. Acreage in these marshy areas is estimated to exceed 4000. Approximately 10,000 acres of marshy areas which align the Colorado River (Backwater Riveredge Management Unit) are not manageable by virtue of their inaccessibility.

Summary

Although populations of marsh and waterbirds appear to be holding firm, there are threats to these niches in the ecosystem, and the refuges must plan to withstand them throughout the 20-year planning cycle.

Water management is the chief variable in the complex puzzle of protecting as well as enhancing marsh habitat. Fluctuations in water levels will affect the viability of marsh and waterbird populations. Flow patterns and rate affect water freshness and the viability of aquatics on which the marsh species rely for food. Other variables are the threats of activities such as jet skiing, which is considered harmful to the backwater marsh habitat areas. The Service must strengthen its efforts to enforce the no-wake restrictions in backwater and sensitive habitat areas within the refuge, and the restrictions on unlawful camping and any other activity deed to be *not compatible* with the refuge purposes, presently or in the future.

All of the refuge stations have a key role to play in managing for marsh and waterbird species, since each contain significant amounts of suitable habitat. Each of the refuges comprise a large carrying capacity for marsh and waterbird species.

5. ANALYSIS: MIGRATORY, RESIDENT AND WINTERING SONG BIRDS, RAPTORS AND OTHER NON GAME AVIAN SPECIES

General

What is known about the general trend of migratory, resident, and wintering avian species is due to the research efforts of a small group of biologists that have studied a full range of wildlife species including migratory, resident, and wintering avian species throughout the Area of Ecological Concern.[131]

The research on these groupings and their use of the lower Colorado River Area of Ecological Concern clearly concludes that populations of key species have been nearly extirpated from the region as a result of massive habitat changes propagated by development for water management and control as noted in PART I, Unit 1, Regional Setting. What used to be large forests and canopies of native cottonwood and willow trees are now equally large forests of monotypical stands of non-native salt cedar. With the losses of the native forests have come considerable losses in avian and other wildlife uses.

In short, the trend lines for many of these key indicators of ecosystem health and natural diversity are downward. Each of the national wildlife refuges have certain roles to play in ensuring that long-range plans and strategies are implemented to slow, and eventually reverse, the trend. What is critical in this already "fragmented" ecosystem is that the refuges and the Service foster the level of interagency cooperation necessary to solve the problem ecosystem wide.

The following summarizes the various refuge habitat suitabilities and capabilities to manage for the migratory, resident, and wintering nongame avian species including neotropical songbirds and raptors.

Refuge Resource Capabilities

Havasu NWR -- Suitable habitat for migratory, resident and wintering nongame avian species is estimated to be well over 2,000 acres, although these areas are quickly being overcome by monotypical stands of non-native salt cedar. Certain areas can be selectively improved through revegetation with native cottonwoods and willows, thus enhancing the resource capability of the refuge. Mesquite mixes, atriplex, and other native vegetation are among varieties that would be important to a revegetation program to enhance carrying capacities for these groupings. This could be done in a variety of areas within the Topock Marsh Management Unit, especially along the perimeter of the Topock Marsh and Pintail Slough Subunits.

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[131]The best available source material for understanding the status of neotropical migrant species (i.e. songbirds and raptors) is *Birds of the Lower Colorado River Valley*, Rosenberg et al., University of Arizona Press, 1991. This book is based on years of research by principal researchers Bertin Anderson, Robert Ohmart, William R. Hunter, and Kenneth Rosenberg.

Existing athel forest near Topock Marsh provides important habitat for perching raptors even though these forests are exotic to the region. Havasu NWR proposes a 600-acre revegetation site near the north boundary of the Refuge in the Topock Marsh Management Unit. It is important to the success of any revegetation effort to be as selective as possible, taking into account various factors (i.e., depth to ground water, salinity, etc.).

Bill Williams River NWR -- Together with the Planet Ranch, the Bill Williams River NWR offers the largest variety of birdlife of any place in the lower Colorado River Valley.[132]

The Bill Williams/Planet Ranch basin is also threatened by recent depletions to the very water source which keeps the last remaining native vegetation galleries alive. The addition of the Planet Ranch will do much to ensure the viability of both the surface and groundwater sources. Fires present an additional hazard to the existing native vegetation stands.

The Bill Williams River NWR, not including the Planet Ranch, offers 2,200 acres of suitable habitat for migratory, resident, and wintering nongame avian species.[133] Some of this acreage is in need of protection from fire, and some of the areas are being infested with monotypical salt cedar stands. Through a strategic program of revegetation, the resource capability of Bill Williams River NWR can be greatly improved within the next 20 years.

Cibola NWR -- Cibola NWR's habitat potential for migratory, resident, and wintering nongame avian species surpasses 6,360 acres. Cibola also presents a unique opportunity to turn around the population trends of these groupings. Assuming it can overcome water management difficulties in the long run, Cibola NWR presents significant revegetation opportunities. Because of its extensive record keeping, Cibola offers itself as a natural test site to gauge success at both revegetation and increase in the number of almost extirpated songbirds. Current revegetation efforts on Cibola, in fact, use the attractibility of replanted cottonwoods and willows to the yellow-billed cuckoo as a gauge for revegetation success or failure.[134] Fire and lack of proper water management capabilities continue to be the hindrances toward easy revegetation efforts.

The primary areas suitable for revegetation include the Island Management Unit along the Old River Channel, the California North Boundary area in the California Management Unit, and areas in the Hart Mine and Cibola Lake Management Units.

Imperial NWR -- Imperial NWR has more than 6,300 acres of suitable habitat for migratory, resident, and wintering nongame avian species. This total includes 2,000 acres of River

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[132]Ibid., Rosenberg et al.

[133]This is the number of approximate acres that contains cottonwood and willow habitat and/or honey mesquite-salt cedar mixes of vegetation that are suitable for neotropical bird use. According to Ohmart and Anderson, the former is the preferred habitat; however, the latter, although not as rich, is also used by neotropical birds. It is only in the monotypical stands of salt cedar where bird use is very low. [Anderson, Bertin W., and Ohmart, Robert D., *Vegetation Management Study for the Enhancement of Wildlife Along the Lower Colorado River*, Center for Environmental Studies, 1984.]

[134]Ibid., Rosenberg et al.

floodplain. Although total acreage of salt cedar stands on the Refuge is less than on Cibola and Havasu NWRs, monotypic stands of this vegetation are the dominant cover type in the riparian zone. Public use patterns indicate there could be an increase in human-caused wildfires on the Refuge, threatening existing stands of native vegetation and promoting even greater salt cedar infestation.

A cottonwood and willow nursery provides stock for pole planting on the Refuge, other refuges, or other portions of the Area of Ecological Concern. Through its fire management capabilities and this nursery program, Imperial NWR offers the southern portion of the Area of Ecological Concern the opportunity to participate actively in the total effort to reverse the downward trend in biological diversity.

Applicable habitats for these species include: Martinez Lake and Riverbank, Martinez Marsh/Upland, Ferguson Lake and Shore, and Backwater/Riveredge Management Units.

6. ANALYSIS: REFUGE WATERFOWL AND FLYWAY TRENDS

The data used for the following narrative is extracted from *Analysis of Selected Mid-Winter Waterfowl Survey Data (1966-1991)*, Region 2, Pacific Flyway Portion, July 1991. The Bill Williams River NWR is incorporated into the Havasu NWR analysis since up until recently the Bill Williams was a unit of Havasu NWR.

The data points for the Pacific Flyway and the statewide trends are based on a survey conducted on one specific day during the first week of January of each year between 1967 and 1991. This has been called the mid-winter survey. Three-year running averages were calculated and then data points were graphed. From these data points, trends were determined for the 26-year period.

In contrast, the data points for the refuge stations are based on observations taken during a 2-month period of each year (December/January) over 19 years at Cibola and Havasu NWRs and 26 years at Imperial NWR. Again, as in the case for the flyway and state counts, 3-year running averages were determined and placed on a graph as data points; a trend was determined from these points.

Because of the differences in data collection methods, it is important that refuge numerical data from the flyway and state not be compared directly to the numerical data from the refuges. However, it is possible to interpret, in general, that the trends can be compared over long periods. The possible trend-line alternatives will show that populations are on the increase; the populations are stabilized; or the populations are on the decrease. From these very basic conclusions, one might be able to infer what actions can be taken to affect the trends in the long term should that be desirable.

Canada Geese

Flyway -- Canada goose averages over 1967 through 1991 show a moderately steep upward trend. The counts show gradual increases and decreases during the period, resulting in a stabilized upward trend in the flyway population.

Arizona Trends -- The 26-year Canada goose trend line for the State of Arizona follows that of the Pacific flyway trends. The state trend line, although showing a gradual increase, is based on a much more erratic set of data points on the graph. Counts between 1967 and 1973 were fairly stable and level. Between 1973 and 1979, the number of birds observed dropped from an average of 5,000 to less than 3,000. Populations did not begin to rise significantly until 1983. In 1987 the population peaked at approximately 21,000 birds. Since that time, the observed population has been on a steep decline with a 1989-1991 observed population of approximately 2,000 for the entire state. It is important to note that the statewide count does not include numbers occurring along the Colorado River.

Refuge Trends --

Havasu NWR -- The 19-year Canada goose trend analysis for Havasu NWR indicates a much steeper rise in Canada goose population than that indicated for the flyway and the state. There appear to be gradual but real increases in population averages between 1973 and 1991. The data points do not fluctuate too far from the mean. The number of birds counted at Havasu during the last 3-year period (1989-1991) appear to be sharply increasing, with peak population reaching 2,700 birds.

Bill Williams River NWR -- There appears to be a stable population of Canada geese in the Delta Management Unit. Although a peak of 3,100 geese was counted in 1989, the Refuge has maintained a steady wintering population of approximately 1,500 birds.

Cibola NWR -- The 19-year Canada goose trend analysis for Cibola NWR indicates protracted and sharp increases in populations. The numbers range from a negligible number of geese in 1973 to amounts in excess of 15,000; the peak population shown for the 1989-1991 period is almost 20,000 birds. This extraordinary increase in the species at Cibola has been attributed to the considerable refuge resources concentrated in managing for Canada geese.

Imperial NWR -- The 26-year Canada goose trend line for Imperial NWR also appears to be consistent with both the state and flyway lines. However, the trend line's upward direction appears to be based upon recent steep increases in counts between 1985 and 1991. Prior to the past 6 years, the Imperial population of Canada geese fluctuated between a high of 1,100 birds in 1973 and less than 300 birds in 1985.

Analysis -- It is apparent that refuge trends for Canada geese are consistent with the Arizona and Pacific Flyway trends, which show moderate increases in the 3-year running averages over 19-

and 26-year periods. It is difficult to empirically determine, on the basis of this trend line consistency, that refuge waterfowl management programs are affecting the number of birds observed. Certainly peak numbers at Cibola NWR indicate that the refuge's highly focused crop programs are important factors. Increases in numbers at Havasu might be due to Cibola's intense management for this species. Arguably, if Cibola NWR draws more of the flyway population, there could be a positive effect on numbers along the way, namely at Havasu NWR.

Another factor affecting the Cibola Valley population of Canada geese is the general agricultural makeup of the area. Private farms provide an important habitat base necessary to support geese and other wildlife. Private farmers are partners with the refuge in managing for geese. It is essential that refuges continually communicate with these farmers regarding management efforts so that crop depredation does not occur or is minimized.

Cibola may not have enough carrying capacity to accommodate the continual increases after year 5 of this plan. The rate of increase in Canada goose populations has been approximately 5 percent per year. Based on this growth the population of Canada geese is projected to rise to more than 25,000 by year 4 of this plan.

Peak numbers of Canada geese at Havasu and Imperial NWRs indicate that these refuges probably have enough carrying capacity to handle moderate increases in numbers for years to come. Havasu has the most limitations since it has only 200 acres of farmable land, 100 acres near the maintenance facility (Bermuda Pasture Subunit of the Topock Marsh Management Unit) and 100 acres in the Pintail Slough Farming Subunit of the Topock Marsh Management Unit. Imperial appears to have a sufficient capacity for farming program expansion over the next 20 years, but until irrigation improvements are made and additional information is obtained regarding the inter-refuge (i.e. Imperial and Cibola) use characteristics of the geese, farming levels should remain at current levels.

Ducks

Ducks can be divided into two major categories: divers and dabblers.

The major characteristics of diving ducks are that they tend to frequent deeper waters, their legs are attached more toward the rear of the body, and they cannot become airborne as quickly as dabblers. The major characteristics of the dabbling duck are that they frequent more shallow water and they can quickly become airborne. Dabbler diets may vary from diver diets because of their respective use of shallow or deeper waters.

Divers include: lesser scaup, bufflehead, redhead, ruddy duck, common goldeneye, canvasback, and three species of mergansers. Dabblers include: northern pintail, mallard, gadwall, green-winged and cinammon teal, northern shoveler, and American widgeon.

Since none of the refuges manage specifically for any one species of duck, this narrative looks at the trend characteristics of the aggregate mix; that is, all ducks.

Flyway -- The mid-year survey indicates that over a 26-year period, the population of ducks has generally decreased. The decline appears to be steady, although duck populations had a series of high years between 1971 and 1979, with a peak average of 7,700,000 for years 1971-1973. Since that time, the 3-year running averages have been continually dropping, with the 1989-1991 average being at an all-time low of 4,200,000 ducks.

Arizona Trends -- The mid-year survey trend line for the State of Arizona has the same slope characteristics as the flyway trend line. Populations of ducks are on the decrease for the State of Arizona as a whole, although the 10-year trend shows a flattening of the slope since 1981.

Refuge Trends -- The trend lines for all of the refuge units show a general rise in contrast to the statewide and flyway trends. The 19-year trend line slope at Cibola and Imperial NWRs are similar, while Havasu NWR's trend line slope is much more flat, with the duck population stabilizing at between 2,000 and 3,000 ducks over a 10-year period from 1981 to 1991. Among the refuges, Cibola again shows the largest of the populations with the 1989-1991 average at 8,500 ducks. Imperial's 1989-1991 average is 6,000 ducks.

Analysis -- The refuge trends for ducks are not consistent with the Arizona and Pacific Flyway trends which show a general drop in duck populations during the 3-year running averages over 19- and 26-year periods. It is possible that both the loss of habitat elsewhere in the Area of Ecological Concern and shifts in use areas may have played a role in increasing numbers on the refuges. It is difficult to empirically determine the basis for this trend-line inconsistency. General waterfowl management efforts at all four refuges could be contributing factors to increases in refuge duck populations.

The Service must decide what changes will be necessary over the long term to the current levels of farming, moist soil management, and other strategies employed on the Colorado River refuges. Farming activities need to be viewed in a cumulative sense. The refuges should make progress toward achieving optimum resource capability. The combination of refuges should provide for the needs of all migratory bird species on the River. The respective refuges should develop their own waterfowl and migratory bird management strategy, but within the context of the riparian corridor and the Area of Ecological Concern. Hopefully, the objectives and strategies of this planning effort will result in providing for the needs of migratory waterfowl as a component to overall biological diversity.

7. SUMMARY TABLES: REFUGE BIOLOGICAL RESOURCE SUITABILITY[135]

The following summaries are based on acreage estimates tallied from the various refuge management units and special activity areas. These estimates are intended to give the reader a proportional sense of the level of desired change to refuge habitat through the implementation of long-term management strategies. These estimates are not the objectives in and of themselves. Degrees of positive change to the habitat and wildlife are desired outcomes rather than objectives.

Current Habitat Suitability

The *Current Suitability* category is comprised of the cumulative estimates of acreage that currently serve various wildlife if even to a minimum. The *Enhancement* category is comprised of the cumulative acreage targeted for improvement. Some acres in this category are in addition to those currently suitable for a particular use; these acres are noted as "additional." In the *Enhancement* category, those that are not noted as "additional" are already suitable but are yet in need of some improvement.

Future Habitat Suitability

The last matrix is comprised of the cumulative estimated acreage for each of the main species groups. Endangered species are listed individually. The *Future Suitability* category is comprised of the combination of currently suitable acres and additional acreage proposed for improvement.

The acreages represented in this summary are the priority areas of the refuges based upon management unit/subunit and special activity area inventories.

[135]The term "suitable" is not intended to represent qualitative aspects of the habitats deemed to be supportive of certain types of species. Each of the species outlined in the tables has basic habitat needs and preferences. Based upon the refuge managers' experiential sense of wildlife use within various habitats on the refuges, acreage was estimated. The numbers represented in the tables are certainly not exclusive of other refuge habitats which support the respective species in some way. Suitable acreage is understood in its broadest sense as acreage preferred by a particular species and where wildlife is observed to feed, breed, or roost.

Biological Resource Suitability Acreage Summary

Havasu National Wildlife Refuge
Present Wildlife Suitability Acreage, and Acreage Targeted For Enhancement

Species	Acres Suitable - current estimate	Acreage Proposed for Enhancement
Southern Bald Eagle (endangered)	14,882	2,013 (additional)
Peregrine Falcon (endangered)	14,882	2,013 (additional)
Y. Clapper Rail (endangered)	3,181	521 (additional)
Colorado Squawfish (endangered)	none	none planned
Razorback Sucker (endangered)	none	none planned
Bonytail Chub (endangered)	none	none planned
Migratory, Resident, and Wintering Nongame Avian Species (songbirds and raptors)	14,276	2,013 (additional)
Marsh and Waterbirds	3,181	971 (additional)
Migratory Waterfowl	376	818 (additional)

Bill Williams National Wildlife Refuges
Present Wildlife Suitability Acreage and Acreage Targeted For Enhancement

Species	Acres Suitable - current estimate	Acreage Proposed for Enhancement
Southern Bald Eagle (endangered)	5,500	820
Peregrine Falcon (endangered)	5,500	820
Y. Clapper Rail (endangered)	300	
Colorado Squawfish (endangered)	none	320
Razorback Sucker (endangered)	none	320
Bonytail Chub	none	320
Migratory, Resident, and Wintering Nongame Avian Species (songbirds and raptors)	6,000	820
Marsh and Waterbirds	300	
Migratory waterfowl	500	none planned

Cibola National Wildlife Refuge
Present Wildlife Suitability Acreage and Acreage Targeted For Enhancement

Species	Acres Suitable - current estimate	Acreage Proposed for Enhancement
Southern Bald Eagle (endangered)	2,600	3,850
Peregrine Falcon (endangered)	2,600	3,850
Y. Clapper Rail (endangered)	1,000	1,765
Colorado Squawfish (endangered)	none	465
Bonytail Chub (endangered)	none	465
Razorback Sucker (endangered)	none	465
Migratory, Resident, and Wintering Nongame Avian Species (songbirds and raptors)	2,600	3,850 (additional)
Marsh and Waterbirds	2,400	2,385 (additional)
Migratory Waterfowl	2,700	1,715 (additional)

Imperial National Wildlife Refuge
Present Wildlife Suitability Acreage and Acreage Targeted For Enhancement

Species	Acres Suitable - current estimate	Acreage Proposed for Enhancement
Southern Bald Eagle (endangered)	13,320	3,310
Peregrine Falcon (endangered)	13,320	3,310
Y. Clapper Rail (endangered)	3,690	2,070
Colorado Squawfish (endangered)	none	1,000
Razorback Sucker (endangered)	none	1,000
Bonytail Chub (endangered)	none	1,000
Migratory, Resident, and Wintering Nongame Avian Species (songbirds and raptors)	13,320	2,910
Marsh and Waterbirds	5,000	2,310
Migratory Waterfowl	1,700	400

Twenty-Year Habitat Improvement Targets

Percentage Increase In Suitable Habitat Through Habitat Enhancement Projects For All Lower Colorado River NWRs

Species	Current Suitability	Future Suitability	% Increase
Southern Bald Eagle (endangered)	36,302	42,165	16%
Peregrine Falcon (endangered)	36,302	42,165	16%
Y. Clapper Rail (endangered)	8,171	10,457	28%
Colorado Squawfish (endangered)	0	1,665	--
Razorback Sucker (endangered)	0	1,665	--
Bonytail Chub (endangered)	0	1,665	--
Migratory, Resident, and Wintering Nongame Avian Species (songbirds and raptors)	36,196	42,665	16%
Marsh and Waterbirds	10,881	14,237	31%
Migratory Waterfowl	6,726	9,229	37%

UNIT 3 -- ANALYSIS: PUBLIC USE PROGRAM

1. INTRODUCTION

Public use activities on the refuge stations along the lower Colorado River can be divided into two basic types: wildlife-oriented and nonwildlife-oriented. The wildlife-oriented category includes traditional hunting and fishing, wildlife observation, and environmental interpretation. Most nonwildlife-oriented recreation such as off-road vehicle use, water skiing, and jet skiing are considered, in most cases, not compatible with the purposes of these refuges. Those activities that have been determined to be incompatible and within the Service's jurisdiction are prohibited and enforced, as in the case of off-road vehicle use. In the case of nonwildlife-oriented recreational activities that occur on the mainstem navigable River, the refuges must work directly with the other jurisdictions, especially the California and Arizona game and fish departments, to develop a cooperative law enforcement program. In order for the states to cooperate, the refuges must agree to abide by the appropriate waterway marking standards for both mainstem and backwater areas along the River. AGFD currently regulates watercraft activites in accordance with Arizona Revised Statutes Title 5 as well as 33 U.S.C. pertaining to uniform navigational marking of waters. CDFG also has a set of similar standards. Any zoning of areas affecting mainstem waters should be done in coordination with AGFD and CDFG.

2. NONWILDLIFE-ORIENTED RECREATION

Socioeconomics and climate are the driving forces behind nonwildlife-oriented recreational visits to the lower Colorado River. High summer and fall temperatures propagate the recreational water use of the Colorado River by the regional population centers in southern California and central Arizona. These users are generally of the middle to upper-middle income categories who can afford the time and expenditures associated with watercraft activities. Normally, the users in this category make no differentiation between refuge and non-refuge areas along the Colorado River. Consequently, these are the refuge visits that are generally problematic. Uncontrolled recreational jet ski and speed boat use is suspected of being harmful to key marsh and waterbird nesting habitat along the River. In addition, increased use of the mainstem River within refuge boundaries has presented a waterway safety challenge, as well as problems for anglers on and off the refuges.[136] Although waterway safety transcends refuge boundaries, local communities, organizations, and members of the public have asked the Service to address this issue.

Continuing increases in public visits (by all categories of visitors) add to the probability for unnaturally set wildfires, human waste disposal, and destruction of fragile desert uplands by illegal use of off-road vehicles. The aggregate (all refuges) nonwildlife-oriented visits are projected to increase throughout the next 20 years.

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[136]Recently the Havasu NWR manager issued a decision disallowing use of any backwater marsh areas on the Refuge by jet skis. There is already a no-wake zone in place for boat access.

3. WILDLIFE-ORIENTED RECREATION

This category of public use is generally expected to occur and is planned for on national wildlife refuges.[137] Each refuge station along the lower Colorado River has a programmatic approach toward integrating these kinds of activities into the refuge management plan. Each refuge fully expects that these kinds of use (assuming they are compatible with refuge purposes and the goals of the National Wildlife Refuge System) will engender a strong appreciation for ecological values in the long run. The following is a discussion of the public use programs for each of the refuge stations.

Havasu NWR

Sentiments from local conservation organizations, community leaders, and members of the public reflect strong support for improving public appreciation and identification with the Refuge's resource values. These groups have registered their concern that a lack of an on-site visitor facility makes it difficult for visitors to fully appreciate the Refuge. In some extreme cases, local citizens are not aware of the Refuge's existence. Public organizations perceive the Refuge as a resource that can produce additional tourism for local communities. While increased tourism may be the result to the liking of local communities, the major benefit of an on-site visitor center and administrative facilities would be the establishment of a central location allowing visitors an opportunity to appreciate the Refuge's resources. In addition, the on-refuge presence would establish a base of operations for all aspects of refuge management activities including law enforcement.

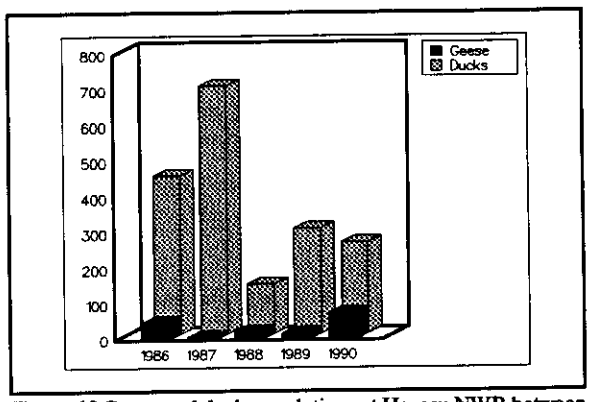

Figure 10 Goose and duck populations at Havasu NWR between 1986 and 1990

Other public sentiments reflected the desire for improvements to water quality in the Topock Marsh. Those expressing this need have stated concern that lack of freshening flows have caused a downturn in the number of fish available to catch. This problem relates directly to the water quality and water management issues previously discussed.[138]

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[137]Planned secondary uses on a national wildlife refuge is subject to annual compatibility reviews. All planned secondary use activities administered and enforced by the Service are also subject to the Refuge Recreation Act, which stipulates that funds must be determined to be available prior to implementation of any secondary use program.

[138]Please refer to Part II, Unit 1, Sections 5 and 6 in this document for discussions regarding the issues of water quality and water management. The concern relates to both the health of the wildlife resources as well as certain aspects of public use. The natural resource and the public use perspective both call for improvements; however, any decision regarding improvements to water quality and management must primarily benefit the natural resource. The public use benefits are secondary.

Havasu NWR's migratory waterfowl hunting program is dependent on the health of the populations of ducks and geese supported on the Refuge. As indicated by Figure 10, goose populations have remained stable while duck populations have decreased in the last 10 years. The Refuge's efforts to improve water quality on the Topock Marsh influence populations of fish and aquatic wildlife which in turn influences use of the habitat by populations of migratory birds. Any improvements made to Topock Marsh water quality should affect wildlife use in a positive way. In addition, expansion of moist soil management where possible on the Refuge would also assist in improving migratory bird use of the refuge.

Bill Williams River NWR

Because of limited data, it is difficult to establish trends in visits to the Bill Williams River NWR. There is, however, evidence of increasing interest in the Bill Williams River NWR for wildlife observation. Interviews with members of the community and officials from the Parker Chamber of Commerce and the Lake Havasu City Chamber of Commerce indicate an increasing number of inquiries concerning the availability of areas for wildlife observation. It can be expected that possible future acquisition or joint management of the Planet Ranch will improve access, and in general, should result in visit increases by wildlife observers.

It should be noted that the Service and BR have developed a draft joint management plan for the Central Arizona Project (CAP) peninsula, or CAP Site. This site is the area upon which the Service has maintained the Refuge office facility. The plan addresses facilities needs as well as public use opportunities. A joint agency facility would enhance efforts to coordinate sport and native fisheries, fish and wildlife interpretive, and other programs on all the Colorado River refuges. Such a joint facility would be a focal point from which assistance to other jurisdictions would originate.

Fishing, primarily in the Delta Management Unit area on the open waters of Lake Havasu, constitutes most of the generalized public use. Hunting has been limited to small game such as dove, quail, and cottontail rabbit. Non-toxic shot is the only legal ammunition allowed. Potentially, the AGFD can issue a bighorn sheep tag for the Buckskin Mountain herd.

Cibola NWR

Throughout the next 20 years, Cibola NWR will have a wide array of public use dilemmas. The Refuge is relatively compact in terms of land mass. The natural resource issues confronting the Refuge are substantial. Throughout the 20-year planning and management cycle, Cibola NWR will probably be involved with a great degree of biological rehabilitation through expanded revegetation programs and enhanced water management programs. This fact alone presents the increased probability of conflict with demands for enhanced levels of public use on the Refuge by local sport organizations.

The current numbers indicate an increasing pressure to expand hunting and fishing opportunities, as well as wildlife observation. Hunting numbers are stable only because goose and duck

hunting trends offset each other. Fishing visits are dropping notably because water levels and quality in the primary fishing areas of the Refuge have fallen. Public sentiment indicates a significant level of dissatisfaction with water management technologies at the Refuge as they relate to sport fishing. Increased demand for wildlife observation most likely will follow any reasonable improvements to native vegetation communities.

Water quality improvements to areas such as Cibola Lake and Hart Mine Marsh could mean increases in waterfowl and other migratory bird use. Certainly, expansion of moist soil and other farm management on the existing Refuge will assist in supporting larger populations and prevent adjacent farm land depredation. The Service has expressed an interest in acquiring lands to the north of the current border owned by the Cibola Valley Irrigation District (approximately 4,000 acres). These lands would be used for substantial native revegetation and a migratory bird crop program. Although these lands would not be open to hunting, they would serve as a sanctuary for migratory waterfowl that would be hunted on an adjacent 1,000 acres controlled by the AGFD. With respect to interpretive opportunities, Cibola NWR has a recently expanded on-site administrative complex and an improved visitor contact station with interpretive information.

Imperial NWR

Fishing on the Refuge takes place on the River and its associated backwaters. Bass anglers travel long distances up-river during tournaments. Catfish anglers can be found during evening and night hours almost anywhere along the River. Some anglers access the River from Picacho State Recreation Area and travel both upstream and downstream. Some anglers base their activities at Walter's Camp to the south of Cibola NWR, and they travel downstream to reduce travel distances. Local bass clubs and other community organizations have expressed their desire that fishing opportunities be expanded in the Martinez Marsh Management Unit and be improved in the Ferguson Lake and Shore Management Unit on the California side of the Refuge. The problem referred to by anglers is the lack of freshening flows and the subsequent degradation of water quality. Likewise, the Martinez Marsh Unit lakes suffer from high evaporation rates and resultant high salinity levels, which affects the quality of the fishery. The Refuge's hunting program is expected to continue at present levels well into the future. As improvements are made to the Refuge's crop program and as moist soil management is employed, increases in waterfowl numbers are forcasted, thus improving opportunities for waterfowl hunting. The Refuge currently has a good base from which to build a wildlife interpretive program. As in the case of the other refuges, the development of interpretive themes for Imperial NWR is an essential precursor to the expansion of existing interpretive programs.

4. SUMMARY

Wildlife-Oriented Public Use

The trends for traditional refuge wildlife-oriented public use activities appear to be stable.[139] Demands for increased sport fishing and hunting, however, are increasing, especially at Cibola NWR. Proposed expansion of any secondary use will have to undergo compatibility analysis and subsequent environmental consideration in accordance with the National Environmental Policy Act (NEPA). The refuges will have to estimate how any proposed use expansion of fishing and hunting will affect any proposed natural resource enhancement efforts and how potential conflicts would be resolved. However, improvements to habitat and water quality will enhance existing programs. Involvement from the AGFD and the CDFG is essential in the public use decision-making activities of the Service along the River. In addition, the public should be involved in any assessment involving major changes in the current public use program at each respective refuge.[140] The key ingredients for the manager to consider are the effects the current and forecasted aggregate visits have or will have on the wildlife and habitat programs. The analyses undertaken by the refuges should be much broader than the simple determination of compatibility. The managers should be looking at cumulative effects of aggregate public visits upon natural resource programs and what the refuges' unique contribution can be to public use opportunities in the Area of Ecological Concern.

Nonwildlife-Oriented Public Use

The nonwildlife-oriented public use activities will continue to present dilemmas for the national wildlife refuges in the foreseeable future. In addition, these problems extend beyond refuge boundaries. Members of the local communities along with local representatives of sport wildlife interests are genuinely concerned about the negative impacts of pure water sport activities on many portions of the lower Colorado River, including parts of the national wildlife refuges. The impacts of these activities on wildlife such as nesting Western and Clark's grebes have been documented. In view of those difficulties acknowledged by the public and representatives

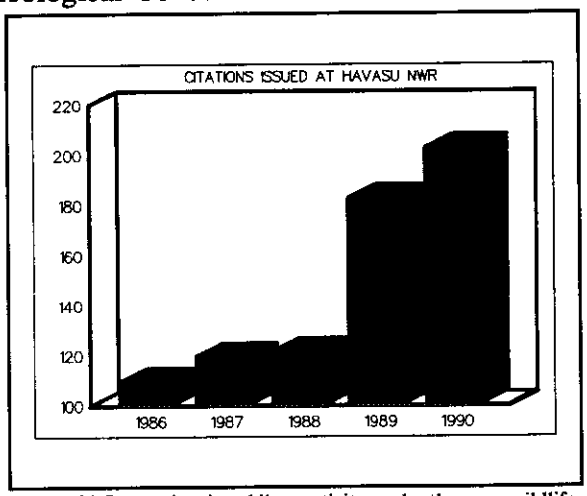


Figure 11 Increasing jet skiing activity and other nonwildlife-oriented recreation has resulted in a subsequent increase in citations issued at Havasu NWR.

[139]Please refer to PART II, Unit 1, Section 9 of this document regarding the application of Compatibility to public uses on national wildlife refuges, and additional discussion regarding non wildlife-oriented recreational uses on the lower Colorado River national wildlife refuges.

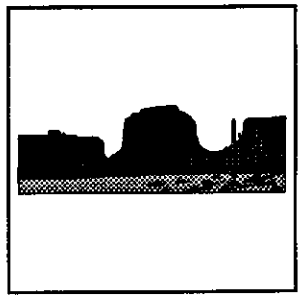
[140]Site-specific discussions related to public use improvements are subject to a more detailed Public Use Management Plan. Discussions of site-specific improvements are intended to prompt consideration of these options, and form the basis for alternative development for the more detailed plan. Specific proposals noted in the latter part of this document should be considered conceptual at this stage.

of other jurisdictions, there appears to be a great need to formulate a multi-jurisdictional approach to arriving at a solution. Figure 11 graphically illustrates the increases in the number of citations issued at Havasu NWR between 1985 and 1990. The numbers of citations after 1990 continues to rise but not as dramatically as indicated between 1988 and 1989. The increases have occurred without an expansion of monitoring activities or any changes in the regulations. The graph depicts a situation which has evolved because of ever increasing recreational visits by the public to the lower Colorado River.

PART III: SYNTHESIS

UNIT 1 -- GOALS AND OBJECTIVES

1. INTRODUCTION



This Unit presents refuge goals and objectives developed in consideration of: (1) the legal mandates reflected in Part I, Unit 2 of this document including statutes, policies, and other administrative directives; (2) the purposes for which the refuges were established; (3) the goals of the National Wildlife Refuge System; and (4) discussions comprising the Analysis portion of this document in relation to the defined issues. Programmatic objectives were developed in consideration of field level analysis offered by the lower Colorado River refuge managers, specific input from the public, private conservation organizations, and other governmental agencies. These objectives are also intended to address the major issues that surfaced during the planning process.

The details of special project activity strategies and specific wildlife and public use numerical objectives are listed in an Appendix available on request. These evolved out of the refuge managers' informal analyses prior to this planning process, and were developed to be consistent with the recommended programmatic objectives.

2. REFUGE GOALS AND OBJECTIVES[141]

The list of 17 issues outlined in PART I, Unit 1, Section 1E are repeated below, each with a goal and a set of objectives. This list is not exclusive, and there may be issues not addressed singularly, but in combination with other issues. For instance, the effect of the Navigable Waterways Act on regulation of water sport activities is an issue considered within the context of jurisdictional rights, compatibility, and public recreational issues. In fact, all of the issues are in some way interrelated.

As the planning horizon is 20 years, the Service has much latitude with respect to project phasing and implementation. However, a suggested project phasing is also offered. Specific public use objectives in this plan will be subject to final determinations contained in a Public Use Management Plan yet to be developed. Project compatibility, scope, and location will be determined in the step-down management plan. Funding considerations will also affect implementation.

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[141]The list of goals as in the case of the issues listed in Part I of this document are not in any order of specific priority. However, they are ordered to indicate that natural resource issues and goals take precedence by virtue of the ordering of the Goals of the National Wildlife Refuge System. **[Refuge Manual 2 RM 1-4]**

ISSUE #1: Biological Diversity and Habitat Management

Goal #1: In cooperation with other resource management agencies, to restore and maintain the natural diversity of the Colorado River Area of Ecological Concern, especially on refuge lands.

Objectives:

(1) Determine specific scientific research data needs (related to land and aquatic ecosystems) for each of the lower Colorado River national wildlife refuges, produce an inventory of those specific needs, and develop a coordinated strategy for meeting those needs. The inventory of needs should be prepared in cooperation with other resource management agencies and institutions of higher learning and research. Strategies should result in increased cooperative research through institutions or enhancement of refuge biological staffs. Research is a specific priority and promotes a better understanding of the land and aquatic habitat needs of various endangered species, interjurisdictional fishery resources, and all migratory bird species, especially those in danger of extirpation from the lower Colorado River Area of Ecological Concern. **[Year 2]**

(2) Improve scientific information bases including improvements to refuge understandings of land ownership, vegetation structures, geological and hydrological regimes, wildlife uses, and other natural resource data bases. Coordination with other agencies in the use of Geographical Information Systems, aerial photography, and other strategies is essential. Agencies include the National Biological Survey, the Arizona Game and Fish Department, and the Bureau of Reclamation (among others). **[Year 1-10]**

(3) Achieve higher levels of scientific information consistency by developing and strengthening cooperative efforts between the refuges and other Area of Ecological Concern jurisdictions (including private landowners). **[Year 1-10]**

(4) Achieve improved levels of international habitat conservation by increasing dialogue with Mexico, using the appropriate channels and legal mechanisms, concerning lower Colorado River biological diversity and endangered species. **Target: Mexico/U.S. meeting once every 2 years. [Years 1-20]**

(5) Improve long-term viability of fish and wildlife resources by developing and fostering long-term research that improves monitoring and identification of nongame fish and wildlife, certain types of habitats and other elements which contribute to overall biological diversity. **Target: Consistent wildlife inventory database for each lower Colorado River refuge. [Year 5]**

(6) Increase awareness of the importance of resident and migratory songbird values by developing new and strengthening existing educational and interpretive programs that emphasize these values along the River. **Target: Development of refuge specific and Area of Ecological Concern interpretive displays, leaflets, videos, educational materials for use in schools, and other strategies. [Years 1-3]**[142]

(7) Increase viability of threatened stands of native vegetation by identifying and targeting essential cottonwood, willow, and other native tree galleries on and off refuge lands that are in need of fire prevention strategies. Enhance existing refuge fire management plans to include an ecosystem-wide fire management perspective. This effort should be conducted in cooperation with other jurisdictions. **[Year 3]**

(8) Enhance habitat diversity by implementing special project and protection strategies detailed in **Appendix A**, attached to this document, and Objective Documentation Records for the individual refuges contained in **Appendix B**, separate from this document, especially those related to revegetation efforts, moist soil, and marsh management strategies on each of the refuges.

ISSUE #2: Endangered Species Management

Goal #2: To achieve threatened and endangered species recovery, and to strengthen the role of the lower Colorado River national wildlife refuges in the recovery of all applicable endangered species, threatened species, all candidate species, and all species of concern to the States of California and Arizona.

Objectives:

(1) Enhance viability and protection of endangered species by establishing minimum water and terrestrial habitat management requirements for each of the threatened and endangered species. **Target: Develop strategies to include (a) effecting changes to Colorado River water releases that will not interfere with threatened and endangered species habitats, and (b) develop interagency cooperative habitat enhancement and protection activities on and off the refuges. [Years 1-5]**

(2) Enhance protection of critical habitat for all refuge and Area of Ecological Concern endangered species by establishing water quality monitoring standards in cooperation with California, Nevada, and Arizona environmental regulators. **Target: Development of standards. [Year 1-4]**

[142]Please refer to Issue #13: Environmental Education and Public Outreach.

(3) Improve endangered species long-term viability by implementing special project and protection strategies detailed in **Appendix A** (attached to this document) and Objective Documentation Records for the individual refuges contained in **Appendix B** (separate from this document) especially those related to revegetation efforts on each of the refuges, moist soil and marsh management strategies, and those related to the enhanced protection of endangered species habitats.[143]

(4) Improve interjurisdictional and organizational knowledge and understanding of endangered species by developing a formal process of information sharing among agencies relative to threatened and endangered species. **Target: The Refuges should establish times throughout each year to meet with other agencies to discuss status and continuity of relative efforts to benefit threatened and endangered species. (At least once a year). [Years 1-20]**

(5) Improve intraorganizational knowledge and understanding of Area of Ecological Concern and refuge endangered species by establishing a formalized inter-refuge information transfer program to improve management, research, and the dissemination of information to the public and the scientific community. **Target: 1 special inter-refuge work detail per year. [Years 1-20]**

(6) Improve protection of sensitive habitat areas by developing public use zoning options for presentation to other jurisdictions in the Area of Ecological Concern. This effort should lead to a coordinated recreational use standard that will benefit endangered and other species on and off the national wildlife refuges.[144] **[Year 1]**

ISSUE #3: Fisheries Enhancement and Management

Goal #3: In cooperation with the Service Fisheries Resource Office, and other state and federal agencies with joint jurisdiction to restore, enhance and protect fish ecosystems on the lower Colorado River Refuges.

Objectives:

(1) Determine specific scientific research data needs (related to aquatic ecosystems) for each of the lower Colorado River national wildlife refuges, produce an inventory of those specific needs, and develop a coordinated strategy for meeting those needs. The inventory of needs should be prepared in cooperation with other resource management agencies and institutions of higher learning and research. Strategies should result in

[143]Please refer to Issue #8 Revegetation.

[144]Please refer to Issue #10 Compatibility and Refuge Allowable Uses.

increased cooperative research through institutions or enhancement of refuge biological staffs. **[Year 2]**

(2) Enhance protection of aquatic habitat for all refuge and Area of Ecological Concern fish species by establishing water quality monitoring standards in cooperation with California, Nevada, and Arizona state environmental regulators. **[Year 4]**

(3) Achieve higher levels of scientific information consistency by developing and strengthening cooperative efforts between the refuges, the Fishery Resource Office (Parker), the AGFD, CDFG, and other Area of Ecological Concern jurisdictions (including Native American governments and private landowners). **[Year 2]**

(4) Improve interjurisdictional and organizational knowledge and understanding of endangered fish by developing cooperative special habitat goals and objectives for the benefit of endangered, threatened aquatic species, or species of concern to the respective States. **[Years 1-10]**

(5) Improve protection of sensitive fish habitat areas by developing public use zoning options in the entire Area of Ecological Concern. This effort should lead to a coordinated interagency recreational use standard that will benefit endangered and other fish species on and off the national wildlife refuges. **[Year 1]**

(6) Increase awareness of the key nature of fish and aquatic values to overall biological diversity by developing new and strengthening existing educational and interpretive programs that emphasize aquatic and fishery resources along the River. **Target: Develop complex-wide resource interpretive management strategies. [Year 3]**

(7) Improve visitor contact and administrative facilities for the Bill Williams River NWR-Parker Fishery Resource Office. **[Year 2]**

ISSUE #4: Migratory Waterfowl Management

Goal #4: To improve ongoing refuge management programs that enhance migratory waterfowl populations and health on each of the four River refuges and other jurisdictions within the Area of Ecological Concern.

Objectives:

(1) The refuges will achieve optimum levels of vegetation mixes, protect water resources, and still provide for refuge waterfowl management for the next 10 years by:

(a) Holding farm management acreage at 1993 levels at Havasu NWR since migratory bird populations clearly appear to be generally stable with a slight upward trend, and no adjacent farm depredation of any significance occurs or is projected to occur. **(Havasu NWR Objective) [Years 1-10]**

(b) Increasing (from 1993 levels) moist soil management acreage at Havasu NWR in the Pintail Slough Moist Soil Subunit and enter into a cooperative agreement with the BLM to employ moist soil management in BLM Section 29, which is adjacent to the refuge. **(Havasu NWR Objective)[Years 1-10]**

(c) Establishing a water quality monitoring standard at Havasu NWR, Topock Marsh Management Unit. **(Havasu NWR Objective)[Year 3]**

(d) Continue policy of not farming lands on Bill Williams River NWR because of threats of extensive groundwater pumping to the deep water aquifer. If the Planet Ranch is acquired by the Service or if management is delegated to the Service, limit farming activities on the Planet Ranch to a minimum of 300 to 500 acres for use as goose browse.[145] **(Bill Williams River NWR Objective)[Years 1-20]**

(e) In cooperation with the AGFD, monitoring adjacent farm depredation at Cibola NWR more closely and improving public outreach efforts to include the surrounding farming community. Strategies could include individual meetings, group meetings, open houses, and newsletters. **(Cibola NWR Objective)[Years 1-20]**

(f) Holding crop acreage at Cibola NWR at the 1993 level until water rights questions are addressed for the California side of the Refuge or until additional lands can be acquired to expand crops and moist soil management. (i.e., Cibola Valley Irrigation District lands). **(Cibola NWR Objective)[Years 1-5]**

(g) Continuing moist soil management activities at Cibola NWR, and with the appropriate water management improvements expanding moist soil management acreage in the Island Management Unit. **(Cibola NWR Objective)[Years 1-10]**

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[145]The Service does not rule out pumping of surface or groundwater at limited levels for the purpose of restoration of vegetation in a manner which does not affect other riparian resources. Once the relationship between surface flows and groundwater elevations on the Bill Williams River are understood through monitoring, there may be circumstances during which minor amounts of pumping can occur with no impact anticipated.

(h) Holding Imperial NWR farm management acreage at the 1993 levels but making substantial improvements to the irrigation systems.[146] **(Imperial NWR Objective)[Years 1-10]**

(i) Expanding moist soil management acreage as much as possible at Imperial NWR in the Martinez Lake and Riverbank Management Unit. **(Imperial NWR Objective)[Years 1-5]**

(j) Monitoring migratory bird and waterfowl interchange between Cibola and Imperial NWRs, and make appropriate adjustments to management practices which will address migratory bird needs. **(Cibola & Imperial NWRs' Objective)[Years 1-20]**

(k) Acquiring Cibola Valley Irrigation District lands as part of the Cibola NWR as outlined in **Appendix A** attached to this plan, and any future lands which become available that can contribute to the conservation of wildlife diversity, including the acquisition of inholdings within any of the refuge boundaries. **(Cibola NWR Objective)[Year 3]**

(2) The Refuges will establish consistency in migratory bird and waterfowl management in the Area of Ecological Concern in association with other agencies and Native American governments including cooperative planning with tribes, the State of Arizona, and the State of California. **Target: Annual meetings (similar to those held in the Middle Rio Grande Valley in New Mexico) with other interested agencies. [Years 1-20]**

(3) Improve migratory waterfowl hunter opportunity throughout the Area of Ecological Concern by developing a coordinated and integrated refuges waterfowl hunt management strategies with the appropriate amount of public involvement and in coordination with AGFD. **[Year 2]**

(4) Improve interorganizational understandings of migratory waterfowl use of the lower Colorado River basin by developing working agreements with the Colorado River Indian Tribe relative to waterfowl management and hunt programs affecting both jurisdictions. **[Year 5]**

(5) Develop an interjurisdictional migratory waterfowl database to better understand the relationship between migratory waterfowl and other species within the lower Colorado River refuges, the Area of Ecological Concern to the Pacific Flyway. **[Year 5]**

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[146]Please refer to Issue #7 Water Management.

(6) Improve habitat for all migratory birds by implementing special project and protection strategies in **Appendix A** (attached to this document) and Objective Documentation Records for the individual refuges contained in **Appendix B**, separate from this document, especially those related to farming, moist soil, and marsh management strategies.

ISSUE #5: Wetlands

Goal #5: To achieve protection and enhancement of existing wetland areas on the four river refuges and rehabilitation of former wetlands where possible.

Objectives:

(1) Enhance existing wetlands and rehabilitate former wetlands by implementing special project and protection strategies detailed in **Appendix A** (attached to this document) and Objective Documentation Records for the individual refuges contained in **Appendix B** (separate from this document) especially those related to reconstitution of former wetlands, moist soil, and marsh management strategies.

(2) Improve consistency in wetland protection efforts by strengthening interagency relationships with the BR, the Army Corps of Engineers, and other Federal and state agencies; and by coordinating an informal wetlands assessment within of the Area of Ecological Concern relative to the existing National Wetlands Inventory database. **Target: Coordinate with appropriate agencies wetlands conservation efforts including backwater restoration projects, impoundments for endangered fish recovery, and development of water resource delivery systems to marsh and lake areas. [Year 1-20]**

(3) Improve opportunities for wetland enhancement by maximizing fiscal, staff, and equipment resource sharing opportunities between the state and Federal levels, related to wetlands protection. **Target: Develop and implement list of resource sharing opportunities for wetlands protection and restoration. [Years 1-20]**

(4) Improve wetland protection efforts by acquiring additional lands with wetland values and the requisite water rights. **Targets: Bill Williams NWR management should consider Planet Ranch joint management or acquisition for protection of Bill Williams River NWR riparian values; Cibola NWR should consider acquisition and**

management (including necessary water rights) of farm lands north of Cibola NWR in Arizona.[147] [Years 1-10]

(5) Enhance existing refuge wetlands by rehabilitating the former wetlands on Cibola NWR (e.g., Three Fingers Lake); backwater lake and marsh enhancement at Imperial NWR, improvements to the Topock Marsh Management Unit of Havasu NWR; and improvements to riparian habitat at Bill Williams River NWR.[148] **[Year 5]**

ISSUE #6: Water Rights

Goal #6: In cooperation with the BR and the lower basin states, to enhance use of Colorado River water by the refuges and, protect existing Refuge water rights holdings in the Area of Ecological Concern, and obtain additional rights when possible without adversely affecting other entitlement holders in the lower basin states.

Objectives:

(1) Maximize present water rights by researching the opportunities to "pool" existing water right allotments on the separate lower Colorado River national wildlife refuges (especially between Cibola NWR and Imperial NWR which are contiguous), and investigating opportunities for acquisition of water rights or other mechanisms for management of water on refuge lands on the California side of the River. **[Years 1-3]**

(2) Improve water rights holdings by researching, and listing in priority available parcels of land with water rights near each of the lower Colorado River national wildlife refuges for possible acquisition. **[Year 2]**

(3) Improve interagency understandings of the Service's Colorado River water right entitlements, regulations impacting the use of water, and the Law of the River. These understandings can be improved by working with the BR; lower basin states of Arizona, California, and Nevada; and the various Colorado River Native American governments. **Target: Agreement between the Service and the BR to address the management of**

[147]Please refer to Issue #11 Land Status and Jurisdiction, Objective (6).

[148]Please refer to Issue #7 Water Management.

the Service's Colorado River water entitlements and annual meetings to track progress.[149]

(4) Improve water use efficiencies by acquisition of the appropriate instream flow and nonconsumptive flow capabilities in cooperation with the BR and California and Arizona state authorities. **[Year 3]**

(5) Improve protection of water resources within the Area of Ecological Concern by monitoring water right transfer and acquisition issues on land areas in the proximity of the national wildlife refuges and recommend action to protect wildlife and habitat resources. **Target: Develop water use information data base in cooperation with BR, States, and local irrigation districts and associations. [Years 1-10]**

ISSUE #7: Water Management

Goal #7: In cooperation with the BR and the Army Corps of Engineers, improve the efficiency of water delivery systems and more effectively gauge water use for the ultimate benefit and enhancements to habitat and wildlife.

Objectives:

(1) Improve understandings of water resources and dynamics by implementing and completing hydrological inventories and full analytical studies where necessary for Havasu, Bill Williams River, Cibola, and Imperial NWRs. **[Year 2]**

(2) Improve water use efficiencies by:

(a) Refurbishing the Havasu NWR Topock Marsh Inlet Canal hydrology and gauging. **(Havasu NWR Objective)[Years 1-3]**

(b) Constructing appropriate water level control mechanisms (i.e., dikes and new inlet and drainage structures) in the Topock Marsh Management Unit. **(Havasu NWR Objective) [Years 1-3]**

(c) Refurbishing Cibola NWR ditches and water delivery canals in the Island Management Unit. **(Cibola NWR Objective)[Years 1-5]**

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[149] The Service and the BR believe that in order for the refuges to be able to optimize their use of Colorado River water, the following actions need to be considered: (1) The Service should explore with the BR various possibilities for using the current entitlements and options for nonconsumptive uses; (2) The BR could assist in the development of a modeling study of projected and actual consumptive use of river water based on the Lower Colorado River Accounting System; (3) The BR could also assist with vegetation management studies, local groundwater hydrology studies, and design of required metering systems; and (4) The BR could assist in the development of water conservation plans relating to the operations on the refuges.

(d) Rehabilitating Cibola NWR pumps in the Hart Mine and Cibola Lake Management Units or other alternatives resulting in the improvement of water diversion and delivery to the two units. **(Cibola NWR Objective)[Years 1-5]**

(e) Redesigning and constructing improvements to the water delivery system for cropland and moist soil management and revegetation activities in the Martinez Lake and Riverbank Management Unit of Imperial NWR. **(Imperial NWR Objective)[Years 1-5]**

(3) Improve water use efficiency by acquiring instream flow rights or nonconsumptive flow through capability for each of the refuges. **[Years 1-5]**

(4) Improve understanding of current water use efficiencies by acquiring and installing the appropriate water gauging equipment for each of the lower Colorado River national wildlife refuges. **[Years 1-3]**

(5) Identify areas on the refuges that are not conducive to revegetation with cottonwood/willow, but conducive to revegetation with other native riparian plants with less consumptive water demand in order to assist the BR to effect a savings in water. (Revegetation targets above those outlined in this plan will be set in coordination with BR.) Under the BR plan, the Bill Williams River area is not part of their water use efficiency and revegetation project since Bill Williams River water is not included in the lower Colorado River allotment. The Bill Williams River NWR will continue to plan revegetation of all salt cedar areas with cottonwood/willow, wherever feasible.[150] **[Years 1-20]**

ISSUE #8: Revegetation

Goal #8: In cooperation with the BR, revegetate substantial amounts of habitat with native mixes of vegetation leading to biological diversity.

Objectives:

(1) Identify areas conducive to salt cedar removal and revegetation with native cottonwoods and willows and other native plants to improve habitat for native resident and migrating avian species.[151] **Targets: Annual revegetation of 50 acres per year,**

[150]Please refer to Issue #8: Revegetation.

[151]Refer to PART III, Unit 1, Section 3 for refuge special project and protection strategies.

per refuge leading to a cumulative annual of 200 acres per year. (4,000 acres by year 20 of this plan.) [Years 1-20]

(2) Maximize efficiency of revegetation among the lower Colorado River refuges by implementing special project and protection strategies detailed in **Appendix A** (attached to this document) and Objective Documentation Records for the individual refuges contained in **Appendix B** (separate from this document) especially those related to revegetation, moist soil, and marsh management strategies.

(3) Improve consistency in revegetation of the refuges by providing the BR with assistance and cooperation toward the accomplishment of targets detailed in the BR's 20-year Vegetation Management Study.[152] **[Years 1-20]**

(5) Identify areas on the refuges that are not conducive to revegetation with cottonwood/willow, but conducive to revegetation with other native riparian plants with less consumptive water demand in order to assist the BR to effect a savings in water. (Revegetation targets above those outlined in this plan will be set in coordination with BR.) Under the BR plan, the Bill Williams River area is not part of their water use efficiency and revegetation project since Bill Williams River water is not included in the lower Colorado River allotment. The Bill Williams River NWR will continue to plan revegetation of all salt cedar areas with cottonwood/willow, wherever feasible. **[Years 1-20]**

ISSUE #9: Water Quality and Contaminants

Goal #9: To improve overall refuge water quality and protect refuge waters from all contamination.

Objectives:

(1) Improve understanding of effects of selenium contamination on species by funding, solely or in cooperation with universities or research institutes, follow-up research. **[Year 3]**

(2) More consistently implement State and Federal water quality standards by strengthening dialogue with the water quality officials from both Arizona and California, **Target: Develop a joint agency river-wide water quality information base.] [Year 1-5]**

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[152]PART I, Unit 2, Section 6F of this document outlines the BR's *Vegetation Management Study* and the associated goals and objectives. Also please refer to PART II, Unit 2, Section 8, Summary Tables For Refuge Biological Resource Suitability, for projected increase in acreage suitability by refuge and species type.

(3) Enhance river-wide and refuge contaminant protection efforts improving emergency preparedness for possible disaster response efforts (i.e., oil spills, hazardous waste spills on the Colorado River) in cooperation with other government agencies. **[Years 1-5]**

(4) Improve understanding of effects of human use and wastes on Area of Ecological Concern and refuge water quality by monitoring public uses, concentrations, and effects on water, land, and wildlife resources. **Target: Develop a monitoring program. [Year 5]**

ISSUE #10: Compatibility and Refuge Allowable Uses

Goal #10: To ensure that only compatible and appropriate activities occur on the lower Colorado River national wildlife refuges, and to regulate, as provided by law, all activities, uses, and practices on and off the refuges that are potentially harmful to refuge resources.

Objectives:

(1) Identify and describe the various jurisdictions' recreational land and water uses including refuge and non-refuge areas along the Area of Ecological Concern. **Target: Produce a jurisdictional and land and water use orientation map in cooperation with the BR and other agencies. [Year 2]**

(2) Ensure the primacy of wildlife resource protection by performing annual compatibility analyses on all activities at each of the national wildlife refuges and submit a report to the Regional Office.[153] **[Years 1-20]**

(3) Ensure clear application of compatibility by first resolving jurisdictional questions as detailed in **GOAL #11: Land Status and Jurisdiction** objectives. **[Year 3]**

(4) Maximize public appreciation for the special role of the Service in managing natural resources and the Service's unique responsibility in protecting wildlife by developing joint-jurisdictional public use opportunity information as detailed in **GOAL #13: Environmental Education and Public Outreach. Target: A joint-jurisdictional public use opportunity brochure. [Year 3]**

[153]Please refer to pages 220 and 221 for a list of secondary uses planned to occur and uses not planned to occur. Those activities that are planned to occur or continue will undergo compatibility analysis. Some activities characterized as "not planned" will undoubtedly occur without refuge authorization. Where jurisdiction applies to the Service, these activities will be stopped or curtailed to the degree possible in cooperation with the appropriate agency having jurisdiction (i.e., AGFD). These are activities that with few exceptions are not wildlife oriented and would probably not meet compatibility criteria for any of the Colorado River refuges.

(5) Reduce levels of nonwildlife-oriented recreation on national wildlife refuges by strengthening enforcement and educational outreach efforts. Recreational activity target levels as detailed in Objective Documentation Records for the individual refuges contained in **Appendix B** (separate from this document). Also refer to **GOAL #13** and **GOAL #14** in this Section.

(6) At a reasonable time prior to the expiration of any permits or lease agreements on refuge lands, the managers will determine the compatibility of current uses and consider the options of not renewing upon expiration, renewal, or changes in the scope and intensity of use(s). For example, the 20 year lease at Five Mile Landing will expire in the year 2006. The refuge manager (Havasu NWR) will make a determination of the current use's compatibility in its current scope, and propose options no later than 10 years prior to lease expiration (i.e., 1996). This will give the lease owners enough notice and time to prepare accordingly.[154] **[Years 1-20]**

(7) Any leasehold or formally permitted activity will be monitored annually to ensure activities are within the scope specified on the permit or lease agreement. Any breach of provisions of leases or permits will be dealt with consistently and quickly. **[Years 1-20]**

Goal #11: Land Status and Jurisdiction

Goal #11: To clarify each of the Colorado River refuges' jurisdictional authorities as they relate to any concurrent or related authorities vested in other Federal, state, local and Native American governments with natural resource interests within the Area of Ecological Concern; to ensure refuge boundary integrity relative to adjacent lands; and when the opportunities, funding, and rationale are present, to acquire additional lands to further protect fish and wildlife resources.

Objectives:

(1) Improve understanding of jurisdiction and authorities by researching chain-of-title and evidence of ownership documents for each of the National Wildlife Refuge system lands along the lower Colorado River. **Target: In cooperation with BR, develop a single point location of refuge and adjacent lands title and conveyance documents. [Year 2]**

[154]Please see page 33 for description of Five Mile Landing lease at Havasu NWR. Also refer to Issue #11 Land Status and Jurisdiction, Objective (7).

(2) Improve jurisdictional standing by perfecting evidence of title for each refuge parcel where necessary. **[Year 5]**

(3) Improve understanding of authorities and proprietary rights of other jurisdictions in the Area of Ecological Concern by identifying and describing the fundamental agency and jurisdictional differences between refuge and non-refuge lands and waters. **Targets: (a) Conduct an interagency review of concurrent jurisdictional authorities, particularly those authorities that relate to the enforcement on navigable waters. This review could result in appropriate memoranda of understanding clarifying these concurrent roles. (b) Produce a jurisdictional map by year two of this plan based upon multiagency mutual understanding.**[155] **[Year 5]**

(4) Improve understanding of potential land status and jurisdictional conflicts in the Area of Ecological Concern by improving interagency communication and public outreach. **Target: Develop a land status conflict resolution strategy. [Year 2]**

(5) Improve understanding of authorities to regulate recreational activities on navigable waters adjacent to the four refuges, where such activities impact on refuge resources and refuge purposes. **Targets: Develop cooperative enforcement strategies along with State regulatory authorities relative to public uses on navigable waters. [Year 1]**

(6) Pursue opportunities to acquire Cibola Valley Irrigation District lands to add to the Cibola NWR (as detailed in **Appendix A** attached to this plan) and any future lands which become available that can contribute to the conservation of wildlife diversity including the acquisition of inholdings within any of the refuge boundaries. **[Year 3]**

(7) As the 20 year lease at Five Mile Landing will expire in the year 2006, the refuge manager (Havasu NWR) will make a determination of the current use's compatibility in its current scope, and propose options no later than 10 years prior to lease expiration (i.e., 1996). This will give the lease owners enough notice and time to prepare accordingly.

[155]Please refer to Issue #10 Compatibility and Refuge Allowable Uses.

ISSUE #12: Nonwildlife-Oriented Recreation and Law Enforcement

Goal #12: To reduce levels of nonwildlife oriented recreation on the River channel that runs through the lower Colorado River refuges, eliminate all nonwildlife-oriented recreation that is not *compatible*, increase the quality experience related to natural values by all River visitors, and raise public awareness of the lower Colorado River ecosystem values.

Objectives:

(1) Reduce nonwildlife-oriented recreation on the River channel that passes through the refuges by consistent enforcement where jurisdiction applies, and through joint-jurisdictional educational efforts. Enforcement will be coordinated with both States' wildlife agencies in consideration of applicable uniform waterway navigation regulations. **Target: Five percent per year reduction throughout the 20-year planning cycle.**

(2) Protect wildlife resources by implementing the appropriate zoning policy for sensitive areas of the refuges, especially those pertaining to endangered species. Each refuge manager will review existing refuge zoning regulations and implement zones that take into account refuge purposes and the proximity to other jurisdictions that are more conducive to the nonwildlife-oriented uses (i.e., water skiing, jet skiing areas).[156] **[Years 1-3]**

(3) Improve educational efforts regarding the unique role of the Service in protecting wildlife resources by coordinating a joint-jurisdictional information and education booklet informing the public of recreational use opportunities River-wide and sensitive habitat areas on the refuges. Investigate and develop River-wide joint-jurisdictional public use opportunity information. (Also see **GOAL #10**). **Target: A joint-jurisdictional public use opportunity brochure. [Year 3]**

(4) Improve law enforcement coordination in cooperation with California and Arizona fish and game officials by developing a River-wide joint-jurisdictional law enforcement strategy that will include the law enforcement officials from all jurisdictions along the lower Colorado River; and increase refuge law enforcement staffing along the River to include new collateral, seasonal, and full-time law enforcement officers, as funding will allow. **[Year 5]**

[156]Please refer to Issue #10 Compatibility and Refuge Allowable Uses.

ISSUE #13: Environmental Education and Public Outreach

Goal #13: To establish a formal program for public outreach, identify important public resources, and improve educational and interpretive programs for refuge habitat, wildlife, and cultural resources.

Objectives:

(1) Improve public appreciation of wildlife resources and awareness of ecological values by developing an environmental education and public outreach strategy. This strategy would detail the role of each of the four lower Colorado River national wildlife refuges in each of the local communities. **[Year 5]**

(2) Improve outreach to children and schools by designing an environmental education and interpretation program tailored to fit the needs of the local schools from elementary grades through secondary levels. **[Year 5]**

(3) Enhance the public's experience of the role of the lower Colorado River refuges by pursuing development of a Lower Colorado River National Wildlife Refuges Resource Interpretation Center in Yuma, Arizona. **[Year 1-10]**

(4) Improve on refuge interpretive programs by developing on-refuge interpretive programs (including displays, and exhibits) for Havasu, Bill Williams River, Cibola, and Imperial NWR's. (See Objective #9 below). **[Year 1-5]**

(5) Consider, with more detailed public use planning, enhancement of the public's appreciation for the ecological region by designing a set of auto tour options including: Havasu, Bill Williams River, Cibola, Imperial, and Kofa NWRs. **Target: Site-development plan for self interpretive auto tour route options.**[157] **[Year 3]**

(6) Improve Service understanding of public use of the Area of Ecological Concern by establishing a public use information database. **Target: Develop Public Use Management strategies. [Year 2]**

(7) Improve local business' understanding of wildlife and ecological values. Encourage business participation in the protection and enhancement of the Area of Ecological Concern resources. This will be done by developing joint interpretation and education

[157]As noted earlier in the document, site-specific discussions related to public use improvements are subject to the development of more detailed public use management strategies. Discussions of specific projects are intended to prompt consideration of these options and form the basis for alternative development for a more detailed plan. These projects should only be considered conceptual at this stage. Any future site-specific proposals would be subject to additional NEPA consideration.

programs with private sector companies and manufacturers of sporting equipment and will take advantage of any possible financial resource opportunities. **[Year 5]**

(8) Improve refuge relationships with local communities by establishing a "Friends of the Colorado River Refuges" support organization. **[Year 1]**

(9) Improve lobby interpretive area at Imperial and Cibola NWRs. Build new visitor contact areas and/or visitor centers at both Havasu, and Bill Williams River NWRs. **[Year 1-5]**

ISSUE #14: Refuge Wildlife Recreation Management

Goal #14: To achieve optimum levels of wildlife observation, fishing, and hunting recreation opportunities where such use is legally *compatible* with the purposes of the refuges and the goals of the National Wildlife Refuge System.

Objectives:

(1) Facilitate salient and consistent interpretive theme development for the lower Colorado River refuges by developing site-specific public use strategies for those uses determined to be compatible with refuge purposes. Projected public use levels for fishing, hunting, and wildlife observation will remain between the ranges indicated in Objective Documentation Records for the individual refuges contained in **Appendix B** (separate from this document). **[Year 3]**

(2) Ensure reasonable levels of hunting and fishing opportunities that do not place harmful pressure on the species populations and sensitive habitat areas and that do not conflict with wildlife management strategies or other forms of allowable wildlife-oriented recreation. **Target: Develop an updated refuge hunting and fishing management plan for each refuge, and develop site-specific public use strategies on each refuge for uses determined to be compatible with refuge purposes. [Year 3]**

(3) Effect improved coordination in the dissemination of information and improvement in communication with local and statewide hunting and fishing organizations. **Target: Meet with representatives from these groups annually. [Years 1-20]**

(4) Effect improved coordination in the dissemination of information and improvement in communication with local and statewide conservation organizations. **Target: Meet with representatives from these groups annually. [Years 1-20]**

(5) Consider, with more detailed public use strategy development, improvements to existing auto tour routes at Cibola NWR including interpretive materials, kiosks, observation towers, and appropriate signage. **[Year 3]**

(6) Consider, with more detailed public use strategy development, the improvement of wildlife observation opportunities at Havasu, Bill Williams River, and Imperial NWRs by adding an auto tour route with appropriate interpretive materials and signage in an appropriate location. **[Year 3]**

(7) Consider, with more detailed public use strategy development, improvements to wildlife observation opportunities at Havasu, Bill Williams River, Cibola, and Imperial NWRs by constructing and/or improving existing wildlife hiking trails to include appropriate interpretive materials and signage.[158] **[Year 5]**

(8) Consider, with more detailed public use strategy development, improvements to wildlife observation at Imperial NWR by improving road access from main Yuma County, Martinez Lake Village Road to Imperial NWR Refuge Visitor Center and Headquarters through joint County/Service cost-share agreement. **[Years 5-10] plan.**

ISSUE #15: Area of Ecological Concern Interagency Coordination

Goal #15: To strengthen interagency and jurisdictional coordination of lower Colorado River issues, resulting in decisions benefiting fish and wildlife resources, while avoiding duplication of effort.

Objectives:

(1) Improve inter-refuge management efficiencies by completing the reorganization of the lower Colorado River national wildlife refuges to form a Lower Colorado River National Wildlife Refuges Complex consisting of: Havasu, Bill Williams River, Cibola, and Imperial NWRs.[159] **[Years 1-5]**

(2) Improve local refuge coordination by completing staffing for each refuge and for the Refuge Complex. **[Year 3]**

(3) Improve interagency coordination, planning, communication, and decision-making by meeting with the appropriate Federal agency representatives at least twice annually

[158]Although interpretive foot trails already exist at Imperial NWR, opportunities exist to construct new interpretive hiking trails and increase wildlife observation on the Refuge.

[159]Please refer to PART II, Unit 1, Section 11 for a general organizational representation of the proposal.

to discuss coordination efforts on an array of issues including: water management, revegetation, human waste and contaminants, fire management, public recreational use, environmental education and interpretation, and law enforcement.

(4) Improve interagency coordination, planning, communication, and decision-making by participating with the Colorado River Interior Management Group in the development of a long range strategic plan for the Colorado River. The strategic plan will consider development of coordinated efforts relative to environmental, recreational, and water management issues. **[Year 2]**

ISSUE #16: Refuge Relationship to Native American Governments

Goal #16: To strengthen Service working relationships with the various Native American governments situated along the lower Colorado River, resulting in decisions that benefit fish and wildlife resources.

Objectives:

(1) Strengthen tribal-Service relationship by setting the groundwork for ongoing dialogue between the Service Regional policy officials and the respective tribal leadership representatives. **Target: Annual meetings with tribal policy officials. [Years 1-20]**

(2) Strengthen tribal-refuge relationship by establishing bi-annual working meetings with Native American government executive staff in preparation for annual meetings between Service Regional policymakers and Native American government policymakers. **[Year 2]**

(3) Improve understanding and increase sensitivity toward cultural practices by preparing an inventory of Native American cultural practices on the four national wildlife refuges, in coordination with the Native American governments. **[Year 1]**

(4) Improve communication with Native American wildlife program leaders by developing a database relating to areas of resource protection priority/concern on Service lands for which the five Native American governments might render advice, expertise, and assistance. **Target: Coordinated database. [Year 1]**

(5) Improve communication with Native American wildlife management leaders by developing in coordination with tribal officials a database relating to areas of natural resource protection priority/concern on tribal lands for which the Service might render advice, expertise, and assistance. These discussions should lead to cooperative efforts in the restoration, preservation, and management of wildlife populations and habitat. **Target: Coordinated database. [Year 2]**

ISSUE #17: Staffing, Funding, and Organizational Structure

Goal #17: To effect improvements to funding and staffing that will result in long lasting enhancements to habitat and wildlife resources in the Area of Ecological Concern and the lower Colorado River national wildlife refuges, leading to the achievement of the goals of this plan and the goals of the National Wildlife Refuge System.

Objectives:

(1) Improve inter-refuge coordination of programs by completing the reorganization of the lower Colorado River national wildlife refuges to form a Lower Colorado River National Wildlife Refuges Complex consisting of: Havasu, Bill Williams River, Cibola, and Imperial NWRs. **[Years 1-5]**

(2) Improve on-refuge program management by completing staffing plan for each refuge and for the Refuge Complex.[160] **[Year 3].**

(3) Improve consistency of management of refuge programs by annually assessing individual program funding needs, prioritizing them, and preparing a budget supported by the goals and objectives of this plan. **[Years 1-20]**

(4) Make management of refuge programs more consistent with Regional management priorities by promoting existing, continuing, and proposed refuge and Service programs in the Area of Ecological Concern, monitoring Work Activity Guidance progress, conducting compatibility reviews with refuge managers, and preparing annual narratives of refuge accomplishments. **[Years 1-20]**

(5) Ensure Comprehensive Management Plan applicability and flexibility for future years by reviewing the document for currency, assessing objective achievement progress, and making suggested amendments to the document in a report to the Regional Director. **Target: Revision of objectives every 5 years. [Years 1-20]**

[160]This objective relates more to the completion (in 3 years) of all necessary administrative staff planning requirements such as Position Descriptions, Grade Levels, and funding sources, and not to the actual filling of the positions as described in Goal 15, Objective 2, which calls for the completion of actual staffing for each refuge and the Refuge Complex by year 6.

UNIT 2 -- LONG-RANGE MANAGEMENT STRATEGIES

1. INTRODUCTION

This management strategy section is the final synthesis of the all the components of this planning effort. The strategies are designed to serve as an effective base on which to achieve efficiencies in the management of the lower Colorado River national wildlife refuges for the enhancement of biological diversity, protection of endangered species, and the achievement of public appreciation of fish and wildlife resources. Thus, refuge management will include public uses consistent with agencywide direction and compatible with the purposes for which the individual refuges were established.

Ideally, the actions prescribed in the Goals and Objectives delineated earlier and the strategies outlined below, should provide basic, long-term guidance for the management of the refuges' resources consistent with the Service's Vision and mission, the long chain of legal and policy guidance, the Refuge System goals, and the purposes for which the refuges were established.[161] This section provides the necessary direction for the formulation of specific refuge program operational planning efforts.

While management of each of the lower Colorado River national wildlife refuges will follow a holistic, ecosystem approach, the respective refuges contain enough unique characteristics to require definable differences in their respective strategies. Management decisions will not be made without giving consideration to the overall impacts on the integrity of the Area of Ecological Concern and its constituent parts.

An ecosystem approach requires that the refuge managers view their responsibilities within the context of scientific, legal, and administrative factors that extend beyond the refuge boundaries. A multijurisdictional, cooperative effort will do much to clarify agency roles in a complex environment and will ensure that activities off the refuges do not attenuate Service efforts to achieve biological diversity, to protect endangered species, and achieve an optimum level of public appreciation of fish and wildlife ecology.

2. GENERAL MANAGEMENT EMPHASES

The following are the general management emphases applicable to all of the lower Colorado River national wildlife refuges. These 10 emphases are designed to be complimentary with the comprehensive management plan goals and objectives detailed in the preceding section. Application of the following management emphases in combination with the accomplishment of

[161]PART I, Unit 2, Section 3 of this document summarizes the "new mission" of the Service based upon *Vision For the Future, 1991, Total Quality Management Plan.*

objectives will foster the achievement of comprehensive management planning goals, National Wildlife Refuge System goals, and the new mission of the Service.[162]

Emphasis on Compatibility

Management considers compatibility as the central and most critical factor in planning and managing the National Wildlife Refuge System. All management activities and allowable uses, including public uses, will undergo analysis to determine whether or not these activities are compatible with the purposes for which the refuges were established, the goals of the National Wildlife Refuge System, and the refuges' comprehensive management plan objectives.[163]

Emphasis on Preservation of Natural Resource Base

Management activities will be directed towards preserving the natural resource base of the refuges: air, water, soil, and vegetation. Activities which have long-term detrimental impacts on this base will not be condoned and will be prohibited when allowable by virtue of jurisdictional right.

Emphasis on Maintenance of Aesthetic Resources

All management will be directed to maintain the aesthetic resources of the refuges. Management activities with long-term negative impacts on visual resources and air quality of the refuges will not be practiced. Refuge activities that have the potential to impact the refuges' aesthetic resources will be assessed for significance and allowed only after the appropriate level of NEPA compliance.

Emphasis on Natural Diversity

Management will emphasize a diverse mixture of habitats to benefit groups of wildlife that use those habitats. With the exception of endangered, threatened, or sensitive species that may have a critical dependence on the Colorado River ecosystem, management will not emphasize a single species to the exclusion or major detriment of another. For example, vegetation management projects aimed at removing salt cedar would be considered only if critical to meeting habitat enhancement objectives. The salt cedar control effort would be both strategic and selective.

Emphasis on Indigenous Biological Diversity

With the exception of crop and moist soil management strategies necessary to maintain refuge migratory bird resources, all management will emphasize native or indigenous biological

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[162]"Provide leadership toward achieving a national net gain of fish and wildlife and the natural systems which support them." [*Vision, A Total Quality Management Plan*, 1991, U.S. Fish and Wildlife Service].

[163]Please refer to PART I, Unit 2, Section 3, and PART II, Unit 1, Section 9 in this document for additional reference to and discussion of compatibility.

diversity. Introduction of exotic plants and animals to increase habitat or wildlife diversity and abundance will not be practiced. In addition, artificial structures such as wood duck boxes, nesting platforms, raptor perches, and other man-made contrivances will be discouraged unless they fill a critical need for endangered, threatened, and other species of concern.

Emphasis on Consistency of Refuge Operational Plans

Comprehensive management plan goals and objectives that are stepped down into refuge operational plans and/or site development plans will be made consistent with each other and will conform to the purposes of the refuge, the goals of the National Wildlife Refuge System, and the objectives of this comprehensive management plan.

Emphasis on Natural Processes

All habitat management will emphasize, where practical, the use of natural ecological processes such as drought-flood cycles and prescribed fire.[164]

Emphasis on Reintroduction of Native Flora and Fauna

Management will encourage the reintroduction of native flora and fauna. This will include only those species historically and commonly part of the lower Colorado River ecosystem, and will not include accidental occurrence or species on the very edge of their range. Special emphasis will be given to the reintroduction of endangered fishes where prudent and feasible. Special emphasis will be given to revegetation of native cottonwoods and willows and honey mesquite bosque type habitat.

Emphasis on Wildlife-Oriented Uses, Wildlife Interpretation, and Environmental Education

Public use is allowable when *compatible* with the purposes for which the refuge was established and the goals of the National Wildlife Refuge System. If proper jurisdictions apply to the Service, most nonwildlife-oriented recreation will be prohibited and others will be regulated. When determined to be *compatible*, wildlife-oriented uses may be allowed, depending on other factors related to refuge management. All management will attempt to implement wildlife interpretative and environmental educational plans that will foster the public's appreciation of fish and wildlife ecology.[165]

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[164]The role of fire along the lower Colorado River will be investigated as one of the objectives under Goal #1, Objective #7. Under this objective, the refuges will develop fire management plans based on site-specific habitat objectives.

[165]Refuge Manual 2 RM 1.4. Also please refer to PART I, Unit 2, Section 3 for an outline of the broad goals of the National Wildlife Refuge System.

Emphasis on Cooperative Leadership, Interagency Communication, and Public Outreach

The long-term management approach for the lower Colorado River national wildlife refuges will be to emphasize the provision of cooperative leadership with other natural resource management agencies in the Area of Ecological Concern. When possible, the lower Colorado River national wildlife refuges will engage in cooperative ventures with the public, private organizations, other governmental agencies, and Native American governments. The refuges will be supportive of mutually beneficial natural resource activities and will be active in developing constituencies supportive of the enhancement of natural resource and ecological values.

3. SPECIFIC REFUGE MANAGEMENT STRATEGIES

Each of the lower Colorado River national wildlife refuges have similar characteristics and share many of the same resource values and problems. Nevertheless, these refuges are also unique by virtue of their relative positioning with the Colorado River, their purposes, their surrounding communities, their management histories, their relative size in acres and geographical configuration, and their accessibility to the public. These differences are evidenced by the various complexities denoted in the relationship between refuge management units, subunits, and special project and protection areas.

For this reason, this comprehensive management plan wishes to treat the refuges' long-range management strategies as outgrowths of both the homogenous refuge elements as well as the differences. These differences between the refuges highlight the need for customized long-range management strategies in order to effect long-term goal achievement.

The choices in strategies range from "active management" approaches to "protective management" approaches with varying possibilities in between.[166] For instance, the biological resource maps in PART II, Unit 2, Section 8 illustrate the differences. Imperial NWR appears to call for a more "protective management" approach because the Colorado River in this area nearest the refuge has not been as intensively dammed or channelized as other reaches of the River. Cibola NWR, on the other hand, calls for a more "active management" approach by virtue of the overall River development in that area.

All future site development work is subject to NEPA documentation. To the degree that any future management actions are consistent with those prescribed by this document, the future

[166]Active management approaches include those activities the refuge engages to produce some definable change in the environment. For example, farming, revegetation, and dredging are considered active management activities. This is the opposite of protective management activities, those activities in which the refuge maintains an existing circumstance or standard. Examples of protective management activities are habitat monitoring, property fencing, and law enforcement.

NEPA documentation may be "tiered" from the Environmental Assessment accompanying this comprehensive management plan.[167]

Havasu NWR

The long-term management approach for Havasu NWR will be a combination active management and protective management approach. Nevertheless, the strategies for all of Havasu NWR will require increased expenditures for additional biological, public use, and law enforcement staff. These staff will provide the capability to design and implement systematic biological surveys, increase coordination with other agencies and the scientific community, develop a Public Use Management Plan that includes a focus on natural area interpretation, and effectively protect sensitive natural areas and resources.

Topock Marsh Management Unit -- The complexities of the refuge programs in the Topock Marsh Management Unit call for an active management approach.

Over the next 20 years, the management of the Topock Marsh Management Unit will require substantial active management efforts to:

(1) Improve biological databases of fish and wildlife species.
(2) Contain salt cedar infestation.
(3) Minimize water contamination (i.e., selenium).
(4) Optimize water quality.
(5) Optimize revegetation with native species.
(6) Provide feeding (although minimal, i.e., current level) and roosting areas for waterfowl.
(7) Optimize marsh habitat and moist soil areas for marsh and waterbirds, especially the endangered Yuma clapper rail.
(8) Continue and enhance current level farming operations.
(9) Optimize cottonwood and willow habitat for resident and migratory avian species especially those that are endangered or threatened.
(10) Provide high quality wildlife observational opportunities.
(11) Continue and enhance quality of existing waterfowl and other hunt programs.
(12) Continue and enhance quality of existing sport fisheries programs.
(13) Optimize fire management.

This will involve attention to interagency coordination, special projects, and site development work such as dike construction, dredging, installation of water pumping and gauging equipment, and improvements to water flows into the Topock Marsh/Pintail Slough Inlet Canal system. Also included for consideration in future years are: construction of a visitor center and administrative facility at an acceptable site on the Refuge (See Map 10); construction of a "foot

[167]"Tiering" is a procedure which allows an agency to avoid duplication of paperwork through the incorporation by reference of general discussions and relevant specific discussion from an environmental impact statement of broader scope into one of lesser scope or vice versa.

trail" in the Pintail Slough Management Subunit; and the generalized improvement of interpretive and directional signage in this management unit.[168]

Topock Gorge Management Unit -- By contrast, the naturalness of the Topock Gorge Management Unit requires diligent protective management through law enforcement, habitat monitoring, and selective scientific research.[169] Over the next 20 years the strategies employed in the Topock Gorge Management Unit will entail increased protective strategies to:

(1) Improve biological databases of fish and wildlife species.
(2) Protect sensitive marsh areas used by the endangered Yuma clapper rail.
(3) Protect desert/wilderness habitat and cultural resource areas.
(4) Improve wildlife observational opportunities.
(5) Maintain quality of naturalness, especially in the backwater marsh and desert wilderness areas.
(6) Improve public appreciation of area naturalness.
(7) Strictly regulate, as allowable by law and in coordination with AGFD, all water sport activities on this segment of the River and prohibit uses not compatible or harmful to refuge wildlife resources.

This will involve expenditures for additional biological staff and law enforcement capabilities, clarification of jurisdiction to zone public use of the main River channel, focused attention to biological survey in the Crystal Beach Management Subunit and other backwater areas of concern, development of a wilderness management plan, attention to interagency coordination, and development of a natural area interpretive plan for this Unit.

Invasion by aggressive exotic plant species such as salt cedar and giant cane, the continual threat from wildfire to existing stands of native vegetation, and selenium contamination are important considerations for the entire Refuge. To offset these negative impacts, some active management strategies will emphasize restoration of biological diversity. This dictates the need for active management strategies including:

(1) Restore native riparian plant communities in riparian habitats presently dominated by exotic plant species.

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[168]As noted earlier in the document, site-specific discussions related to public use improvements are subject to a more detailed Public Use Management Plan. Discussions of site-specific improvements are intended to prompt consideration of these options and form the basis for alternative development for the more detailed plan. They should only be considered conceptual at this stage.

[169]It is important to note that important marsh habitats in the Topock Gorge Management Unit may not be sustained by protective management strategies alone. Major perturbatory forces, in the form of floods, once set back succession along the Colorado River. Those floods no longer occur. Marshes are in an early seral stage and will not remain as they are today by protection alone. Without the employment of some active strategies, eventually succession and sediment deposition from flows higher than normal, but insufficient to scour the area, will turn them into higher ground, no longer suitable as habitat for the Yuma clapper rail and other marsh species. This is also the case for many of the backwater areas of Imperial NWR.

(2) Integrate active fire prevention and pre-suppression activities into revegetation program to provide optimum levels of protection to restored habitats.
(3) Restore former shallow riparian wetlands and their functional values, which have filled in and are dominated by stands of exotic vegetation. Emphasize benefits for endangered Yuma clapper rails and other species of special concern.
(4) Enhance shallow and deep backwater wetland habitats. Emphasize benefits for endangered fish, Yuma clapper rails, and other species of special concern.
(5) Enhance moist soil management where possible by developing water management capabilities. Emphasize benefits for a wide array of wildlife and plant species, including waterfowl and several shorebird and wading bird species of special concern.
(6) Continue cropland management at current levels for wintering and migrating waterfowl, but increase benefits and efficiency by improving water management capabilities. Develop water management plan for croplands to broaden benefits to include other wildlife species.
(7) As determined by scientific research, implement recommended management actions to improve water quality and minimize selenium contamination in backwater wetlands.

Bill Williams River NWR

The long-term management approach for Bill Williams River NWR will be to emphasize protective management. Nevertheless, the strategies for all of the Bill Williams River NWR will require increased expenditures for additional biological, public use, and law enforcement staff. These staff will provide the capability to design and implement systematic biological surveys, increase coordination with other agencies and the scientific community, develop a Public Use Management Plan that includes a focus on natural area interpretation, and effectively protect sensitive natural areas and resources.

The Bill Williams River NWR, in its entirety, is an area of special concern. As has been described in this document, this Refuge is the last vestige of Colorado River native riparian habitat. Invasion by aggressive exotic plant species such as salt cedar and giant cane, the continual threat from wildfire to existing stands of native vegetation, and selenium contamination are important considerations for the entire Refuge. To offset these negative impacts, active management strategies will emphasize restoration of biological diversity. This dictates the need for active management strategies including:

(1) Restore native riparian plant communities in riparian habitats presently dominated by exotic plant species.
(2) Integrate active fire prevention and pre-suppression activities into revegetation program to provide optimum levels of protection to restored habitats.

(3) Restore former shallow riparian wetlands and their functional values, which have filled in and are dominated by stands of exotic vegetation. Emphasize benefits to endangered Yuma clapper rails and other species of special concern.
(4) Enhance shallow and deep backwater wetland habitats. Emphasize benefits for endangered fish, Yuma clapper rails and other species of special concern.
(5) Enhance moist soil management where possible by developing water management capabilities. Emphasize benefits for a wide array of wildlife and plant species.
(6) As determined by scientific research, implement recommended management actions to improve water quality and minimize selenium contamination in backwater wetlands.

Each of the Refuge management units require diligent natural management through habitat monitoring, selective scientific research, and law enforcement. However, it is important to consider that this preferred management approach for Bill Williams River NWR presents a no less challenging effort to protect existing habitat and restore habitat affected by such threats as recreational abuses, fire, and infestation of non native vegetation species. Given the negative forces impacting Bill Williams River NWR and the degraded state of the overall ecosystem, all management activities, including those specifically aimed at enhancing biological diversity will require the inclusion of aggressive active management approaches. Efforts will not be successful without the strategic inclusion of aggressive active management techniques to provide and enhance water management capabilities and control the spread of aggressive exotic plant species.

Over the next 20 years, the combination of active and protective approaches will be employed to:

(1) Improve biological databases of fish and wildlife species.
(2) Protect water flow and deep aquifer resources.
(3) Improve level of scientific research.
(4) Protect sensitive native cottonwood/willow forested areas used by migratory and resident avian species, especially those that are endangered or threatened.
(5) Protect sensitive marsh areas used by the endangered Yuma clapper rail.
(6) Protect desert and forested natural habitat areas used by diverse species.
(7) Improve wildlife observational opportunities.
(8) Maintain quality of naturalness and natural ecological processes.
(9) Improve public appreciation of area's naturalness.
(10) Prohibit uses not compatible or harmful to the Refuge wildlife resources as required by law.
(11) Optimize fire management.

This will involve expenditures for additional biological staff and law enforcement capabilities, additional research regarding Bill Williams River Basin hydrology, focused attention to biological surveys, attention to interagency coordination and scientific research opportunities, and development of a refuge interpretive plan.

Cibola NWR

The long-term management approach for Cibola NWR will be to emphasize active management approaches toward maximizing the full potential of the Refuge. These approaches include revegetation, extensive water management, habitat manipulation, and scientific research. Nevertheless, the strategies for all of Cibola NWR will require increased expenditures for additional biological, public use, and law enforcement staff. These staff will provide the capability to design and implement systematic biological surveys, increase coordination with other agencies and the scientific community, develop a Public Use Management Plan that includes a focus on natural area interpretation, and effectively protect sensitive natural areas and resources.

Over the next 20 years, the management of all five Cibola NWR management units will require substantial active management efforts to:

(1) Contain salt cedar infestation.
(2) Minimize water contamination (e.g., selenium).
(3) Optimize water quality.
(4) Optimize revegetation with native species.
(5) Provide feeding and roosting areas for waterfowl.
(6) Optimize marsh habitat and moist soil areas for marsh and waterbirds, especially the endangered Yuma clapper rail.
(7) Continue and improve farming operations.
(8) Optimize cottonwood and willow habitat for neotropical birds and raptors.
(9) Improve wildlife observational opportunities.
(10) Continue and enhance the quality of existing hunting and fishing programs.
(11) Optimize reintroduction of endangered fishes where possible.
(12) Optimize fire management.

This will involve attention to interagency coordination, special projects, and site development work such as canal rehabilitation, dredging, installation of water pumping and gauging equipment, and improvements to water flows into the Cibola Lake and Hart Mine Management Units.

As in the case of the other Colorado River refuges, invasion by aggressive exotic plant species, the continual threat from wildfire to existing stands of native vegetation, and selenium contamination are important considerations. To offset these negative impacts, active management strategies will emphasize restoration of biological diversity. This dictates the need for active management strategies including:

(1) Restore native riparian plant communities in riparian habitats presently dominated by exotic plant species.

(2) Integrate active fire prevention and pre-suppression activities into revegetation program to provide optimum levels of protection to restored habitats.
(3) Restore former shallow riparian wetlands and their functional values, which have filled in and are dominated by stands of exotic vegetation. Emphasize benefits for endangered Yuma clapper rails and other species of special concern.
(4) Enhance shallow and deep backwater wetland habitats. Emphasize benefits for endangered fish, Yuma clapper rails, and other species of special concern.
(5) Enhance moist soil management where possible by developing water management capabilities. Emphasize benefits for a wide array of wildlife and plant species, including waterfowl, several shorebird, and wading bird species.
(6) Continue cropland management at current levels for wintering and migrating waterfowl, but increase benefits and efficiency by improving water management capabilities. Develop water management plan for croplands to broaden benefits to include other wildlife species.
(7) As determined by scientific research, implement recommended management actions to improve water quality and minimize selenium contamination in backwater wetlands.
(8) Improve biological databases of fish and wildlife species.
(9) In cooperation with the Bureau of Reclamation, acquire Cibola Valley Irrigation District lands for additional revegetation with native cottonwood and willow forests, and for additional moist soil management and croplands for growing migratory bird use.

Site specific proposals include completion of improvements to the Refuge headquarters, construction of a foot trail, the possible improvement of boat access to Cibola Lake and the Colorado River, and generalized improvement of interpretive and directional signage on the Refuge.

Imperial NWR

The long-term management approach for Imperial NWR will be to emphasize protective management. Each of the Imperial NWR management units requires diligent protective management through wildlife and habitat monitoring, selective scientific research, and law enforcement to protect sensitive resource values.

As in the case of Bill Williams River NWR, it is important to consider that this preferred management approach presents no less a challenging effort to protect existing habitat and restore habitat affected by such threats as recreational abuses, fire, and infestation of non-native vegetation species. Given the negative forces impacting Imperial NWR and the degraded state of the overall ecosystem, all management activities, including those specifically aimed at enhancing biological diversity, will require the inclusion of aggressive active management strategies. A good example on Imperial NWR (as well as on other Colorado River refuges)

involves revegetation, moist soil management, and wetland restoration. All these activities are aimed at restoring and enhancing biological diversity. Efforts will not be successful without the strategic inclusion of aggressive active management techniques to provide and enhance water management capabilities and to control aggressive exotic plant species.

Over the next 20 years, protective management strategies for Imperial NWR will be employed to:

(1) Improve biological databases of fish, wildlife, and vegetative communities.
(2) Protect water flow and quality.
(3) Identify informational needs and support increased levels of scientific research.
(4) Protect sensitive native cottonwood/willow forested areas used by resident and migratory birds (especially threatened and endangered species) including those stands of native plants established through revegetation activities.
(5) Protect sensitive marsh areas used by the endangered Yuma clapper rail.
(6) Protect desert and wilderness natural habitat areas used by diverse species.
(7) Maintain quality of naturalness especially in backwaters and desert wilderness management units.
(8) Improve public appreciation of the area's naturalness.
(9) Prohibit uses that are incompatible or harmful to refuge wildife resources as required by law.
(10) Optimize fire management program capabilities through active participation in Colorado River Zone interagency fire community.

These strategies will require expenditures for additional biological, public use, and law enforcement staff. These staff will provide the capability to design and implement systematic biological surveys, increase coordination with other agencies and the scientific community, develop a Public Use Management Plan that includes a focus on natural area interpretation, and effectively protect sensitive natural areas and resources.

Although the overall acreage available for active management on Imperial NWR is less than Havasu and Cibola NWRs, and limited access to portions of the Refuge restrict these activities, similar factors have negatively impacted biological diversity on this Refuge. Invasion by aggressive exotic plant species such as salt cedar and giant cane, the continual threat from wildfire to existing stands of native vegetation, and selenium contamination are examples. To offset these negative impacts, a protective management approach that emphasizes restoration of biological diversity dictates the need for certain active management activities on Imperial NWR. These include the following:

(1) Restore native riparian plant communities in riparian habitats presently dominated by exotic plant species.
(2) Integrate active fire prevention and pre-suppression activities into revegetation program to provide optimum levels of protection to restored habitats.

(3) Restore former shallow riparian wetlands and their functional values, which have filled in and are dominated by stands of exotic vegetation. Emphasize benefits for endangered Yuma clapper rails and other species of special concern.
(4) Enhance shallow and deep backwater wetland habitats. Emphasize benefits for endangered fish, Yuma clapper rails, and other species of special concern
(5) Enhance moist soil management where possible by developing water management capabilities. Emphasize benefits for a wide array of wildlife and plant species, including waterfowl, several shorebird species, and wading bird species of special concern.
(6) Continue cropland management at current levels for wintering and migrating waterfowl, but increase benefits and efficiency by improving water management capabilities. Develop water management plan for croplands to broaden benefits to include other wildlife species.
(7) As determined by scientific research, implement recommended management actions to improve water quality and minimize selenium contamination in backwater wetlands.
(8) Conform buoys and other waterway markings to standards provided in the Arizona Revised Statutes, Title 5, Section 302, in order to establish uniformity. This also enables the State law enforcement authorities to more easily engage in cooperative efforts on the River.

Other active management activities are needed at Imperial NWR to:

(1) Improve wildlife observational opportunities.
(2) Improve access road to Refuge headquarters (See Map 13).
(3) Improve interpretive education opportunities in visitor center.
(4) Continue and enhance the quality of existing hunting and fishing programs.

4. SUMMARY TABLES

Lower Colorado River National Wildlife Refuge Goals

There are 17 goals for the lower Colorado River national wildlife refuges corresponding to the major issues that have surfaced as a result of the planning process. These goals are applicable to each of the refuges.

As delineated in PART III, Unit 1 of this comprehensive management plan, each refuge goal has a series of objectives leading to the achievement of the goal. Many of the objectives apply to all of the refuges; however, there are a few related directly to one or two of the refuges.

Refuge Objective Accomplishment Schedule

This table attempts to illustrate the timing for the accomplishment of the various refuge goal/objective proposals. The numbers in the "cells" represent the year or range of years following the approval of the comprehensive management plan.

General Long-Range Management Emphases

This table illustrates ten long-range management emphases that apply to the management of all four lower Colorado River national wildlife refuges.

LOWER COLORADO RIVER NATIONAL WILDLIFE REFUGES COMPREHENSIVE MANAGEMENT PLAN GOALS

1. Biological Diversity and Habitat Management--In cooperation with other resource management agencies, to restore and maintain the natural diversity of the Colorado River Area of Ecological Concern, especially on refuge lands.	7. Water Management--In cooperation with the BR and the Army Corps of Engineers, to improve the efficiency of water delivery systems and more effectively gauge water use for the ultimate benefit and enhancements to habitat and wildlife.	13. Environmental Education and Public Outreach To establish a formal program for public outreach, identify important public resources, and improve educational and interpretive programs for refuge habitat, wildlife, and cultural resources.
2. Endangered Species Management--To achieve threatened and endangered species recovery, and to strengthen the role of the lower Colorado River national wildlife refuges in the recovery of all applicable endangered species, threatened species, candidate species, and species of concern to the States of California and Arizona.	8. Revegetation--In cooperation with the BR, revegetate substantial amounts of refuge habitat with native mixes of vegetation leading to biological diversity.	14. Refuge Wildlife Recreation Management To achieve optimum levels of wildlife observation, fishing, and hunting recreation opportunities where such use is legally *compatible* with the purposes of the refuges and the goals of the National Wildlife Refuge System.
3. Fisheries Enhancement and Management--In cooperation with the Service Fishery Resource Office, and other state and Federal agencies with joint jurisdiction, to restore, enhance, and protect fish ecosystems along the lower Colorado River refuges.	9. Water Quality and Contaminants--To improve overall refuge water quality and protect all refuge waters from all contamination.	15. Area of Ecological Concern Interagency Coordination--To strengthen interagency and jurisdictional coordination of lower Colorado River issues, resulting in decisions benefitting fish and wildlife resources while avoiding duplication of effort.
4. Migratory Waterfowl Management--To improve ongoing refuge management programs that enhance migratory waterfowl populations and health on each of the four River refuges and other jurisdictions within the Area of Ecological Concern.	10. Compatibility and Refuge Allowable Uses--To ensure that only *compatible* and appropriate activities occur on the lower Colorado River national wildlife refuges, and to regulate, as provided by law, all activities, uses, and practices on and off the refuges that are potentially harmful to refuge resources.	16.Refuge Relationship to Native American Governments--To strengthen Service working relationships with various Native American governments situated along the lower Colorado River, resulting in decisions that benefit fish and wildlife resources.
5. Wetlands--To achieve protection and enhancement of existing wetland areas on the four River refuges and rehabilitation of former wetlands where possible.	11. Land Status and Jurisdiction--To clarify each of the Colorado River refuges' jurisdictional authorities as they relate to any concurrent or related authorities vested in other Federal, state, local, and Native American governments with natural resource interests within the Area of Ecological Concern; to ensure refuge boundary integrity relative to adjacent lands; and, when the opportunities, funding, and rationale are present, to acquire additional lands to further protect fish and wildlife resources.	17. Staffing, Funding and Organizational Structure--To effect improvements to funding and staffing which will result in long lasting enhancements to habitat and wildlife resources in the Area of Ecological Concern and the lower Colorado River National wildlife refuges, leading to the achievement of goals of this plan and the goals of the National Wildlife Refuge System.
6. Water Rights--In cooperation with the BR and the lower basin States, to enhance use of Colorado River water by the Refuges, protect existing Refuge water rights holdings in the Area of Ecological Concern, and obtain additional rights when possible without adversely affecting other entitlement holders in the lower basin states.	12. Non-wildlife Oriented Recreation and Law Enforcement--To reduce levels of non wildlife oriented recreation on the River channel that runs through the lower Colorado River refuges, eliminate all non wildlife oriented recreation uses that are not *compatible*, and increase the quality experience related to natural values by all River visitors, and raise public awareness of the lower Colorado River ecosystem values.	

PART IV: MAPPING, APPENDIX, AND SPECIAL PROJECT/PROTECTION AREAS

Biological Resource and Activity Mapping

Refuge Management Units and Subunits

The vegetation and wildlife inventory information delineated in PART I, Unit 3, Section 1, provided the means to determine the four refuges' capability to satisfy wildlife needs. This information has been delineated on the Refuge Management Unit Maps which follow.

The maps show the major management unit and subunit activities. Associated with the maps are summary descriptions of each of the elements (i.e., management units and subunits). The summary describes the acreage, habitat, and wildlife use.

Special Projects and Activities

Special Project Areas on refuges are those targeted for focused enhancement or protection. A map depicting these areas follows along with summary descriptions of each of the map elements. Project Activity Areas are depicted with orange cross-hatching while Protection Activity Areas are marked with green cross hatching.

In addition, the refuge managers of each of the lower Colorado River National Wildlife Refuges have formulated strategies for these special refuge areas. The strategies will facilitate the achievement of the refuges' objectives that are outlined in Part III, Synthesis in this document.[170]

[170]A full description of the special project areas and the associated strategies are delineated in this Appendix.

Havasu NWR Management Units/Subunits
MAP 2

1. Topock Marsh Management Unit

MANAGEMENT SUBUNITS/ ACREAGE	HABITAT TYPE	WILDLIFE USE
A. Pintail Slough Cropping (120 acres)	farm, mesquite, salt cedar woodland	waterfowl, marsh, and waterbirds, raptors, passerine
B. Pintail Slough Moist Soil (61 acres)	marsh, cattail, bulrush	waterfowl, marsh, and waterbirds, raptors
C. Yuma Clapper Rail (Topock Marsh) (1,000 acres)	marsh, open water, cattail	Yuma clapper rail, other marsh and waterbirds, fish and aquatics, waterfowl
D. Dredged River (500 acres)	open river channel dry cut, rip-rapped banks	coots, waterbirds, fish and aquatics, waterfowl
E. Inlet Canal (50 acres)(4 linear miles)	open water, unlined ditch, marsh emergent vegetation	waterfowl, marsh, and waterbirds
F. Bermuda Pasture (95 acres)	bermuda grass field	waterfowl browse, migratory bird use including passerines and raptors

2. Topock Gorge Management Unit

MANAGEMENT SUBUNITS/ACREAGE	HABITAT TYPE	WILDLIFE USE
A. Riverine Management (650 acres)	natural river flow, beaches, backwater marshes, island beaches and riparian vegetation, high rock outcroppings	coots, waterbirds, fisheries, marsh birds, Yuma clapper rail, waterfowl
B. Crystal Beach Management (300 acres)	marsh, cattails, beaches	Yuma clapper rails, marsh birds, waterbirds, shorebirds, waterfowl, fisheries and aquatic
C. Wilderness Uplands (14,606 acres)	desert brush, creosote, mesquite, dry washes, salt cedar, some cottonwood and willow in riparian zone	upland mammals, reptiles, passerine, raptors

3. Havasu NWR Special Project Areas/ MAP 3

ACTIVITY AREA (ACREAGE)	HABITAT TYPE/ACTIVITY TYPE	WILDLIFE USE
#1. N.W. Powell Lake (123 acres) Enhancement	marsh/project	marsh birds, waterbirds, waterfowl, Yuma clapper rail
#2. No Name Lake (195 acres) Moist Soil Enhancement	marsh/project	marsh, waterbirds, waterfowl, Yuma clapper rail
#3. North Refuge Revegetation (600 acres)	salt cedar bosque/project	POTENTIAL: passerine, neotropical migrants, raptors
#4. Beal Lake (500 acres) Moist Soil Enhancement	open water/marsh/project	fish, waterfowl, raptors, marsh and waterbirds
#5. Sacramento Wash Athel Forest (145 acres) Revegetation	marsh/athel forest/protection and project	raptors, passerine, marsh birds POTENTIAL: Improved song bird use.
#6. Topock Gorge Backwaters (1,700 acres)	marsh/protection	Yuma clapper rail, other marsh birds, waterbirds, fish, waterfowl

HAVASU NATIONAL WILDLIFE REFUGE
MAP 3
1. Northwest Powell Lake

Location: Topock Marsh Management Unit

Size: Approximately 123 acres

Habitat Description: An emergent vegetation marsh being invaded by salt cedar. Historically the area was the northwest edge of Powell Lake. The area has been cut off from Topock Marsh by the interior dike constructed by the BR. Underground seepage provides some water into the lower portions of the area.

Water: Water supply presently is from seepage and is of low quantity depending on depth of Topock Marsh.

Wildlife Uses: Yuma clapper rails (endangered), common marsh dwelling birds, and mammals including the feral pig.

CMP Goals:[171]

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation
14. Refuge Wildlife Recreation Management
15. Area of Ecological Concern Interagency Coordination

Strategies:

1. Provide water through diversion or pumping to rehabilitate wetland area and reconstitute marsh.
2. Plant cottonwood/willow poles to provide for neotropical bird use.
3. Prescribe burn as necessary for habitat improvement.
4. Construct dike on west side of area if necessary.

[171]These CMP Goals represent the 17 issue/goals represented between pages 136 and 155.

2. No Name Lake

Location: Topock Marsh Management Unit

Size: 195 acres

Habitat Description: This area has become encroached upon by heavy stands of cattails. The culverts providing water into the lake have become laden with silt on both ends. This area was originally part of Topock Marsh, but was cut off with the construction of the interior dike. Like the Northwest Powell Lake, underground seepage provides some water for the area.

Water: Water supply is primarily from seepage. The quantity depends on the depth of Topock Marsh.

Wildlife Uses: Yuma clapper rails use the area. Common marsh dwelling birds and mammals, including the feral pig and horse, also use the area. In fall and winter the area is used by ducks and geese. There is good potential habitat for bald eagle, Yuma clapper rails, and migratory waterfowl.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation
14. Refuge Wildlife Recreation Management
15. Area of Ecological Concern Interagency Coordination

STRATEGIES:

1. Provide water through diversion or pumping to rehabilitate wetland area and reconstitute marsh.
2. Plant cottonwood/willow poles to provide for neotropical bird use.
3. Prescribe burn as necessary for habitat improvement.
4. Establish moist soil farming and management in portions of area.
5. Dig and enhance wetlands by use of excavator.

3. North Refuge Revegetation

Location: Topock Marsh Management Unit

Size: Approximately 600 Acres

Habitat Description: Predominantly monotypical salt cedar, the area was one of the largest cottonwood and willow forests before the infiltration of the exotic salt cedar.

Wildlife Use: There is minimal use by birds and and some feral pigs. The area presents potential for fire because of the dense groves of salt cedar. With good pole plantings, this area can be successfully revegetated. The depth-to-groundwater is sufficient for recovery.

CMP Goals:
1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation
15. Area of Ecological Concern Interagency Coordination

Strategies:
1. Clear away (eradicate) salt cedar stands.
2. Plant cottonwood/willow poles. Also plant mesquite and atriplex.
3. Pump water from Topock Marsh through drip irrigation to revegetation areas.
4. Control regrowth of salt cedar.
5. Control burn where possible.

4. Beal Lake

Location: Topock Marsh Management Unit

Habitat Description: Open lake with some emergent vegetation. Water can be drawn down. Beal Lake was originally part of the Colorado River lakes, intermittent channels, and oxbow complex. The lake is now within the Refuge with the inlet and outlet structures.

Wildlife Uses: Used occasionally in fall and winter by bald and golden eagles. Not much use by Yuma clapper rail. Waterfowl and marsh birds use other area year round,

particularly in the fall and winter. One of the best areas for viewing wintering waterfowl on the Refuge. Areas surrounding the lake are used by a variety of birds and mammals, including feral pigs, and a variety of raptors. Sport fishing occurs in Beal Lake. Primarily channel catfish and largemouth bass are taken; carp are also abundant.

CMP Goals:
1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation
14. Refuge Wildlife Recreation Management
15. Area of Ecological Concern Interagency Coordination

Strategies:
1. Plant cottonwood and willow poles.
2. Improve water management.
3. Prescribe burn as necessary for habitat improvement.
4. Optimize carp control.
5. Develop wetland/moist soil management complex.

5. Sacramento Wash Athel Forest Rehabilitation (approx. 70 acres)

Location: Topock Marsh Management Unit

Size: 145 Acres

Habitat Description: A monotypic athel forest growing in the Sacramento Wash and delta. Historically, native trees grew in this area, but the introduced athel has, over time, displaced native trees.

Water: Water supply in the wash is dependent on rainfall and flash flooding. Water in the delta is subsurface, related to the level of Topock Marsh and the Colorado River.

Wildlife Use: There is some limited Yuma clapper rail use of the area closest to Topock Marsh. Some coyote and bobcat use the area. Numerous species of birds use the area including summer tanagers, Lucy's warbler, yellowthroats, verdins, lesser night hawks, doves, and turkey vultures.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
8. Revegetation
14. Refuge Wildlife Recreation Management
15. Area of Ecological concern Interagency Coordination

Strategies:

1. Remove the number of athel trees by at least 40 percent.
2. Plant honey mesquite, palo verde and screwbean mesquite.
3. Plant cottonwood poles close to the water.
4. Control athel by a combination of prescribed burning, cutting, and herbicide application.

6. Topock Gorge Backwaters

Location: Topock Gorge Management Unit

Size: Approximately 1,700 acres adjacent the Colorado River.

Habitat Description: There are hundreds of separate backwater marshes connected to the Colorado River throughout the Topock Gorge to the vicinity of Castle Rock. Historically, the area was the same, except now the water is deeper for longer periods of time. Salt cedar and scattered stands of giant cane have invaded the shores of various locales. Backwater areas have roundstem bulrush and cattails in varying degrees of thickness and have spiny naiad and some potamogeton. Willows grow in some backwater areas.

Wildlife Use: Yuma clapper rails are found throughout the various backwaters. Grebes and egrets on the AGFD threatened lists occur here. Clark's and Western grebes are found throughout these backwaters. Raptors and all marsh dwelling birds and mammals found in this area occur in the backwater areas. Sport fishery is an integral part of this area.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
6. Water Rights

7. Water Management
8. Revegetation
9. Water Quality and Contaminants
10. Compatibility and Refuge Allowable Uses
12. Nonwildlife-Oriented Recreation and Law Enforcement
13. Environmental Education and Public Outreach
14. Refuge Wildlife Recreation Management
15. Area of Ecological concern Interagency Coordination
16. Refuge Relationship to Native American Governments

Strategies:

1. Hire one full-time refuge law enforcement officer.
2. Plant cottonwood/willow poles.
3. Control salt cedar, giant cane.
4. Prescribe burn decadent stands of emergent vegetation.
5. Establish an "adopt-a-reach" program.
6. Establish firm policy on use of jet skis and clarify law enforcement direction.
7. Zone backwater areas as no-wake areas and close to jet ski use.
8. Apply uniform waterway marking standards in cooperation with AGFD.

Bill Williams River NWR
Management Units
MAPS 4 & 5

MANAGEMENT UNITS	HABITAT TYPE	WILDLIFE USE
A. Delta Management Unit (500 acres	lacustrine, open water, some marsh cattails	waterfowl roosting, Yuma clapper rail, other water and marsh birds, raptor, passerine, neotropical migrants
B. Bill Williams Riparian Unit (2,200 acres)	cottonwood and willow, streambed, salt cedar, minor agricultural	waterfowl, passerine, marsh birds, raptor
C. Bill Williams Upland Unit (2,900 acres)	desert upland, creosote, salt cedar mixes, palo verde	small mammals, reptiles, passerine, raptor, big horn sheep

For mapping purposes, those areas designated for special protection and project activities are primarily the last remaining native vegetation communities along the Bill Williams River. These areas are targeted for enhanced protection and in some cases revegetation with native cottonwood and willow trees.

The Bill Williams River NWR is viewed as an area in need of extensive protection efforts. Continuing encroachment of salt cedar and losses of native cottonwoods and willows are the chief problems the refuge faces for the next 20 years. Of the approximately 2,200 refuge acres of riparian habitat, less than 50 percent is considered to be cottonwood and willow stands. Of that 50 percent of communities designated cottonwood/willow, only 10 percent is actually cottonwood and willow forest. The remainder consists of honey mesquite/salt cedar mixes. In 1986, the percentage of cottonwood and willow habitat was approximately 57 percent.[172] Revegetation efforts between 1987 and 1990 have been moderately successful. As indicated earlier in this document, U.S. Soil Conservation Service experts placed the loss of cottonwoods less than 4 years of age during the summer of 1989 as high as 85 percent. Additional research is expected to improve revegetation efficiencies at the Bill Williams River NWR and on the other lower Colorado River refuges.

If the Planet Ranch (8,389 acres) were acquired or jointly managed, the carrying capacity of the Bill Williams River NWR would increase by more than 100 percent for passerine, neotropical migrants, raptor, and waterfowl species. The Planet Ranch would be an area targeted to possibly serve as a revegetation tree nursery for the Area of Ecological Concern.

[172]Younker, Gordon L., and Chris W. Andersen, *Methods and Vegetation Changes Along the Lower Colorado River Between Davis Dam and the Border with Mexico*, 1986.

SPECIAL PROJECT AND PROTECTION AREAS:
BILL WILLIAMS RIVER NWR
MAP 5

Size. 6,105 acres.[173]

Ownership. The area is owned by the Service.

Habitat description. The site can be described as the large remaining single tract of riparian vegetation on lower Colorado River. The site consists of approximately 1000 acres of riparian vegetation, about 20 percent of which is native species; and about 500 acres of desert brushlands, with substantial salt cedar invasion. Approximately 3,200 acres of desert upland exist. The site has nearly 400 acres of cattail marsh at Bill Williams River delta and about 500 acres of open water on Lake Havasu.

Riparian acreage was originally composed almost entirely of a cottonwood and willow association including 800 acres of closed canopy cottonwood willow gallery. The acreage for other habitat has remained fairly constant but salt cedar invasion has continued to accelerate in both riparian and brushland habitats.

Water. The Bill Williams River NWR has a consumptive right of approximately 1,110 acre feet. Water quantities are influenced by releases at Alamo Dam, removals from surface waters by upstream users, and subsurface pumping by the City of Scottsdale. Major losses of native riparian vegetation have occurred since 1980 due to water problems. This trend is likely to continue without intervention from higher levels. Subsurface pumping by the City of Scottsdale on the Planet Ranch may be having the greatest adverse impact on downstream water needs of the Refuge. Hydrological studies are currently being completed by the Service as a basis for addressing this issue. Water released from Alamo Dam is controlled by U.S. Army Corps of Engineers. Application for instream-flow is being sought.

Wildlife use. Use includes the following threatened and endangered species: Federally listed--Yuma clapper rail, southern bald eagle, brown pelican, peregrine falcon, bonytail chub, razorback sucker, and Colorado squawfish. Arizona listed: lowland leopard frog, great egret, black rail, willow flycatcher, snowy egret, osprey, yellow billed cuckoo, Clark's grebe, least bittern, desert tortoise, Yuma puma, and common black hawk. Other species: desert bighorn, javelina, several riparian obligate avian species, several species of waterfowl and shorebirds. Sport fisheries: Moderate to heavy use for striped bass, largemouth bass, catfish, and carp. Native fisheries: There is an effort underway to reintroduce native nonlisted fishes such as longfin dace, roundtail chub, and Sonoran sucker into the Bill Williams River on the Refuge.

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[173]Should the Planet Ranch be acquired or jointly managed with another land management agency, approximately 8,389 acres would become a part of the Bill Williams River NWR management regime.

Public use. Use is primarily fishing on the lake portions of the delta. Limited small game hunting and sightseeing occurs on the Refuge.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation
14. Refuge Wildlife Recreation Management
15. Area of Ecological Concern Interagency Coordination
16. Refuge Relationship to Native Americans

Strategies:

1. Maintain strong working relationship with Army Corps of Engineers to ensure a reasonable supply of water for riparian maintenance.
2. Restore native vegetation where possible.
3. Participate in efforts to result in Federal acquisition of the Planet Ranch for habitat and water management purposes.
4. If Planet Ranch is transferred to Federal ownership and the Service becomes responsible for management of fish and wildlife resources, the Service will maintain a limited crop program in support of Canada goose populations.
5. Implement additional hydrological study and analysis.
6. Use Geographical Information Systems (GIS) if possible for resource mapping.
7. Establish limited farming for Canada geese if feasible
8. Establish a revegetation research center for the lower Colorado River.
9. Establish a plant materials center.
10. Apply for Registered Natural Landmark status.
11. Establish cooperative agreements for joint management with BLM and/or AGFD.
12. Use fencing to control the negative effects of public access.
13. Apply for Wild and Scenic Rivers status.
14. Continue to participate in the Bill Williams River Technical Committee.

Cibola NWR Management Units/Subunits
MAP 6

1. Arizona North Management Unit

MANAGEMENT SUBUNITS	HABITAT TYPE	WILDLIFE USE
A. Farm Subunit #1 (1,200 acres)	croplands, moist soil, seasonally flooded ponds,	sandhill cranes, Canada geese, shore birds, invertebrates, other waterfowl
B. Arizona North Revegetation Subunit (40 acres)	cottonwood, willow, atriplex, salt cedar, mesquite	passerine, quail, invertebrate, deer, coyotes, amphibians

2. Hart Mine Marsh Management Unit

MANAGEMENT SUBUNITS	HABITAT TYPE	WILDLIFE USE
A. Farm Subunit #2 (300 acres)	cropland (high alkaline)	cranes, geese, ibis, other marsh and waterbirds
B. Hart Mine Marsh Subunit (300 acres)	cattail marsh, salt cedar, open water, mesquite	fisheries, marsh and waterbirds, waterfowl
C. Hart Mine Revegetation (150 acres)	salt cedar, mesquite	POTENTIAL: passerine, neotropical songbird
D. Old River Bend Subunit (200 acres)	old river bottomland, salt cedar, some marsh	small mammals, Yuma clapper rail, marsh birds

3. Island Management Unit

MANAGEMENT SUBUNITS	HABITAT TYPE	WILDLIFE USE
A. Revegetation Subunit (300 acres)	cottonwood, willow, salt cedar, limited marsh	small mammals, raptor, passerine, reptiles
B. Farm Subunit #3 (500 acres)	cropland	upland game, seed eating passerines, small mammals, reptiles, some waterfowl
C. Island Moist Soil Subunits (300 acres)	moist soil plants and salt cedar	shorebirds, swans, waterfowl, upland game, migratory birds
D. Upland Management Subunit (200 acres)	salt cedar, screwbean and honey mesquite	small and large mammals, raptors, passerine

4. California Management Unit

MANAGEMENT SUBUNITS	HABITAT TYPE	WILDLIFE USE
A. Three Fingers Lake Subunit (300 acres)	open water, salt cedar, mesquite, cottonwood, willow	egrets, herons, small mammals, amphibians, invertebrates, largemouth bass, carp
B. California North Revegetation Subunit (200 acres)	salt cedar	small and large mammals, raptors, limited passerine
C. California North Boundary Subunit (30 acres)	mesquite, willow, salt cedar	small and large mammals, passerine
D. California South Revegetation Subunit (100 acres)	salt cedar	raptor, passerine, small mammals

5. Cibola Lake Management Unit

MANAGEMENT SUBUNITS	HABITAT TYPE	WILDLIFE SPECIES
A. North Cibola Lake Subunit (100 acres)	small impoundment, upland, salt cedar	marsh and waterbirds, Yuma clapper rails, herons
B. Cibola Lake Lacustrine Subunit (600 acres)	open water, marsh, emergent, salt cedar	marsh and waterbirds, Yuma clapper rail, waterfowl, raptors, passerine, fisheries

6. Cibola Special Project Areas/ MAP 7

ACTIVITY AREA	HABITAT/ACTIVITY TYPE	WILDLIFE SPECIES
#1. Cibola Lake (600 acres)	marsh, open water, emergents, salt cedar/ PROJECT	marsh and waterbirds, Yuma clapper rail, waterfowl, raptors, passerine, fisheries, POTENTIAL: passerine and raptors, sport fisheries
#2. Three Finger Lake (300 acres) Rehabilitation	marsh, wooded, open water, mesquite, salt cedar/PROJECT	raptors, marsh and waterbirds, mammals, POTENTIAL: raptors, waterbirds, passerines, fisheries
#3. Island Unit (5,000 acres) Canal Rehabilitation and Revegetation	mesquite/salt cedar, agricultural, potholes, shallow marshes/PROJECT	passerine, raptors, waterfowl, marsh and waterbirds
#4. Hart Mine Marsh (300 acres) Rehabilitation	cattail marsh/PROJECT	marsh and waterbirds, waterfowl, fisheries
#5. Old River Channel (350 acres)	riparian, cattail, marsh, salt cedar, salt bush/PROTECTION	shore birds, marsh and waterbirds, raptors, amphibians, waterfowl, aquatic plants POTENTIAL: endangered fishery
#6. Palo Verde Irrigation District Outfall Drain/ Pretty Water Junction (50 acres)	marsh, emergents/PROJECT	shoreline invertebrates, marsh and waterbirds, Yuma clapper rail
#7. Pretty Water (65 acres) Enhancement	marsh, emergents/PROJECT	fisheries, marsh and waterbirds, waterfowl POTENTIAL: endangered fishery
#8. Refuge Revegetation Site 1 (40 acres)	atriplex, cottonwood, willow, mesquite/PROJECT	mammals, passerine, migratory birds POTENTIAL: game mammals, upland birds, passerine
#9. Refuge Revegetation Fire Site (300 acres)	cottonwood, willow, salt cedar, limited marsh/PROJECT	marsh and waterbirds, raptors, bald eagles, passerine POTENTIAL: passerine, waterbird rookery, raptors
#10. California North Boundary (30 acres) Revegetation	mesquite, willow/PROJECT	game mammals, passerine, raptors, neotropical songbirds
#11. California River Dry Cut (20 acres) Revegetation	dry cut, marsh, cottonwood, willow/PROJECT	POTENTIAL: marsh and waterbirds, passerine, raptors, neotropical songbirds

SPECIAL PROJECT AND PROTECTION AREAS:
CIBOLA NATIONAL WILDLIFE REFUGE
MAP 7
1. Cibola Lake

Size: 600 surface acres (2 miles in length)

Ownership. The site is owned by the Service.

Habitat description: Cibola Lake is approximately 600 surface acres in size and is approximately 2 miles in length. It is a man made lake created after dredging activities left it dry in the 1960s.

Wildlife use: The lake attracts several species of wildlife, including nesting species such as Yuma clapper rails (endangered), several species of marsh and waterbirds and waterfowl. Nesting near the fringe of the lake and commonly seen passerine species are the yellow-breasted chat and the common yellow throat. During the winter, the lake serves as a sanctuary and roosting area for several species of ducks, Canada geese (numbering up to 25,000), and all species mentioned above.

There are several species of fish utilizing the lake. The most abundant game fish are small and largemouth bass and channel and flathead catfish. There are also several species of sunfish, whose numbers have declined along the lower Colorado River and its backwaters.

The Cibola Lake area also serves as habitat for a number of lower animal forms. Numerous invertebrates inhabit the area. Crayfish, one of the chief prey for the endangered Yuma clapper rail, are in abundance.

Public use: No public use.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
7. Water Management
9. Water Quality and Contaminants
14. Refuge Wildlife Recreation Management, Objective 1

Strategies:

1. Eradication of monotypical stands of salt cedar.
2. Revegetation of cottonwood and willow species near the lake's edge to provide nesting and lofting habitat for herons and egrets, the Refuge's raptor population, and perches for bald eagles and ospreys.
3. Pump and transport water from channel.
4. Evaluate effect of water level management on fishery.

2. Three Finger Lake

Size: 300 acres

Ownership: The site is owned by the Service.

Habitat description: Although renovation is in dire need, the Three Finger Lake area remains a very important wetland community. It is located along the Old River Channel on the California side of the Refuge. Three Finger Lake encompasses approximately 300 acres, though its wetlands are considerably less. It consists of both wooded and shallow areas.

Water: Water availability is dependent upon river flows and groundwater levels.

Wildlife use: Wooded shallow areas provide excellent feeding for egrets, herons, and occasionally ospreys. The upland areas provide food and cover for mammals such as the mule deer. Milpitas Wash, a large wash which extends to the lake, is used as a travel lane for many species which use the area.

Public use: No public use.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
7. Water Management
8. Revegetation

Strategies:

1. Create an inlet canal to facilitate water circulation throughout the channel and encouraging voluntary growth of native species such as cottonwood and willow.
2. Establish rookeries for herons and egrets and perches for bald eagles and ospreys near the lake's edge.

3. Push for upgrade in mitigation priority with BR.
4. Dredge inlet canal. Install new pipe where required.
5. Establish agreement with BR for inlet cleaning.

3. Island Unit

Size: 5,000 acres

Ownership: The site is owned by the Service.

Habitat description: The Island Unit was created when the channelized portion of the Colorado River (Dry Cut) was constructed in the Cibola, Arizona area prior to the establishment of the Refuge. It is characterized by approximately 5,000 acres of upland divided equally with mature mesquite and salt cedar. Approximately 500 acres were farmed in the past and have been reduced to less than 100 acres. Many of the remaining acres are used as moist soil units when water conditions are favorable. The lowlands are characterized by potholes, old river meanders, and sloughs left dry after dredging activities within the Dry Cut. After some rehabilitation, some of the wetlands have been revitalized, thereby reestablishing a most important wetland community. By far, it is the most diversified area on the refuge and, by its standard, on most refuges.

Water: Water availability is very dependent on river flows and groundwater levels are based on those flows. During high water times, the old river meanders, sloughs, and potholes have sufficient water to provide for habitat.

Wildlife use: Use by a variety of avian species, including marsh and waterbirds that frequent potholes and sloughs when water levels allow. The farm fields provide feeding for migratory waterfowl. The cottonwoods and willows, although few, provide breeding and wintering habitat for passerine and neotropical species.

Public use: Minimal use allowed for wildlife observation.

CMP Goals:
1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
7. Water Management
8. Revegetation
14. Refuge Wildlife Recreation Management, Objective 1

4. Hart Mine Marsh

Size: 300 surface acres (when project is completed.)

Ownership: The site is owned by the Service.

Habitat description. The area is primarily a cattail marsh habitat.

Water.

Wildlife use: Although not completed, the Hart Mine serves as an excellent loafing and feeding area for egrets and herons and as a wintering area for many species of ducks, particularly teal and mallard. The area is a frequent site for the few wood ducks that visit the area during the wintering season.

The Hart Mine Marsh hosts several species of aquatic life forms. Most numerous are talapia, bass, and a few catfish. These, of course, are restricted to the main inlet drain and the deep part of the marsh area.

Public use: No public use.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
7. Water Management
9. Water Quality and Contaminants
14. Refuge Wildlife Recreation Management, Objective 1

Strategies:

1. Interlocking canals must be designed and excavated.
2. Some channels will need to be dredged and deepened.
3. A siltation basin needs to be designed and constructed.
4. An outlet structure needs to be designed and installed at the tie back levee. (Separate outlet with two-way pump).

5. Old River Channel

Size: 350 surface acres. 9 miles length/ 300-350 feet in width.

Ownership: The site is owned by the Service.

Habitat description: The old river channel portion of the Colorado River is approximately 9 miles in length and consists of excellent edges of cattail and bulrush with a scattering of salt cedar and other plants. Some of the other plants include various aquatic plants and abundant growths of yellow netsedges. The banks range from a steep to gradual slope and consist of sand to a sandy loam soil. Because of the contour and thick vegetation near access points, human encroachment is limited, thereby providing for a diversity of species that are left undisturbed.

Water: Water is dependent on groundwater levels of the channelized River.

Wildlife use: The Old River Channel provides an excellent ecosystem for several species including shorebirds, ducks, egrets, herons, greater sandhill cranes, bald eagles, ospreys, and many species of fish and amphibians. Unlike the Dry Cut, the Old River channel is not rip-rapped and boating and water skiing is not permitted.

CMP Goals:
1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
7. Water Management
9. Water Quality and Contaminants

Strategies:
This area is to be protected from recreation activity, such as boating and water skiing, and preserved as shorebird and dabbling duck habitat. There is a potential for use of the Old River Channel to develop grow-out ponds for the Colorado River endangered native fishes.

6. Palo Verde Irrigation District Outfall Drain/ Pretty Water Junction

Size: 50 acres

Ownership: The site is owned by the Service.

Habitat description: Years ago, the Palo Verde Irrigation District Outfall Drain was tied into the Colorado River just north of Mitchell's Camp. When the Dry Cut was

completed, water flow was diverted from the portion of the Colorado River termed the "Old River Channel." The combination of the former led to the development of a sill at the junction where the drain met the Colorado River. This brought about a condition where siltation gradually filled in the area, thereby completely changing the ecological environment. The former condition gave rise to shallow growing species such as duck weeds, cattail, bulrush, smartweed, and other plants.

Water (See Habitat Description): Water availability is dependent upon groundwater levels based upon annual releases from Parker Dam.

Wildlife use: This area provides habitat for shoreline invertebrates and marsh dwelling species such as the Yuma clapper rail. The Palo Verde Irrigation District Outfall Drain/Pretty Water Junction has been one of the best areas on the Refuge for producing the endangered Yuma clapper rail.

Public use: No public use.

CMP Goals:
1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
7. Water Management
9. Water Quality and Contaminants

Strategies:
1. Routine habitat management activities such as pothole or channel blasting will periodically be needed in order to maintain an acceptable water to vegetation ratio.
2. Other than monitoring, little, if any, management is needed.

7. Pretty Water

Size: 65 acres. 1.41 miles in length. 300-350 feet width.

Ownership: The site is owned by the Service.

Habitat description: Pretty Water lies in the upper or northernmost portion of the Old River Channel. It begins where the dredging of the Colorado left the main channel to start the Dry Cut. The upper portion is characterized by dense growths of cattail and bulrush, with an impenetrable emergence of water that provides excellent cover for fishery and adds to the protection of the area. The lower end has been sealed by an

accumulation of sediment that has transformed the area into an excellent bulrush-cattail community.

Water: Water is dependent on river flows and groundwater levels.

Wildlife use: Both sections of the area serve as important nesting areas for the endangered Yuma clapper rail.

Public use: No public use.

CMP Goals:
1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
7. Water Management
9. Water Quality and Contaminants

Strategies:
1. Maintenance and habitat monitoring.

8. Revegetation Site -- Refuge

Size: 40 acres

Ownership: The site is owned by the Service.

Habitat description: The refuge's 40-acre revegetation site was established in 1979. While it is not considered a "representative" site, it does possess a scattering of cottonwoods, willows, mesquite, and tremendous growth of atriplex.

Water: Dependent on river flows and groundwater levels.

Wildlife use: The site supports a diversity of nesting birds and provides excellent habitat for resident species such as Gambel's quail, mule deer, and other small mammals.

Public use: No public use

CMP Goals:
1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1

7. Water Management
8. Revegetation

Strategies:
1. Maintain existing site by monitoring for salt cedar invasion.
2. Develop fire lane.

9. Revegetation (Island Unit)[174]

Size: 200-300 acres

Ownership: The site is owned by the Service.

Habitat description: Approximately 200-300 acres are to be revegetated following a wildfire which destroyed some of the last large cottonwoods and willows on the Refuge. Destroyed with the important riparian habitat were two colonies of egret and heron rookeries, red tailed hawk nests, perches for raptors such as bald eagles and ospreys, and habitat for nesting passerines and white-winged and mourning doves.

There are two sites targeted for revegetation. One is located near the dry cut portion of the Colorado River and the refuge ponds and marshes. The other is located near the old river channel portion of the Colorado River and will serve as an excellent site for nesting and loafing raptors and songbird species.

Water: Water is dependent upon groundwater levels, pumping, river flows.

Wildlife use: When revegetated, these will be of use to nesting and loafing raptors and songbird species.

Public use: No public use.

CMP Goals:
1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
7. Water Management
8. Revegetation

[174]In June 1991 the Fire Management funds were appropriated for the revegetation of the Island Unit. The amount of the contractor's bid was approximately $233,000. All of the necessary salt cedar eradication had taken place. The refuge manager estimated that this Targeted Core Habitat will have a mature stand of cottonwoods and willows in the necessary quantity and densities to support some of the extirpated and near extirpated neotropical songbirds and raptors by 1996.

Strategies:
1. Establish an interspersion of tall trees and native shrubs that will serve as riparian habitat for a variety of wildlife species.
2. Replant cottonwood and willow.
3. Bulldoze monotypical stands of salt cedar.

10. California North Boundary

Size: 30 acres. 3,500 feet length. Old river bottom 250 feet wide.

Ownership: The site is owned by the Service.

Habitat description: The north boundary of the California side of the Refuge follows along the original path of the Colorado River before the channel moved to its new location (Pretty Water). This former boundary line of Arizona and California is now characterized by tremendous growths of mature mesquite and willows.

Water: Water availability is dependent on river flows and groundwater levels.

Wildlife use: It serves as nesting habitat for many species of birds and loafing and cover for mammals such as the mule deer. It also provides a very important buffer between the Refuge and a nearby private farm.

Public use: No public use.

CMP Goals:
1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
7. Water Management

Strategies:
1. Area should be patrolled more often.
2. No other active management suggested.

11. Revegetation Site -- Dredge Spoil, Off Refuge

Size: 40 acres

Ownership: The site is owned by BR.

Habitat description: Representing approximately 40 acres, the "Dredge Spoil" revegetation site represents a model for revegetation. It consists of cottonwood, willow,

and other native vegetation. There is also an exotic representation (eucalypti trees) planted primarily to experiment growth versus native species.

Water: Availability is dependent on River flows and groundwater levels.

Wildlife use: The Dredge Spoil Site was one of the areas chosen for the release of Harris' hawks during 1986 and 1988. The area supports nesting for a variety of passerine and
neotropical species, and white winged mourning doves. Also, many species of small reptiles and mammals are abundant.

Public use: No public use.

CMP Goals:
1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
7. Water Management
8. Revegetation

Strategies:
1. Continue to work with researchers (Ohmart-Anderson experimental plot) off the Refuge.
2. Acquire the site for Harris hawk management (water rights intact).

Non Fish and Wildlife Service Owned Lands and Waters

a. Cibola Valley Irrigation District -- Old River Meander

Size: 4,000 acres

Ownership: The site is owned by the Cibola Valley Irrigation District.

Habitat description: Located immediately to the north of Cibola NWR's northern boundary lies the Cibola Valley Irrigation District. There are approximately 4,000 acres within the district and at first glance it does not appear to be very wildlife oriented. However, there are areas that could potentially be developed or reclaimed into major wildlife sanctuaries. One of these areas is the Old River Meander. Although a portion of the meander has been filled, there are still many remaining acres that would be developed into excellent wetland communities.

Water: Water rights are desirable with the property should it be acquired. This would include allotments already in place for this land with diversionary rights from the river. Groundwater pumping could also be done if necessary.

Wildlife use: The a large area could be transformed into a sanctuary for neotropical species. Another section could be actively farmed to provide additional wintering for migratory waterfowl.

Public use: Wildlife Observation could be planned for this area as well as regulated hunts for migratory waterfowl and other game species.

CMP Goals:
1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation

Strategies:
1. Acquire site owned by Cibola Valley Irrigation District.
2. Revegetate approximately 3,000 acres with native cottonwood/willow.
3. Acquire at least 18,000 acre feet of water rights or pool water rights with Imperial NWR to allow for use of Imperial NWR's allocation in sufficient quantities to engage in revegetation strategies and farming for migratory bird use (approximately 1,000 acres. (See Goal #6).
4. Farm approximately 1,000 acres for waterfowl and other migratory bird use.
5. Manage area as sanctuary for migratory birds (i.e., close to hunting).

b. Colorado River Oxbow Unit

Size: 400 acres

Ownership: BR

Habitat description: The Colorado River Oxbow unit was created when the BR straightened the Colorado River by channelization. This created an island of approximately 400 acres. The Old River Channel portion is equipped with an inlet and outlet to aid water movement and manage water levels. The entrance of the oxbow is characterized by a shallow elevation, thereby facilitating use by shorebirds and dabbling ducks. The rest of the channel has a moderate depth with a steep to shallow sloping embankment.

The upland area consists of approximately 250 acres of farmland. The rest consists of a wide buffer zone between the farm fields and River and has a mixture of cottonwood, willow, salt cedar, and mesquite. The area of the most significance and with, perhaps, the most potential lies on the California side of the Colorado River Oxbow. This area exhibits a sloping bank line which could provide excellent ponds and sloughs and support native plant revegetation at higher elevations.

Water: Water availability is directly tied to river flows and groundwater levels.

Wildlife use: There is an abundance of aquatic emergents throughout. The area receives moderate to heavy use from waterfowl and marsh birds during fall and winter. There is use by shorebirds and dabbling ducks.

Additional ponds and sloughs would enhance this ecosystem by providing additional nesting habitat for a wide variety of marsh and water birds and adjacent trees could certainly provide rookery habitat for herons and egrets.

Public use: None would be planned if acquired.

CMP Goals:
1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation
14. Refuge Wildlife Recreation Management

Strategies:
1. Acquire property with water rights (100 acre-feet available).
2. Develop agreement with county government regarding management of public park area.
3. Work with BR to protect egret rookery.

c. California River Meander

Ownership: The site is owned by the State of California.

Habitat description: Prior to channelization, the Colorado River meandered along its present course in the Cibola District. After straightening the River, over a mile of these

old river bottoms was left. Some of the wetlands still remain intact, but with a limited water source.

Water: Dependent on groundwater levels and River flows.

Wildlife use: This area serves as habitat for many species of marsh and waterbirds. The major problem so far has been human encroachment.

Public use: Wildlife observation would be planned if acquired.

CMP Goals:
1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation
11. Land Status and Jurisdiction

Strategies:
1. Work with States of California and Arizona in clearing up the boundary issues. Formulate agreements if necessary.
2. Propose cooperative management.
3. Develop rookery.
4. Manage for Yuma clapper and black rails.

d. Major Washes

Ownership: This site is owned by the BLM.

Habitat description: There are several large washes located within this described area that empty into the Colorado River.

Water: Water availability here is dependent upon annual precipitation levels.

Wildlife use: These washes provide habitat for many species of birds, mammals, reptiles, and other species. Although tortoise surveys have not been completed in these areas, habitat exists that should support the desert tortoise, which is threatened in Arizona. At present, off-road vehicle destruction and habitat degradation have not been a problem

throughout most of these areas. Most of the impact has been near the River where boaters and campers congregate.

Public use: Boating and camping is allowed near the River.

CMP Goals:
1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation
15. Area of Ecological Concern Interagency Coordination

Strategies:
1. Work with BLM biologists concerning neotropicals in the major wash areas and how habitat work on refuges affects populations and vice versa.
2. Enter into cooperative management agreements if necessary for habitat enhancement opportunities.
3. Promote additional research in behalf of neotropical species, in coordination with BLM biologists.

e. Colorado River Dry Cut Flood Plain

Size: Runs the full length of the Refuge and is the channelized portion of the River. The area of principal concern is the lower end, which consists of 20 acres.

Ownership: This site is owned by the Service.

Habitat Description: This area has an abundance of salt cedar. At the very low end, (about 20 acres) the Refuge has a newly planted stand of cottonwood/willow, and has great potential for future larger stands.

Water: Natural sloughs and ponds are located on this site. The land needs to be inundated to manage for California black rails.

Wildlife: Yuma clapper and California black rails could potentially use the area. The ponds and sloughs would nest many species of shorebirds and passerine species such as Lucy's warblers.

Public Use: There is no public use in the area.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation

Strategies:

1. Plant additional poles of cottonwoods.
2. Inundate lower areas with water for rail habitat development.
3. Maintain natural sloughs and ponds.

Imperial NWR Management Units/Subunits
MAP 8

1. Martinez Lake and Riverbank Management Unit

MANAGEMENT SUBUNITS	HABITAT TYPE	WILDLIFE USE
A. East Farm Subunit (240 acres)	croplands, some marsh	waterfowl, marsh and waterbirds, raptors, mammals
B. West Moist Soil Subunit (160 acres)	marsh, moist soil, open water, cottonwood	waterfowl, marsh and waterbirds, Yuma clapper rail, raptors
C. Martinez Lake Riverbank Subunit (260 acres)	salt cedar, marsh, cottonwood, willow, mesquite	marsh and waterbirds, Yuma clapper rail, raptors, peregrine falcon, passerine, neotropical songbirds

2. Martinez Marsh/Upland Management Unit

MANAGEMENT SUBUNITS	HABITAT TYPE	WILDLIFE USE
A. Backwater Lake/Marsh Subunit (500 acres)	backwater lakes, wetland and marsh, cattails, open water, salt cedar and palo verde, mesquite on edges, cottonwood and willow	marsh and waterbirds, Yuma clapper rail, waterfowl, raptors, peregrine falcon, passerine, neotropical songbirds, fisheries
B. Martinez Upland Subunit (500 acres)	desert washes, streambed, palo verde, creosote, mesquite, salt cedar, ocotillo and other native Sonoran desert cacti	large mammals, raptors, golden eagles, passerine, reptiles, amphibians

3. Ferguson Lake and Shore Management Unit

MANAGEMENT SUBUNITS	HABITAT TYPE	WILDLIFE USE
A. Lake and Marsh Subunit (800 acres)	open water, marsh, emergents, cottonwood, willow, salt cedar, mesquite	marsh and waterbirds, Yuma clapper rail, waterfowl, raptors, peregrine falcon, passerine, sport fisheries
B. Ferguson Shore and Upland Subunit (1000 acres)	sand beach, emergents, cottonwood, willow, salt cedar, palo verde, mesquite	shorebirds, passerine, raptors, mammals, reptiles, amphibians

4. Backwater Riveredge Management Unit

MANAGEMENT SUBUNITS	HABITAT TYPE	WILDLIFE USE
A. Arizona Riveredge Subunit (2,989 acres)	riverbank, woodlands, salt cedar, arrowweed, cottonwood, willow, mesquite, marsh, uplands, desert wash, streambeds, riverine	marsh and waterbirds, Yuma clapper rail, raptors, fisheries, passerine, neotropical songbirds
B. California Riveredge Subunit (2,620 acres)	riverbank, woodlands, salt cedar, arrowweed, cottonwood, willow, mesquite, marsh, uplands, desert wash, streambeds, riverine	marsh and waterbirds, Yuma clapper rail, raptors, fisheries, passerine, neotropical songbirds

5. Wilderness Management Unit

MANAGEMENT SUBUNITS	HABITAT TYPE	WILDLIFE USE
A. Desert Wilderness Area/ Az. (9,220 acres)	desert washes and stream bed, rocky outcroppings, desert flats, cacti, creosote, brush, mesquite	desert bighorn, desert tortoise (sonoran), reptiles, amphibian, coyote, burros, small mammals, raptors, passerine, quail, dove
B. Proposed Desert Wilderness Area /Ca. (5,836 acres)	desert washes and stream bed, rocky outcroppings, desert flats, cacti, creosote, brush, mesquite	desert bighorn, desert tortoise (sonoran), reptiles, amphibian, coyote, burros, small mammals, raptors, passerine, quail, dove
C. Upland Desert Subunit / Ca. (1,000 acres)(Buffer Zone)	desert washes and stream bed, rocky outcroppings, desert flats, cacti, creosote, brush, mesquite	desert bighorn, desert tortoise (sonoran), reptiles, amphibian, coyote, burros, small mammals, raptors, passerine, quail, dove

6. Imperial Special Project Areas/ MAP 9

ACTIVITY AREA	HABITAT/ACTIVITY TYPE	WILDLIFE USE
#1. East Farm Subunit Irrigation Improvements (240 acres)	agricultural, marsh/PROJECT	waterfowl, raptors, mammals, marsh and waterbirds
#2. West Farm Subunit Irrigation Improvements (160 acres)	marsh, open water, cottonwood, willow/PROJECT	waterfowl, marsh and waterbirds, yuma clapper rail, raptors
#3. Martinez Marsh and Upland (600 acres)	cattail, giant bulrush, giant cane, cottonwood, willow, screwbean mesquite/PROJECT	marsh and waterbirds, Yuma clapper rail, raptors, bald eagle, passerine, small mammals, game mammals
#4. Martinez Lake and Riverbank Revegetation (260 acres)	salt cedar, marsh cottonwood, willow, mesquite/PROJECT	marsh and waterbirds, Yuma clapper rail, waterfowl, raptors, peregrine falcon POTENTIAL: passerine, neotropical songbirds
#5. Martinez Marsh Enhancement (400 acres)	marsh, salt cedar, cottonwood, willow/PROJECT	marsh and waterbirds, Yuma clapper rail, waterfowl, raptors, peregrine falcon POTENTIAL: passerine, neotropical songbirds, fisheries, endangered fish
#6. Ferguson Lake and Shore Management Unit (750 acres)	open water, marsh, islands, salt cedar, cottonwood, willow/PROJECT	marsh and waterbirds, Yuma clapper rail, waterfowl, raptors, peregrine falcon, fisheries POTENTIAL: passerine, neotropical songbirds
#7. Backwater Riveredge/Arizona (2,989 acres)	riverbank, woodlands, salt cedar, arrowweed, cottonwood, willow, mesquite, marshes, uplands, desert wash, open water, riverine/PROJECTR/ PROTECTION	marsh and waterbirds, Yuma clapper rail, waterfowl, raptors, peregrine falcon, fisheries POTENTIAL: passerine, neotropical songbirds, endangered fish
#8. Backwater Riveredge/California (2,620 acres)	riverbank, woodlands, salt cedar, arrowweed, cottonwood, willow, mesquite, marshes, uplands, desert wash, open water, riverine/PROJECT/ PROTECTION	marsh and waterbirds, Yuma clapper rail, waterfowl, raptors, peregrine falcon, fisheries POTENTIAL: passerine, neotropical songbirds, endangered fish
#9. Wilderness Management Unit (16,056 acres)	desert washes and stream bed, rock outcroppings, desert flats, cacti, creosote, bruch, mesquite / PROTECTION	desert bighorn, javalina, desert tortoise (sonoran), reptiles, amphibian, coyote, burros, small mammals, raptors, passerine, quail, dove

SPECIAL PROJECT AND PROTECTION AREAS:
IMPERIAL NATIONAL WILDLIFE REFUGE
MAP 9
1. East Farm Management Subunit (240 acres)

Size: 240 acres

Ownership: The site is owned by the Service.

Habitat Description: The primary habitat (160 acres) is agricultural cropland, including wheat, ryegrass, millet, milo, and corn. Crops provide forage for wintering and migrating migratory birds, primarily waterfowl. Moist soil units (65 acres) and shallow marsh (15 acres) comprise the remaining 80 acres, and provide habitat for a variety of waterfowl, shorebirds, wading birds and waterbirds. In 1993, a 3-acre cottonwood/willow pole nursery was established. Beginning in 1995, this nursery will provide poles for restoring native hardwoods on suitable sites.

Water: Water supply and quantity is from secured water rights (23,000 acre-feet consumptive, 28,000 acre-feet diversion), pumped into an irrigation ditch system for distribution onto fields. The subunit is contained within a gravel dike, and is subdivided by a series of interior dikes.

An inadequate irrigation system has hampered habitat management activities. In 1993, improvements to 5,000 linear feet of the irrigation canal were completed and a new electric pump was installed, greatly enhancing capabilities and efficiency. Repair of the remaining 5,000 linear feet of irrigation canal is needed.

Wildlife Uses: Overwintering Canada geese, snow geese, mallards, northern pintails, American wigeon, gadwall, tundra swans and greater sandhill cranes utilize green forage and grain crops. White-fronted geese, cinnamon and blue-winged teal and several other waterfowl species utilize moist soil units during migration. Moist soil units also provide migrational and wintering habitat for several shorebird species including long-billed curlew, long-billed dowitcher, willet, white-faced ibis, black-necked stilt, American avocet, least and western sandpipers, and wading bird species including great egret, snowy egret, and great blue heron. Raptors including northern harrier, Cooper's hawk, sharpshinned hawk, red-tailed hawk, osprey, Harris hawk, and kestrel forage over fields. Coyote, bobcat, and mule deer are present. Several passerine species including Say's phoebe, black phoebe and western meadowlark use agricultural lands during winter. Gambel's quail are abundant. In 1993, three Yuma clapper rails was present in the shallow marsh.

Public Use: Public use is not permitted.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Migratory Waterfowl Management, Objective 6
4. Wetlands, Objective 1
5. Water Rights
6. Water Management
8. Revegetation
15. Area of Ecological Concern Interagency Coordination

Strategies:

1. Develop water delivery capabilities to entire management subunit by completing irrigation canal improvements. Determine the feasibility of establishing gravity flows to the subunit (see Martinez Marsh Project) to reduce pumping costs.
2. Develop water management capabilities in moist soil units by installing water control structures.
3. Develop and implement a water management plan, including quantification of water use, determination of effects of irrigation on groundwater levels and movement, and determination of effects of fluctuating Colorado River flows on groundwater and wetland habitats.
4. Develop and implement a cropland/moist soil management plan, incorporating the most advanced soil conservation, water management, and cropping techniques to increase productivity and efficiency, and integrated pest management strategies to control exotic plant species.
5. Utilize Moist Soil Advisor computer software to direct and monitor moist soil management.
6. Maintain and enhance developing stands of three-square and alkali bulrush in moist soil units to provide nesting habitat for California black rails. Following systematic site suitability analyses, restore native cottonwood, willow and mesquite on upland sites within moist soil units. Expand cottonwood/willow pole nursery to 3 acres. Determine the feasibility of using flood irrigation (simulation of short-term flood events) to promote natural reproduction of restored native plants.
7. Maintain and enhance shallow marsh habitat for waterfowl and waterbirds, including nesting Yuma clapper rails, primarily with water management and control of exotic vegetation.
8. Develop and implement a spring and fall watering schedule to provide migrational habitat for shorebirds.

2. West Farm Moist Soil Management Subunit

Size: 160 acres

Ownership: The site is owned by the Service.

Habitat Description: The primary habitat (120 acres) is currently salt cedar and giant cane, with the former dominating on moist sites and the latter dominating on drier upland sites. Small remnant stands of willow exist adjacent to shallow marshes. Cattail and giant bulrush are the predominant emergents in the shallow marshes (40 acres).

Increasing salinity in wetlands due to high rates of evaporative water loss has decreased productivity and the functional value of existing wetlands in this management subunit. Plant encroachment and succession has converted former shallow marshes to monotypic stands of exotic vegetation, and this process is ongoing in existing wetlands. Water delivery capability is needed to restore former wetlands and maintain and enhance existing wetlands.

Water: Current water supply and quantity is from the Colorado River via groundwater seepage. Secured water rights (23,000 acre-feet consumptive, 28,000 acre-feet diversion) are available for development of water delivery capability to this subunit. The subunit is contained within gravel dikes, and is subdivided by a series of interior dikes.

Wildlife Use: In 1993, five Yuma clapper rails were recorded in shallow marsh habitats within this subunit. These wetlands also provide wintering and migrational habitat for several waterfowl, waterbird, and wading bird species, including white-fronted geese, mallard, green-winged and cinnamon teal, northern pintail, gadwall, greater sandhill cranes, American coot, eared and pied-billed grebes, great egret, snowy egret, great blue heron, green-backed heron, and least and American bitterns. Osprey and wintering southern bald eagles forage in wetlands. Other raptors present include northern harrier, Cooper's hawk, sharpshinned hawk, red-tailed hawk, osprey, Harris hawk, and kestrel. Remnant willow stands provide nesting, wintering, and migrational habitat for several resident songbird and neotropical migratory bird species. The are also used as roosts by herons and egrets, and as they mature, will provide rookery habitat. Gambel's quail are abundant. Coyote, bobcat, mule deer, and several species of small mammals, reptiles, and amphibians are present.

Public Use: Public use is not permitted in this management subunit. Human-caused wildfires, originating from recreational activities on and along the Colorado River, are the primary threat to resources. Encroachment of non-native plants, which provide few benefits for wildlife, follows wildfires.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8.
2. Endangered Species Management, Objective 3
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation
9. Water Quality and Contaminants
15. Area of Ecological Concern Interagency Coordination

Strategies:

1. Improve water quality in wetlands and provide irrigation water for native plant revegetation by developing water delivery capability to entire subunit. Determine the feasibility of establishing gravity flows to the subunit (see Martinez Marsh Project).
2. Develop water management capability by installing water control structures.
3. Develop and implement a water management plan, including quantification of water use (consumptive and diversion), determination of effects of irrigation on groundwater levels and movement, and determination of effects of fluctuating Colorado River flows on groundwater and wetland habitats.
4. Restore former wetlands using mechanical manipulation to remove existing stands of exotic vegetation and sediments.
5. Monitor water quality in wetlands, and where possible, implement water management strategies to prevent contaminant build-up.
6. Maintain and enhance existing shallow marsh habitat for waterfowl and water birds, including nesting Yuma clapper rails, primarily with water management and control of exotic vegetation.
7. Following systematic site suitability analyses, restore native cottonwood, willow, and mesquite to upland sites. Utilize combination of mechanical manipulation, prescribed fire, and herbicide application to control exotic plant species to prepare and maintain revegetation sites. Determine the feasibility of using flood irrigation (simulation of short-term flood events) to promote natural reproduction of restored native plants.
8. Develop and implement a moist soil management plan, incorporating the most advanced soil conservation and water management techniques to increase productivity and efficiency, and integrated pest management strategies to control exotic plant species. Utilize Moist Soil Advisor computer software to direct and monitor moist soil management.
9. Maintain and enhance developing stands of three-square and alkali bulrush in moist soil units to provide nesting habitat for California black rails.
10. Develop and implement a spring and fall watering schedule to provide migrational habitat for shorebirds.

11. Maintain fire breaks around subunit, utilizing existing dike road network.
12. Increase fire prevention activities.

3. Martinez Upland Management Subunit

Size: 500 acres

Ownership: The site is owned by the Service.

Habitat Description: Stands of cattail and giant bulrush are present along the eastern shore of the dredge canal extending north from Martinez Lake and in the Dancing Circle marsh east of the canal. Saltcedar, giant cane and arrowweed are the primary vegetation on upland sites along wetlands in this subunit. Small remnant stands of willow, and occasional cottonwood and screwbean mesquite trees are present. Significant stands of honey mesquite are present in desert washes closest to the Colorado River floodplain. More upland sites in the washes contain ironwood and paloverde, with an understory comprised of quailbush, desert broom, chuperosa, and catclaw acacia.

Increasing salinity in wetlands due to high rates of evaporative water loss has decreased productivity and the functional value of existing wetlands in this management subunit. Plant encroachment and succession has converted former shallow marshes to monotypic stands of exotic vegetation, and this process is ongoing in existing wetlands.

Water: Water supply and quantity is dependent on Colorado River flows, through backflow into Martinez Lake, and groundwater seepage into shallow marshes.

Wildlife Uses: Wetland habitats in this management unit provide wintering and migrational habitat for several waterfowl, waterbird, wading bird, and shorebird species. Marshes provide habitat for great and snowy egrets; great blue, black-crowned night and green-backed herons; and American and least bitterns. No Yuma clapper rails were recorded in this subunit in 1993, although potential habitat is present. Osprey and southern bald eagles forage in open water habitats, peregrine falcons have been observed in the unit, and desert washes and uplands are used by Harris hawks, Cooper's hawks, prairie falcons, and great-horned and western screech owls. Remnant stands of willow and cottonwood and honey mesquite provide important habitat for several resident songbird and neotropical migratory bird species. Coyote, bobcat, mule deer, feral burros, and horses and several species of small mammals, reptiles and amphibians are present.

Public Use: This management subunit provides the primary sites for interpretation and wildlife observation opportunities for Refuge visitors on foot or in vehicles. The Visitor Center/Headquarters building, the 1-mile Painted Desert hiking trail, and four vehicle-accessible overlooks of backwater wetlands are centers of attraction. The Red Cloud

Mine Road, a designated county right-of-way, bisects the subunit and provides access through the Refuge to the Red Cloud Mine in La Paz County.

Human-caused wildfires originating from recreational activities along the Colorado River and Martinez Lake and burning into riparian habitats and desert washes are a threat to native habitats. Encroachment of non-native plants, which provide few benefits for wildlife, follows wildfires. Illegal off-road vehicle activity occurs throughout the unit, and is concentrated in McCallister Wash.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management, Objective 3
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management, Objective 6
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation
9. Water Quality and Contaminants
10. Compatibility and Refuge Allowable Uses
12. Nonwildlife-Oriented Recreation and Law Enforcement
14. Refuge Wildlife Recreation Management
13. Environmental Education and Public Outreach
15. Area of Ecological Concern Interagency Coordination

Strategies:

1. Improve biological databases, with emphasis on avian, mammalian, amphibian, and reptilian species of concern.
2. Develop and implement interpretive/environmental education plan to increase the quantity and quality of wildlife observation and interpretation opportunities and to increase public awareness of refuge regulations and refuge mission through development of interpretive facilities and written materials, improved signage, and increased enforcement.
3. Develop and implement a water management plan, including quantification of water use (consumptive and diversion), determination of effects of irrigation on groundwater levels and movement, and determination of effects of fluctuating Colorado River flows on groundwater and wetland habitats.
4. Restore former wetlands in the Dancing Circle Marsh using mechanical manipulation to remove stands of exotic vegetation and sediments.
5. Monitor water quality in wetlands, and where possible, implement water management strategies to prevent contaminant build-up. Following systematic site suitability analyses, restore native cottonwood, willow, and mesquite to upland sites. Utilize combination of mechanical manipulation, prescribed fire,

and herbicide application to control exotic plant species to prepare and maintain revegetation sites.

7. Construct and maintain fire breaks to protect native plant stands.
8. Increase fire prevention activities.

4. Martinez Lake/Riverbank Management Unit

Size: 260 acres

Ownership: The site is owned by the Service. A 2-acre area at the entrance to Martinez Lake is owned by the State of Arizona.

Habitat Description: Salt cedar, giant cane and arrowweed are the primary vegetation on upland sites along the Colorado River. Extensive stands of cattail and giant bulrush are present along the western shore of Martinez Lake. Small remnant stands of willow, and occasional cottonwood and screwbean mesquite trees, are present. Spiny naiad is the principal submergent plant species in open water habitat in Martinez Lake and several shallow marshes.

Increasing salinity in wetlands due to high rates of evaporative water loss has decreased productivity and the functional value of existing wetlands in this management unit. Plant encroachment and succession has converted former shallow marshes to monotypic stands of exotic vegetation, and this process is ongoing in existing wetlands. Perennial streams or small channels of the Colorado River formerly flowed through the shallow marshes and into Martinez Lake, but have been closed by sedimentation and/or lowering of the main channel bottom elevation by recent flood events.

Water: Water supply and quantity is dependent on Colorado River flows, through backflow into Martinez Lake, and groundwater seepage into shallow marshes.

Wildlife Uses: Wetland habitats in this management unit provide wintering and migrational habitat for several waterfowl, waterbird, wading bird, and shorebird species. Wintering Canada geese utilize the refuge portion of Martinez Lake as a roosting area. This area also provides undisturbed habitat for wintering western grebes and white pelicans, and exposed sandbars receive heavy use by Forster's and Caspian terns, ring-billed gulls, and several shorebird species. Osprey and southern bald eagles forage in open water habitats, and peregrine falcons have been observed in the unit. Marshes provide habitat for great and snowy egrets, great blue and green-backed herons, and American and least bitterns. In 1993, 18 Yuma clapper rails were recorded in this unit. Remnant stands of willow and cottonwood provide important habitat for several resident songbird and neotropical migratory bird species. Cottonwoods and willows are also used as roosts by herons and egrets, and as they mature will provide rookery habitat. Coyote,

bobcat, mule deer, and several species of small mammals, reptiles, and amphibians are present.

Public Use: Daily use, heaviest on weekends and holidays, occurs on two small riverbank "beaches" from April through October in this management unit. Activities include sunbathing, swimming, and picnicking/barbecues. Threats to resources associated with this high intensity public use include wildlife and habitat disturbance, bank erosion from watercraft wakes and vegetation trampling, litter and human waste, and human-caused wildfires. Encroachment of non-native plants, which provide few benefits for wildlife, follows wildfires. The Colorado River is a navigable waterway. Access to the main channel of the River must be allowed.

The refuge portion of Martinez Lake is closed to public entry from October 1 to March 1. Recreational fishing during the remainder of the year is a popular wildlife-oriented recreation. In 1993, a no-wake regulation was put into effect, through posting and enforcement, in the refuge portion of Martinez Lake.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation
9. Water Quality and Contaminants
10. Compatibility and Refuge Allowable Uses
12. Non Wildlife Oriented Recreation and Law Enforcement
14. Refuge Wildlife Recreation Management
13. Environmental Education and Public Outreach
15. Area of Ecological Concern Interagency Coordination

Strategies:

1. Following systematic site suitability analyses, restore native cottonwood, willow, and mesquite to upland sites. Utilize combination of mechanical manipulation, prescribed fire, and herbicide application to control exotic plant species to prepare and maintain revegetation sites. Determine the feasibility of using flood irrigation (simulation of short-term flood events) to promote natural reproduction of restored native plants.
2. Construct and maintain fire breaks to protect native plant stands.
3. Improve biological databases, with emphasis on avian, mammalian, amphibian, and reptilian species of concern.

4. Develop and implement a water management plan, including quantification of water use (consumptive and diversion), determination of effects of irrigation on groundwater levels and movement, and determination of effects of fluctuating Colorado River flows on groundwater and wetland habitats.
5. Restore former wetlands using mechanical manipulation to remove stands of exotic vegetation and sediments.
6. Improve water quality and productivity in wetlands by restoring Colorado River flows through mechanical removal of vegetation and sediments in former channels.
7. Monitor water quality in wetlands, and where possible, implement water management strategies to prevent contaminant build-up.
8. Promulgate and enforce public use regulations to eliminate negative impacts of incompatible recreational activities on refuge lands.
9. Increase public awareness of refuge regulations and refuge mission through development of interpretive facilities and written materials, improved signage (including water buoys), and increased enforcement.
10. Increase fire prevention activities.

5. Martinez Marsh Management Subunit

Size: 700 acres

Ownership: The site is owned by the Service.

Habitat Description: Salt cedar, giant cane, and arrowweed are the primary vegetation on upland sites (450 acres). Small remnant stands of willows and cottonwoods are also present. Wetland habitats (250 acres) comprise a sizable portion of this management subunit. Extensive stands of cattail and giant bulrush occur in shallow marshes, and along the edges of backwater lakes and former river channels. Spiny naiad is the principal submergent plant species in open water habitat in marshes and backwater lakes.

Increasing salinity in wetlands due to high rates of evaporative water loss has decreased productivity and the functional value of existing wetlands in this management subunit. Plant encroachment and succession has converted former shallow marshes to monotypic stands of exotic vegetation, and this process is ongoing in existing wetlands. Perennial streams or small river channels formerly flowed from the Colorado River through marshes and backwaters and into Martinez Lake, but have been closed by sedimentation and/or lowering of the main channel bottom elevation by recent flood events.

Levels of selenium contamination in sediments, plants, and invertebrates have been found to be lower in backwater wetlands no longer receiving direct Colorado River flows as compared to wetlands directly connected to the River. Research aimed at developing

water management regimes necessary to enhance wetland productivity without increasing contaminant loads is urgently needed.

The Martinez Marsh Enhancement Project, a cooperative Service-BR habitat management project, was developed in the early 1980s to restore shallow marsh habitats and increase water quality in backwater lakes by providing Colorado River water to these wetlands through gravity flow during high water flows and pumping during low flows. The project involved dredging former river channels, construction of dikes, and installation of pumps, water control structures, and pipes. The project was initiated in 1983, but not completed. One mile of channel was dredged from Martinez Lake northward, and 2 miles of dike was constructed along the Colorado River.

Water: Water supply and quantity is dependent on Colorado River flows, through backflow into Martinez Lake and groundwater seepage into shallow marshes and backwater lakes. Water is available through secured water rights (23,000 acre-feet consumptive, 28,000 acre-feet diversion) for provision of instream flow to wetland habitats.

Wildlife Uses: Wetland habitats in this management unit provide wintering and migrational habitat for several waterfowl, waterbird, wading bird and shorebird species. Osprey and southern bald eagles forage in open water habitats, and peregrine falcons have been observed in the subunit. Marshes provide habitat for great and snowy egrets; great blue, black-crowned night, and green-backed herons; and American and least bitterns. In 1993, 16 Yuma clapper rails were recorded in this subunit. Remnant stands of willow and cottonwood provide important habitat for several resident songbird and neotropical migratory bird species. Cottonwood and willow are also used as roosts by herons and egrets, and as they mature will provide rookery habitat. Coyote, bobcat, mule deer, and several species of small mammals, reptiles, and amphibians are present. Several backwater wetlands in this management unit provide potential grow-out habitats for endangered Colorado River native fish.

Public Use: Recreational fishing occurs in McCallister and Butler lakes, but use levels have decreased in recent years due to a declining fishery. The backwater overlook road network provides access for wildlife observation in this subunit. This is a popular wildlife-oriented recreational activity from October through April.

Human-caused wildfires, primarily originating from recreational activity along the main channel of the Colorado River, is the principal threat to resources in this management subunit. Encroachment of non-native plants providing few wildlife benefits follows wildfires.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management

3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation
9. Water Quality and Contaminants
10. Compatibility and Refuge Allowable Uses
12. Nonwildlife-Oriented Recreation and Law Enforcement
14. Refuge Wildlife Recreation Management
13. Environmental Education and Public Outreach
15. Area of Ecological Concern Interagency Coordination

Strategies:

1. Reinitiate a revised Martinez Marsh Enhancement Project through coordination with BR, University of Arizona Cooperative Wildlife Research Unit, lower Colorado River Backwaters Subcommittee, and AGFD with the following objectives:

    - Improvement of water quality and wetland productivity in existing backwaters by restoring Colorado River flows through mechanical removal of vegetation and sediments in former channels; installation of pumps, water control structures, and pipes; and dike construction.
    - Monitoring of water quality and productivity in project wetlands in order to develop water management strategies that enhance productivity while preventing contaminant build-up.
    - Restoration of former wetlands and channels using mechanical manipulation to remove stands of exotic vegetation and sediments.
    - Provision of irrigation water for native plant revegetation.
    - Provision of gravity flows to the East and West Farm Management Subunits.

2. Develop and implement a water management plan, including quantification of water use (consumptive and diversion), determination of effects of irrigation on groundwater levels and movement, and determination of effects of fluctuating Colorado River flows on groundwater and wetland habitats.
3. Improve biological databases, with emphasis on avian, mammalian, amphibian, and reptilian species of concern and vegetative community mapping.
4. Following systematic site suitability analyses, restore native cottonwood, willow, and mesquite to upland sites. Utilize combination of mechanical manipulation, prescribed fire, and herbicide application to control exotic plant species to prepare and maintain revegetation sites. Determine the feasibility of using flood

irrigation (simulation of short-term flood events) to promote natural reproduction of restored native plants.

5. Construct and maintain fire breaks to protect native plant stands.
6. Develop moist soil management units on suitable sites.
7. Assess suitability of various backwater habitats for and establish native fish grow-out facility(s).
8. Enhance recreational fishing opportunities in McCallister Lake through installation of habitat structures.
9. Promulgate and enforce public use regulations to eliminate negative impacts of incompatible recreational activities on refuge lands.
10. Increase public awareness of Refuge regulations and purposes through development of interpretive facilities and written materials, improved signage (including water buoys), and increased enforcement.
11. Increase fire prevention activities.

6. Ferguson Lake and Shore Management Unit

Size: 750 acres

Ownership: The site is owned by the Service. The BLM administers lands south of the refuge that include developed camping facilities.

Habitat Description: Ferguson Lake historically received direct flows from the Colorado River through a series of channels. Recent flood events closed entrance channels through sedimentation and lowering of the main river channel bottom elevation. The lake remains connected to the Colorado River via a single channel at its southern end, and water levels in Ferguson Lake are dependent on backflow from the River. The refuge portion of Ferguson Lake is comprised of open water habitat and interconnected backwater marshes. Cattail and giant bulrush are the predominant emergents; spiny naiad is the principal submergent. Increasing salinity in wetlands due to high rates of evaporative water loss has decreased productivity and the functional value of existing wetlands in this management unit. Plant encroachment and succession has converted former shallow marshes to monotypic stands of exotic vegetation, and this process is ongoing in existing wetlands. Salt cedar and giant cane dominate on upland sites. Remnant stands of cottonwood, willow, and honey and screwbean mesquite are also present.

Water: Water supply and quantity is dependent on Colorado River flows, through backflow into Ferguson Lake and groundwater seepage into shallow marshes and backwater lakes. No secured water rights are available for the California portion of the Refuge.

Wildlife Use: Wetland habitats in this management unit provide wintering and migrational habitat for several waterfowl, waterbird, wading bird, and shorebird species.

This area also provides undisturbed habitat for wintering western grebes and white pelicans, and exposed sandbars receive heavy use by Forster's and Caspian terns and ring-billed gulls. Osprey and southern bald eagles forage in open water habitats, and peregrine falcons have been observed in the unit. Marshes provide habitat for great and snowy egrets, great blue black-crowned night and green-backed herons, and American and least bitterns. In 1993, 18 Yuma clapper rails were recorded in this portion of the Refuge. In addition, one California black rail responded to clapper rail call-back tapes. Remnant stands of willow and cottonwood provide important habitat for several resident songbird and neotropical migratory bird species. Cottonwoods and willows are also used as roosts by herons and egrets, and as they mature will provide rookery habitat. Coyote, bobcat, mule deer and several species of small mammals, reptiles, and amphibians are present.

Public Use: Ferguson Lake receives high levels of recreational boating and associated uses from April through October. Recreational fishing is a popular activity on the refuge portion of the lake. Some wildlife observation while boating also occurs. The refuge portion of Ferguson Lake is a designated no-wake zone and is closed to public entry from October 1 to March 1 to provide undisturbed habitat for wintering migratory birds.

Human-caused wildfires associated with recreational activities in and along Ferguson Lake and the Colorado River are the principal threat to resources in this management unit. Encroachment of non-native plants, which provide few benefits for wildlife follows wildfires. Illegal boating, including personal watercraft use, occurs during high water periods on the Refuge. Illegal off-road vehicle activity occurs on upland sites.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation
9. Water Quality and Contaminants
10. Compatibility and Refuge Allowable Uses
12. Nonwildlife-Oriented Recreation and Law Enforcement
14. Refuge Wildlife Recreation Management
13. Environmental Education and Public Outreach
15. Area of Ecological Concern Interagency Coordination

Strategies:

1. Initiate an Upper Ferguson Lake Enhancement Project through coordination with BR, University of Arizona Cooperative Wildlife Research Unit, Lower

Colorado River Backwaters Subcommittee, and CDFG, with the following objectives:

- Improvement of water quality and wetland productivity in existing backwaters by restoring Colorado River flows through mechanical removal of vegetation and sediments in former channels; possibly installation of pumps, water control structures, and pipes; and dike construction.
- Monitoring of water quality and productivity in project wetlands and Ferguson Lake in order to develop water management strategies that enhance productivity while preventing contaminant build-up.
- Restoration of former wetlands and channels using mechanical manipulation to remove stands of exotic vegetation and sediments.
- Provision of irrigation water for native plant revegetation.
- Water and/or instream flow rights must be secured for this project.

2. Develop and implement a water management plan, including quantification of water use (consumptive and diversion), determination of effects of irrigation on groundwater levels and movement, and determination of effects of fluctuating Colorado River flows on groundwater and wetland habitats.
3. Improve biological databases, with emphasis on avian, mammalian, amphibian, and reptilian species of concern.
4. Following systematic site suitability analyses, restore native cottonwood, willow, and mesquite to upland sites. Utilize combination of mechanical manipulation, prescribed fire, and herbicide application to control exotic plant species to prepare and maintain revegetation sites. Determine the feasibility of using flood irrigation (simulation of short-term flood events) to promote natural reproduction of restored native plants.
5. Construct and maintain fire breaks to protect native plant stands.
6. Develop moist soil management units on suitable sites.
7. Assess suitability of various backwater habitats for and establish native fish grow-out facility(s).
8. Promulgate and enforce public use regulations to eliminate negative impacts of incompatible recreational activities on refuge lands.
9. Increase public awareness of refuge regulations and purposes through development of interpretive facilities and written materials, improved signage (including water buoys), and increased enforcement.
10. Increase fire prevention activities.

7. and 8. Backwater/Riveredge Management Unit

Size: Arizona - 2,989 acres; California - 2,620 acres.

Ownership:
All backwater/riveredge habitats are owned by the Service.

Habitat Description: This management unit includes a system of backwater wetlands extending along 24 and 14 miles of the Colorado River on the Arizona and California sides, respectively. This series of wetlands is a unique feature of Imperial NWR within the Area of Ecological Concern, and is singular in importance to maintenance of biodiversity on the Refuge.

The system contains open water habitat in larger wetlands and shallow and deep marshes. Cattail and giant bulrush are the predominant emergents; spiny naiad is the principal submergent. Salt cedar and giant cane dominate on upland sites. Remnant stands of cottonwood, willow, and honey and screwbean mesquite are also present.

Recent flood events and sedimentation have closed channels from the Colorado River into several backwater wetlands in this system. Increasing salinity in wetlands no longer receiving flows, due to high rates of evaporative water loss, has decreased productivity and the functional value of these wetlands. Plant encroachment and succession has converted former shallow marshes to monotypic stands of exotic vegetation, and this process is ongoing in existing wetlands.

Wildlife Use: Wetland habitats in this management unit provide wintering and migrational habitat for several waterfowl, waterbird, and wading bird species. This area also provides undisturbed habitat for wintering western grebes and white pelicans, and exposed sandbars receive heavy use by Forster's and Caspian terns, ring-billed gulls, and several shorebird species. Most wintering southern bald eagles on the Refuge are found in this management unit. Osprey forage in open water habitats, and peregrine falcons have been observed. Marshes provide habitat for great and snowy egrets; great blue, black-crowned night, and green-backed herons; and American and least bitterns. In 1993, 65 Yuma clapper rails were recorded in this portion of the refuge. Remnant stands of willow and cottonwood provide important habitat for several resident songbird and neotropical migratory bird species. Cottonwood and willow are also used as roosts by herons and egrets. As the trees mature, they will provide rookery habitat. One mature stand of willows, north of Island Lake, currently supports a heron rookery. Coyote, bobcat, Yuma puma, desert bighorn sheep, mule deer, feral burros and horses, and several species of small mammals, reptiles and amphibians are present.

Public Use: The Colorado River receives high levels of recreational boating and associated uses from April through October. "Beach use" of sandbars and sandy river bank areas include sunbathing, swimming, picnicking/barbecues and associated activities. Recreational fishing, waterfowl hunting and wildlife observation are popular wildlife-oriented activities on the Colorado River and backwater wetlands accessible from the River. All backwater wetlands on the Refuge are designated No Wake zones.

Threats to resources associated with this high intensity public use include wildlife and habitat disturbance, bank erosion from watercraft wakes and vegetation trampling, litter and human waste, and human-caused wildfires. Encroachment of non-native plants,

which provide few benefits for wildlife, follows wildfires. Illegal boating, primarily personal watercraft use, occurs during high water periods in accessible backwaters. Illegal camping occurs along the Colorado River, and illegal off-road vehicle activity occurs on upland sites. The Colorado River is a navigable waterway; access through the main River channel must be allowed.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management
3. Fisheries Enhancement and Management
4. Migratory Waterfowl Management
5. Wetlands, Objective 1
6. Water Rights
7. Water Management
8. Revegetation
9. Water Quality and Contaminants
10. Compatibility and Refuge Allowable Uses
12. Nonwildlife-Oriented Recreation and Law Enforcement
13. Environmental Education and Public Outreach
14. Refuge Wildlife Recreation Management
15. Area of Ecological Concern Interagency Coordination

Strategies:

1. Develop and implement a Backwaters Management Plan through coordination with BR, University of Arizona Cooperative Wildlife Research Unit, Lower Colorado River Backwaters Subcommittee, AGFD, and CDFG with the following objectives:

    - Maintenance of backwater wetland habitats in variety of successional stages to restore and enhance biodiversity.
    - Improvement of water quality and wetland productivity in project backwaters by restoring Colorado River flows through mechanical removal of vegetation and sediments in former channels, and potential installation of water control structures and dikes.
    - Monitoring of water quality and productivity in project wetlands in order to develop water management strategies that enhance productivity while preventing contaminant build-up.
    - Restoration of former wetlands and channels using mechanical manipulation to remove stands of exotic vegetation and sediments.
    - Provision of irrigation water for native plant revegetation.
    - Water and/or instream flow rights must be secured for backwater enhancements in California.

2. Develop and implement a water management plan, including quantification of water use (consumptive and diversion), determination of effects of irrigation on groundwater levels and movement, and determination of effects of fluctuating Colorado River flows on groundwater and wetland habitats.
3. Improve biological databases, with emphasis on avian, mammalian, amphibian, and reptilian species of concern.
4. Following systematic site suitability analyses, restore native cottonwood, willow, and mesquite to upland sites. Utilize combination of mechanical manipulation, prescribed fire, and herbicide application to control exotic plant species to prepare and maintain revegetation sites. Determine the feasibility of using flood irrigation (simulation of short-term flood events) to promote natural reproduction of restored native plants.
5. Construct and maintain fire breaks to protect native plant stands.
6. Assess suitability of various backwater habitats for and establish native fish grow-out facility(s) and/or exclusive habitat for native fish.
7. Improve access to selected backwaters for recreational fishing and other wildlife-oriented recreational activities.
8. Promulgate and enforce public use regulations to eliminate negative impacts of incompatible recreational activities on refuge lands.
9. Increase public awareness of refuge regulations and purposes through development of interpretive facilities and written materials, improved signage (including water buoys), and increased enforcement.
10. Increase fire prevention activities.

9. Wilderness Management Unit

Size: Arizona - 9,220 acres (designated Wilderness); California - 5,836 (proposed Wilderness) plus 1,000 acres buffer

Ownership: The unit is owned by the Service. The site includes the 9,220-acre Imperial wilderness area, designated by the Arizona Wilderness Act of 1990, and 5,836 acres of proposed Wilderness in California, currently being considered for designation by Congress under the California Desert Protection Act.

Habitat Description: This management unit is comprised of Sonoran Desert upland habitats, including mountainous terrain reaching 3,200 feet in elevation and several desert washes. The dominant plant association in desert uplands is creosote bush-white bursage. Other plant species include numerous ephemerals, eight species of cacti, and ocotillo. Tree species found in the washes are microphyllous and include honey mesquite, ironwood, palo verde, and smoketree. Understory plants in the washes include cat claw acacia, burrobrush, desert broom, desert willow, chuparosa, and desert honeysuckle.

Wildlife Use: Desert washes provide important nesting and wintering habitat for several passerine species, including northern gilded flicker, Gila woodpecker, phainopepla, verdin, and ash-throated and brown-crested flycatcher. Raptors including peregrine falcon, prairie falcon, Harris hawk, Cooper's hawk, sharpshinned hawk, red-tailed hawk, burrowing owl, and great-horned owl utilize desert habitats. Yuma puma, coyote, bobcat, ring-tailed cat, gray, and kit fox and several species of small mammals are present. At least two sensitive bat species, the Arizona cave myotis and California leaf-nosed bat are known to occur in caves and abandoned mine shafts on the Refuge. A wide array of desert-dwelling reptiles, including several species of concern such as the Sonoran desert tortoise, chuckwalla, Gila monster, and rosy boa are present.

Public Use: Public uses in this management unit include upland and big game hunting and wildlife observation.

Human-caused wildfires originating from recreational activities along the Colorado River and burning into desert washes are a threat to native habitats. Illegal off-road vehicle activity occurs throughout the unit. Human disturbance to roosts and maternity colonies of sensitive bat species occurs at mine shafts and caves accessible from the Colorado River.

CMP Goals:

1. Biological Diversity and Habitat Management, Objective 8
2. Endangered Species Management
10. Compatibility and Refuge Allowable Uses
12. Nonwildlife-Oriented Recreation and Law Enforcement
14. Refuge Wildlife Recreation Management
13. Environmental Education and Public Outreach
15. Area of Ecological Concern Interagency Coordination

Strategies:

1. Improve biological databases, with emphasis on avian, mammalian, and reptilian species of concern and vegetative community mapping.
2. Coordinate with Arizona and California wildlife agencies to conduct a complete inventory of Refuge mine shafts and caves for development of management recommendations to protect sensitive bat species.
3. Increase public awareness of Refuge regulations and purposes through development of interpretive facilities and written materials, improved signage, and increased enforcement.
4. Increase fire prevention activities.

Lower Colorado River Refuges Secondary Uses (Public Use Activity Maps 10, 11, 12, 13, 14)

Secondary Uses not Planned to Occur on the Refuges[175]

The following Secondary Uses are listed as "not planned to occur" at any of the Lower Colorado River National Wildlife Refuges because they do not conform to uses which could be, in a regulated manner, "compatible" with the purposes of the refuges, or they have been determined to be harmful to refuge resources.

1. Commercial Fishing
2. Recreational Trapping
3. Commercial Trapping
4. Camping[176]
5. Off-road Vehicles
6. Airboats[177]
7. Water skiing[177]
8. Beach Use/Swimming[177]
9. Grazing
10. Haying
11. Timber Harvest
12. Mineral Exploration
13. Mining
14. Oil/Gas Exploration
15. Oil/Gas Extraction
16. Rental of Facilities
17. Military Ground Exercises
18. Billboards
19. Fishing Derbies
20. Geothermal Exploration

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[175]These uses as listed are extracted from the 1990 Report to the Director entitled ***Secondary Uses Occurring On National Wildlife Refuges***. They are not proposed or planned to be conducted by the Service within the Lower Colorado River National Wildlife Refuge Complex. Uses that occur on the mainstem Colorado River and are known to be harmful to refuge resources will be regulated in coordination with the AGFD.

[176]Camping at Five Mile Landing concession is one of the uses provided for by the concessionaire in accordance with a long term lease which will not expire until 2006. This CMP calls for the manager of Havasu NWR to determine the compatibility of the current uses provided for by the agreement and develop options 10 years in advance of expiration so that the Service may decide whether to renew, terminate, or adjust the scope of uses at the site. Please refer to Goal #10: Compatibility and Refuge Allowable Uses, Objective (6) and (7); and Goal #11: Land Status and Jurisdiction, Objective (7). Pages 148 - 150 of this document.

[177]While the Service has the authority to regulate and control activities on waterways under which the Service owns subsurface lands, it may not have the authority to ban these kinds of uses from the main Colorado River channel. This CMP calls for the clarification of these jurisdictional authorities on page 150 under Goal #11 Land Status and Jurisdiction, Objective (5). The refuge managers will continue to work closely with the appropriate State authorities with respect to the impacts of these kinds of uses on refuge wildlife resources. The refuge managers will monitor these uses when they occur so as to empirically establish relationships between the use and impacts to resources. When such impacts are established, the managers should work with State authorities to regulate and control such uses in order to deter future impacts.

21. Jogging Trails
22. Model Airplane/Kite Flying
23. Rock Hounding
24. Jet Skiing[177]
25. Technical Rock Climbing

Secondary Uses that May Occur Within the Lower Colorado River Refuge Complex

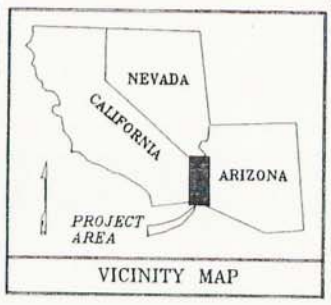
Subject to site-specific annual compatibility review and Refuge Recreation Act funding analysis. The following are uses that could possibly be regulated creating conditions under which they might be compatible with the refuges purposes and the goals of the refuge system.

1. Wildlife Trails (non-motorized)
2. Wildlife Tour Routes (motorized)
3. Interpretive Center
4. Visitor Contact Station
5. Interpretive Exhibits
6. Environmental Education
7. Wildlife Observation
8. Photography
9. Walking/Hiking
10. Waterfowl Hunting
11. Other Migratory Bird Hunting
12. Upland Game Bird Hunting
13. Big Game Hunting
14. Small Game Hunting
15. Recreational Fishing
16. Boating (non-motorized)
17. Boating (motorized)
18. Horseback Riding
19. Field Trials
20. Beekeeping
21. Rights-of-Way (as proposed)
22. Bicycling (Refuge Roads)
23. Concessions[178]
24. Research
25. Guided Tours
26. Cooperative Farming

[178]Please refer to Goal #10 Compatibility and Refuge Allowable Uses, Objectives 6 and 7.

MAP #1

LOWER COLORADO RIVER AREA OF ECOLOGICAL CONCERN AND CORE HABITAT AREAS



VICINITY MAP

CORE HABITATS

- A MOHAVE CORE HABITAT
- B HAVASU CORE HABITAT
- C BILL WILLIAMS / PLANET RANCH CORE HABITAT
- D CRIT CORE HABITAT
- E PALO VERDE CORE HABITAT
- F CIBOLA CORE HABITAT
- G IMPERIAL CORE HABITAT
- H YUMA / LIMINTROPHE CORE
- I GULF OF CALIFORNIA ESTUARY CORE HABITAT

NEVADA

CALIFORNIA

ARIZONA

COLORADO RIVER

DAVIS DAM

LAUGHLIN, NEVADA

BULLHEAD CITY, ARIZ.

KINGMAN

NEEDLES, CALIF.

TOPOCK

HAVASU NWR

MOHAVE CO.

SAN BERNARDINO CO.

LAKE HAVASU CITY

Bill Williams River *NWR*

PLANET RANCH

BILL WILLIAMS RIVER

PARKER

RIVERSIDE CO.

LA PAZ CO.

BLYTH, CALIF.

QUARTZITE

CIBOLA NWR

IMPERIAL CO.

IMPERIAL NWR

YUMA CO.

MARTINEZ LAKE, ARIZ.

YUMA

SAN LUIS

MEXICO

93 99 66 40 95 60 10 8 80

NORTH

0 16 32 64 96 118 150

SCALE IN MILES

LEGEND

- PARKS & RECREATION
- INDIAN
- NATIONAL WILDLIFE REFUGES
- AREAS OF ECOLOGICAL CONCERN CORE HABITATS

NOTE: CALIFORNIA JURISDICTIONS TO BE ADDED IN FINAL DRAFT

DRAWN BY RAFAEL T. FERNANDEZ 1/1994 (U.S.F.W.S.)

MAP #2

HAVASU NATIONAL WILDLIFE REFUGE

TOPOCK MARSH & TOPOCK GORGE MANAGEMENT UNITS

ARIZONA

CALIFORNIA

LAKE HAVASU CITY

CASTLE ROCK PARKING

ARIZONA / CALIFORNIA

SAN BERNARDINO CO. / MOHAVE CO.

RIVER

CATFISH BAY

CLEAR BAY

BLANKENSHIP BEND

COLORADO RIVER

DEVILS ELBOW

TOPOCK MARSH

TOPOCK

SANTA FE

TOPEKA ATCHISON

NATIONAL OLD TRAILS ROAD

PIPELINES

PIPELINE

JEEP TRAIL

OLD 66

INLET CANAL

BLM SECTION 29

THREEMILE LAKE

BEAL LAKE

MAINTENANCE FACILITY

NEEDLES

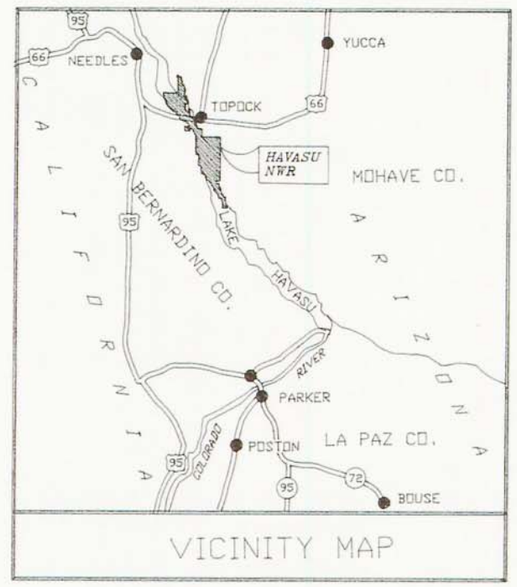
DRAWN BY RAFAEL T. FERNANDEZ 1/1994 (U.S.F.W.S)

TOPOCK MARSH MANAGEMENT SUB - UNITS

- FARM MANAGEMENT AREAS (PINTAIL SLOUGH & BERMUDA PASTURE)
- MOIST SOIL MANAGEMENT UNIT
- YUMA CLAPPER RAIL MANAGEMENT UNIT
- DREDGED RIVER MANAGEMENT UNIT
- INLET CANAL MANAGEMENT UNIT

TOPOCK GORGE MANAGEMENT SUB - UNITS

- CRYSTAL BEACH - YUMA CLAPPER RAIL MANAGEMENT UNIT
- WILDERNESS MANAGEMENT UNIT
- RIVERLINE MANAGEMENT UNIT



VICINITY MAP

MAP #8

IMPERIAL NATIONAL WILDLIFE REFUGE

IMPERIAL NWR MANAGEMENT UNITS AND SUBUNITS

MARTINEZ LAKE AND RIVERBANK MANAGEMENT UNIT

- A. EAST FARM SUBUNIT
- B. WEST MOIST SOIL SUBUMIT
- C. MARTINEZ LAKE RIVERBANK SUBUNIT

MARTINEZ MARSH / UPLAND MANAGEMENT UNIT

- A. BACKWATER LAKE / MARSH SUBUNIT
- B. MARTINEZ UPLAND SUBUNIT

FURGUSON LAKE AND SHORE MANAGEMENT UNIT

- A. LAKE AND MARSH SUBUNIT
- B. FERGUSON SHORE AND UPLAND SUBUNIT

BACKWATER RIVEREDGE MANAGEMENT UNIT

- A. ARIZONA RIVEREDGE SUBUNIT
- B. CALIFORNIA RIVEREDGE SUBUNIT

WILDERNESS MANAGEMENT UNIT

ARIZONA DESERT WILDERNESS AREA

CALIFORNIA PROPOSED DESERT WILDERNESS AREA

UPLAND DESERT SUBUNIT – THIS AREA WILL BE MANAGED AS WILDERNESS

ARIZONA

CALIFORNIA

LA PAZ CO.
IMPERIAL CO.

COLORADO RIVER

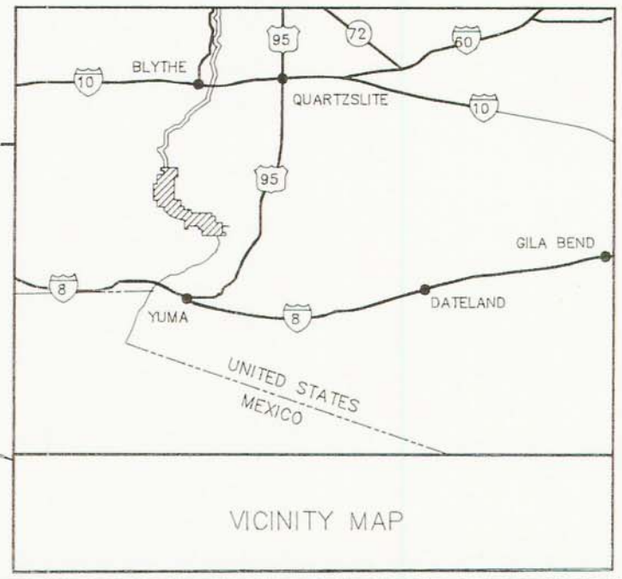
LA PAZ COUNTY
YUMA COUNTY

ADOBE LAKE
NORTONS LAKE
ISLAND LAKE
CLEAR LAKE
McALLISTER LAKE
FERGUSON LAKE
MARTINEZ LAKE
FISHERS LANDING

REFUGE HEADQUARTERS

TURNAROUND WASH
JEEP TRAIL
CLIP WASH
DRAPER WASH
GRAVEL TRAIL
VELIAN WASH
JULIAN WASH
CLOUD WASH
BLACK ROCK WASH
ARRASTRA WASH
YUMA WASH
CARRIZO CANYON
BEAR WHITE WASH
ANGELES WASH

VICINITY MAP



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MAP #7

CIBOLA NATIONAL WILDLIFE REFUGE

ARIZONA

CALIFORNIA

REFUGE HEADQUARTERS

#1 CIBOLA LAKE

#2 THREE FINGER LAKE

#3 ISLAND UNIT

#4 HART MINE MARSH

#5 OLD RIVER CHANNEL

#6 / #7 PRETTY WATER JUNCTION

#8

#9 REFUGE FIRE REVEGETATION

#10 N. CALIF. BOUNDARY

CIBOLA IRRIGATION DISTRICT *

DREDGE SPOIL REVEGETATION *

OXBOW LAKE *

COLORADO RIVER

PALO VERDE IRRIGATION DISTRICT OUTFALL DRAIN

CIBOLA DRY CUT

OLD RIVER CHANNEL

COLORADO RIVER

YUMA CO. — IMPERIAL CO.

THREE FINGER LAKE

CIBOLA LAKE

LOPES WASH

WALKER LAKE

WALTER'S CAMP

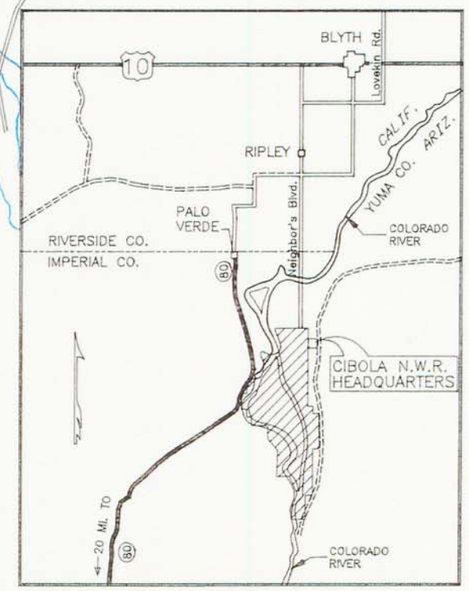
DAVIS LAKE (Dry)

78

LEGEND

PROJECT AREAS

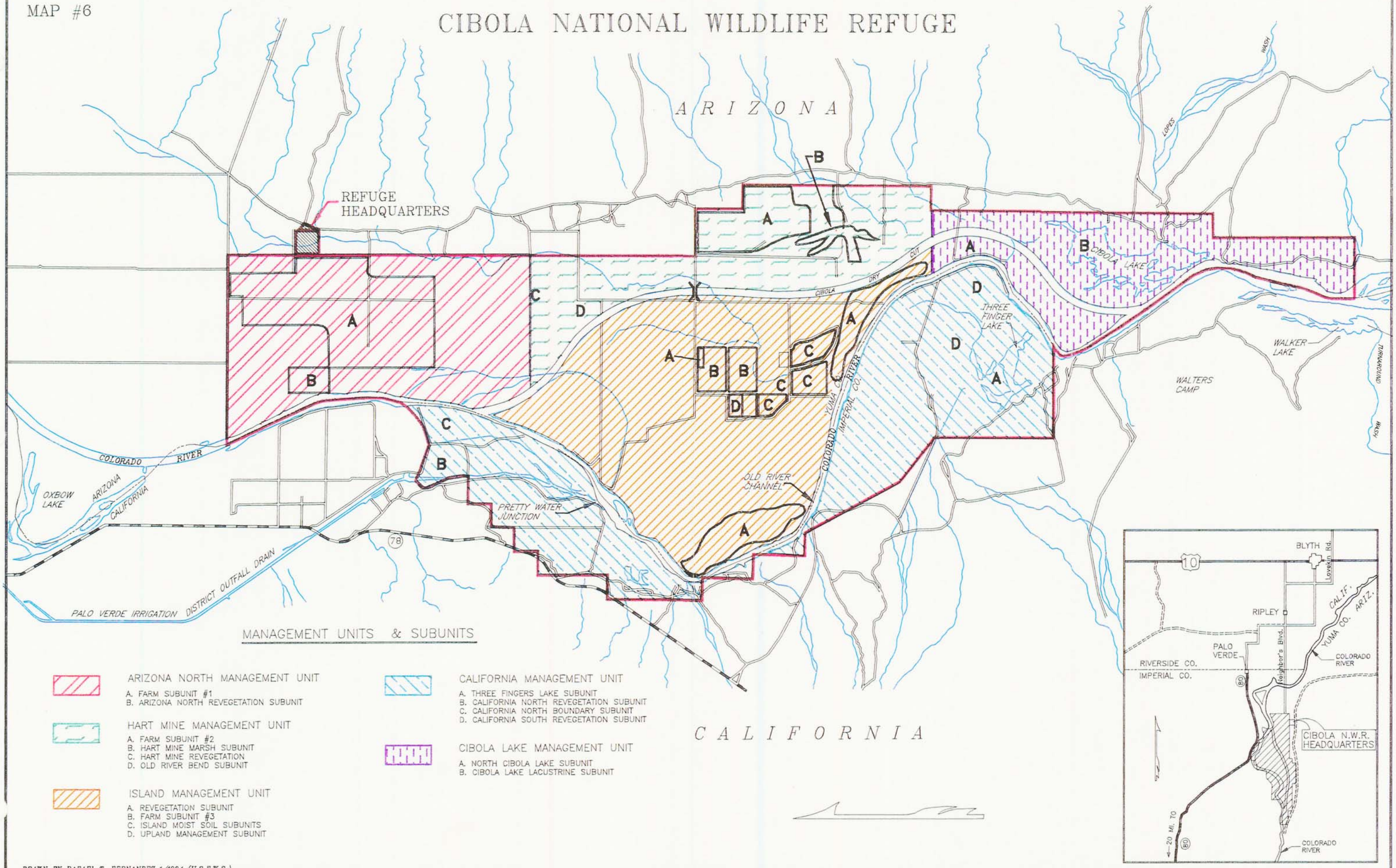
* NOT OWNED BY U.S.F.W.S.



DRAWN BY RAFAEL T. FERNANDEZ 1/1994 (U.S.F.W.S.)

MAP #6

CIBOLA NATIONAL WILDLIFE REFUGE



MANAGEMENT UNITS & SUBUNITS

ARIZONA NORTH MANAGEMENT UNIT
- A. FARM SUBUNIT #1
- B. ARIZONA NORTH REVEGETATION SUBUNIT

HART MINE MANAGEMENT UNIT
- A. FARM SUBUNIT #2
- B. HART MINE MARSH SUBUNIT
- C. HART MINE REVEGETATION
- D. OLD RIVER BEND SUBUNIT

ISLAND MANAGEMENT UNIT
- A. REVEGETATION SUBUNIT
- B. FARM SUBUNIT #3
- C. ISLAND MOIST SOIL SUBUNITS
- D. UPLAND MANAGEMENT SUBUNIT

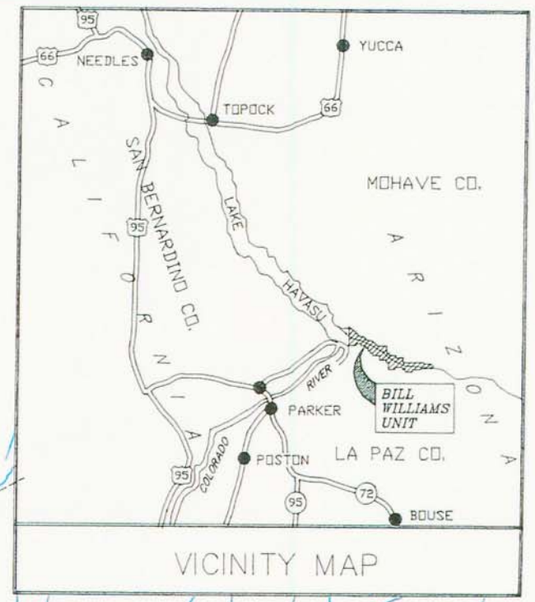
CALIFORNIA MANAGEMENT UNIT
- A. THREE FINGERS LAKE SUBUNIT
- B. CALIFORNIA NORTH REVEGETATION SUBUNIT
- C. CALIFORNIA NORTH BOUNDARY SUBUNIT
- D. CALIFORNIA SOUTH REVEGETATION SUBUNIT

CIBOLA LAKE MANAGEMENT UNIT
- A. NORTH CIBOLA LAKE SUBUNIT
- B. CIBOLA LAKE LACUSTRINE SUBUNIT

DRAWN BY RAFAEL T. FERNANDEZ 1/1994 (U.S.F.W.S.)

#5

BILL WILLIAMS RIVER NATIONAL WILDLIFE REFUGE



VICINITY MAP

LEGEND

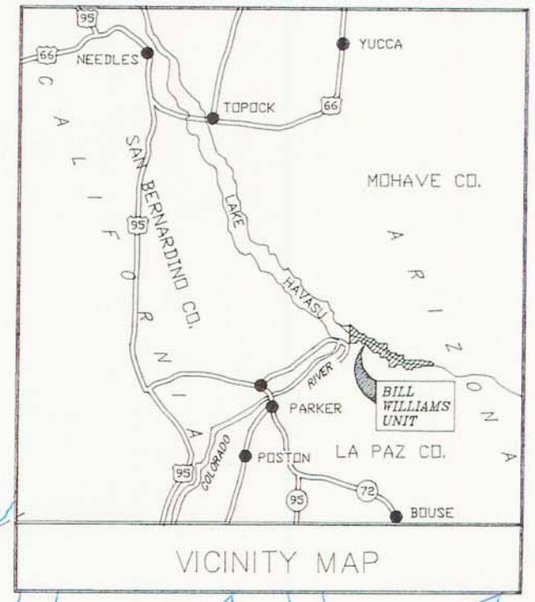
AREAS OF SPECIAL CONCERN (COTTONWOOD/WILLOW HABITAT)

NOTE: ALL OF THE BILL WILLIAMS NWR IS CONSIDERED AS CORE HABITAT #8

DRAWN BY RAFAEL T. FERNANDEZ 1/1994 (U.S.F.W.S.)

#4

BILL WILLIAMS RIVER NATIONAL WILDLIFE REFUGE



VICINITY MAP

MANAGEMENT UNITS

- DELTA MANAGEMENT UNIT
- RIPARIAN MANAGEMENT UNIT
- UPLAND DESERT MANAGEMENT UNIT

DRAWN BY RAFAEL T. FERNANDEZ 1/1994 (U.S.F.W.S.)

MAP #3

HAVASU NATIONAL WILDLIFE REFUGE
TOPOCK MARSH & TOPOCK GORGE MANAGEMENT UNITS

ARIZONA

CALIFORNIA

LAKE HAVASU CITY

CASTLE ROCK PARKING

MOHAVE CO.

SAN BERNARDINO CO.

ARIZONA CALIFORNIA RIVER

CATFISH BAY

CLEAR BAY

COLORADO RIVER

BLANKENSHIP BEND

DEVILS ELBOW

TOPOCK MARSH

TOPOCK

GOLDEN SHORES MARINA

#5 SACRAMENTO ATHEL WASH

CATFISH PARADISE

#2 NO NAME LAKE

#1 N.W. POWEL LAKE

BLM SECTION 29

THREEMILE LAKE

#4 BEAL LAKE

#3 NORTH REFUGE REVEGETATION

INLET CANAL

PIPELINES

TOPEKA ATCHISON & SANTA FE

NATIONAL OLD TRAILS ROAD

JEEP TRAIL

NEEDLES

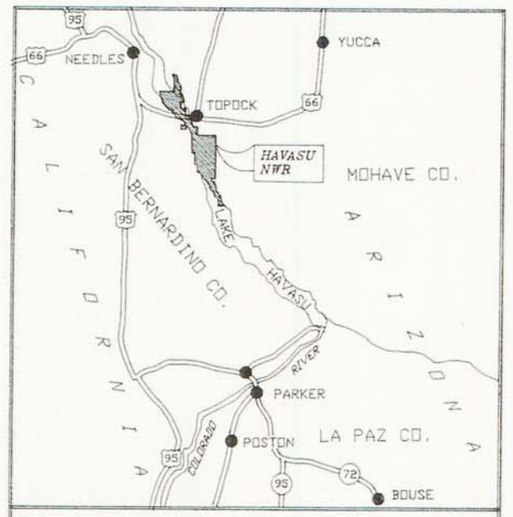
DRAWN BY RAFAEL T. FERNANDEZ 1/1994 (U.S.F.W.S)

PROJECT AREAS
(REFER TO APPENDIX FOR NARRATIVE DISCRIPTIONS)

AREAS IN NEED OF PROTECTION
(PRIMARILY BACKWATER RIVERLINE HABITAT)

WILDERNESS AREA

* NOT OWNED BY U.S.F.W.S.



VICINITY MAP

MAP #9

IMPERIAL NATIONAL WILDLIFE REFUGE

SPECIAL PROJECT & PROTECTION AREAS

PROJECT

PROTECTION / PROJECT *

ARIZONA

CALIFORNIA

#8

#7

#30

#5

#3

#1

#2

#4

#6 FERGUSON LAKE

ADOBE LAKE

NORTONS LAKE

ISLAND LAKE

CLEAR LAKE

McALLISTER LAKE

MARTINEZ LAKE

FISHERS LANDING

REFUGE HEADQUARTERS

LA PAZ CO.

IMPERIAL CO.

LA PAZ COUNTY

YUMA COUNTY

TURNAROUND WASH

JEEP TRAIL

GUIP WASH

DRAPER WASH

TRAIL

JEEP

VELIAN WASH

JULIAN WASH

TRAIL

JEEP

CLOUD WASH

BLACK ROCK WASH

ARRASTRA WASH

YUMA WASH

TRAIL

JEEP

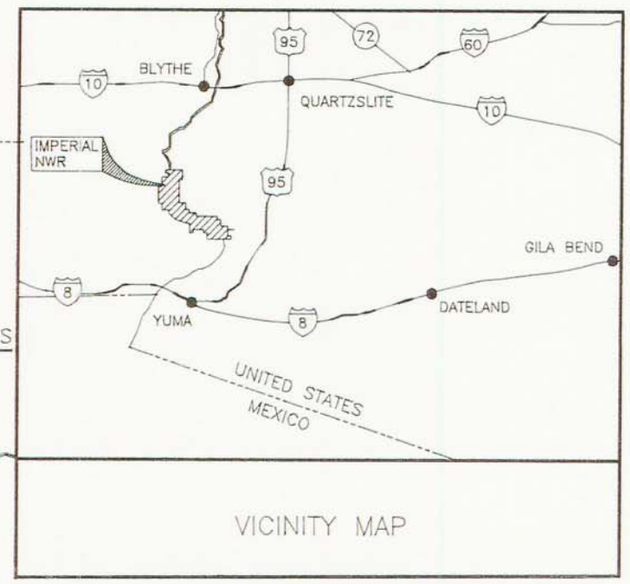
WASH

CARRIZO CANYON

BEAR WASH

WHITE WASH

* *CURRENT RIPARIAN ZONE "PROTECTION" AREAS WILL INCLUDE SUCH ACTIVITIES AS REVEGETATION, ENDANGERED FISH MANAGEMENT, WETLAND RESTORATION, ETC., POSSIBILITIES.*

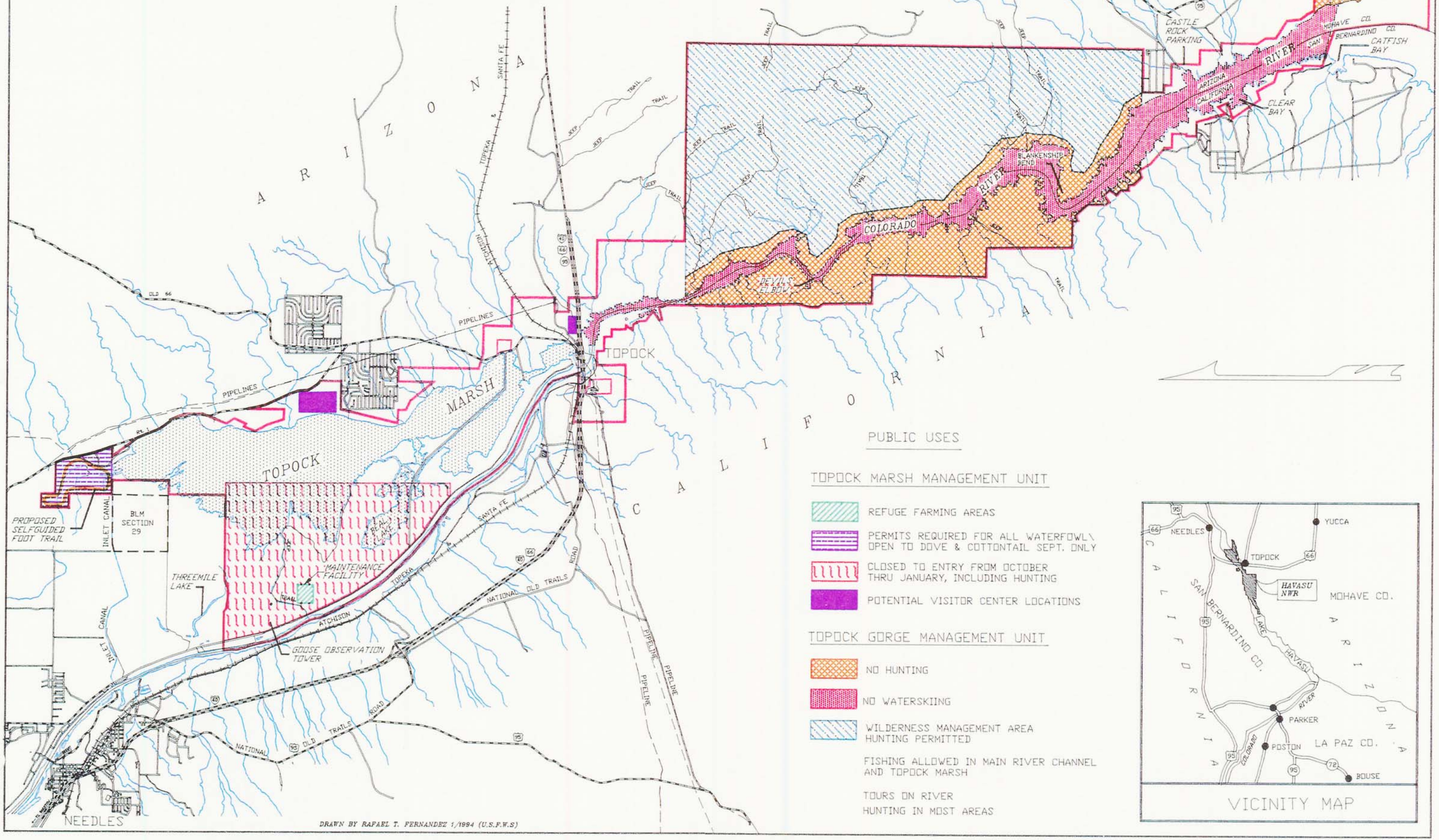


VICINITY MAP

DRAWN BY RAFAEL T. FERNANDEZ 1/1994 (U.S.F.W.S.)

MAP #10

HAVASU NATIONAL WILDLIFE REFUGE
TOPOCK MARSH & TOPOCK GORGE MANAGEMENT UNITS



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PUBLIC USES

TOPOCK MARSH MANAGEMENT UNIT

- REFUGE FARMING AREAS
- PERMITS REQUIRED FOR ALL WATERFOWL\ OPEN TO DOVE & COTTONTAIL SEPT. ONLY
- CLOSED TO ENTRY FROM OCTOBER THRU JANUARY, INCLUDING HUNTING
- POTENTIAL VISITOR CENTER LOCATIONS

TOPOCK GORGE MANAGEMENT UNIT

- NO HUNTING
- NO WATERSKIING
- WILDERNESS MANAGEMENT AREA HUNTING PERMITTED

FISHING ALLOWED IN MAIN RIVER CHANNEL AND TOPOCK MARSH

TOURS ON RIVER

HUNTING IN MOST AREAS

VICINITY MAP

MAP #13

IMPERIAL NATIONAL WILDLIFE REFUGE

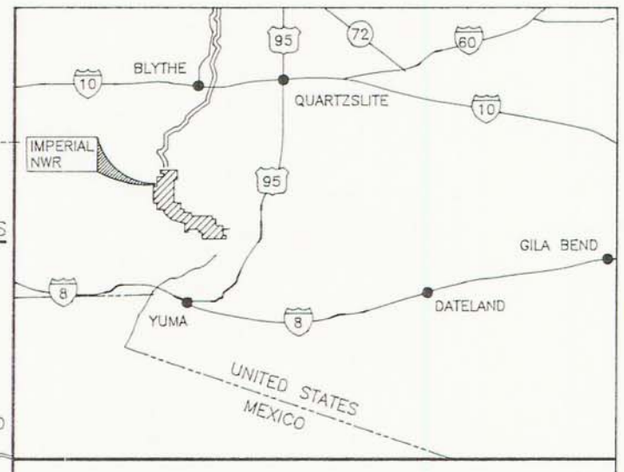
PUBLIC USE

- NO WATER SKIING
- CLOSED TO PUBLIC ENTRY FROM OCTOBER 1. THRU MARCH 1.
- CALIFORNIA STATE RECREATION AREA
- WILDERNESS
- FISHING / NOTE: THE MAIN RIVER CHANNEL AND ALL THE ADJACENT BACKWATERS ARE IMPORTANT FISHING AREAS
- HUNTING (HUNTING ALSO ALLOWED IN WILDERNESS AREA)
- NO HUNTING AREA

ARIZONA

CALIFORNIA

TURNAROUND WASH
JEEP TRAIL
CLIP WASH
DRAPER WASH
TRAIL
JEEP
VELIAN WASH
CALIFORNIA
ARIZONA
WASH
JULIAN WASH
CLOUD WASH
BLACK ROCK WASH
HASH WASH
ARRASTRA WASH
YUMA WASH
ADOBE LAKE
NORTONS LAKE
ISLAND LAKE
CLEAR LAKE
LA PAZ
IMPERIAL CO.
LA PAZ COUNTY
YUMA COUNTY
McALLISTER LAKE
CARRIZO CANYON WASH
BEAR WHITE WASH
FERGUSON LAKE
PAINTED DESERT FOOT TRAIL
REFUGE HEADQUARTERS
MARTINEZ LAKE
PROPOSED ROAD IMPROVEMENTS
FISHERS LANDING



VICINITY MAP

DRAWN BY RAFAEL T. FERNANDEZ 1/1994 (U.S.F.W.S.)

MAP #12

CIBOLA NATIONAL WILDLIFE REFUGE

ARIZONA

REFUGE HEADQUARTERS

COLORADO RIVER

OXBOW LAKE

ARIZONA

CALIFORNIA

PALO VERDE IRRIGATION DISTRICT OUTFALL DRAIN

78

PRETTY WATER JUNCTION

OLD RIVER CHANNEL

CIBOLA DRY CUT

COLORADO RIVER

YUMA CO.

IMPERIAL CO.

THREE FINGER LAKE

PICKLE LAKE

WALKER LAKE

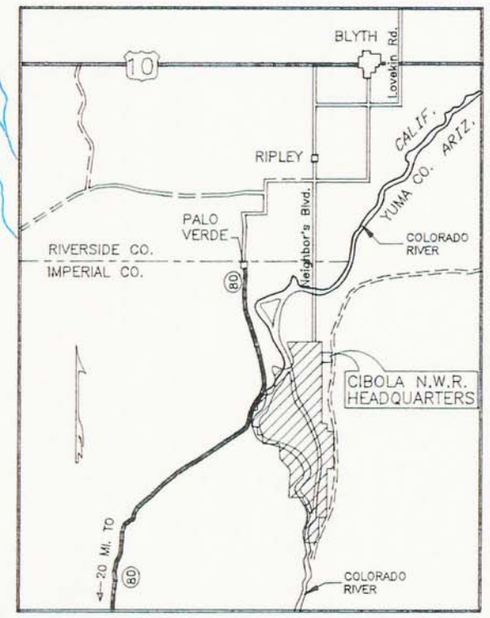
LOPES WASH

TURNAROUND WASH

CALIFORNIA

PUBLIC USES

- ARIZONA – ZONE II – HUNTS
- ARIZONA – ZONE IIB – HUNTING
- CALIFORNIA – ZONE IIC
- CLOSED TO ALL HUNTING
- FISHING – SEASONAL OPENER
- FISHING – YEAR ROUND
- CANADA GOOSE AUTO TOUR
- PROPOSED WALKING TRAIL (OPEN ONLY WHEN HUNT SEASONS ARE CLOSED
- REFUGE HEADQUARTERS & SITE OF PROPOSED VISITOR CONTACT CENTER



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#11

BILL WILLIAMS RIVER NATIONAL WILDLIFE REFUGE

LAKE HAVASU STATE RECREATION AREA

LAKE HAVASU

SAN BERNARDINO CO.

MOHAVE CO.
LA PAZ CO

CALIFORNIA

COLORADO RIVER

BUCKSKIN MOUNTAINS STATE PARK

ARIZONA

REFUGE HEADQUARTERS

TRANSMISSION LINE

HAYDEN-RHODES AQUEDUCT

BUCKSKIN MOUNTAINS TUNNEL

FOX WASH

MOHAVE CO.
LA PAZ CO.

BILL WILLIAMS RIVER

CAVE WASH

MOHAVE WASH

YUCCA TRANSMISSION LINE

WASH

CASTANEDA WASH

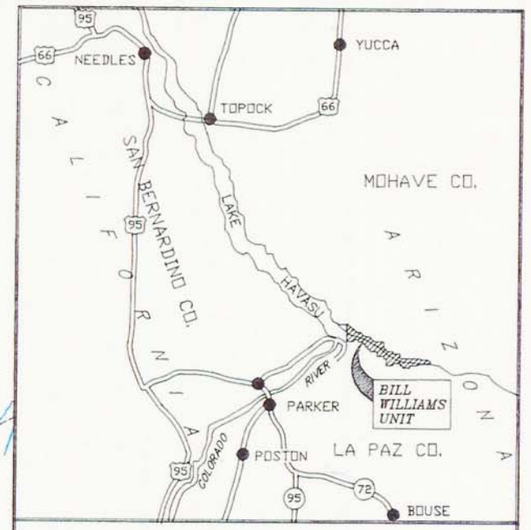
PLANET RANCH

MOHAVE CO.
LA PAZ CO.

BILL WILLIAMS RIVER

MINERAL WASH

PLANET RANCH ROAD



VICINITY MAP

PUBLIC USES

NO HUNTING / AREA IS CURRENTLY OPEN FOR WILDLIFE OBSERVATION AND IS BEING EVALUATED FOR POSSIBLE DEVELOPMENT OF WILDLIFE OBSERVATION TRAILS AND INTERPRETIVE SIGNING.

OPEN HUNTING / SEPTEMBER – MARCH FOR QUAIL, DOVE, COTTONTAIL AND BIGHORN SHEEP. THE AREA IS OPEN TO WILDLIFE OBSERVATION WHEN THE AREA IS CLOSED TO HUNTING.

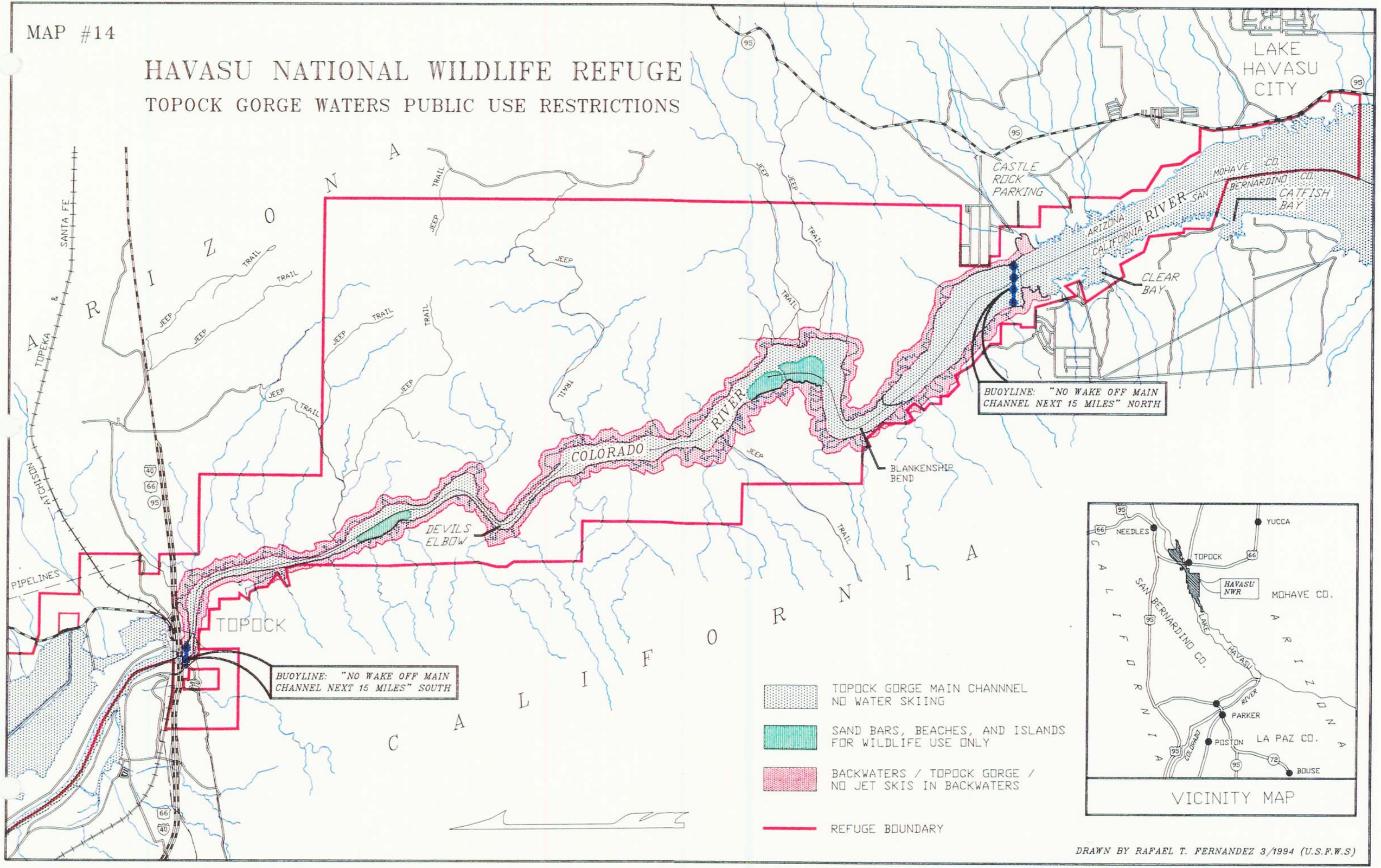
FISHING

DRAWN BY RAFAEL T. FERNANDEZ 1/1994 (U.S.F.W.S.)

MAP #14

HAVASU NATIONAL WILDLIFE REFUGE

TOPOCK GORGE WATERS PUBLIC USE RESTRICTIONS



VICINITY MAP

DRAWN BY RAFAEL T. FERNANDEZ 3/1994 (U.S.F.W.S)

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