

DRAFT ENVIRONMENTAL ASSESSMENT

For

Feral Swine Eradication Plan

HAVASU NATIONAL WILDLIFE REFUGE
Needles, CA

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1.0 PURPOSE OF AND NEED FOR PROPOSED ACTION ALTERNATIVE

1.1 Introduction

The United States Fish and Wildlife Service (Service or USFWS), is proposing to implement the Havasu National Wildlife Refuge Feral Swine Eradication Plan. This Environmental Assessment (EA) is being prepared to evaluate the effects associated with this proposal and complies with the National Environmental Policy Act (NEPA) in accordance with Council on Environmental Quality regulations (40 CFR 1500-1508) and Department of the Interior (516 DM 8) and Service (550 FW 3) policies (see Section 1.7 of this document for a list of additional regulations that this EA complies with). NEPA requires examination of the effects of proposed actions on the natural and human environment. In the following sections, two alternatives are described and environmental consequences of each alternative are analyzed.

The No Action Alternative would continue enduring feral swine populations on Havasu National Wildlife Refuge (Havasus NWR or refuge) resulting in continued habitat destruction, threats to endangered species and other wildlife, and human safety risks. A second alternative (Alternative 2), which is the Service's Proposed Action, would remove feral swine from Havasu HWR and maintain biosecurity to prevent future ingress.

In this analysis, the term feral swine is used to refer collectively to free-ranging swine. This term includes escaped (estrays) domestic and pet hogs and their descendants, including those purposefully released, Polynesian pigs, and Eurasian wild boar and their hybrids. Other terms used may include wild pig, feral pig, feral hog, wild hog, and wild boar. A species similar in appearance, javelina (*Tayassu tajacu*), is a native species in the peccary family, and is not included in this document.

1.2 Location

Havasus NWR encompasses 37,515 acres adjacent to the lower Colorado River, spanning from Mohave Valley, Arizona, to Lake Havasu City, Arizona (Figure 1). Occupying both Mohave County in Arizona and San Bernardino County in California, Havasus NWR protects 300 shoreline miles, including the approximately 17-mile Topock Gorge, one of the last remaining natural stretches of the lower Colorado River. Topock Marsh, an area approximately 4000 acres located north of I-40, occupies a majority of the northern portion of the refuge and consists of a large freshwater body surrounded by emergent wetland species. Most of the land south of the I-40 bridge surrounding Topock Gorge was designated Wilderness in 1990 and 1994 by the states of Arizona and California, respectively. Approximately 47% (17,600 acres) of the refuge is designated as a Wilderness Area. Predominant riparian community vegetation throughout the refuge consists of dense stands of salt cedar (*Tamarix* spp.) with mixed Goodding's willow (*Salix gooddingii*), coyote willow (*Salix exigua*), and Fremont cottonwood (*Populus fremontii*).

The predominant understory consists of arrowweed (*Pluchea sericea*) and cattails (*Typha* spp.) in wetter and emergent wetland areas. Upland areas consist of mesquite (*Prosopis* spp.) and creosote bush (*Larrea tridentata*) desert scrub communities.



Figure 1. Location of Havasu NWR.

1.3 Background

Havasu NWR was established by the Federal Property and Administrative Service Act of 1949 (40 U.S.C. 471-535), as amended; Fish and Wildlife Coordination Act of 1934 (16 U.S.C. 661-666c) as amended; Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j Stat. 1119) as amended; the Act of May 19, 1948, Public Law 80-537 (16 U.S.C. 667b-667d; 62 Stat. 240) as amended; and The National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee).

In order to meet specific refuge and other broader Service directives, Havasu NWR was established by Executive Order 8647 on January 22, 1941, concurrently with the Bill Williams River Unit (now the independent Bill Williams River National Wildlife Refuge), "...as a refuge and breeding ground for migratory birds and other wildlife."

The refuge actively participates in land management and restoration activities that are designed to improve habitats for federally endangered southwestern willow flycatchers (*Empidonax traillii extimus*), federally threatened yellow-billed cuckoos (*Coccyzus americanus*), federally endangered Yuma Ridgway's rails (*Rallus obsoletus yumenensis*), waterfowl, other migratory bird populations, as well as other native wildlife. Restoration of these habitats is on-going as funding and personnel allow.

In addition to providing sanctuary and breeding habitat for migratory and resident birds and other wildlife, the refuge also provides wildlife-oriented recreational activities for the public. Wildlife observation, photography, hunting, fishing, education and interpretive programs are available. Havasu NWR serves an estimated 3,000,000 visitors annually who enjoy the area for recreation and wildlife values. Feral swine detract from these experiences by altering the wildlife habitat and threatening the health and safety of visitors.

In order to meet the species protection and enhancement goals for the Havasu NWR, refuge staff and U.S. Department of Agriculture, Animal and Plant Health Inspection Service-Wildlife Services (USDA-APHIS-WS) will strive to maintain feral swine at zero population levels in collaboration with the Integrated Feral Swine Damage Management Program. This program was developed as a national response to reduce, and where possible, eliminate, the risks and damages inflicted by feral swine to agriculture, natural resources, property and human health.

Because feral swine are largely nocturnal, obtaining accurate population estimates through surveys are very difficult. Trail cameras are strategically placed on the refuge to monitor feral swine presence, and anecdotal incident reports of feral swine encounters by the public, staff, and other conservation partners are increasing, particularly near the southern part of the refuge. Swine have also been observed on shorelines within the Topock Gorge on the Arizona side of the river during USFWS aerial waterfowl surveys. Future encounters may increase as there are few population controls on swine and they may continue encroaching into the suburban areas of Lake Havasu City to secure additional food resources. In the absence of controls, an increasing

population of feral swine will increase damage to the habitat on the refuge and neighboring properties and could result in dangerous encounters with the public in addition to impacting native wildlife.

Feral swine populations on the refuge are restricted to riparian habitats within the Pintail Slough Management Unit, Topock Marsh Unit, Topock Gorge Unit, and the riparian areas within the Lake Havasu Unit (Figure 2). They are able to swim to islands within Topock Marsh and in Topock Gorge and are found along roadsides and in or near dense vegetation. Anecdotal sightings on the refuge suggest feral swine are concentrated near water in the summer, including the emergent vegetation on the marsh edges. In winter when temperatures are milder, swine may be more dispersed throughout the riparian habitat.

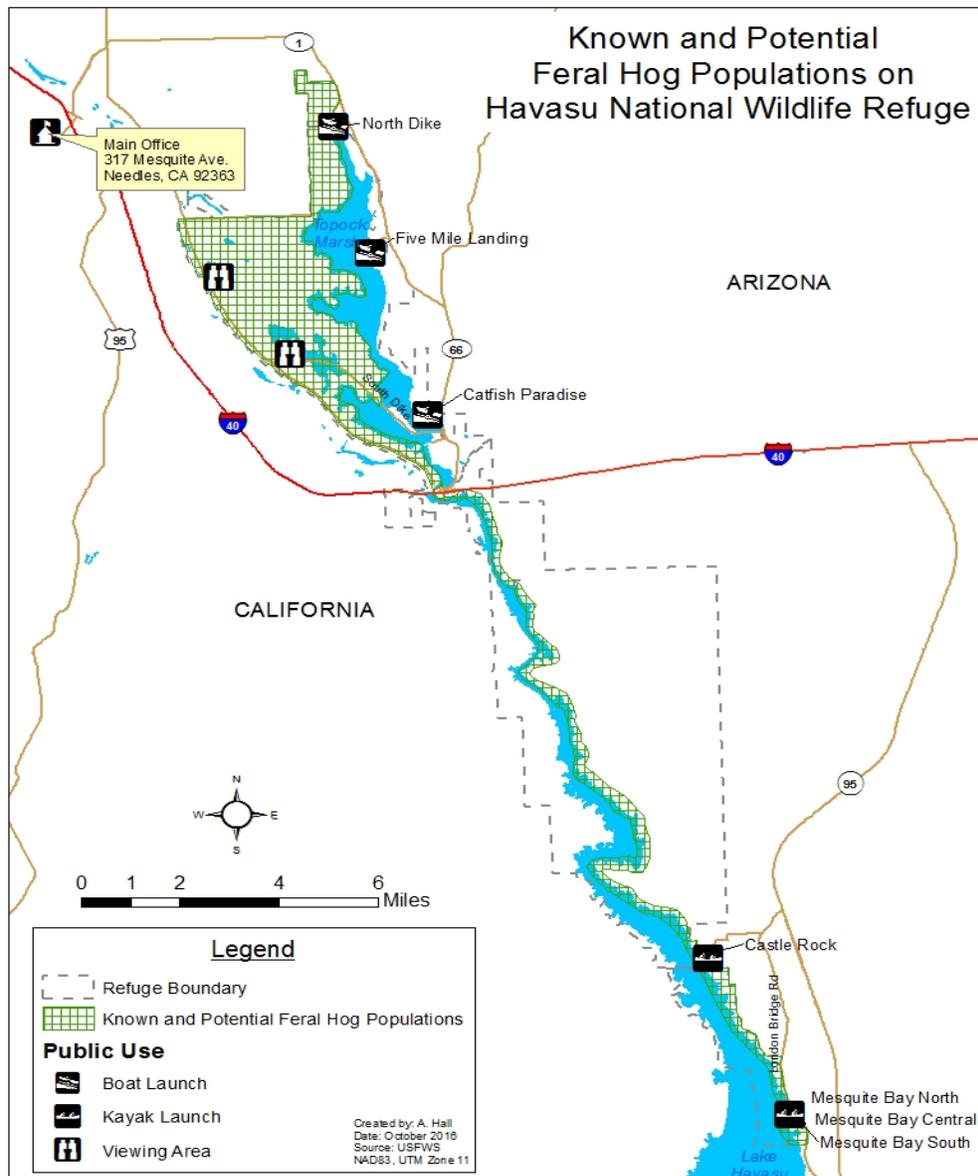


Figure 2. Map of potential and known locations of feral swine on Havasu NWR.

Feral swine are members of the family Suidae. Little is known about the introduction of feral swine on Havasu NWR. It is believed they were either released or escaped from domestic stock from a nearby ranch north of Needles, California. Records suggest feral swine have been in the area since at least 1900 and Havasu NWR documents indicate the refuge began initiating dialogue with other entities regarding the need for feral swine control, citing wildlife and habitat destruction, since at least 1975 (USFWS 1975).

Havasu NWR was open to feral swine hunting, by permit, in March 1975 within the western part of the Topock Marsh Unit. Hunting was approved on a permit basis via a random drawing with 25 hunters allowed at a time, due to dense vegetation and hunter safety concerns. As a result of a poor quality hunt and high administrative costs, the hunt was not reinstated after that year. Only 42 hogs were taken by 175 hunters. Management efforts for feral swine are difficult and have consisted of this one-time hunt and removal for disease monitoring by USDA-APHIS-WS.

In the State of Arizona feral species are non-game, non-protected species. As such, there are no formal hunting seasons and no licensing requirement. Their non-game status exempts them from the laws concerning animal waste and bag limits. Hunting of this species on Havasu NWR is prohibited. With relatively recent policy revisions (National Wildlife Refuge System Improvement Act of 1997), all proposed hunting on national wildlife refuges must undergo a public process to determine compatibility and appropriateness with the mission of the refuge system and goals and objectives of the refuge and be published in the Code of Federal Regulations (CFR) before it can be initiated.

1.4 Purpose and Need for the Proposed Action

The purpose of the EA is to evaluate the effects of the feral swine eradication program on Havasu NWR. The purpose of the proposed action is to eradicate feral swine on the refuge. The need for stringent control measures is based on escalating damage caused by feral swine throughout the refuge and they pose a serious threat to native wildlife and all refuge habitats. The goal of feral swine eradication on Havasu NWR is to control the expanding population of this destructive, invasive species by reducing their numbers to zero and conducting long-term monitoring to identify ingress and assure complete and sustained eradication through early detection-rapid response (EDRR) measures. Successfully accomplishing this goal will result in: less competition for food, water and space between feral swine and native wildlife, reduced potential for competition between feral swine and threatened and endangered species (thereby assisting in the recovery of these species), reduced habitat disturbance, reduced damage to refuge roads, impoundments, riparian habitat, and farm fields through excessive rooting, minimizing potential of disease transmission from swine to humans and wildlife, and reduced destruction of nests of ground nesting species, particularly the endangered Yuma Ridgway's rail, California black rail (*Laterallus jamaicensis*) and other marsh birds.

This action is needed to remove the constant threat that feral swine pose to the long-term viability and sustainability of marsh bird and riparian habitat, damage to property, and public and staff safety. Feral swine are susceptible to a wide range of infectious and parasitic diseases (Davis 1993). They can carry up to 30 viral and bacterial diseases and 40 parasites that can infect humans, livestock and wildlife. The most serious diseases found in feral swine are brucellosis, hepatitis E, tuberculosis, trichinellosis and pseudorabies. Other potential diseases include; leptospirosis, toxoplasmosis, influenza, classical swine fever, and porcine reproductive and respiratory syndrome.

Leptospirosis, *Salmonella* and *Escherichia coli* (STEC) have been positively documented in feral swine at Havasu NWR during annual disease monitoring efforts by USDA-APHIS-WS (Jay-Russell et al. 2014). Leptospirosis is a bacterial disease in humans and animals that can lead to kidney and liver failure, meningitis, respiratory distress, and death. Salmonellosis is a type of food poisoning caused by the *Salmonella enterica* bacterium that can cause severe infections in people. *E. coli* has been documented as the cause of a nationwide outbreak linked to fresh bagged baby cabbage in past years in California (Jay-Russell et al. 2014). The same genetic strain has been documented in feral swine sampled from Havasu NWR, which could pose human health issues when swine stray into gardens or agricultural fields. Humans and domestic livestock can become infected via contact with brucellosis diseased feral swine. Pseudorabies, despite its name, is not related to rabies; however, it is often fatal to wild and domestic animals, including raccoons, foxes, opossums, cattle, and dogs (West et al. 2009).

The feral swine population has become a serious problem for Havasu NWR and adjacent property owners. Feral swine are highly adaptable opportunistic omnivores, have high reproductive capabilities, and can be found in a wide range of habitat types. They compete with native wildlife for food, cover, water, and space as well as prey on native wildlife. Rooting and digging activities adversely impact vegetative communities, soil properties and plant successional patterns (Stevens 1996). The negative impacts and destructive nature of feral swine cause damage to Arizona's agriculture and private properties (e.g. golf courses). Nationally, the estimated cost of damage caused by feral swine is \$1.5 billion annually (Pimental 2007).

Impacts to ecosystems by feral swine can take the form of decreased water quality, increased propagation of exotic plant species, increased soil erosion, modification of nutrient cycles, and damage to native plant species (Kaller and Kelso 2006, Stone and Keith 1987, Singer et al. 1984, Patten 1974).

Due to the intensity of concern regarding invasive species, the National Invasive Species Council (NISC) was established by Executive Order (EO) 13112 to ensure that Federal programs and activities to prevent and control invasive species are coordinated, effective and efficient. NISC members are the Secretaries and Administrators of 13 federal departments and agencies to provide high-level coordination on invasive species and is co-chaired by the Secretaries of

Commerce, Agriculture, and the Interior. The Service is the only agency of the U.S. Government whose primary responsibility is the conservation of fish, wildlife, and plants. Because of our responsibilities, the Service is very concerned about the impacts that invasive species are having across the Nation. Invasive plants and animals have many impacts on fish and wildlife resources. Invasive species degrade, change or displace native habitats and compete with our native wildlife for food, water, shelter and space, and are thus harmful to our fish, wildlife and plant resources. The development and implementation of an effective and humane eradication plan to remove these animals is essential to achieving the Service's goals of conserving a diversity of fish, wildlife and plants, perpetuating migratory bird populations, and providing the public with safe, high quality public use. The Feral Swine Eradication Plan combines several forms of control techniques to maximize success.

1.5 Decision to be Made

The Service's Regional Director will review the recommendations assessed in this EA and select one of the two Alternatives presented. The Regional Director will also determine whether this EA is adequate to support a Finding of No Significant Impact (FONSI) or whether an Environmental Impact Statement will need to be prepared. This EA is an evaluation of the environmental impacts of the alternatives and provides information to help the Service fully consider these impacts and any proposed mitigation. Using the analysis in this EA, the Service will decide whether there would be any significant effects associated with the alternatives that would require the preparation of an environmental impact statement or whether the Proposed Action Alternative can proceed.

This EA serves as the NEPA document which analyzes the impacts on environmental, cultural, and historical resources of implementation of the Havasu NWR Feral Swine Eradication Plan. The Havasu NWR Feral Swine Eradication Plan is presented in this document as the preferred action alternative. Proposed uses within this plan have been determined to be appropriate and compatible with the mission of the Refuge System and purposes for which the refuge was established.

1.6 Regulatory Compliance

National wildlife refuges are guided by the mission and goals of the National Wildlife Refuge System (NWRS), the purposes of an individual refuge, Service policy, and laws and international treaties. Relevant guidance includes the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, Refuge Recreation Act of 1962, and selected portions of the CFR and Fish and Wildlife Service Manual.

The mission of the Refuge System is:

“... to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (National Wildlife Refuge System Improvement Act of 1997, Public Law 105-57).

The goals of the Refuge System are to:

- conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered;
- develop and maintain a network of habitats for migratory birds, anadromous and inter-jurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges;
- conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts;
- provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography, and environmental education and interpretation); and
- foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.

The NWRS Improvement Act of 1997 provides guidelines and directives for the administration and management of all areas in the NWRS. It states that national wildlife refuges must be protected from incompatible or harmful human activities to ensure that Americans can enjoy Refuge System lands and waters. Before activities or uses are allowed on a national wildlife refuge, the uses must be found to be compatible. A compatible use “... will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuges.” In addition, “wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety.” The act also recognized that wildlife-dependent recreational uses involving hunting, fishing, wildlife observation, photography, environmental education and interpretation, when determined to be compatible with the mission of the System and purposes of the refuges, are legitimate and appropriate public uses of the NWRS and they shall receive priority consideration in planning and management.

This EA was prepared by the Service and represents compliance with applicable Federal statutes, regulations, Executive Orders, and other compliance documents, including the following:

- American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996)
- Archaeological Resources Protection Act of 1979 (16 U.S.C. 470)
- Clean Air Act of 1972, as amended (42 U.S.C. 7401 et seq.)
- Clean Water Act of 1972, as amended (33 U.S.C. 1251 et seq.)
- Endangered Species Act of 1973, (ESA) as amended (16 U.S.C. 1531 et seq.)
- Executive Order 12898, Federal Action Alternatives to Address Environmental Justice in Minority Populations and Low Income Populations, 1994
- Fish and Wildlife Coordination Act of 1958, as amended (16 U.S.C. 661 et seq.)
- Floodplain Management (Executive Order 11988)
- National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 et seq.)
- Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500 et seq.)
- National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 et seq.)
- Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001 et seq.)
- Protection and Enhancement of the Cultural Environment (Executive Order 11593)
- Protection of Wetlands (Executive Order 11990)
- National Pollutant Discharge Elimination System, as amended (33 U.S.C. 1251 et seq.)
- Executive Order 13112, Invasive Species (issued in February 1999)
- Administrative Procedures Act (5 U.S.C. 551-559, 701-706, and 801-808) as amended
- Antiquities Act of 1906 (16 U.S.C. 431-433)
- Bald Eagle Protection Act (16 U.S.C. 668-668d) as amended
- Federal Land Recreation Enhancement Act (REA), 16 U.S.C.6803(c), Consolidated Appropriations Act (PL 108-447)
- Fish and Wildlife Act of 1956 (16 U.S.C. 742a-754j-2)
- Fish and Wildlife Conservation Act (16 U.S.C. 2901-2911) as amended
- Fish and Wildlife Improvement Act of 1978 (16 U.S.C. 7421)
- Migratory Bird Treaty Act (16 U.S.C. 703-712 as amended)
- National Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee) as amended
- Recreation Hunting Safety and Preservation Act of 1994 (16 U.S.C. 5201-5201) Refuge Recreation Act (16 U.S.C. 460K-460K-4) as amended
- Sikes Act (16 U.S.C. 670a-680o) as amended
- Soil and Water Conservation Act of 1977 (16 U.S.C. 2001-2009) as amended
- Title 50 CFR Part 30, Section 11 – Control of feral animals
- Title 50 CFR Part 30, Section 12 – Disposition of feral animals
- Title 50 CFR Part 31, Section 14 – Official animal control operations

The policy of the Service is to engage in the necessary control of wildlife within the National Wildlife Refuge System to assure balance of wildlife and fish populations consistent with the optimum management of refuge habitat. All control methods will be accomplished by the most humane manner and in accordance with Service directives [(e.g. Refuge Manual (7RM 14.2), Service Manual (601 FW1, 602 FW1, 603 FW1)].

Title 50 CFR Part 30, Section 11 – Control of feral animals:

Feral animals, including horses, burros, cattle, swine, sheep, goats, reindeer, dogs, and cats, without ownership that have reverted to the wild from a domestic state may be taken by

authorized Federal or State personnel or by private persons operating under permit in accordance with applicable provisions of Federal or State law or regulations.

Title 50 CFR Part 30, Section 12 – Disposition of feral animals:

Feral animals taken on wildlife refuges may be disposed of by sale on the open market, gift or loan to public or private institutions for specific purposes, and as otherwise provided in section 401 of the act to June 15, 1935 (49 Stat. 383, 16 U.S.C. 715s).

Title 50 CFR Part 31, Section 14 – Official animal control operations:

Animal species which are surplus or detrimental to the management program of a wildlife refuge area may be taken in accordance with Federal and State laws and regulations by Federal or State personnel or by permit issued to private individuals. Animal species which are damaging or destroying Federal property within a wildlife refuge area may be taken or destroyed by Federal personnel.

Executive Order 13112 - Invasive Species:

Issued in February, 1999 instructs Federal Agencies to use their programs and authorities to prevent the spread or to control populations of invasive species that cause economic or environmental harm, or harm to human health.

Further, this EA reflects compliance with applicable State of Arizona and local regulations, statutes, policies, and standards for conserving the environment and environmental resources such as water and air quality, endangered plants and animals, and cultural resources.

1.7 Public Involvement and Issues Identified

Public scoping of the proposed action was initiated on 07 July 2015 in a news release titled “Wildlife Refuge Seeks Public Input on Proposed Feral Hog Management Plan”, which was distributed to local media outlets and Arizona Game and Fish Department (AZGFD). The news release stated that the “purpose of this proposed Feral Hog Management Plan is to eliminate the feral hog population on refuge lands and prevent further habitat degradation.” The Service announced its intent to develop a Feral Hog Management Plan and Environmental Assessment of alternatives for eradication of feral hogs from the refuge and actively solicited written comments to facilitate identification of issues and concerns. During the development of these documents, it was decided that an “eradication plan” was a more appropriate name than a “management plan” and more clearly states the intent of this project. Additionally, during the final draft of the plan, we used the more appropriate term “swine” in the title and throughout the document, as recommended by USDA-APHIS-WS.

On 10 August 2015, a Kingman newspaper, Daily Miner, published an article titled “Input sought on feral pig hunts at Havasu refuge”, which initiated letters from the public to comment solely on feral hog hunting rather than eradication or management proposals. A total of 70 letters

were received from the public (58 commenting on both the draft Havasu NWR Hunt Management Plan and 12 with comments only on the proposed Feral Hog Management Plan). In August 2016, the FWS requested comments on the final drafts of the eradication plan and EA from USDA-APHIS-WS and AZGFD prior to public distribution. USDA-APHIS-WS, as the experts on feral swine control and eradication, provided valuable comments that improved the drafts. The letter received from AZGFD was wholly supportive of the proposed eradication of feral swine on the refuge, and encouraged FWS and partner USDA-APHIS-WS to coordinate with neighboring property owners to include those lands in our eradication efforts and offered their assistance in order to fully eradicate this invasive species from the area.

Issues

Desire for additional hunting opportunities on Havasu NWR

Feral species in the State of Arizona, including swine, are non-game, non-protected species (AZGFD). As such, there are no formal hunting seasons and no licensing requirement. Their non-game status exempts them from the laws concerning animal waste and bag limits. Multiple letters were received during the initial scoping period requesting that feral hog hunting be permitted on the refuge as a management option. In reviewing this request, the refuge identified concerns about the safety, feasibility and practicality of permitting hunting of feral swine on Havasu NWR. These concerns are noted in the Section 2.3.

Disease

Feral swine are susceptible to a wide range of infectious and parasitic diseases that can contribute to contamination of watersheds, soil and plants. They can carry up to 30 viral and bacterial diseases and 40 parasites that can infect humans, livestock and wildlife. The most serious diseases found in feral swine are brucellosis, hepatitis E, tuberculosis, trichinellosis and pseudorabies. Other potential diseases include; leptospirosis, toxoplasmosis, influenza, classical swine fever, and porcine reproductive and respiratory syndrome. Leptospirosis, *Salmonella* and *Escherichia coli* (STEC) have been positively documented in feral swine at Havasu NWR during annual disease monitoring efforts by USDA-APHIS-WS (Jay-Russell et al. 2014), all of which can affect humans. Humans and domestic livestock can become infected via contact with brucellosis diseased feral swine. Pseudorabies, despite its name, is not related to rabies and does not infect humans; however, it is often fatal to wild and domestic animals, including raccoons, foxes, opossums, cattle, and dogs (West et al. 2009). Because *Salmonella*, leptospirosis, and *Escherichia coli* have been documented in feral swine at Havasu NWR, protection of hunters exposed to these pathogens when handling game animals is a safety concern. These pathogens are also a threat to fresh fruit and vegetable growers when feral swine intrude on crops and transport these fecal-borne pathogens to crops intended for human consumption (Jay-Russell et al. 2014).

Habitat Destruction

Yuma Ridgway's rail nesting habitat can be impacted if it is trampled leaving open pathways for predators to locate and access nests. Based on staff observations, feral swine readily use densely vegetated marsh habitat resulting in beaten down cattail (*Typha* spp.) and bulrush (*Scirpus* spp.) and feed on cattail tubers, thereby destroying the plants. Furthermore, there is documentation of feral swine depredating nests of marsh birds (Donlan et al. 2007), though the extent on Havasu NWR is not known.

2.0 ALTERNATIVES; INCLUDING PROPOSED ACTION ALTERNATIVE

This chapter discusses the alternatives considered for feral swine eradication on the refuge.

2.1 Alternative A – No Action (Current Management):

No feral swine management activities on the refuge would occur. Current management includes intermittent feral swine collections by USDA-APHIS-WS for disease monitoring and analyses. Trail cameras would continue to be operational to track hog use in areas of the refuge. Wildlife and habitat destruction would continue and human health and safety would continue to be at risk. Damage to soils, water quality, and vegetation resulting from rooting and wallowing of feral swine would increase as the population increased and impacts to wildlife, including rails and other marsh bird nests would continue.

2.2 Alternative B–Implementation of the Feral Swine Eradication Plan (Proposed Action):

Under the Implementation of the Feral Swine Eradication Plan Alternative, USDA-APHIS-WS and refuge staff would employ a variety of control measures to reduce and maintain the feral swine population on the refuge to zero animals. Feral swine population reduction would benefit conservation and protection of refuge resources and contribute to recovery of endangered species.

This alternative would assist in the goal of eliminating the feral swine population at Havasu NWR by utilizing all available methods of feral swine control. It is designed to meet the need for action which is to reduce the impact of feral swine on refuge resources and the constant threat that these invasive species pose to the long-term viability and sustainability of marsh bird and riparian habitat, damage to property, and staff and public health and safety.

2.3 Alternatives Considered But Dismissed From Detailed Analysis

All comments and suggestions received during scoping were considered during alternative development. Alternatives that were determined to be infeasible are discussed below.

Permit a Short Term Public Hunt Prior to Eradication Efforts: An alternative to allow a 30- to 45-day recreational feral swine hunt, refuge-wide, between October and the end of January, just prior to the initiation of eradication efforts, was considered, but dismissed, due to timing and safety concerns. Adding a species to a refuge hunt program requires a lengthy, public input

process and publication in the CFR. Eradication is expected to be completed before this process could be finalized, thus, there would be no feral swine available to hunt. Additionally, because *Salmonella*, leptospirosis, and *Escherichia coli* have been documented in feral swine at Havasu NWR, protection of hunters exposed to these pathogens when handling game animals is a safety concern.

Permit Sustained Public Recreational Hunting of Feral Swine: Letters received from hunt enthusiasts requested that Havasu NWR open the refuge to hunting as the management tool for controlling feral swine populations. This option was considered and dismissed for the following reasons:

Hunting ≠ Eradication

The Service, in partnership with USDA-APHIS-WS and the National Integrated Feral Swine Damage Management Program, advocates eradicating feral swine from Havasu NWR as well as other areas in the state. Management of feral swine through a hunt program does not lead to their eradication. The goal is eradication; complete elimination of this non-native, invasive species from the refuge, not management of populations in perpetuity. Based on literature that documents recreational hunting will not lead to eradication, but in fact, could cause an increase in the feral hog population, the Service believes allowing recreational swine hunting would be discordant with the goal of eradication (USDA 2015, Bevins et al. 2014, Waithman et al. 1999).

The greatest challenge for managers in controlling feral swine occurs in areas with good habitat conditions and abundant food. In these areas and during periods of particularly abundant food (such as during good mast years), juvenile breeding can contribute more to population growth than that of adults (Bieber and Ruf 2005). Under these conditions, even a mortality rate of 90 to 100% of adult females may not cause a population decline, as reproduction in juvenile females would be sufficient to sustain the population. Under good habitat conditions, both adults and juveniles must be removed, as this is likely the only way to affect a population reduction (West et al. 2009). As a result, recreational hunting, which normally removes mostly adult pigs, is usually ineffective as a population control method (Hanson et al. 2009).

Public safety concerns

Visibility is very limited in the marsh habitats that feral swine favor. Hunting with high powered rifles and some other weapons would pose a significant safety issue and likely interfere with other hunting opportunities (waterfowl, quail, cottontail rabbit).

Because *Salmonella*, leptospirosis, and *Escherichia coli* have been documented in feral swine at Havasu NWR, protection of hunters exposed to these pathogens when handling game animals is a safety concern. These pathogens are also a threat to fresh fruit and vegetable growers when feral swine intrude on crops and transport these fecal-borne pathogens to crops intended for human consumption (Jay-Russell et al. 2014).

Interference with other hunting opportunities

There are a number of constraints on the timing of potential hunting activities: To protect threatened and endangered avian species, hunting could not be allowed during the breeding season, approximately March through August. And for the safety of summer recreationalists in the marshes and backwaters, hunting would be most compatible during the time periods of October through January, which is also the time period of the state waterfowl hunting season. Due to the popularity of waterfowl hunting on the refuge, permitting swine hunting at this time could potentially lead to conflict between waterfowl hunters and feral swine hunters as both would be hunting in overlapping areas/habitat on the refuge. Public safety of visitors is a priority with a goal of minimizing interference among hunt enthusiasts.

Future funding/staffing concerns

With current staffing/funding levels, it is not feasible to expand refuge hunting opportunities. This is not likely to change in the foreseeable future.

3.0 AFFECTED ENVIRONMENT

Havasu NWR encompasses 37,515 acres adjacent to the lower Colorado River, spanning from Mohave Valley, Arizona, to Lake Havasu City, Arizona. Occupying both Mohave County in Arizona and San Bernardino County in California, Havasu NWR protects 300 shoreline miles, including the approximately 17-mile Topock Gorge, one of the last remaining natural stretches of the lower Colorado River. Topock Marsh, an area approximately 4000 acres located north of Interstate 40, occupies a majority of the northern portion of the refuge and consists of a large freshwater body surrounded by emergent wetland species. Predominant riparian community vegetation throughout the refuge consists of dense stands of salt cedar with mixed Goodding's willow, coyote willow, and Fremont cottonwood. The predominant understory consists of arrowweed (*Pluchea sericea*) and cattails in wetter and emergent wetland areas. Upland areas consist of mesquite and creosote bush desert scrub communities.

In addition to providing sanctuary and breeding ground habitat for migratory birds, threatened and endangered species, and other wildlife, the refuge also provides wildlife-oriented recreational activities for the public. The following resources are not discussed in this EA because the proposed eradication activities are not expected to have impacts on them: physiography, hydrology, minerals, land use and wilderness. The resources described below are those that could be impacted (directly or indirectly) by the alternatives discussed in this document.

3.1 Physical Environment

3.1.1 Air Quality

The project area has excellent air quality, due to the rural land uses in most of the surrounding area. It lies within the U.S. Environmental Protection Agency's Clark-Mohave Intrastate Air Quality Control Region 13, which is an attainment area for National Ambient Air Quality Standards.

3.1.2 Water Quality and Quantity

The entirety of the project area is located within the 100-year floodplain of the Colorado River Valley. The Colorado River is the primary source of water for the refuge, both in terms of surface water and groundwater resources. The refuge diverts surface waters from the Colorado River through a series of earthen ditches and several groundwater wells, with typical depths to groundwater ranging from essentially zero to 10 feet (distance from the ground surface).

Havasu NWR's water rights were established through the 1964 Arizona v. California Supreme Court Decree. The decree language is as follows: "*Havasu Lake National Wildlife Refuge in annual quantities reasonable to fulfill purposes of the Refuge, not to exceed (i) 41,839 acre-feet of water diverted from mainstream, or (ii) 37,339 acre-feet of consumptive use of mainstream water, whichever of (i) or (ii) is less, with a priority date of 1/22/41, for lands reserved by Executive Order of said date of 2/11/49, for land reserved by the Public Land Order of said date (No.559)*". These rights are administered by the U.S. Bureau of Reclamation, as the duly authorized representative of the Secretary of the Interior.

Water quality conditions within the project area are characterized by moderately saline water that has a history of observed high levels of turbidity particularly when winds mobilize fine soils in the shallows of the marsh. Dissolved oxygen levels within the marsh are variable, with observations occasionally being below the 5.0 mg/L level (considered a lower threshold for healthy biological processes).

Feral swine activity has been found to alter water quality and chemistry, although the direction of the changes varies among sites. In the United States, Singer et al. (1984) reported nitrate content doubled in rooted streams, and in Australia, Doupe' et al. (2010) found higher turbidity, anoxic conditions, and enhanced acidity in lagoons occupied by feral hogs.

3.1.3 Soils / Geology

Refuge soils consist primarily of coarse alluvium (sand and sandy loam) deposited by the river prior to construction of the river's extensive levee system. Finer texture soils (silts and clays) occur to a lesser extent, mostly in association with low areas and sloughs. The close proximity of the lower Colorado River and the generally coarse soil textures result in a strong correlation between groundwater depths and river elevation. The project area overlies the geological feature loosely referred to as the "river aquifer", which is composed of largely saturated deposits of sand, silt, and clay, laid down by the late prehistoric and historic Colorado River. The area is

typified by the presence of several former river meanders and by multiple sand dunes created by river channeling and dredging. The terrain consists mostly of broad, flat valleys with widely-scattered, small mountain ranges of almost barren rock. There are also seas of loose sand and the spectacular Pinacate volcanic field.

3.2 Biological Environment

3.2.1 Vegetative Communities

Over 215 plant species have been documented on Havasu NWR. A plant list for Havasu NWR is available at: http://www.fws.gov/uploadedFiles/Hav_NWR_Plants_2012.pdf. Havasu NWR is within the Lower Colorado River Valley subdivision of the Sonoran Desert (Brown and Lowe 1978). Named for its location surrounding the lower Colorado River in parts of four states, this is the largest, hottest, and driest subdivision. It is one of the hottest and driest places in North America. The intense solar radiation from predominantly cloudless skies and the very low humidity suck the life-sustaining water from plants, water that cannot be replaced from the parched mineral soil. Annual rainfall in the driest sites averages less than three inches (76 mm). Even so, life exists here, abundantly in the rare wet years. The waters of the lower Colorado River sustain life in this hot, arid desert.

The Sonoran Desert has the greatest diversity of vegetative growth of any desert in the world (Nabham & Plotkin 1994). The valleys are dominated by low shrubs, primarily creosote bush and white bursage (*Ambrosia dumosa*). These are the two most drought-tolerant perennial plants in North America, but in the driest areas of this subdivision even they are restricted to drainages. Trees grow only along the river and larger washes. The mountains support a wider variety of shrubs and cacti, but the density is still very sparse. Columnar cacti, one of the indicators of the Sonoran Desert, are rare (virtually absent in California) and are restricted to valley floors. Annual species comprise over half the flora, up to ninety percent at the driest sites; they are mostly winter growing species and abundant only in wet years.

The physical environments near the agricultural units on Havasu NWR are typified as dry, relatively higher elevation sand dunes (depth to groundwater greater than five feet), seasonally moist flats and sloughs (depth to groundwater less than five feet), and predominately wet emergent marsh (depth to groundwater approximately zero). Saltcedar and arrowweed dominate the higher and drier areas. Saltcedar, with occasional mesquite, willow, and cottonwood form thick stands in the riparian areas. Cattail and bulrush are the most common (macrophytic) vegetation in the marsh proper and along its perimeter.

3.2.2 Wildlife

The richness of the topography leads to equally diverse species composition; the area supports habitat for many native plants, fish and wildlife species, including many endemic species. Havasu NWR has a diversity of resident and migratory wildlife due to the complexity of habitats – from the Colorado River proper, through wetlands, marshes, and desert uplands. Included are seven Federally Threatened or Endangered species (Table 3).

The refuge provides important habitat for a wide variety of migrating birds and marsh birds. Higher elevation areas contain habitats for various terrestrial mammals and reptiles. Common species of small mammals that are likely to occur in or adjacent to the project area include pocket mice, cottontail rabbits, and packrats. Coyotes, bobcats, bighorn sheep, feral burros, and feral swine are common large mammals. Reptiles that inhabit the upland areas include whiptail lizards, rattlesnakes, and kingsnakes. Beavers and muskrats can be found in the river and marshes. The most widespread fish are common carp, largemouth bass, bluegill, and catfish.

Biodiversity is relatively high on Havasu NWR due both to the complexity of habitats ranging from the Colorado River through backwaters, marshes, terrestrial riparian areas and upland deserts. Biodiversity is enhanced by being on the confluence of the Mojave and Sonoran desert biomes. Most species of wildlife are considered either residents, whose entire life cycle is spent in one area and, consequently, entirely dependent on that habitat; or migratory, wherein some portion of the life cycle is dependent on one or more habitats not locally available. Examples of these may be birds or butterflies that breed here and winter in Mexico or further south, or those that winter here and breed further north. A few species have populations that can fall into both categories, such as mourning doves or some dragonflies with some individuals spending their entire lives on the lower Colorado River while others may breed in more northern states and then winter here to avoid freezing conditions.

Mammals

Fifty-six mammals have been identified on Havasu NWR. Those include bighorn sheep, mule deer, bobcat, coyote, raccoon, gray fox, skunk, black-tailed jackrabbit, desert cottontail, fifteen species of bats, and a wide variety of mice and rats.

Reptiles and Amphibians

Approximately thirty-four species of reptiles and eight species of amphibians are found on Havasu NWR, including Northern Mexican gartersnakes, a federally threatened species. Other reptiles include; desert iguana, common chuckwalla, zebra-tailed lizard, desert spiny lizard, common kingsnake, striped whipsnake, desert tortoise and western diamondback rattlesnake. Some of the more common amphibians are; American bullfrog and red-spotted toad.

Fish

Historically there were several species of native fish found on Havasu NWR. Today, only two are present on the refuge (razorback sucker and bonytail chub) with the assistance of augmentation projects. At least 22 species of non-native fish occur on the refuge, hence, an important factor in the decline and extinction of native southwestern fishes (Minckley 1991, Minckley and Marsh 2009).

Avifauna

Over 318 species of birds have been identified on the refuge. A bird list is available at http://www.fws.gov/uploadedFiles/Hav_NWR_Birds_2011_Final.pdf

Below are some of the more common species.

Marsh and waterbirds: great blue heron, black-crowned night-heron, great egret, snowy egret, cattle egret, pied-billed grebe, western grebe, Clark's grebe, and American coot, and least bittern. Waterfowl: mallard, gadwall, northern pintail, green-winged teal, redhead, bufflehead, ruddy duck, and snow geese.

Shorebirds, gulls, terns, and allied species: American avocet, ring-billed gull, killdeer, and spotted sandpiper.

Raptors: red-tailed hawk, Cooper's hawk, northern harrier, American kestrel, turkey vulture, common raven, great-horned owl, and western-screech owl.

Neotropical birds: yellow warbler, blue grosbeak, black-headed grosbeak, Vermilion flycatcher, ash-throated flycatcher, ruby-crowned kinglet, loggerhead shrike, phainopepla, Lucy's warbler, MacGillivray's warbler, western kingbird, Say's phoebe, black phoebe, yellow-breasted chat.

Game birds: Gambel's quail, mourning dove, white-winged dove, and inca dove.

Invertebrates

Twenty-five dragonfly and damselfly species have been documented on Havasu NWR. A list is available at: http://www.fws.gov/uploadedFiles/Hav_NWR_Dragonfly.pdf

3.2.3 Threatened and Endangered Species and Species of Concern

Various human activities and construction of dams on the lower Colorado River have altered the hydrology and flow dynamics changing the ecosystem drastically. The refuge provides a critical role in maintaining a sanctuary for multiple plant and wildlife species of special concern (federal and/or state listed) which are identified in Table 3.2.

Table 3.2. Seven Known Federally Listed Species that Occur on or Immediately Adjacent to Havasu NWR.

Status	Common Name	Scientific Name	Occurrence
FE	Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	Migratory-breeding
FT	Yellow-billed cuckoo	<i>Coccyzus americanus</i>	Migratory-breeding
FE	Bonytail chub	<i>Gila elegans</i>	Resident
FE	Razorback sucker	<i>Xyrauchan texanus</i>	Resident
FT	Mohave desert tortoise	<i>Gopherus agassizii</i>	Resident
FE	Yuma Ridgway's rail	<i>Rallus obsoletus yumanesis</i>	Resident
FT	Northern Mexican garter snake	<i>Thamnophis eques megalops</i>	Resident

Status: FE = Federally Listed Endangered FT = Federally Listed Threatened

3.3 Human Environment

3.3.1 Cultural Resources

Given that the project area is within the 100-year flood plain of the Colorado River, much of the ground surface has historically been flooded and reworked, making the location of archeological sites an infrequent occurrence. This is especially true in terms of long-term habitation/village sites, which would normally be expected in an area with a record of continuous occupation of at least a thousand years (as is true of the Colorado River Valley). Indeed, perhaps 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 broad terms, conventional measures of archeological significance typically 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 within the Colorado River Valley is the recognition that a cultural continuum exists between the prehistoric and modern Native American presence on the river. 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 national wildlife refuge lands with a profound reverence for religious and ancestral values.

3.3.2 Socioeconomic Resources

Havasu NWR is tied to the local economy largely through the public's use of the refuge for recreational opportunities. These opportunities typically come in the form of fishing, hunting, wildlife viewing, boating activities and sightseeing. Feral swine occur in several areas of the refuge, all of which are areas that sustain recreational hunting, fishing, boating, and wildlife viewing. Limited beach recreation occurs along the lower Colorado River. The refuge also plays a role in the local economy as relates to the fact that refuge employees typically live in the community, own property and support local businesses through their routine purchases.

Total population in Lake Havasu City in 2014 was 53,103 people, up 1.1% from 52,532 in 2010, and up 25.25% from 2000. Home ownership rate from 2009-2013 is 69.9%. Persons 65 years or older represent the highest percentage age group (26.9%) as of 2010, and 17.9% of Lake Havasu City residents are under the age of 18 (Source: Census 2000, Census 2010, Census 2014).

3.3.3 Public Use/Recreation

Havasu NWR serves an estimated 3,000,000 visitors annually who enjoy the refuge for recreation and wildlife values. The refuge actively participates in all of the "Big 6" uses outlined by the NWRS Improvement Act of 1997: wildlife observation, photography, hunting, fishing, education and interpretive programs. Feral swine detract from these experiences by altering the wildlife habitat and threatening the health and safety of visitors.

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter analyzes and discusses the potential environmental effects or consequences that can reasonably be expected by the implementation of the proposed action. An analysis of the effects of management action has been conducted on the physical environment (climate, air quality, hydrology, geology, mineral resources, and soils); biological environment (habitat, resident wildlife, migratory species, and threatened and endangered species); and socioeconomic environment (cultural resources, socioeconomic, visitor service/recreational opportunities, public health and safety, facilities, and visual and aesthetic resources). The direct, indirect, and cumulative impacts of each alternative are considered. The type, duration and intensity of impacts are also considered. Definitions of the terminology used in this EA can be found in Appendix A.

It has been determined that Alternative A (Current Management) and Alternative B (Preferred Alternative) will not have impacts on hydrology, geology, and mineral resources; therefore there will be no further discussion of these resources in the analysis. Potential impacts on other physical, biological, and socioeconomic resources are addressed in the sections below. Potential impacts are described in terms of type, duration, intensity and context (scale). General definitions are defined in Appendix A.

4.1 Effects Common to All Alternatives

4.1.1. Environmental Justice

Executive Order 12898 “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” to focus federal attention on the environmental and human health conditions of minority and low-income populations with the goal of achieving environmental protection for all communities. The Order directs federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The Order is also intended to promote nondiscrimination in federal programs substantially affecting human health and the environment, and to provide minority and low-income communities’ access to public information and participation in matters relating to human health or the environment.

None of the alternatives described in this EA will disproportionately place any adverse environmental, economic, social or health impacts on minority and low income populations. Implementation of the proposed action is anticipated to be beneficial for the environment over the long-term and people in the surrounding communities.

4.1.2. Climate Change

Climate change is already affecting fish, wildlife, plants and their habitats around the globe. The Service's Southwest Region has been working with the U.S. Geological Survey, the academic community, and other natural resource management agencies and interest groups to translate available and emerging science into concrete actions that reduce the impacts of a changing climate on the broadly diverse ecosystems in Arizona, New Mexico, Oklahoma and Texas. The Service believes that the proposed feral hog eradication will have negligible impacts on climate change; however, much is unknown about this subject. The Service has recently addressed the subject of Climate Change with the issuance of the publication “Rising to the Urgent Challenge: Strategic Plan for Responding to Accelerating Climate Change” (USFWS 2010). This five-year plan calls for the establishment of baseline data and development of long-term processes and protocols for biological planning and conservation at broad, landscape scales. This subject will be further addressed as future direction is developed and provided on how to step this Strategic Plan down to the field level.

4.1.3. Impacts on Cultural Resources

Hunting, regardless of method or species targeted, is a consumptive activity that does not pose a threat to historic properties on and/or near Havasu NWR. In fact, hunting meets only one of the two criteria used to identify an “undertaking” that triggers a federal agency’s need to comply with Section 106 of the National Historic Preservation Act. These criteria, which are delineated in 36 CFR Part 800, state:

1. An undertaking is any project, activity, or program that can alter the character or use of an archaeological or historic site located within the “area of potential effect;” and
2. The project, activity, or program must also be either funded, sponsored, performed, licensed, or have received assistance from the agency.

Consultation with the pertinent State Historic Preservation Office and federally recognized Tribes is, therefore, not required.

4.2. Physical Environment

4.2.1 Impacts on Air Quality

Alternative A – Current Management (No Action):

There are no expected direct or indirect impacts associated with this alternative.

Alternative B – Implementation of the Feral Swine Eradication Plan (Proposed Action):

Impacts would be slightly higher, for a short time period, than in Alternative A due to increased efforts by USDA-APHIS-WS and Service staff to achieve feral hog removal in a short time period. These impacts are expected to be negligible, short-term, and local because the small number of vehicles and short time periods of helicopter use. It is anticipated the greatest impact on air quality may result from the rotor wash of the helicopter blades hovering low over land and water, however, many areas will be marsh environments where dust will be minimal.

4.2.2 Impacts on Water Quality and Quantity

Alternative A – Current Management (No Action):

Feral hog activity has been found to alter water quality and chemistry, although the direction of the changes varies among sites. In the United States, Singer et al. (1984) reported nitrate content doubled in rooted streams, and in Australia, Doupe´ et al. (2010) found higher turbidity, anoxic conditions, and enhanced acidity in lagoons. Furthermore, Doupe´ et al. (2010) found no effect on nutrient content (i.e., N and P). Similarly, a study in a Hawaiian watershed showed that only total suspended solids increased in response to wild boar activity but that the amount of runoff, total dissolved solids, and nutrient content did not change (Browning 2008). In contrast, Dunkell et al. (2011) found that total suspended solids in runoff from streams during storm events were consistently greater in areas with feral swine.

Kaller et al. (2007) observed increases in waterborne bacteria, including increases over the levels considered acceptable under state and federal water guidelines, in areas damaged by feral swine in Louisiana. Although there were many potential sources of *Escherichia coli* (*E. coli*; fecal coliform bacteria) in water, polymerase chain reaction (PCR)-based testing identified a more

than 95% similarity between fecal coliform bacteria in the contaminated water and samples from feral swine harvested within the treated area. The Topock Marsh unit, the main unit used by waterfowl hunters and many fishermen, harbors the greatest number of feral swine. Topock Marsh receives minimal fresh water flow, thereby possibly sustaining *E. coli* as well as exasperating the turbidity of the water.

Rooting and wallowing by feral swine disturbs the soil, then this eroded soil enters surface waters as sediment and negatively impacts water quality. This impact is magnified in riparian and floodplain habitats, which are especially sensitive to changes in water quality. Doupé et al. (2010) noted that feral swine foraging in wetlands and lagoons increased problems with water turbidity and low dissolved oxygen. Smaller particles such as clay stay in suspension for very long periods, contributing significantly to water turbidity (Cook 1990).

Alternative B – Implementation of the Feral Swine Eradication Plan (Proposed Action):

Water quality is expected to improve in the absence of swine rooting along shorelines, defecating in the water, and consuming aquatic plants that aid in water quality improvements.

4.2.3 Impacts on Soils

Alternative A – Current Management (No Action):

Habitat damage can be particularly harmful in wet areas where plant communities and soils are more vulnerable to disturbance. Diong (1982) found that feral swine rooting prevented regeneration of young plants and modified forest community structure and composition in Hawaiian forests. Feral swine feeding also reduced populations of native tree ferns and sub canopy cover. Feral swine appear to have a preference for wetlands and riparian habitats (Mayer 2009).

Alternative B – Implementation of the Feral Swine Eradication Plan (Proposed Action):

Under this alternative, the negative impacts on soil caused by feral swine would cease and soil composition is expected to improve.

4.3 Biological Environment

4.3.1 Impacts on Habitat

Alternative A – Current Management (No Action):

Under Alternative A, there would be continued habitat degradation in the form of rooting, trampling, and soil compaction, which influence plant regeneration, community structure, soil

properties, nutrient cycling, and water infiltration (Seward et al. 2004). Feral swine may induce the spread of invasive plant species because invasive exotics typically favor disturbed areas and colonize more quickly than many native plants (Coblentz and Baber 1987, Stone and Keith 1987, Hone and Pederson 1980). Habitat damage is particularly important in wet areas where plant communities and soils tend to be more sensitive to disturbance.

Alternative B – Implementation of the Feral Swine Eradication Plan (Proposed Action):

Under this alternative negative impacts on wildlife habitat from feral swine would cease and wildlife habitat would begin the process of recovery. Removing swine from the landscape would improve the potential for native vegetation regrowth and fewer trails through cattail stands that could be used by predators to access marsh bird nests.

4.3.2 Impacts on Resident Wildlife

Alternative A – Current Management (No Action):

Under this alternative, impacts on wildlife would remain the same or increase as hog populations increase. Continued negative impacts from feral swine to wildlife habitat, increased predation of birds, reptiles, amphibians, small mammals, invertebrates and other wildlife would continue.

Alternative B – Implementation of the Feral Swine Eradication Plan (Proposed Action):

Native wildlife will experience a minor increase in short-term disturbance under this alternative during project implementation. USDA-APHIS-WS and refuge staff participating in the eradication activities would select techniques which are less likely to result in disturbance to wildlife for the shortest duration (Kessler 2004). Additionally, to minimize disturbance to nesting birds, the initial project phase (aerial gunning) will cease by mid/late March. Elimination of feral swine on the refuge would result in an increase in the native vegetation beneficial to plants, invertebrates, reptiles, amphibians, fish, and mammals and decrease depredation of native species.

4.3.3 Impacts on Migratory Wildlife

Alternative A – Current Management (No Action):

Migratory species present on the refuge include waterfowl, other water birds, neo-tropical migrant birds, and raptors. This alternative would result in the same short-term disturbance (human presence and noise associated with refuge activities including hunting, birdwatching, habitat improvements, etc.) to migratory birds that occur on the refuge. However, the level of disturbance perceived likely varies by species and individual.

Alternative B – Implementation of the Feral Swine Eradication Plan (Proposed Action):

Migratory species present on the refuge include waterfowl, other water birds, neo-tropical migrant birds, and raptors. This alternative would result in some short-term disturbance (increased human presence and noise associated with feral hog removal) to migratory birds that occur on the refuge. However, feral hog eradication is expected to decrease soil disruption resulting in improved riparian habitat which will benefit multiple migratory species, particularly those that breed in the area.

4.3.4 Impacts on Threatened, Endangered and Special Status Species

Alternative A – Current Management (No Action):

One of the refuge's primary concerns is the long-term sustainability of Yuma Ridgway's rail, southwestern willow flycatcher and yellow-billed cuckoo populations and habitat. Any activity that reduces the long-term sustainability of their habitat and population is ultimately detrimental to the mission of the refuge. Feral animals are known to adversely affect habitat, and indirectly affect endangered species populations. Donlan et al. (2007) documented that Galápagos rail populations were heavily impacted due to predation by pigs, and rail densities increased after swine were eradicated, spurring Galápagos rail recovery. There have been no documented nest or individual predations of Yuma Ridgway's rails on the refuge, but since feral swine, as well as rails, are relatively elusive, the probability of documenting such occurrences is remote. Any perpetuation of feral swine populations would only result in an increase in their population and likely result in an increase in the direct and indirect impacts to listed species. As the swine population continues to increase, we expect continued and increasing habitat destruction and predation on native species.

Alternative B – Implementation of the Feral Swine Eradication Plan (Proposed Action):

It is anticipated that there would be a minor and short-term adverse direct impact to endangered Ridgway's rails as a result of this project's proposed initial eradication method; aerial gunning. A helicopter will fly within 200 feet above the marsh habitat. The rotor wash from the helicopter may cause rails to either flee the area temporarily or hunker down in the vegetation until the aircraft passes. It is expected that this impact would be addressed to a large degree by initiating the project during their non-breeding season (fall/winter). No impacts to southwestern willow flycatchers or yellow-billed cuckoos are anticipated as these migratory species will not be present during the time of initial project implementation. The proposed action would decrease impacts on listed and special status species that occupy the same areas by removing a direct predator and improvement in wildlife habitat is expected.

4.4 Socioeconomic Environment

4.4.1 Impacts on Socioeconomic Resources

Alternative A – Current Management (No Action):

Under Alternative A, the economic and social condition of the area would remain the same.

Alternative B – Implementation of the Feral Swine Eradication Plan (Proposed Action):

Eradication of feral swine from the refuge and adjacent areas is expected to improve wildlife habitat and improve visitor safety for recreational opportunities that may result in a socioeconomic increase in surrounding communities. Additionally, absence of feral swine and their destructive behaviors will result in a decreased cost to homeowners and businesses impacted by their foraging, rooting, and wallowing behaviors (e.g. golf courses, agriculture, gardens).

4.4.2 Impacts to Visitor Services/Recreation Opportunities

Alternative A – Current Management (No Action):

Under Alternative A, there would be no change in the existing visitor services and recreational opportunities on the refuge.

Alternative B – Implementation of the Feral Swine Eradication Plan (Proposed Action):

Under this alternative, there would be a beneficial impact to visitor services and no change to recreational opportunities other than possible short term closures in areas where aerial gunning activities are occurring. Overall, impacts to visitor services/recreation opportunities are considered short-term, minor and local since other parts of the refuge are available for use by wildlife-dependent recreationists.

4.4.3 Impacts on Public Health and Safety

Alternative A – Current Management (No Action):

Under this alternative, feral animals would continue to be a threat (disease, attack, and potential vehicle collisions) to human health and safety.

Alternative B – Implementation of the Feral Swine Eradication Plan (Proposed Action):

Under this alternative, the risks of feral animals transmitting disease or causing accidents or attacks will be reduced to zero once all feral swine are removed.

4.4.4 Impacts on Refuge Facilities

Alternative A – Current Management (No Action):

Damages to roads and refuge facilities from refuge users and staff would continue at the current level, which requires some periodic road grading. Other non-consumptive users would also continue to use refuge facilities, thereby necessitating periodic maintenance throughout the year. Feral swine cause damage by directly consuming crops, damaging fields by rooting and digging, and trampling crops (Whitehouse 1999). In addition to directly damaging crops, swine can damage infrastructure such as fences, irrigation ditches, roads, dikes, and other structures. Rooting and wallowing in agricultural fields creates holes that, if unnoticed, can damage farming equipment and pose potential hazards to equipment operators (Nunley 1999).

Alternative B – Implementation of the Feral Swine Eradication Plan (Proposed Action):

Under this alternative there will be a slight increase in road use due to the short term addition of USDA-APHIS-WS staff and USFWS staff during project implementation.

4.4.5 Impacts to Visual and Aesthetic Resources

Alternative A – Current Management (No Action):

The aesthetic character of shorelines on portions of Havasu NWR where swine are present is currently degraded due to their rooting and wallowing behavior. No change or improvement is expected under Alternative A.

Alternative B – Implementation of the Feral Swine Eradication Plan (Proposed Action):

The visual character of the refuge where feral swine are present is expected to improve and return to a more natural state by the removal these invasive animals. Eliminating feral swine would avert degradation of the existing visual character. Disturbances from swine are limited to vegetation and ground disturbances.

4.4.6 Humaneness and Animal Welfare Concerns

Alternative A – Current Management (No Action):

No additional mortality of feral swine would occur under this alternative.

Alternative B – Implementation of the Feral Swine Eradication Plan (Proposed Action):

Under Alternative B, feral swine would be hunted using a variety of methods outlined in the Havasu NWR Feral Swine Eradication Plan in order to meet the goal of complete eradication. Animals requiring euthanasia will be safely dispatched quickly and humanely.

For aerial control, shooting from a helicopter would be conducted by a professional sharpshooter employed or contracted by USDA-APHIS-WS. Accurate shots are taken from the lowest safe altitude at which the helicopter can operate. If appropriate, carcasses are left where shot in remote areas where they are normally consumed by coyotes, vultures, and other wildlife within a few days. In some areas, carcasses will be removed and either buried in a ground pit on the refuge or donated to wildlife or recovery facilities where carcasses, untainted with lead are needed. All disposals will be made in a manner consistent with Federal, State, county, and local regulations and which demonstrate USFWS's recognition of public sensitivity to the viewing of wildlife carcasses. This method is consistent with USDA-APHIS-WS Directive 2.515 (2011). Non-lead ammunition will be used to eliminate any potential for lead poisoning in vultures and other scavengers. Feral swine that are trapped and require euthanasia will be dispatched quickly and humanely. Carcasses will not be eligible for donation for human consumption because the Federal Meat Inspection Act requires feral swine to be inspected live, slaughtered under inspection, and processed under inspection to be eligible for donation to charities. All animals will be euthanized at the refuge, off-site of a processing facility.

4.5 Cumulative Impacts Analysis

A cumulative impact is defined as an impact on the environment that results from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future action regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Cumulative impacts are the overall, net effects on a resource that arise from multiple actions. Impacts can "accumulate" spatially, when different actions affect different areas of the same resource. They can also accumulate over the course of time, from actions in the past, the present, and the future. Sometimes different actions counterbalance one another, partially canceling out each other's effects on a resource. But more typically, multiple effects add up, with each additional action contributing an incremental impact on the resource.

The adverse direct and indirect effects of the proposed action on air, water, soil, habitat, wildlife, and aesthetic/visual resources are expected to be minor and short-term. The benefits to long-term ecosystem health that these efforts will accomplish far outweigh any of the short-term adverse impacts discussed in this document.

The proposed action is intended to reduce negative economic and environmental impacts caused by feral swine, improve wildlife habitat, remove a direct predator, and increase human safety. Cumulative effects to an exotic, invasive species are not a concern, however, the Service is responsible for assessing the impacts that eradication of feral swine may have to flora and fauna and overall habitat. It is the objective of the Service to eradicate invasive species when possible.

Alternative A – Current Management (No Action):

As detailed in the preceding analysis, it is anticipated that maintaining the current condition through the No Action alternative would involve a continuation and deepening of many of the challenges the refuge faces in its management of invasive species. The No Action alternative is expected to contribute to further degradation of the refuge's wildlife and habitat/water resources and likely will lead to an increase in the current feral swine population, increased human health and safety issues, increased human encounters with feral swine, and continued potential direct predation of birds and eggs. Further, this alternative would not address the NWRS's mission nor the National Strategy for Management of Invasive Species as well as other appropriate authorities related to invasive species control/eradication on NWRS lands.

Impacts to ecosystems can take the form of decreased water quality, increased propagation of exotic plant species, increased soil erosion, modification of nutrient cycles, and damage to native plant species (, Kaller and Kelso 2006, Cushman et al. 2004, Stone and Keith 1987, Singer et al. 1984, Patten 1974).

These factors sum to make the No Action alternative one that would reduce the cumulative benefit that Havasu NWR represents to the lower Colorado River habitats and surrounding communities.

Alternative B – Implementation of the Feral Swine Eradication Plan (Proposed Action):

Conversely, it is expected that implementation of the Proposed Action would effectively eliminate the escalating damage to the integrity of natural ecosystems caused by feral swine inflicting significant damage to property, agriculture, native species, and potential historic and cultural resources. They also pose a threat to the health of wildlife, domestic animals, and humans. Feral swine are susceptible to a wide range of infectious and parasitic diseases that can contribute to contamination of watersheds, soil and plants. Leptospirosis, *Salmonella* and *Escherichia coli* (STEC) have been positively documented in feral swine at Havasu NWR during annual disease monitoring efforts by USDA-APHIS-WS (Jay-Russell et al. 2014), all of which can affect humans. Eradication of this invasive species will contribute to the achievement of many of the USFWS and refuge's environmental goals and objectives.

Similarly, in a cumulative context of what the Proposed Action alternative represents, it is anticipated that other governmental and private entities, and the public at large, will be

supportive of the purpose of this project and the rationale for its implementation. This is expected as the project addresses shared concerns related to arresting the increased dispersal of feral swine and subsequent degrading trends of environmental conditions in the lower Colorado River that have occurred over the last several decades from these invasive species. In that light, the Proposed Action significantly improves the refuge's ability to recuperate wildlife and habitat conditions and better contribute in the recovery actions for some listed species that are believed to be negatively affected by hog presence. Additionally, Alternative B is expected to lead to an increase in human health and safety for fishermen, waterfowl hunters, bird watchers, and other members of the public interested in the outdoor experiences offered by the refuge. This could result in a positive economic impact to the local area from increased visitation to Havasu NWR.

4.6 Unavoidable Adverse Effects

Implementation of feral swine eradication on the refuge may result in some temporary, unavoidable adverse impacts. Feral swine would be killed in the most humane manner possible. This species is considered an extremely invasive, non-native species that should be eradicated whenever possible to minimize adverse impacts on native species and habitats. There would also be some short-term disturbance to other resident wildlife, but these impacts are expected to be minimal. Opportunities for public recreation on Havasu NWR may be temporarily impacted during project implementation for the safety of refuge visitors.

4.7 Irreversible and Irrecoverable Commitment of Resources

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that this use could have on future generations. Irreversible effects primarily result from the use or destruction of specific resources that cannot be replaced within a reasonable time-frame, such as energy or minerals. Irrecoverable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action, such as extinction of a threatened or endangered species or the disturbance of a cultural resource.

None of the alternatives would result in a large commitment of nonrenewable resources, primarily fuel for vehicles. Project implementation of Alternative B would require the irretrievable additional commitment of a small amount of fossil fuels (gasoline, oil, and lubricant) used by vehicles and aircraft for a short time period. Roads and parking areas would be maintained and law enforcement activities would increase under Alternative C.

4.8 Summary of Impacts by Alternative

Table 4.8-1 Summary of Environmental Consequences by Alternative

Environmental Resource	Alternative A: Current Management	Alternative B: Eradication of Swine
Impacts to Air Quality	No change	Slight, short-term decrease in air quality due to rotor wash and vehicle emissions and the stirring of road dust
Impacts to Water Quality and Quantity	No change	Positive effect due to lack of swine wallowing and rooting and fowling water
Impacts to Soils	No change	Positive effect due to lack of swine wallowing and rooting
Impacts on Habitat	Negative direct impacts to habitat with continued swine populations	Positive effect on habitat
Impacts on Resident Wildlife	Negative direct impacts to resident wildlife with continued swine populations	Minimal direct negative effect (some disturbance and harvest); minor indirect effects mitigated by use of non-toxic ammunition
Impacts to Migratory Species	Negative direct impacts to migratory species with continued hog populations	Positive effect on migratory species
Impacts on Threatened and Endangered Species	Continued potential negative direct impacts to Ridgway's rails, narrow-headed and Northern Mexican gartersnakes	Short-term effects during project implementation. Long-term positive effects for recovery.
Impacts on Socioeconomic Resources	No change	Possible positive impacts, or same as alternative A
Impacts to Visitor Service/Recreation	No change	Short-term effects during project implementation
Impacts on Public Health and Safety	No change or slight negative increase if swine population increases.	Reduction in human health and safety issues as a result of absence of feral swine
Impacts of Refuge Facilities	No change	Short-term increase in road use during project implementation

5.0 CONSULTATION, COORDINATION and DOCUMENT PREPARATION

This document was prepared by Brenda Zaun. Havasu NWR staff and Regional Inventory and Monitoring staff are working with USDA-APHIS-WS concerning the proposed implementation of the Havasu NWR Feral Swine Eradication plan in a collaborative effort to eradicate feral

swine statewide under the National Integrated Feral Swine Damage Management Program (USDA 2015).

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6.0 APPENDICES

Appendix A DEFINITION OF TERMS

Carrying capacity is the maximum population of a particular organism that a given environment can support without detrimental effects.

Effects

Direct effects are the impacts that would be caused by the alternative at the same time and place as the action.

Indirect effects are impacts that occur later in time or distance from the triggering action.

Cumulative effects are incremental impacts resulting from other past, present, and reasonably foreseeable future actions, including those taken by federal and non-federal agencies, as well as undertaken by private individuals. Cumulative impacts may result from singularly minor but collectively significant actions taking place over a period of time.

Impact Type

Beneficial/positive impacts are those resulting from management actions that maintain or enhance the quality and/or quantity of identified refuge resources or recreational opportunities.

Adverse/negative impacts are those resulting from management actions that degrade the quality and/or quantity of identified refuge resources or recreational opportunities.

Duration of Impacts

Short-term impacts affect identified refuge resources or recreational opportunities; they occur during implementation of the management action but last no longer.

Medium-term impacts affect identified refuge resources or recreational opportunities that occur during implementation of the management action; they are expected to persist for some time into the future though not throughout the life of the CCP.

Long-term impacts affect identified refuge resources or recreation opportunities; they occur during implementation of the management action and are expected to persist throughout the life of the Plan and possibly longer.

Intensity of Impact

Insignificant/negligible impacts result from management actions that cannot be reasonably expected to affect identified refuge resources or recreational opportunities at the identified scale.

Minor impacts result from a specified management action that can be reasonably expected to have detectable though limited effect on identified refuge resources or recreation opportunities at the identified scale.

Moderate impacts result from a specified management action that can be reasonably expected to have apparent and detectable effects on identified refuge resources or recreation opportunities at the identified scale.

Major impacts result from a specified management action that can be reasonably expected to have readily apparent and substantial effects on identified refuge resources and recreation opportunities at the identified scale.