Draft Environmental Assessment for San Luis National Wildlife Refuge Complex Feral Pig Monitoring and Management Plan

February 2024

U.S. Department of Interior
Fish and Wildlife Service
Region 8 (Pacific Southwest Region)
San Luis National Wildlife Refuge Complex
Stanislaus, San Joaquin, and Merced Counties, California

Executive Summary

This environmental assessment (EA) evaluates one action alternative, a no action alternative, and alternatives considered, but dismissed from further consideration. The proposed action would be implementing feral pig monitoring and management within the San Luis National Wildlife Refuge (NWR or Refuge) Complex on fee-title and easement land, which includes the San Joaquin River NWR, San Luis NWR, Merced NWR, and Grasslands Wildlife Management Area (WMA). The proposed feral pig monitoring and management activities would be in accordance with the *San Luis NWR Complex Feral Pig Monitoring and Management Plan* (Plan). This EA has been prepared concurrent with the Plan. The no action alternative would not implement feral pig monitoring and management activities within the San Luis NWR Complex. The proposed action is important in order to prevent the establishment of a feral pig population within the approximately 128,747-acre San Luis NWR Complex located in Merced, Stanislaus, and San Joaquin counties and thus prevent further damage to sensitive environmental resources caused by this destructive species.

This EA examines the potential environmental impacts associated with the proposed action and complies with the National Environmental Policy Act (NEPA), in accordance with the Council on Environmental Quality NEPA regulations (40 Code of Federal Regulations, or CFR, 1500-1509), the Department of the Interior NEPA regulations (43 CFR 46; 516 Department Manual, or DM, 8), United States (U.S.) Fish and Wildlife Service (Service) policies, as outlined in the Service Manual (550 Fish and Wildlife, or FW, 3, NEPA Documenting and Implementation; 569 FW 1, Integrated Pest Management; 601 FW 3, Biological Integrity, Diversity, and Environmental Health; and other relevant regulations and requirements. NEPA requires examination of the effects of proposed actions on the natural and human environment.

The following resources either (1) do not exist within the project area or (2) would either not be affected or only negligibly affected by the proposed action: traffic and historic properties. Therefore, these resources are not analyzed in this EA.

Chapter 1: Introduction

1.1 Background

Each NWR is guided by the mission and goals of the NWR System (Refuge System), the purposes of an individual refuge, Federal laws, Executive Orders, Service Policy, and international treaties. Relevant guidance includes, but is not limited to, the National Wildlife Refuge System Administration Act (Administration Act) of 1966, as amended (16 United States Code [U.S.C.] 668dd et seq.), the Refuge Recreation Act of 1962, selected portions of the Code of Federal Regulations, and the Service Manual.

The mission of the Refuge System is:

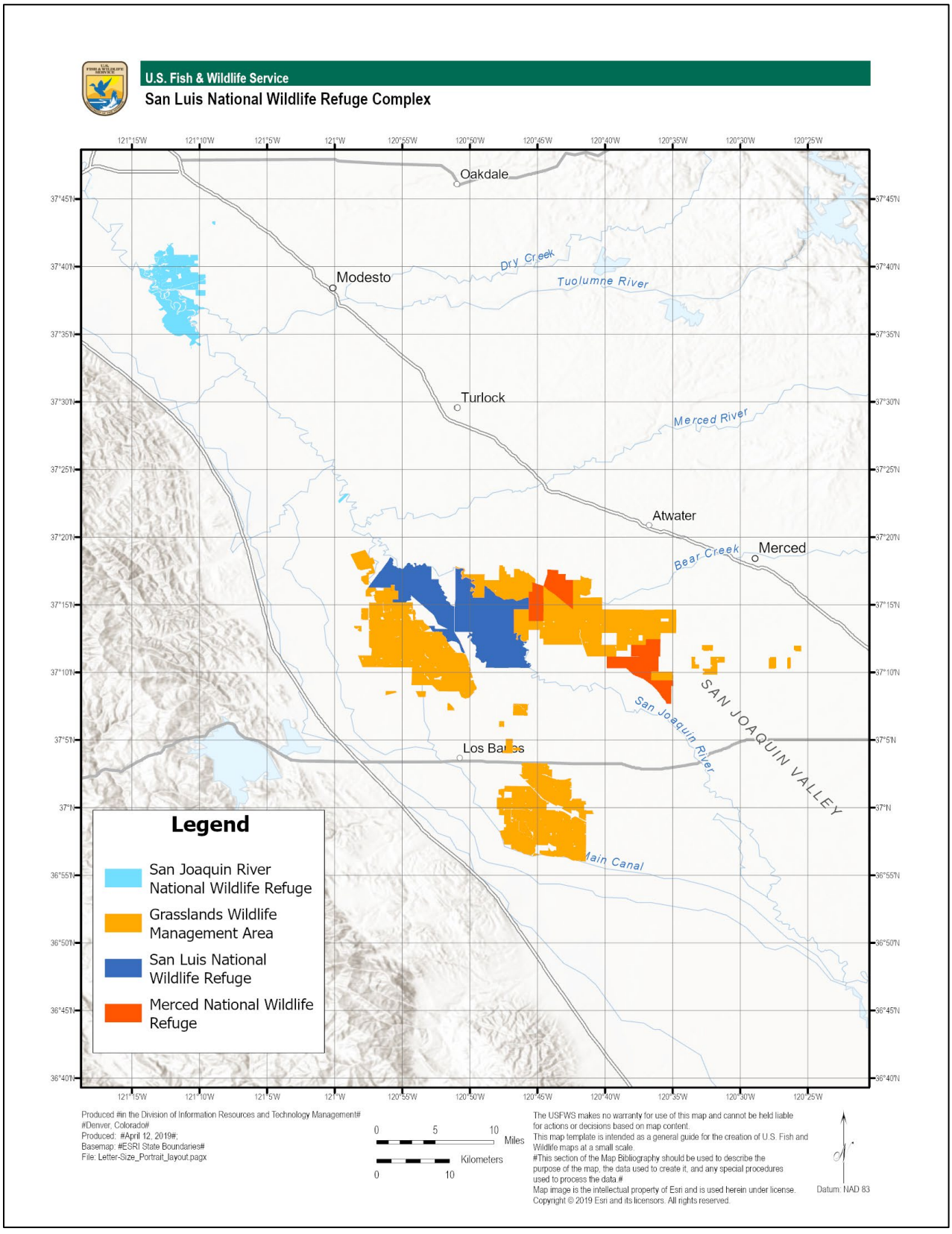
> *"... to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (*U.S.C. 668dd(a)(2))

The Administration Act directs the Secretary of the Interior to manage each Refuge to fulfill the mission of the Refuge System and individual Refuge purposes (16 U.S.C. 668dd(a)(3)(A)). Additionally, the Administration Act mandates the Secretary of the Interior in administering the NWRS (16 U.S.C. 668dd(a)(4)) to:

- Provide for the conservation of fish, wildlife, and plants, and their habitats within the Refuge System;
- Ensure that the biological integrity, diversity, and environmental health of the Refuge System are maintained for the benefit of present and future generations of Americans;
- Ensure that the mission of the NWRS described at 16 U.S.C. 668dd(a)(2) and the purposes of each Refuge are carried out;
- Ensure effective coordination, interaction, and cooperation with owners of land adjoining refuges and the fish and wildlife agency of the states in which the units of the Refuge System are located;
- Assist in the maintenance of adequate water quantity and water quality to fulfill the mission of the Refuge System and the purposes of each Refuge;
- Recognize compatible wildlife-dependent recreational uses as the priority general public uses of the Refuge System through which the American public can develop an appreciation for fish and wildlife;
- Ensure that opportunities are provided within the Refuge System for compatible wildlife-dependent recreational uses; and
- Monitor the status and trends of fish, wildlife, and plants in each Refuge.

The San Luis NWR Complex supports significant waterfowl and waterbird resources, and provides habitat for populations of other sensitive species (see **Figure 1**, *San Luis NWR Complex Location Map*). This NWR Complex protects and restores many of the unique, native upland, wetland, and riparian habitats of the Central Valley, as well as the wildlife and plants that they support.

Figure 1. San Luis NWR Complex Location Map



San Joaquin River NWR

The San Joaquin River NWR was established in 1987 for the purpose of preserving wetland, grassland, pasture, and riparian habitats for use by the previously endangered Aleutian Canada geese (*Branta canadensis leucopareia*), as well as four other endangered wildlife and plant species, and a great variety of Pacific Flyway geese, ducks, cranes and other birds (USFWS 1987, see **Figure 2**, Land Status Map – San Joaquin River NWR).

The initial acquisition that established the San Joaquin River NWR was made under the authorities of:

> The Endangered Species Act (ESA) of 1973 (16 U.S. Code 1531-1543; 87 Statute 884), as amended; Migratory Bird Conservation Act of 1929; and Fish and Wildlife Act of 1956, using funds made available through the Land and Water Conservation Fund Act of 1965 (U.S. Code 4601-4-4601011; 78 Statute 897).

The San Joaquin River NWR purposes, as stated in the law, are:

> *"To conserve (A) fish or wildlife which are listed as endangered species or threatened species or (B) plants..."* 16 U.S.C. § 1534 (ESA of 1973)
>
> *"...For use as an inviolate sanctuary, or for any other management purpose, for migratory birds."* 16 U.S.C. § 715d (Migratory Bird Conservation Act of 1929)
>
> *"...For the development, advancement, management, conservation, and protection of fish and wildlife resources."* 16 U.S.C. § 742f(a)(4)
>
> *"...For the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition and servitude."* 16 U.S.C. § 742f(b)(1) (Fish and Wildlife Act of 1956)

Goals of the San Joaquin River NWR include:

> *"Conserve and protect the natural diversity of migratory birds, resident wildlife, fish and plants through restoration and management of riparian, upland and wetland habitats on Refuge lands."*
>
> *"Contribute to the recovery of threatened/ endangered species, as well as the protection of populations of special status wildlife and plant species and their habitats.*
>
> *"Provide optimum wintering habitat for Aleutian Canada geese to ensure the continued recovery from threatened and endangered species status."*
>
> *"Coordinate the natural resource management of the San Joaquin River National Wildlife Refuge within the context of the larger Central Valley/San Francisco Ecoregion."*
>
> *"Provide the public with opportunities for compatible, wildlife-dependent visitor services to enhance understanding, appreciation and enjoyment of natural resources at the San Joaquin River NWR."*

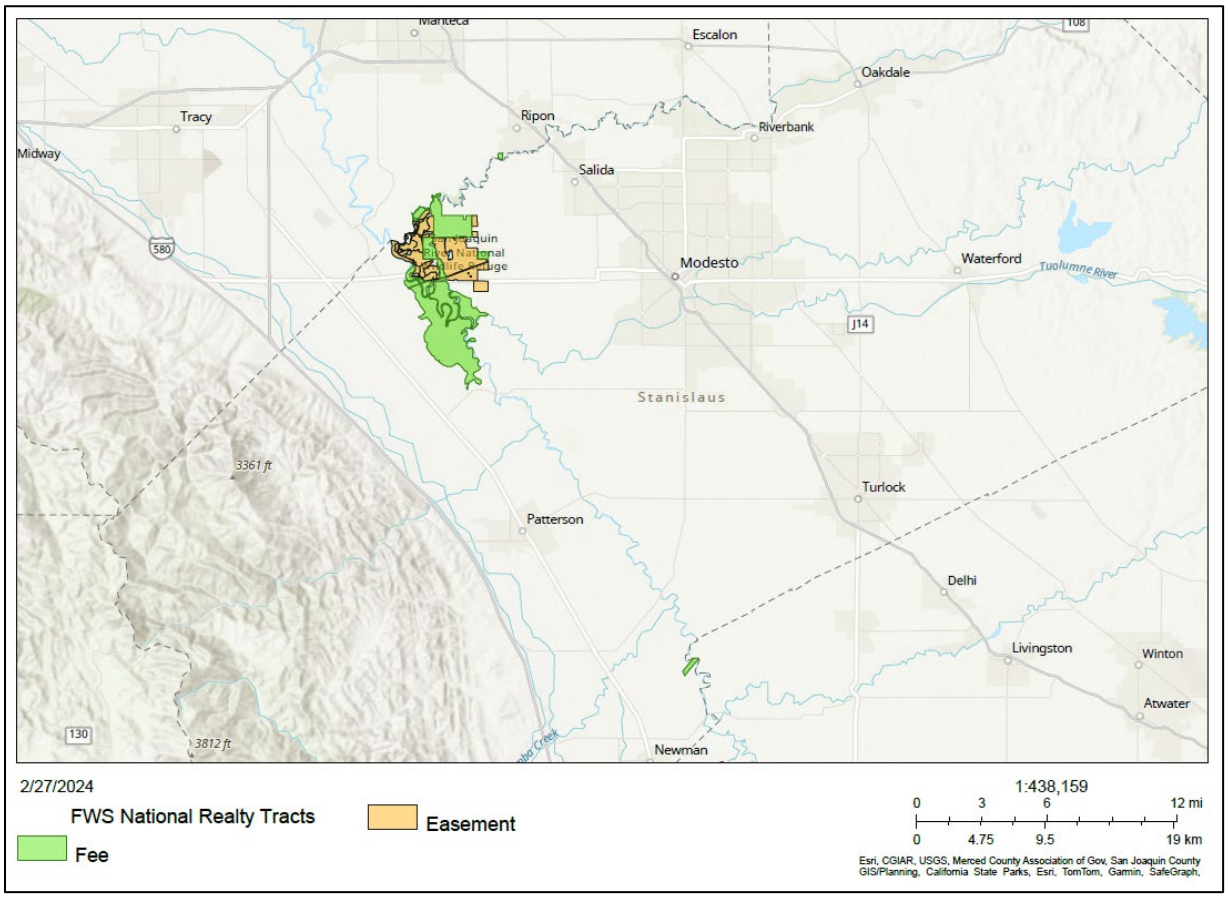
San Joaquin River NWR is managed to conserve, protect, and enhance native habitats of the San Joaquin Valley, focusing on wildlife and the ecological processes on which they depend. Due to intensive land use and development, a large portion of native habitats and species have been reduced within the

Central Valley. The Refuge maintains the land as an important riparian corridor within the State's Central Valley by conserving and restoring the native habitats (Service 2006).

The San Joaquin River NWR expanded their focus in 1999 to include protecting floodplain lands through acquisition and restoration of floodplain habitats, as well as function of those lands. The goal for the San Joaquin River NWR is to restore and enhance habitat for threatened, endangered, and sensitive wildlife species, while increasing connectivity to existing riparian habitat, and creating self-sustaining native habitats (Service 2011a). The Service purchased over 3,000 acres of land between 1998 and 2000 to contribute to the San Joaquin River NWR and have garnered $24.5 million in grant funding for both riparian and floodplain restoration since 2002. Approximately 2,700 acres of riparian woodland habitat and 700 acres of wetland habitat, as well as eight miles of flood refugia on levee slopes, has been restored within this Refuge (Service 2021a). In addition, re-establishment of the Federally endangered riparian brush rabbit (*Sylvilagus bachmani riparius*) was initiated in 2002 at the San Joaquin River NWR as part of the species' recovery program.

The San Joaquin River NWR's focus has expanded over time to include other threatened and endangered species, migratory birds, wildlife dependent on wetlands and riparian floodplain habitat, as well as restoration of habitat and ecological processes. However, providing wintering habitat for Aleutian Canada geese and protecting this species remains a primary objective of this Refuge. The San Joaquin River NWR and its management have assisted in the recovery of the Aleutian Canada goose and its removal from the Threatened and Endangered Species list. This species was delisted in 2001 and the population expanded to approximately 215,000 in 2022 (Service 2022). The San Joaquin River NWR and adjacent lands still provide important wintering habitat for Aleutian Canada geese even as the wintering population size has increased and expanded to other areas, including northern California counties (Pacific Flyway Council 2023).

Figure 2. Land Status Map - San Joaquin River NWR



San Luis NWR

The San Luis NWR was established in 1967, in order to provide habitat for migratory birds. The initial acquisition that established the San Luis NWR was made under the authority of the Migratory Bird Conservation Act of 1929 (see **Figure 3**, *Land Status Map – San Luis NWR, Merced NWR, and Grasslands WMA*).

The San Luis NWR purposes, as stated in the law, are:

> *"…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds."* 16 U.S.C. § 715d (Migratory Bird Conservation Act of 1929)
>
> *"... shall be administered by him [Secretary of the Interior] directly or in accordance with cooperative agreements ... and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon..."* 16 U.S.C. § 664 (Fish and Wildlife Coordination Act of 1934)
>
> *"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..."* 16 U.S.C. § 742f(a)(4)

> *"... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..."* 16 U.S.C. § 742f(b)(1) (Fish and Wildlife Act of 1956)

Goals of the San Luis NWR include:

> *"Conserve, protect, manage, restore and enhance natural habitats and associated plant and wildlife species of the Northern San Joaquin Valley on Complex lands, with an emphasis on supporting an abundance and natural diversity of migratory birds including waterfowl, shorebirds, waterbirds, raptors, songbirds and other wildlife."*
>
> *"Contribute to the recovery of threatened/endangered species as well as the protection and management of populations of endemic Central Valley wildlife and special status wildlife, plants and habitats."*
>
> *"Provide the public with opportunities for compatible, wildlife-dependent recreation and other uses to enhance understanding, appreciation and enjoyment of natural resources on the Complex."*
>
> *"Maintain and/or restore natural ecological processes to promote healthy, functioning ecosystems for wildlife on Complex lands by developing strong partnerships with Partners, research institutions, and other local, state and Federal agencies. Coordinate the natural resource management of the Complex's natural resources within the larger context of the Central Valley/San Francisco Ecoregion and Pacific Flyway"* (Service 2023).

The San Luis NWR is the largest contiguous Refuge in the Refuge System in California's Central Valley and includes sensitive habitats, such as annual grasslands, riparian corridors, and wetlands, including vernal pools (Service 2023).

Merced NWR

In 1951 the Merced NWR was established and was the first acquisition of the San Luis NWR Complex. This NWR was acquired under the Lea Act of 1948 (16 U.S.C. 695-695c; 62 Stat. 238) for the purpose of protecting surrounding agricultural land from waterfowl depredation by attracting these birds to the Merced NWR. Additional acquisitions occurred under the authorities of the ESA of 1973 (16 U.S. Code 1531-1543; 87 Statute 884), as amended; the Migratory Bird Conservation Act of 1929; the Fish and Wildlife Act of 1956, as amended; and the Refuge Recreation Act of 1962 (see **Figure 3**, *Land Status Map – San Luis NWR, Merced NWR, and Grasslands WMA*).

The Merced NWR purposes, as stated in the law, are:

> *"...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds."* 16 U.S.C. § 715d (Migratory Bird Conservation Act of 1929)
>
> *"...for the management and control of migratory waterfowl and other wildlife ..."* 16 U.S.C. § 695 (Lea Act of 1948)
>
> *"…to conserve (A) fish or wildlife which are listed as endangered species or threatened species …. or (B) plants …"* 16 U.S.C. Sec 1534 (ESA of 1973)

Goals of the Merced NWR include:

> *"Conserve, protect, manage, restore and enhance natural habitats and associated plant and wildlife species of the Northern San Joaquin Valley on Complex lands, with an emphasis on supporting an abundance and natural diversity of migratory birds including waterfowl, shorebirds, waterbirds, raptors, songbirds and other wildlife."*
>
> *"Contribute to the recovery of threatened/endangered species as well as the protection and management of populations of endemic Central Valley wildlife and special status wildlife, plants and habitats."*
>
> *"Provide the public with opportunities for compatible, wildlife-dependent recreation and other uses to enhance understanding, appreciation and enjoyment of natural resources on the Complex."*
>
> *"Maintain and/or restore natural ecological processes to promote healthy, functioning ecosystems for wildlife on Complex lands by developing strong partnerships with Partners, research institutions, and other local, state and Federal agencies. Coordinate the natural resource management of the Complex's natural resources within the larger context of the Central Valley/San Francisco Ecoregion and Pacific Flyway"* (Service 2023).

Since the original acquisition, no additional land was acquired for this Refuge until the 1990s, which included adding the Arena Plains unit in 1992, and supports at least nine natural communities, including vernal pool, freshwater marsh, native grassland, and a remnant of the Merced River Alluvial Dune Ecosystem. This area has not been cultivated or irrigated and thus supports a wide diversity of endemic, rare, and endangered plants and animals that were once abundant throughout California's Central Valley (Service 2023). Additional land has been added to the Merced NWR since that time and the Refuge is split into four discrete parcels, the Merced unit, Snobird unit, Lone Tree unit, and the Arena Plains unit.

Grasslands WMA

The Grasslands WMA was officially established in 1979 pursuant to the Migratory Bird Conservation Act of 1929, with the requirement of the lands within the easement program benefiting migratory birds, and specifically waterfowl. The purpose of the easements is to provide waterfowl habitat, in addition to protecting land from urban and agricultural encroachment (Service 2023).

The initial approval of the acquisition boundaries occurred in 1978 and was approved by the Migratory Bird Conservation Commission for the West Grasslands WMA, which allowed for the establishment of Conservation Easements on privately owned land (see **Figure 3**, *Land Status Map – San Luis NWR, Merced NWR, and Grasslands WMA*).

The Grasslands WMA purposes, as stated in the law, are:

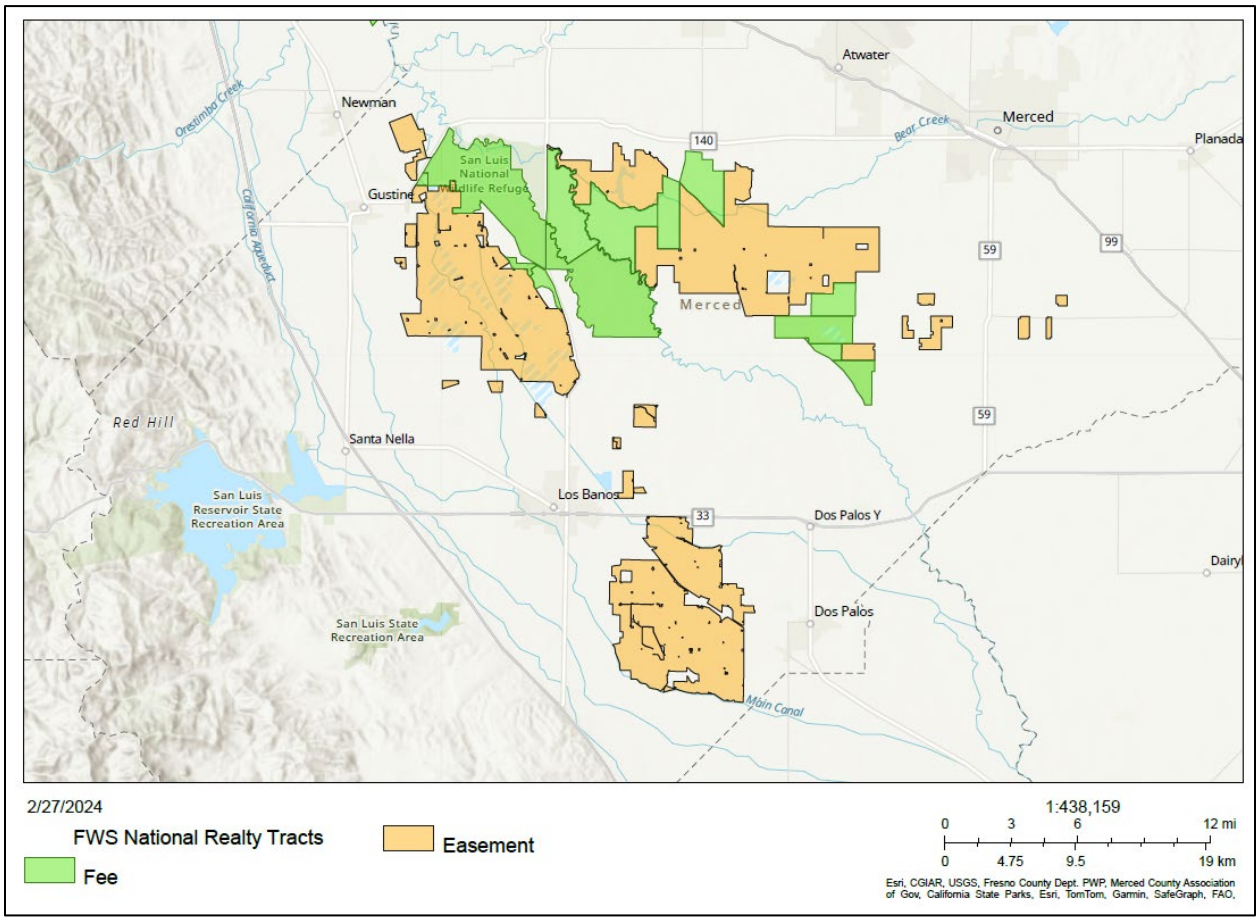
> *"...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds."* 16 U.S.C. § 715d (Migratory Bird Conservation Act of 1929)
>
> *"...the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions..."* 16 U.S.C. § 3901(b) (Emergency Wetlands Resources Act of 1986)

> *"...to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..."* 16 U.S.C. § 1534 (ESA of 1973)

The goal of the Grasslands WMA is to:

> *"Manage the Service's easement program on private lands for the benefit of wildlife and explore the potential for additional wildlife easement from willing sellers within the approved easement acquisition boundary"* (Service 2023).

Figure 3. Land Status Map - San Luis NWR, Merced NWR, and Grasslands WMA



1.2 Proposed Action

The Service is proposing to implement a Feral Pig Monitoring and Management Plan for the San Luis NWR Complex. The proposed action would assist in achieving the purposes for which the Refuges within the San Luis NWR Complex were established and would help in fulfilling the mission of the Refuge System and ensure the biological integrity, diversity, and environmental health of the Refuge System are maintained. The Plan describes the details of future actions to monitor and control, when deemed necessary, the presence of feral pigs within the San Luis NWR Complex.

The proposed action may evolve during the NEPA process as the Service refines its proposal and gathers feedback from the public, tribes, and other agencies. Therefore, the final proposed action may be

different from the original. The proposed action would be finalized at the conclusion of the public comment period for the EA.

1.3 Purpose and Need for Action

The purpose of the proposed action is to prevent the establishment of a feral pig population by controlling for the species, as well as reducing damage associated with feral pigs within the approximately 128,747-acre San Luis NWR Complex. The proposed action would assist in protecting the cultural resources, sensitive habitats, and listed species that occur within the San Luis NWR Complex.

The Service would be implementing the Plan, with the following objectives for the proposed project:

1. Within three years of implementation of initial control efforts, achieve a 50 percent or greater decline in feral pig detections compared to baseline camera survey results.
2. Within five years of implementation of control methods, achieve 80 percent or great decline in feral pig detections compared to baseline camera survey results.
3. Reinitiate control efforts within one year of determining that a resident population is forming on the Complex or if negative impacts to sensitive environmental resources from this invasive species are observed.

Carrying out these objectives is dependent on availability of funding and resources. Monitoring methods may change to better suit the conditions and/or needs.

The proposed action would meet the Refuge purposes, as stated in Section 1.1 above, by:

> Conserving fish or wildlife which are listed as endangered or threatened species or plants; protecting habitat from destruction that acts as an inviolate sanctuary for migratory birds; managing, conserving, and protecting fish and wildlife resources; and for the benefit of the Service in performing its activities and services.

The need of the proposed action is to meet the Service's priorities and mandates, as outlined by the Administration Act to:

- Provide for the conservation of fish, wildlife, and plants, and their habitats within the Refuge System;
- Ensure that the biological integrity, diversity, and environmental health of the Refuge System are maintained for the benefit of present and future generations of Americans;
- Ensure that the mission of the Refuge System described at 16 U.S.C. 668dd(a)(2) and the purposes of each refuge are carried out;
- Ensure effective coordination, interaction, and cooperation with owners of land adjoining refuges and the fish and wildlife agency of the states in which the units of the Refuge System are located; and
- Assist in the maintenance of adequate water quantity and water quality to fulfill the mission of the Refuge System and the purposes of each Refuge.

Domestic pigs (*Sus scrofa*) were brought to California by Spanish and Russian settlers in the early 1700s as livestock; however, many became feral and in the 1920s the European wild boar was introduced and bred with the domestic pigs. These introductions created wild boar/feral domestic pig hybrids, which ravage native landscapes (California Department of Fish and Wildlife [CDFW] 2023). Feral pigs, which are

known to carry a wide variety of diseases and parasites, are a destructive species with a voracious appetite, including preying on native wildlife and plants. One study reported 49 spadefoots (*Scaphiopus holbrookii*) in the stomach of a single feral pig (Finzel and Baldwin 2015). This invasive species has an affinity for acorns, thus reducing the regeneration of oak trees in California and causing damage to their root systems. They are known to reduce habitat quality for native and listed species (candidate, threatened, and endangered), in addition to competing with native wildlife for food sources, such as mule deer (*Odocoileus hemionus*) that depend on the hard mast crops that feral pigs prefer. Through their natural behavior of rooting and wallowing, they uproot native plants and expose bare soil for invasive plant species to invade, in addition to causing erosion and water quality issues for sensitive riparian areas (Finzel and Baldwin 2015). Feral pigs have contributed to the decline of almost 300 native flora and fauna, over 250 of which are listed as threatened or endangered in the U.S. (USDA 2020a).

Approximately 1.5 billion is spent annually to cover control costs and repair damages caused by this invasive species within the U.S. (Glow et al. 2020). The recent presence of feral pigs within the San Luis NWR Complex has caused considerable damage to sensitive habitats utilized by native wildlife, including listed species, due to this invasive species rooting around wetland edges and within riparian forests (see **Figures 4** and **5** for *Northern* and *Southern Portion of San Joaquin River NWR – Feral Pig Distribution Maps*). The recent passage of California Senate Bill 856 supports the reduction of feral pig populations statewide and prohibits the intentional release of this invasive species into the wild (California State Legislature 2022).

Figure 4. Northern Portion of San Joaquin River NWR - Feral Pig Distribution Map

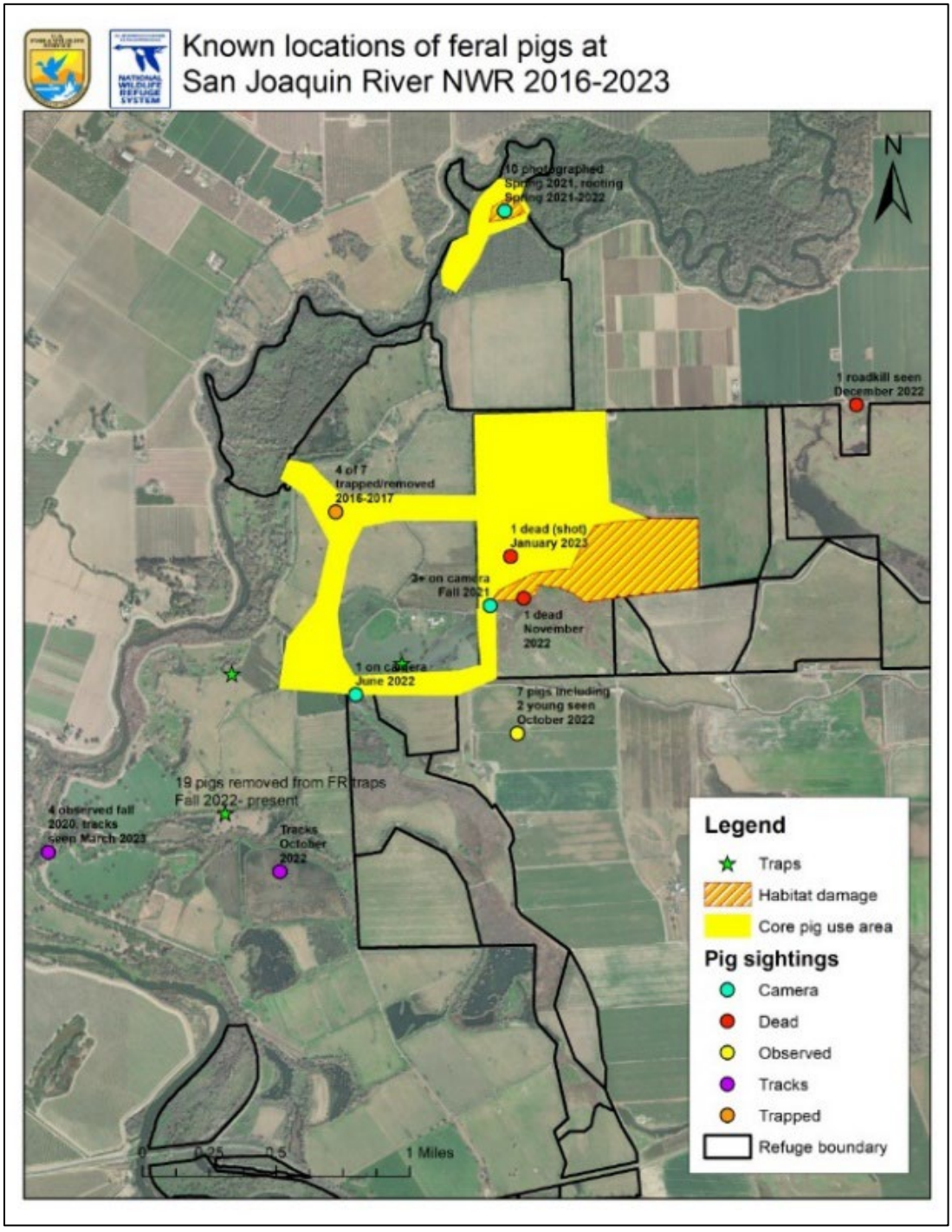
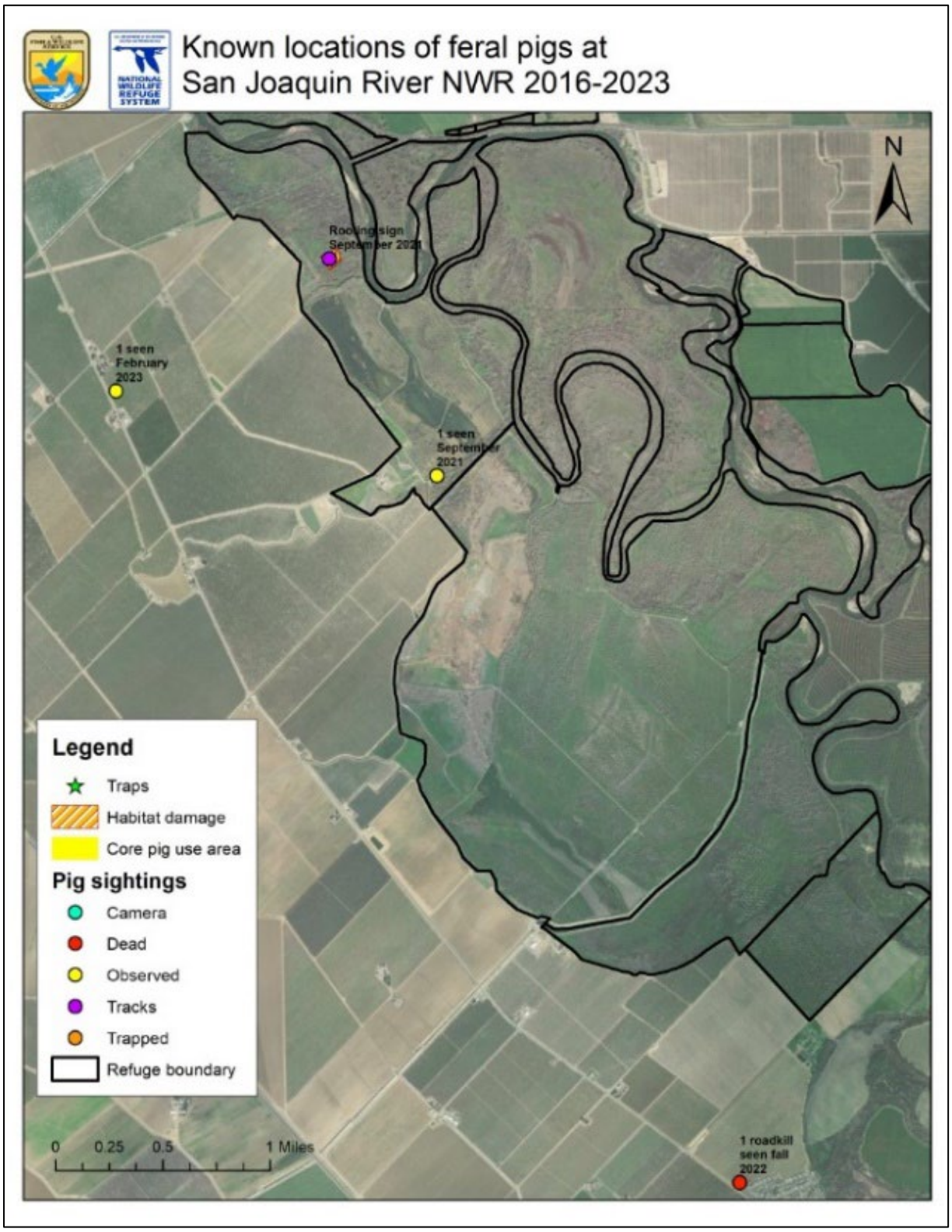
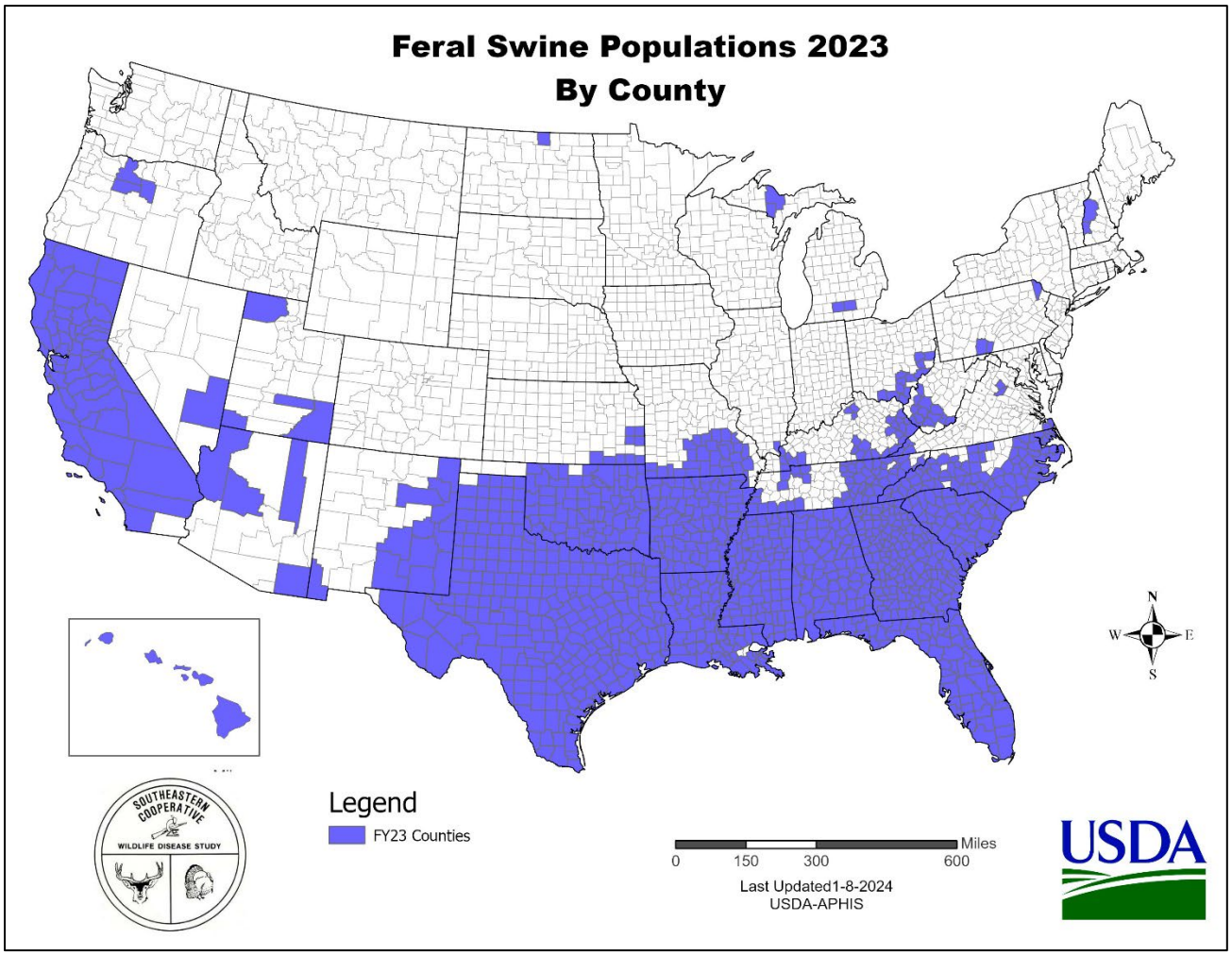


Figure 5. Southern Portion of San Joaquin River NWR – Feral Pig Distribution Map



The San Luis NWR Complex is located on the northern boundary of the Grasslands area, which contains the largest remaining acreage of freshwater wetlands in California (Service 2023). Feral pig presence within the San Luis NWR Complex was not observed until 2016, when they were documented within the San Joaquin River NWR. Implementation of the proposed Plan would prevent further damage to sensitive environmental resources within the Complex that is caused by this destructive species, which are considered an invasive species throughout the U.S., with a rapidly expanding population that is currently estimated at six million (USDA 2023; see **Figure 6**, *Feral Pig Distribution Map*).

Figure 6. Feral Pig Distribution Map



The Service is proposing monitoring and management in the Plan through the use of the following tools:

1) Pre-trapping camera surveys with or without bait
2) Telemetered Animal
3) Spotlighting and driving/walking surveys
4) Uncrewed Aerial System (Drone) flights
5) Detector dogs
6) Trapping
7) Dispatching

Chapter 2: Involvement, Coordination and Consultation

2.1 Public Involvement

This draft EA would be available for public review and comment for 30 days from February 29th, 2024 to March 30th, 2024. Members of the public would be notified of the availability of the draft documents via email and posted on the San Luis NWR website. The draft document would be made available at the San Luis NWR visitor center at 7376 S. Wolfsen Road Los Banos, CA 93635, via email and can be downloaded from the San Luis NWR website. For access to the document in an alternative format, please contact the Refuge. Comments may be submitted in writing via email. Any comments, concerns, suggestions or other feedback would be incorporated into the final EA if a substantive response is required.

Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware that your entire comment, including your personal identifying information, may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we would be able to do so.

2.2 Federal and State Coordination

The Service is coordinating with the U.S. Department of Agriculture Wildlife Services (USDA WS) on the proposed monitoring and management efforts and would attain a CDFW depredation permit. Following approval of the Plan, the Service will enter into an Inter-Agency Agreement with the USDA WS for implementation of feral pig monitoring and management methods within the San Luis NWR Complex.

2.3 Tribal Coordination

The Service is coordinating with the following Tribes that have cultural ties to the general area where the proposed action would occur: Big Sandy Rancheria of Western Mono Indians of California, California Valley Miwok Tribe, Chicken Ranch Rancheria of Me-Wuk Indians of California, Cold Springs Rancheria of Mono Indians of California, Ione Band of Miwok Indians of California, Jackson Band of Miwuk Indians, Northfork Rancheria of Mono Indians of California, Picayune Rancheria of Chukchansi Indians of California, Santa Rosa Rancheria Tachi Yokut Tribe, Table Mountain Rancheria of California, Tule River Indian Tribe of the Tule River Reservation, Tuolumne Band of Me-Wuk Indians of the Tuolumne Rancheria of California, and Wilton Rancheria.

Chapter 3: Alternatives

3.1 Decision Framework

The Region 8 of the Service Assistant Regional Director, Refuges will make two decisions based on this EA once the review process is complete. They will: (1) select an alternative for implementation, and (2) determine if the selected alternative is a major Federal action that would significantly affect the quality of the human environment, and therefore, require the preparation of an environmental impact statement.

3.2 Alternative A – Continue Current Management Strategies - No Action Alternative

Alternative A proposes no changes to the present wildlife and habitat management actions implemented within the San Luis NWR Complex and no new actions would be implemented. This alternative represents the baseline from which other “action” alternatives would be evaluated. Under this alternative, management of feral pigs within the San Luis NWR Complex, would not occur, as the

Plan would not be implemented. While there are incidental observations of feral pigs within the Complex, no formal monitoring would occur under this alternative and therefore the full extent of the feral pig population and associated damage caused by this invasive species would not be known. Due to the lack of feral pig control on the San Luis NWR Complex under this alternative, they may continue harboring in the Complex, thus reducing the effectiveness of current feral pig control efforts conducted by any adjacent landowner. Under this alternative there would be no coordinated efforts with adjacent landowners and impacts to their agricultural land from feral pigs going between the Complex and private land could continue.

With no Plan implementation, feral pigs would continue to cause damage to the sensitive environmental resources that the San Luis NWR Complex serves to protect, such as riparian and floodplain habitat that was restored within the San Joaquin River NWR. The habitats contained within the Complex that are of international importance for migratory waterfowl and shorebirds of the Pacific Flyway would continue to be degraded by feral pigs rooting, wallowing, and trampling behavior.

The population of this invasive species would continue to increase within the Complex, as they have a high reproductive rate and can start reproducing at only six to nine months of age. Although the average litter size is five to six piglets, one female can produce up to two litters per year, with as many as 18 per litter. A quickly reproducing population with voracious appetites lead to competition with native wildlife for food sources. In addition to degrading native habitats and competing with native wildlife, this non-native species can host close to 40 parasites and around 30 diseases, with potential to spread to native species. As carriers of five major waterborne pathogens, they can contaminate drinking water, in addition to potentially being carriers for 20 diseases that can be spread to humans (Finzel and Baldwin 2015).

This highly invasive species, which is already documented in 56 out of 58 of California's counties, is extremely costly to the U.S. in part due to the damage they cause to native landscapes, agricultural land, and urban areas. One study documented a six to ten percent loss in revenue in agricultural commodities when feral pigs are present (Finzel and Baldwin 2015). Under Alternative A, damage within and potentially surrounding the San Luis NWR Complex in adjacent agricultural land could continue to grow as the feral pig population is left unmanaged within the Complex and coordinated efforts with adjacent landowners already managing for feral pigs would not occur. The Alternative 1, No Action is required under the NEPA of 1969 and establishes a baseline for comparing the present management direction and environmental consequences of the proposed action alternative.

3.3 Alternative B – Implement the San Luis NWR Complex Feral Pig Monitoring and Management Plan - Preferred Alternative

The San Luis NWR Complex has prepared a Plan, which is presented in this document as the proposed action alternative. As feral pig management is often challenging due to the prolific nature of the species, efficient and effective population "management" is necessary for the protection of sensitive resources within the San Luis NWR Complex. Control effort administration would be under the jurisdiction of Service personnel, USDA WS, or other cooperator pursuant to *Executive Order 13751*, which directs Federal agencies whose actions may affect the status of invasive species to reduce invasion of exotic species and associated damages to the extent practicable and permitted by law.

Under the proposed action alternative, the Service, with the assistance of the USDA WS or other cooperator, would monitor and manage feral pigs on the San Luis NWR Complex. The goal of the proposed action alternative is to prevent establishment of a feral pig population by managing for this invasive species, as well as reducing damage associated with the species.

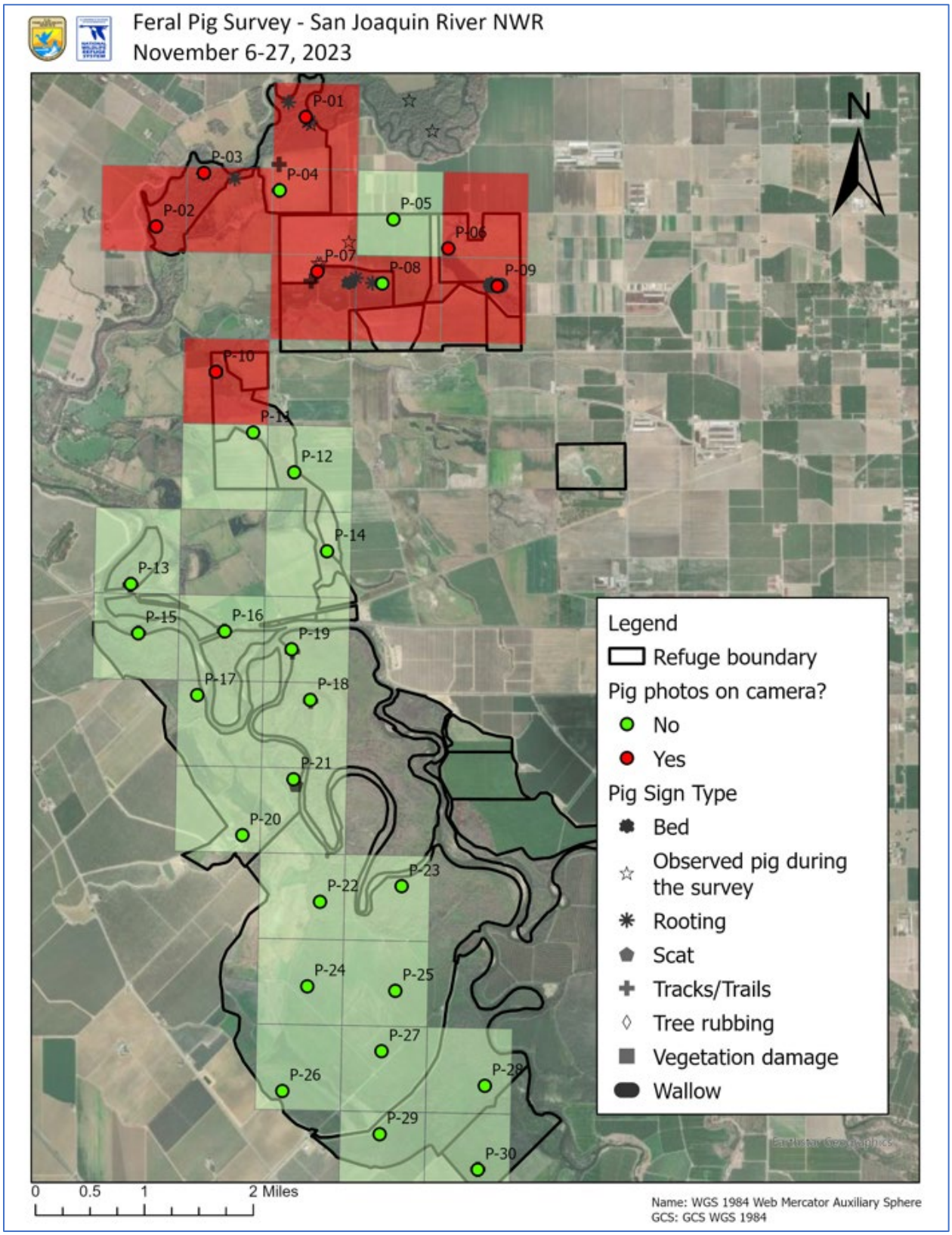
The proposed action alternative may utilize the following methods:

Inventory Feral Pig Population and Monitoring

Monitoring and trapping may initially occur within the San Joaquin River NWR, north of Highway 132. The results of the initial feral pig survey would assist in determining where trapping may initially occur within the San Joaquin River NWR (see **Figure 7**, *Initial Feral Pig Survey Results for the San Joaquin River NWR*). However, monitoring and management could occur throughout the San Luis NWR Complex, depending on where feral pig or their damage are observed.

The Service would conduct pre-trapping population surveys following the Feral Pig Camera Survey Protocol, which is Appendix C of the Plan, and may be updated in the future as adaptive management occurs. The pre-trapping population survey assists trapping and dispatching efforts by detailing locations of high feral pig use. Annual and post trapping population surveys would be completed in subsequent years to inform population trends and future trapping efforts, as necessary.

Figure 7. Initial Feral Pig Survey Results for the San Joaquin River NWR



Cameras with or without Bait

Feral pigs have poor eyesight and rely primarily on their sense of smell, which makes them sensitive to human presence. Use of remote cameras minimizes human presence and provides the ability to monitor large tracts of land (USDA 2015). Cameras may be utilized to identify the locations of feral pig within the San Luis NWR Complex, which can be used to track size and habits of sounders of pig (i.e., feral pigs that travel in family groups). This information may help concentrate trapping and ground shooting efforts by Service personnel or USDA WS in key areas and make those efforts as effective as possible. Contact with other landowners would be maintained to track feral pig sightings on adjacent privately owned lands. When pig activity is identified within the Complex, staff would respond immediately to initiate the control methods. Monitoring data would be used to adaptively manage where search, trapping, and dispatch activities should occur.

Cellular-enabled game cameras may be used for monitoring, which allows personnel to minimize travel expenses and monitor feral pig activity without disturbing bait and trap sites. Camera systems may be used with remote-activated cage traps to maximize the chance that an entire sounder is captured and minimize risks to non-target species. Some of the traps proposed may utilize remote trigger, while others may not and may be visually inspected, instead.

Telemetered Animal

A telemetered pig is generally an adult female that has been trapped and released by staff after attaching a radio-collar, as females tend to be part of a sounder (Parkes et al. 2010). The telemetered animal may then be monitored and located through telemetry. Once the sounder's location is discovered, the Service, USDA WS, or other cooperator would lethally remove the feral pig (USDA 2015).

Spotlighting and Driving/Walking Surveys

Surveyors may spotlight by vehicle in the early morning or evening to aid in detecting feral pigs. Surveys may also be conducted during the daytime and travel by vehicle along roads, via utility task vehicles (UTVs) or on foot to search for feral pig sign. Any observations of pig sign (tracks/trails, scat, wallows, rooting, beds, and tree rubbings) may be uploaded as point locations with an attached photo or staff may utilize other methods of documenting feral pig, as feasible. The survey area searched would be tracked. The survey tracks may be uploaded following the survey to detect areas that were not searched.

Uncrewed Aerial System (Drone) Flights

Drones may be utilized by the Service or USDA WS, according to current Service and/or Department of Interior Policy, to find the locations of feral pig within the San Luis NWR Complex where the canopy is open, as necessary. This monitoring action can assist in locating remaining feral pigs within the San Luis NWR Complex.

Detector Dogs

Tracking feral pig with dogs that are managed by Service personnel or USDA WS may be utilized to locate feral pig. Staff would be present whenever dogs are utilized and dogs would be trained to locate feral pig specifically.

Removal of Feral Pigs from San Luis NWR Complex

Two methods may be employed to remove feral pigs from the San Luis NWR Complex: 1) trapping and shooting, and 2) pursuit and shooting of individuals. The methods would be used strategically, and the

Service would coordinate with USDA WS and adjacent landowners in order maximize the reduction in feral pig numbers. It is anticipated that most feral pigs would be removed by trapping, with professional ground-based marksmen from USDA WS, Service personnel, or other cooperator used to pursue and shoot (dispatch) "trap-averse" feral pigs after trapping efforts have taken place. All feral pigs captured in traps located on the San Luis NWR Complex would be euthanized in situ and disposed of on-site by dragging away from the trap to facilitate recapture in the same trap, as well as to minimize possible spread of zoonotic diseases associated with feral pigs. Feral pig may also be transported off Complex for disposal or donation for animals, following general disease testing.

Trapping

Traps may be baited to attract feral pigs and types of traps may vary and include pig brig (a drop net), corral traps, box traps, or other types of cage traps. Traps may be baited with whole kernel corn or other types of bait, and the Service or USDA WS may install cellular-enabled game cameras adjacent to the traps. Trapping is anticipated to be the largest part of feral pig control efforts. The trapping efforts may focus on utilizing corral style traps large enough to hold multiple feral pigs in areas documented to be frequented by this invasive species. Open corral-style traps allow large non-target wildlife, such as deer, to escape. The number of traps utilized would be based on available and qualified personnel and the population of feral pigs in a treatment area.

Determinations as to where traps would be located would be based on the results of on-going efforts to monitor feral pig populations and their impacts. They may be set near water sources where pigs are likely to congregate and forage, as well as travel corridors and any other areas where feral pigs may occur. Traps would be placed to avoid resource damage and trapping in areas easily accessible by or visible to the public would be avoided as much as possible. Installation of traps by hand may involve minor ground disturbance associated with minor vegetation removal, and trap installation, including rebar stakes, driving t-posts and other earth anchors and cables to secure the trap to the ground, as necessary, to contain captured feral pig. The activity of the feral pigs themselves while they are inside the traps may also cause minor ground disturbance. Traps may be baited with corn, grain, or other food attractive to feral pigs.

All proposed trapping locations on the San Luis NWR Complex may be flagged on the ground and global positioning system (GPS) locations provided to Service archaeological and biological staff to avoid or minimize impacts to biological and cultural resources.

Humane treatment of captured feral pigs would be emphasized throughout the control program and traps would be checked daily. Traps would be placed in locations with at least partial shade to the greatest extent practicable. Traps set to capture feral pigs would be monitored in person or via cell phone cameras daily and captured pigs would be dispatched before noon to the greatest extent practicable. Dispatching would consist of careful yet quick and humane rifle shots to the head. Non-target animals like deer would be released by opening the traps to allow escape.

Trapping may take place year-round, as needed. Traps doors are locked open and pre-baited prior to being set to capture feral pigs. Successive pre-baiting and capture periods may continue for the duration of the trapping session. All trap sites would be preapproved by Refuge Manager. Technicians may move traps to new locations when no additional captures occur. At the end of the first session of intensive trapping, traps may be removed from trapping locations, cleaned, repaired, and stored until the next trapping session. If traps are not removed, they would be left open to ensure no impacts to native or

non-native species while the trap is not in use. Periodic surveys for fresh rooting and wallowing disturbance may be used to assist trackers in locating areas with active groups of feral pig. Trapping efforts would be utilized throughout the year, as feral pig and associated soil/vegetation damage are observed.

Dispatching Feral Pigs

Captured pigs would be dispatched quickly with a gunshot to the head using non-lead ammunition. Firearms may be equipped with noise suppressors. For scientific purposes and for evaluating the progress of the control effort for changes in population age structure, basic biological and wildlife disease, data or samples may be collected. After dispatching the pig, the carcass may remain on-site to decompose or transported off Complex for disposal or donation for animals, following general disease testing, consistent with CDFW codes and regulations and any other applicable laws and regulations.

Shooting of individual feral pigs may also be conducted without the use of traps, by shooting over bait piles, or ground hunting by Service staff, USDA WS, or another cooperator. Shooting feral pigs at night may occur, possibly with the use of night vision and suppressors.

Adaptive Management

Following five years of intensive feral pig monitoring and management efforts, if resource impacts from feral pigs have not been eliminated or drastically reduced within the San Luis NWR Complex, then the project goals would be re-evaluated. If it is determined through this evaluation that feral pig elimination or drastic reduction in population is not a practical objective, efforts would be re-evaluated to determine what amount of feral pig reduction and overall management is feasible to protect the resources.

Public Safety and Risk Management

Public and worker safety would be a top priority during all feral pig management activities. Service staff would be trained in safe firearm and trap operation prior to the first trapping efforts and refreshed the beginning of each year thereafter, in addition to trained USDA WS or other cooperator.

Mitigation Measures

The following mitigation measures would be implemented to minimize and avoid negative effects to the environment:

1. Surveys for Feral Pig Damage and Focused Removals: Prior to initiation of feral pig removal activities, surveys would be carried out to identify specific locations being impacted by feral pigs. Pig removal efforts may be highly focused to such areas.
2. Trap Placement and Vegetation Trimming: When feasible, traps would be placed in locations that require minimal to no vegetation trimming and minimal ground disturbance. Traps would be placed in such a manner as to avoid water quality impacts.
3. Active Traps: All active traps, regardless of the type, would be checked daily.
4. Lead Free Ammunition: Lead-free ammunition would be used to dispatch all pigs to avoid lead contamination and associated non-target effects.
5. Cultural Resources: Where ground disturbance is necessary for minor vegetation removal prior to fence and trap installation, minor digging for fence and trap installation, as well as the potential for feral pigs to disturb soil while temporarily in the traps, the Complex staff would coordinate with the Service's Regional Archaeologist to comply with Federal laws relating to

cultural resources. These activities would be coordinated with the Service's Regional Archaeologist to avoid any potential adverse effects to cultural resources and to comply with Federal laws related to cultural resources.

6. Discovery of Unknown Cultural Resources: In the event that unanticipated cultural or tribal resources are encountered during the course of the project, the Service would cease any ground-disturbing activities within 50 feet of the resource. The Service's Regional Archaeologist would evaluate the resource and recommend treatment measures, as appropriate.
7. Documented Cultural Resources: If ground disturbance is proposed in the vicinity of a documented cultural or tribal resource, coordination with the Service's Regional Archaeologist would occur to put a buffer in place and not disturb the ground within that buffer.
8. Closures: Efforts would be made for feral pig trapping to take place in locations away from publicly accessible areas within the Complex. If trapping is necessary near publicly accessible areas, temporary closures may occur.
9. Disposal Sites and Sanitary Landfills: After dispatching the pig, they may remain on-site or transported off-site for disposal or donation for animals, following general disease testing, consistent with California Department of Fish and Wildlife codes and regulations and any other applicable laws and regulations.

3.4 Alternatives Considered but Dismissed from Detailed Analysis

Exclusion Fencing

Feral pigs are strong enough to upturn many fencing types and go underneath them during rooting behavior. If utilizing exclusion fencing, the fence should be monitored closely to ensure the perimeter hasn't been breached (Finzel and Baldwin 2015). According to the USDA, feral pigs are strong, clever, and can destroy most fences (USDA 2020d). Exclusion fencing was considered, but dismissed due to the inability to ensure exclusion of feral pig within the entire San Luis NWR Complex through fencing, inaccessibility to install and monitor fencing regularly over a large area, cost and upkeep of a large amount of fencing, and potential negative impacts of fencing to native, sensitive wildlife species within the Complex.

Harassment or Hazing

Harassment or hazing through arm waving and noise may cause feral pigs to immediately leave an area, but is not practical on a large scale, and likely shifts the feral pig damage from one area to another. This method of control is dangerous for Service, USDA WS staff, or other cooperator to conduct, as they would need to be in close proximity and it could make feral pig wary, making other control methods potentially less successful (USDA 2020d). In addition, animals habituate quickly to external stimuli, which is where the animals adjust to and ignore the non-lethal harassment (Gilsdorf et al. 2003). Harassment was considered, but dismissed as it would not be a long-term solution; could cause feral pig to damage other areas; could be dangerous for Service, USDA WS staff, or other cooperator to conduct; and could potentially lessen the effects of other control methods.

Electric fencing

Electric fencing was considered, as it would potentially make it more difficult for feral pigs to upturn fencing through their rooting behavior. Due to inaccessibility to install and monitor the fencing on a regular basis over a large area; inability to ensure it is adequately powered at all times; general upkeep

of a large amount of fencing; and potential to negatively impact native, sensitive species, it was dismissed.

Hunting

Public hunting was considered; however, public hunting is not an allowed use within all of the San Luis NWR Complex due to potential for negative impacts to sensitive environments and species. Hunting complicates efforts to remove feral pig because they are social animals that tend to travel in groups (also known as sounders) and shooting into a group will not remove enough to reduce the population. Instead, it would cause the sounder to scatter, thereby making trapping efforts designed for catching a group more difficult. Due to their high reproductive rate and affinity to travel in sounders, hunting is not an effective tool for managing feral pig (Missouri Department of Conservation 2021).

Aerial Shooting

Aerial shooting from a helicopter could be effective in quickly reducing a feral pig population. However, this method is cost-prohibitive (USDA 2020d). This method was considered, but will not be utilized due to cost constraints and other method availability.

Relocation

Feral pig should not be moved or released back into the environment after they are trapped, and instead should be humanely euthanized (USDA 2020d). Methods such as relocation of feral pigs are complex, labor intensive, and not practical given the magnitude of the problem. There are no known facilities in the region that are capable of lawfully handling captured feral pigs for relocation purposes. In addition, this invasive species can carry at least 30 diseases and almost 40 various parasites, many of which can impact humans (USDA 2020b).

Snares and Leg Hold Traps

Snares have advantages over cage traps in regard to cost and portability (USDA 2020d). However, due to potential for snares to catch species other than feral pig, such as deer, they would not be utilized.

Repellent

Repellents are only effective in the short-term and only practical for use on a smaller scale (i.e. not the entire San Luis NWR Complex). Repellents could also concentrate damage from feral pig in adjacent areas and therefore would not be utilized (Massei et al. 2011).

Chapter 4: Affected Environment and Environmental Consequences

This section is organized by affected resource categories. Each affected resource discusses both (1) the existing environmental and socioeconomic baseline in the action area and (2) the effects and impacts of the alternatives on each resource. Effects and impacts from the proposed action or alternatives are changes to the human environment, whether adverse or beneficial, that are reasonably foreseeable (40 CFR 1508.1(g)). The impact analysis directly follows the affected environment description for a resource and is organized by alternative.

The impact analysis will evaluate a variety of criteria, as defined below, to describe the context and intensity of impacts on affected resources. The Council on Environmental Quality does not require the use of these terms, however, they are commonly used in NEPA documents and will be referenced in the subsequent sections.

Impact analysis criteria and terminology:

- Adverse effects: negative or detrimental effect to the resource
- Beneficial effects: positive effect to the resource
- Cumulative effects: effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR 1508.1(g)(3))
- Direct effects: caused by the action and occur at the same time and place (40 CFR 1508.1(g)(1))
- Indirect effects: caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.1(g)(2))
- Irreversible: unable to be undone or altered
- Irretrievable: unable to regain, recover or repair
- Major: effects would be obvious, and would result in substantial local and larger scale consequences to the resource
- Minor: effects would be detectable but small, and of little consequence and would not affect the population or resource on a large-scale
- Moderate: effects would be readily detectable and may have some temporary effects to the population or resources on a large-scale but would not cause a substantive decline or increase in the resource
- Negligible: resource is slightly affected but the impact is so minimal that effects are not detectable or may not be observable
- No effect: resource would not be affected
- Short-term effects: occurring in or relating to a relatively short period of time
- Long-term effects: occurring in or relating to a relatively long period of time
- Unavoidable: unable to be prevented or ignored; inevitable

4.1 General Description of Affected Environmental Applicable to All Affected Resources

Within the San Luis NWR Complex there is the San Joaquin NWR, San Luis NWR, Merced NWR, and Grasslands WMA. The San Luis NWR Complex is surrounded by Interstate 5 to the west and California Highway 99 to the east, and is located in Merced, Stanislaus, and San Joaquin counties. The NWR Complex is enclosed by the Sierra Nevada Mountains to the east and the Coast Range to the west in the northern San Joaquin Valley. The City of Los Banos separates the West and South units of the Grasslands WMA, and the acquisition boundary of the Grasslands WMA extends to six miles from the City of Merced (see **Figure 1**, *San Luis NWR Complex Location Map*). The San Joaquin River NWR is approximately 35 miles north of the San Luis NWR and is located within western Stanislaus and San Joaquin counties, nine miles west of the City of Modesto, California. The San Luis NWR, Merced NWR, and Grasslands WMA are located wholly in Merced County, California.

The approved acquisition boundary for San Luis NWR, Merced NWR, and Grasslands WMA is over 200,000 acres in size, with approximately half of the lands being either fee-title and owned by the Service or privately owned land in perpetual conservation easements (see **Figure 3**, *Land Status Map - San Luis NWR, Merced NWR, and Grasslands WMA*). The Service has the land-use rights to protect or enhance the habitats on the conservation easements within the Complex.

The San Luis NWR, Merced NWR, Grasslands WMA, and San Joaquin River NWR currently total approximately 128,747 acres, of which approximately 44,158 acres are fee-title and 84,589 acres are conservation easements to protect native plants and wildlife. The Grasslands WMA, which has the largest concentrated easement program for wildlife in California, contains approximately 80,335 acres of land in conservation easements. The Grasslands WMA "East Unit" contains approximately 14,412 acres of fee-title land, while the "West Unit" contains approximately 691 acres of fee-title land. Merced NWR contains approximately 3,822 acres of fee-title land, while San Luis NWR is approximately 17,817 acres of fee-title land. Meanwhile, San Joaquin River NWR is approximately 7,416 acres of fee-title land and approximately 4,254 acres of conservation easement land (see **Figure 2**, *Land Status Map - San Joaquin River NWR*).

The San Joaquin River NWR occurs along the main stem of the San Joaquin River, from near the confluence of the Merced River, north to the Stanislaus River. While most of the San Joaquin NWR is within Stanislaus County, California, the Refuge contains two noncontiguous parcels, the Mohler tract, which is located approximately three miles east of the main portion of the Refuge, along the north bank of the Stanislaus River in San Joaquin County, California, as well as the Eplin tract, which is south of the Refuge. The landscape of the San Joaquin River NWR, in addition to the San Luis NWR, Merced NWR, and Grasslands WMA, represents a locally and regionally significant remnant of what was once a broad floodplain of major rivers in California's Central Valley and the entire Complex occurs within the San Joaquin River watershed (see **Figure 8**, *Watershed Map*, Service 2006).

The San Luis NWR is the largest contiguous Refuge occurring in California's Central Valley and consists of seven management units, while the Merced NWR consists of four discrete parcels: Merced Unit, Snobird Unit, Arena Plains Unit, and Lone Tree Unit. The Grasslands WMA consists principally of private lands protected by conservation easements and serves as a critical east-west corridor for wildlife between the Sierra Nevada and Coastal Range. Active wetland management occurs at nearly all of the regularly flooded wetlands located within the San Luis NWR Complex, with the goal of producing high-quality habitats for wetland-dependent wildlife, especially migratory birds (Service 2023).

Figure 8. Watershed Map

This section is organized by affected resource categories and for each affected resource discusses both (1) the existing environmental and socioeconomic baseline in the action area for each resource and (2) the effects and impacts of the proposed action and any alternatives on each resource. The effects and impacts of the proposed action considered here are changes to the human environment, whether adverse or beneficial, that are reasonably foreseeable and have a reasonably close causal relationship to the proposed action or alternatives. This EA includes the written analyses of the environmental consequences on a resource only when the impacts on that resource could be more than negligible and therefore considered an "affected resource."

The following resources either (1) do not exist within the project area or (2) would either not be affected or only negligibly affected by the proposed action: traffic and historic properties. Therefore, these resources are not analyzed in this EA.

4.2 Natural Resources

Habitat and Vegetation: Affected Environment

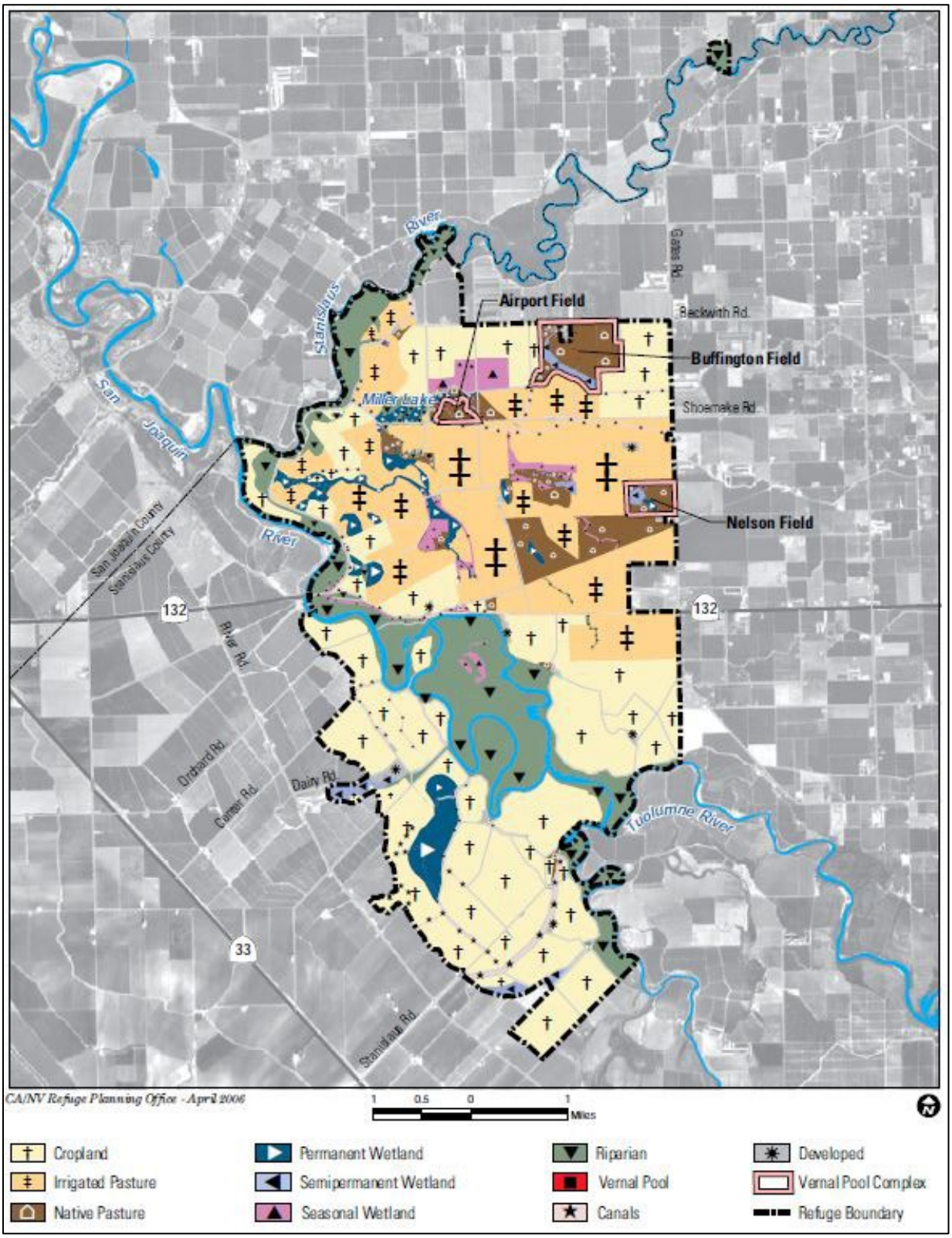
The San Luis NWR Complex is located on the northern boundary of the Grasslands area, which contains the largest remaining acreage of freshwater wetlands in California. The importance of this critical area for waterfowl and other waterbirds has been recognized by the Central Valley Joint Venture and the North American Waterfowl Management Plan. It is considered of international importance for migratory waterfowl and shorebirds of the Pacific Flyway (Service 2006).

Within the Complex, habitat types include wetlands, such as vernal pools, semipermanent wetlands, and seasonal wetlands; riparian areas, including riparian woodlands; and grasslands (uplands), including native grasslands, tilled cropland, fallowed fields, and irrigated pastures. Wetlands are the most actively managed, including restoration activities (Service 2006, 2023).

San Joaquin River NWR

Within the Central Valley where the San Joaquin River NWR occurs, there are three major vegetation communities, which include riparian, wetland, and grassland habitats. This Refuge supports a variety of native habitats, ranging from valley oak gallery and mixed riparian forests/woodlands to seasonal and permanent wetlands, and native grasslands. These habitats support a diversity of native anadromous fish, wildlife, and plants (see **Figure 9**, *Land Cover Map – San Joaquin River NWR*, Service 2006).

Figure 9. Land Cover Map - San Joaquin River NWR



San Luis NWR

The San Luis NWR consists of wetland, riparian, and grassland habitats. This Refuge contains the largest acreage of mature woody riparian habitat within the Complex, with the majority associated with the San Joaquin River, as well as its tributaries and sloughs (see **Figure 10**, *Land Cover Map – San Luis NWR, Merced NWR, and Grasslands WMA*; Service 2023).

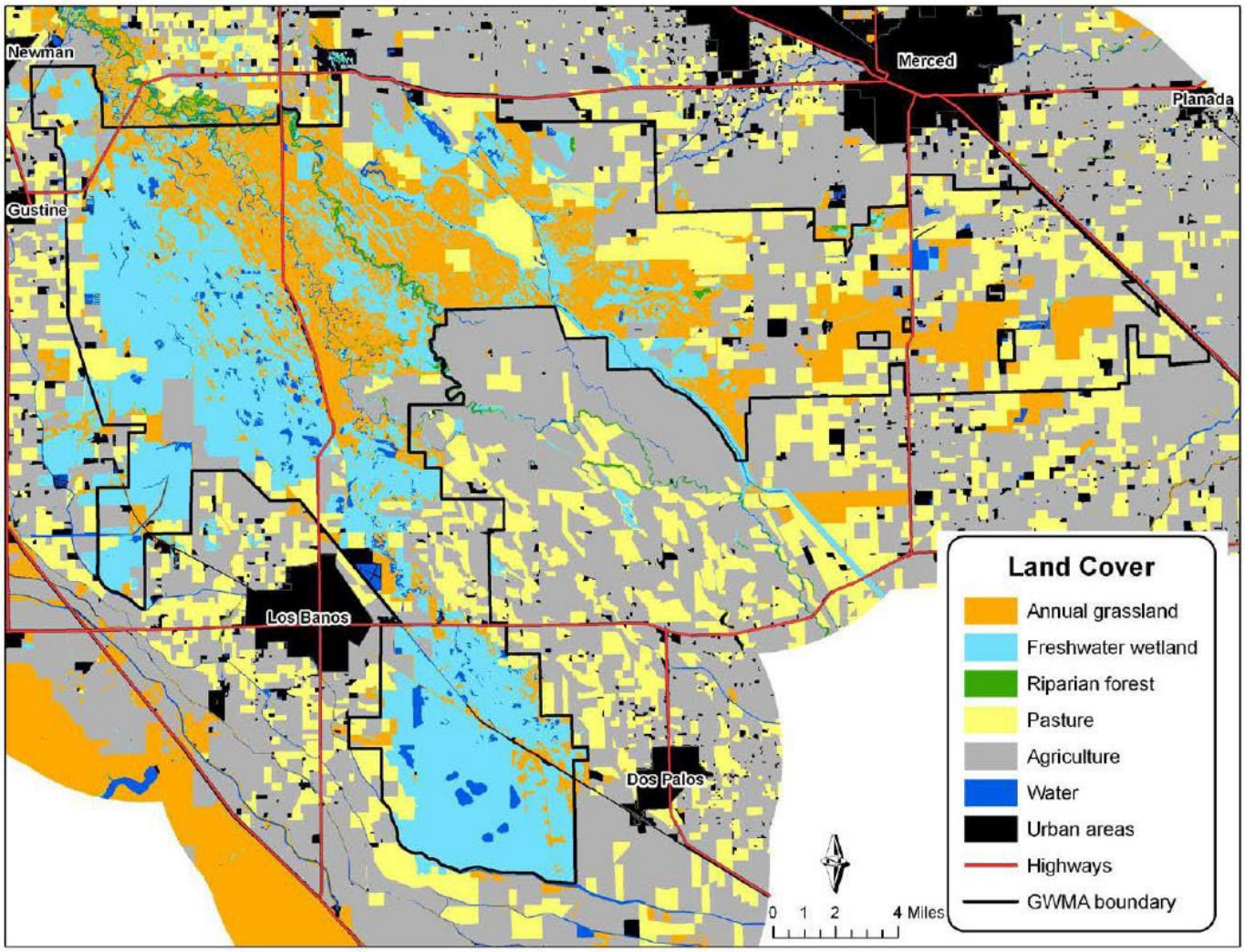
Merced NWR

Habitats within the Merced NWR include wetland, riparian, grassland, and cropland. While the majority of cropland habitat within this Refuge has been restored to other habitat types, some remain, such as irrigated pastures, in order to provide shortgrass winter foraging habitat for waterfowl and other migratory birds. Riparian woodlands are limited to narrow strips along some of the waterways within this Refuge (see **Figure 10**, *Land Cover Map – San Luis NWR, Merced NWR, and Grasslands WMA*; Service 2023).

Grasslands WMA

Within the Grasslands WMA, the habitat types are classified as wetland, riparian, grassland, and cropland. In addition, some of the easements within the Grasslands WMA contain irrigated pastures, which provide upland habitat for waterfowl and various migratory birds (see **Figure 10**, *Land Cover Map – San Luis NWR, Merced NWR, and Grasslands WMA*; Service 2023).

Figure 10. Land Cover Map - San Luis NWR, Merced NWR, and Grasslands WMA



For more information regarding the habitat and vegetation of the San Joaquin River NWR, please see Section 3 *Refuge Setting* of the Comprehensive Conservation Plan (CCP).

For information on the habitat and vegetation of the San Luis NWR, Merced NWR, and Grasslands WMA, please see Chapter 3 *Environmental Settings* of the draft CCP.

Habitat and Vegetation: Environmental Consequences

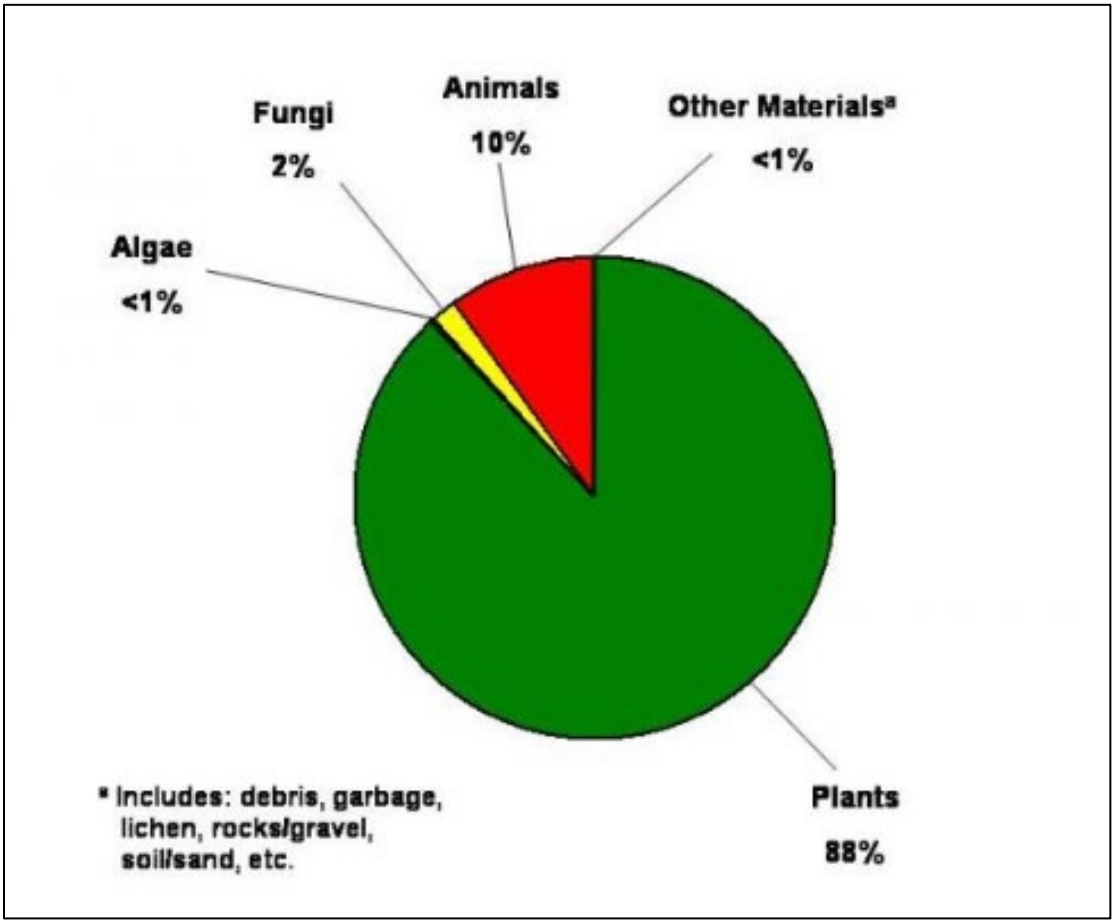
Alternative A

The most far-reaching impact feral pigs have on the landscape is causing habitat-type conversion from native to non-native habitat through their rooting, wallowing, trampling, and feeding behaviors. Feral pigs are considered "ecosystem engineers," due to their ability to change the water quality and runoff into wetlands, shift plant composition and distribution in grasslands, as well as decrease tree diversity in forests (USDA 2020a). Alternative A would not prevent feral pigs from further degrading sensitive habitats within the San Luis NWR Complex, as they are habitat generalists, and their rooting and walling behavior disturbs wetland and riparian habitats (Finzel and Baldwin 2015). Feral pigs can have a

pronounced impact on wetland and riparian habitats through their rooting and wallowing behavior, where the soils are more sensitive to disturbance (Engeman et al. 2003, 2004; West et al. 2009; USDA 2015). This invasive species favors food sources of wetland habitats that are easier to attain, such as roots, tubers, and bulbs (USDA 2015). Feral pigs are effective at seed dispersal of invasive plants through their excrement and hair, easily dispersing invasive plant seeds from agricultural and urban areas into the Complex's sensitive habitats (Dovrat et al. 2012).

This invasive species could degrade the woodland habitats within the Complex, as they are known to use mature trees as rubbing posts and leave scent marks by "tusking," thus damaging mature trees; root in the ground and chew the roots of trees, damaging the roots; as well as disturb seedlings. With a voracious appetite, this invasive species has been documented destroying young trees at a rate of six per minute per feral pig, which can total between 400 and 1,000 seedlings per day (Cooperative Extension 2019a). Feral pigs also have an affinity for acorns, thus reducing the regeneration of oak trees through rooting (Finzel and Baldwin 2015). They are omnivorous and opportunistic feeders, preferring to maximize their intake of a preferred food source when encountered, with plant material making up the majority of their diet (see **Figure 11**, *Composition of a Typical Feral Pig Diet*, Cooperative Extension 2019b). Therefore, Alternative A could have adverse, long-term effects on the San Luis NWR Complex habitats and vegetation.

Figure 11. Composition of a Typical Feral Pig Diet



Alternative B

Alternative B could have short-term, minor effects through minor soil disturbance from monitoring the cameras and traps, removing vegetation to set the traps, installing the fencing/traps in the ground, and feral pigs disturbing the soil while inside the traps. However, as stated in **Mitigation Measure 3**, *Active Traps*, the traps would be checked daily while set and the monitoring and management activities would be temporary in nature. In addition, the Service would implement **Mitigation Measure 2**, *Trap Placement and Vegetation Trimming*, to place traps, when feasible, in locations that require minimal to no vegetation trimming and minimal ground disturbance. The long-term, beneficial effects of Alternative B would include protecting the sensitive habitats within the San Luis NWR Complex from degradation due to this invasive species rooting and wallowing behavior, in addition to preventing them from spreading invasive seeds onto Complex land they have disturbed, as well as preventing the destruction of native trees.

Floodplains and Water Resources: Affected Environment

Executive Order 11988, Floodplain Management of 1997, as amended, directs Federal Agencies to, "assert leadership in reducing flood losses and losses to environmental values served by floodplains; avoid actions located in or adversely affecting floodplains unless there is no practicable alternative; take action to mitigate losses if avoidance is not practicable; and establishes a process for flood hazard evaluation based upon the 100-year base flood standard of the National Flood Insurance Program. It also directed Federal agencies to issue implementing procedures; provided a consultation mechanism for developing the implementing procedures; and provided oversight mechanisms" (Federal Emergency Management Agency [FEMA] 2021).

Although seasonal flooding is naturally occurring in riparian and floodplain ecosystems, land conversion and hydrological changes to the riverine systems within the Central Valley have severely altered the hydroperiod and flooding regime (Service 2021a). Levees and dams provide flood control, as well as consistent water supply for agricultural land, but increase the severity and duration of flooding within the remaining riparian ecosystem, which can be aggravated by breaks in the levee system (Service 2020, 2021). Flooding is an expensive natural disaster, costing $260 billion between 1980 and 2013 in the U.S. (FEMA 2015). Therefore, floodplain management is pertinent to controlling the negative impacts caused by flooding.

Over the last 20 years, woody riparian habitat has increased throughout the region through the efforts of riparian restoration projects on the San Luis NWR Complex, as well as on privately owned land (Service 2021a). For example, the San Joaquin River NWR launched a major initiative to protect floodplain lands in 1999, through acquisition, restoration, and improved function of floodplain habitats and to maximize the benefits of the habitats to riparian and wetland dependent native species (Service 2006). In addition, within the San Luis NWR, Merced NWR, and Grasslands WMA, floodplains are a priority resource of concern and actively managed. The floodplain and riverine systems within the San Luis NWR Complex are important for native wildlife, as they are migration corridors and rearing habitat for salmonids and other fish species, as well as migratory and residential waterbirds habitat (Service 2021a).

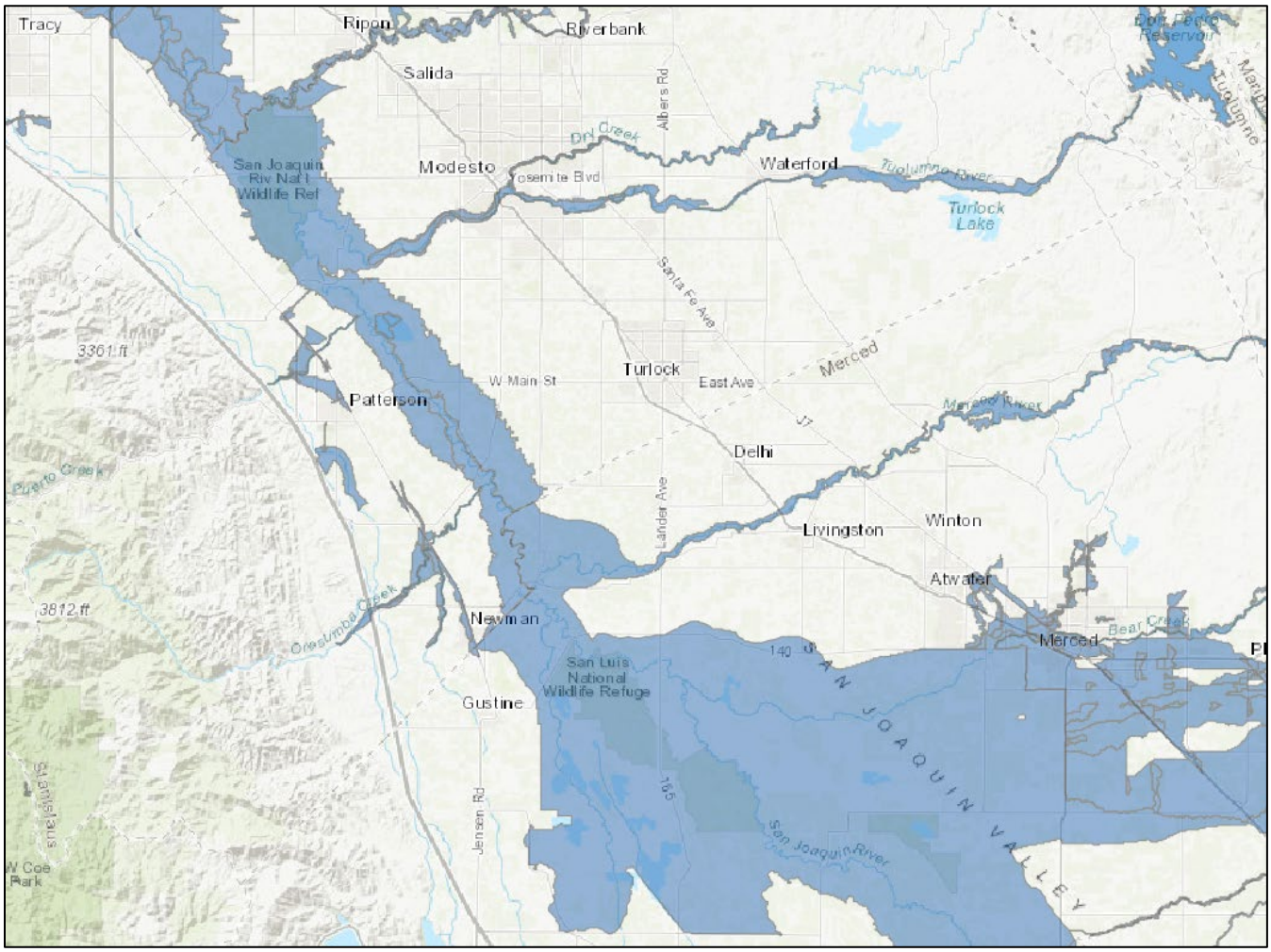
The Complex lies within the 100-year floodplain and the Service's goal for the land west of the San Joaquin River within the San Joaquin River NWR, which mostly consists of abandoned agricultural fields, is to restore the floodplain and riparian habitats (Service 2006, California Department of Water

Resources 2023, see **Figure 12**, *100-Year Floodplain*). Human-made levees separate most of this Refuge's land from river floodwater, while the course of the San Joaquin River has been modified and channelized to enhance water delivery and flood control. Aside from extreme flood events that could result in levee failure, river water remains within the levee corridor and does not spread across the floodplain. As river flows are reduced through this process from historic levels, the fluvial processes are reduced most years, including in the riparian areas occurring within the levee corridor (Service 2006).

The Complex's wetlands and other aquatic habitats depend on delivered water from the Henry Miller Reclamation District (Merced County 2009). In order to meet wetland habitat management needs, the Complex prefers to have water delivered, which consists of surface water from the northern portion of California, thus optimizing water quality, while not depleting local groundwater and surface water supplies. However, water quality can vary due to the delivered water being mixed with lower-quality water from the Salt Slough unit, as that unit produces varying water quality. Due to changes in the natural hydrology of the San Joaquin Valley's past and current land use practices, such as urbanization, the severe loss of wetlands, and modern agricultural practices, water quality varies, and the Complex operates with low-quality water supplies (Service 2023).

The Service enrolled two of the San Joaquin River NWR's Units in the USDA Natural Resources Conservation Space's (NRCS) Floodplain Easement Program, which has the purpose of restoring, protecting, maintaining, and enhancing the functions of floodplains; conserving fish and wildlife habitat, open space, water quality, flood water retention and ground water recharge; and safeguarding lives and properties from erosion, as well as from floods and drought (USDA 2022). The Lara, 515.69 acres, and Vierra, 632.65 acres, are the two Units within this Refuge that are enrolled in the Floodplain Easement Program and are part of the Floodplain Warranty Easement with USDA NRCS, which requires the Service to provide in perpetuity for, "the unimpeded reach and flow of any waters in, over, or through the easement area; to retard runoff and prevent soil erosion through the restoration, protection, or enhancement of the floodplain; to restore, protect, manage, maintain, and enhance the functional values of wetlands, riparian areas, conservation buffer strips, and other lands; to conserve natural values including fish and wildlife habitat, water quality improvement, floodwater retention, groundwater recharge, open space, aesthetic values, and environmental education; and to safeguard lives and property from floods, drought, and the products of erosion" (Service 2006).

Figure 12. 100-Year Floodplain



Floodplains and Water Resources: Environmental Consequences

Alternative A

Under Alternative A, feral pigs could have long-term, adverse effects to riparian and floodplain habitat within the San Luis NWR Complex, as they could continue to degrade these sensitive resources, including compacting soils that surround water resources. Feral pigs could continue to negatively impact water quality within the Complex, as they typically feed by digging or rooting through the upper soil layer, in addition to wallowing within or near water resources. This disturbance can be extensive and frequently occurs in riparian and other wetland areas, resulting in displaced soils and vegetation, as well as large areas of bare ground vulnerable to erosion and potentially increasing turbidity in wetland and riparian areas. The correlation between soil erosion and the presence of feral pig in a watershed is supported in the scientific literature (Browning 2008). Feral pigs could also introduce infectious waterborne organisms into water resources, such as *Giardia*, *Cryptosporidium*, *Balantidium*, and *Entamoeba*, as they are often present in the feces of this invasive species. A California study suggested "that given the propensity for feral pigs to focus their activity in riparian areas, feral pigs may serve as a source of protozoal contamination for surface water" (Atwill et al. 1997).

Alternative B

Alternative B could have beneficial, long-term effects for the floodplains and water resources within and surrounding the San Luis NWR Complex. The Service would implement **Mitigation Measure 2**, *Trap Placement and Vegetation Trimming*, to avoid water quality impacts. Monitoring and management of feral pigs would prevent them from causing further damage to the banks of these sensitive resources. Soil compaction caused by this invasive species, as well as potential erosion and water quality issues from them would be prevented. The proposed action would prevent feral pigs from further damaging these sensitive resources by preventing establishment within the Complex.

Wetlands: Affected Environment

Executive Order 11990, Protection of Wetlands, was issued in May 1977, as amended by Executive Order 12608 in 1987. This Executive Order directed each Federal agency to minimize the destruction, loss or degradation or wetlands, as well as to preserve and enhance the natural and beneficial values of wetlands (42 Fed. Reg. 26961 [1977]).

The Central Valley contains the majority of the California's wetlands, as well as wintering waterfowl. Within the Pacific Flyway, California supports over 60 percent of wintering waterfowl populations, aside from sea ducks, and 20 percent of the entire U.S. wintering population (Service 2006). The wetlands contained within the San Luis NWR Complex are of significant importance to waterfowl, in addition to many other native species, such as the riparian brush rabbit, by providing habitat and protection (Service 2006).

In addition to the Service's active management of wetlands throughout the entire Complex, the USDA NRCS administered a Wetlands Reserve Program Easement. This easement applies to the Hagemann Tract that of the San Joaquin River NWR and covers 2,017.8 acres, located west of the San Joaquin River. The Wetlands Reserve Program Easement requires the Service to, "restore, protect, manage, maintain, and enhance the functional values of wetlands and other lands, and for the conserving of natural values including fish and wildlife habitat, water quality improvement, floodwater retention, groundwater recharge, open space, aesthetic values, and environmental education" for 30 years (Service 2006). However, the entire Central Valley is experiencing drought conditions, which limit the availability of water resources for managing wetlands (Service 2023).

See *Floodplains and Water Resources* section above in regard to availability of water and water quality within the Complex.

Wetlands: Environmental Consequences

Alternative A

Alternative A could have long-term, adverse effects on the wetlands within the San Luis NWR Complex, as feral pigs would continue degrading this sensitive habitat that occurs throughout the Complex. As stated in greater detail in the *Habitat and Vegetation* section above, feral pigs prefer food sources of wetland habitats that are easier to attain, such as roots, tubers, and bulbs (USDA 2015). In addition, the soils within wetland habitats are more sensitive to disturbance from this invasive species' rooting and wallowing behavior that degrades banks and causes erosion and water quality issues. Lack of feral pig monitoring and management would exacerbate negative impacts to wetlands, as this invasive species has the ability to rapidly increase their population and thus their impact on the landscape.

Alternative B

Through monitoring and management of feral pigs, Alternative B could have long-term, beneficial effects for the wetlands contained within the San Luis NWR Complex. Alternative B would control the feral pig population within the Complex and monitor for sign of feral pigs, especially along sensitive wetland habitat where this invasive species prefers to wallow and root. Through implementation of this alternative, the Service would minimize the destruction, loss, and degradation of wetlands within the Complex, as this alternative would allow for the preservation of wetlands by managing this destructive species.

Vegetation of special management concern: Affected Environment

San Joaquin River NWR

Within the San Joaquin River NWR, Service staff actively manages upland and wetland habitats, in addition to restoring the riparian floodplain, in order to support listed species and migratory birds. Due to alteration of hydrology to support agricultural and urban purposes, water management is necessary for most of the wetlands within this Refuge (Service 2006). The Service purchased over 3,000 acres of land between 1998 and 2000 to contribute to the San Joaquin River NWR and have garnered $24.5 million in grant funding for both riparian and floodplain restoration since 2002. Approximately 2,700 acres of riparian woodland habitat and 700 acres of wetland habitat, as well as eight miles of flood refugia on levee slopes, has been restored within this Refuge (Service 2021a).

San Luis NWR, Merced NWR, and Grasslands WMA

Within the Grasslands WMA, as well as the San Luis and Merced Refuges, habitat management, which is the manipulation of vegetation, water, and soil, is a major day-to-day management focus for Service staff. Due to the loss of naturally occurring hydrology within the Central Valley, coupled with land development (i.e. agriculture and human-dominated landscapes), there has been a loss in many ecological processes necessary to maintain native wildlife and habitats. Therefore, active management is required in order to maintain the sensitive habitats within the Complex, as well as the native wildlife. Nearly all of the regularly flooded wetlands are actively managed at San Luis NWR, Merced NWR, and the Grasslands WMA to protect these sensitive resources. The main goal of this active management is for migratory birds and other native species that depend on wetlands to have high-quality habitat. (Service 2023).

Vegetation of special management concern: Environmental Consequences

Alternative A

Alternative A could have long-term, adverse effects, as it would not prevent feral pigs from damaging vegetation of special management concern within the San Luis NWR Complex, as there would be no feral pig monitoring or management. Major impacts from this destructive species due to their wallowing, rooting, and trampling behavior would continue within the sensitive habitats contained within the Complex. The voracious appetite of feral pigs, consuming three percent of their body weight per day, coupled with their extensive rooting behavior while searching for food, can lead to water quality issues and erosion within the sensitive wetlands and riparian areas, as well as allow for invasion by non-native plants (Finzel and Baldwin 2015).

Alternative B

Implementation of Alternative B could have beneficial, long-term effects by protecting the sensitive vegetation of special management concern within the San Luis NWR Complex from detrimental impacts caused by feral pigs wallowing, rooting, and trampling behavior. USDA considers feral pigs “ecosystem

engineers" due to their ability to alter water quality and runoff in wetlands, in addition to reducing tree diversity in forests and shifting plant composition (USDA 2020a). By monitoring and managing for this invasive species, Service staff will be able to prevent potential habitat-type conversion, in addition to protecting water quality and the sensitive habitats contained within the Complex.

Fish and Wildlife Species: Affected Environment

The San Luis NWR Complex land provides high-quality, native habitat, with a special emphasis on wetlands that support waterbirds diversity and abundance within the Pacific Flyway (Service 2006). The lands protected within the Complex provide suitable habitat for native birds, mammals, amphibians, reptiles, invertebrates, and fish.

Within the San Joaquin River NWR, the vision statement emphasizes the management of native wildlife, as well as actions that focus on recovering Federal and State listed threatened and endangered species, species of special concern, and the protection and/or enhancement of resources for migratory birds (Service 2006). Management priorities include waterfowl and other waterbirds, with a particular emphasis on the Aleutian Canada goose and neotropical migratory birds.

The vision statement for the Grasslands WMA, as well as the San Luis and Merced NWRs states that the land together:

> *"…make(s) up the heart of California's largest contiguous freshwater wetlands, providing vital habitat for waterfowl and other migratory birds, as well as assemblages of resident wildlife. Together, these lands are managed as a vital link in a chain of wetlands along the Pacific Flyway, providing refuge for millions of migratory birds; it is a unique area of incredible beauty and biodiversity offering permanent and seasonal wetlands, riparian corridors and native grasslands"* (Service 2023).

Candidate, Proposed, Threatened, Endangered and Other Special Status Species and Critical Habitat

Several native species listed as threatened or endangered under the Federal ESA; threatened or endangered under the California ESA; proposed, candidate, or protected under other environmental laws and regulations occur on the San Luis NWR Complex for at least a part of their life cycle. These species are protected and managed in accordance with the following sources of law:

- Bald and Golden Eagle Protection Act of 1940, as amended, 16 U.S.C. 668-668c, 50 CFR 22;
- ESA of 1973, as amended, 16 U.S.C. 1531-1544; 36 CFR Part 13; 50 CFR Parts 10, 17, 23, 81, 217, 222, 225, 402, and 450;
- Fish and Wildlife Coordination Act of 1934, 16 U.S.C. 661-666(e);
- Fish and Wildlife Act of 1956, 16 U.S.C. 742 a-m;
- Lacey Act of 1900, as amended, 16 U.S.C. 3371 et seq.; 15 CFR Parts 10, 11, 12, 14, 300, and 904;
- Migratory Bird Treaty Act of 1918, as amended, 16 U.S.C. 703-712; 50 CFR Parts 10, 12, 20, and 21; and
- Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds, 66 Fed. Reg. 3853 (2001).

Within the San Luis NWR Complex, the species that are known to occur or have potential to occur include nine Federally listed endangered species, one Federally proposed endangered species, eight Federally listed threatened species, two Federally proposed threatened species, six State listed

endangered species, six State listed threatened species, 23 California species of special concern, seven State watch list species, and one State fully protected species (see **Tables 1**, **2**, and **3** below).

Table 1. Federally Endangered and Proposed Endangered Species and State Listed Species

Scientific Name	Common Name	Federal Status	State Status	CDFW Status	Critical Habitat
Branchinecta conservatio	Conservancy fairy shrimp	E			Present
Branchinecta longiantenna	longhorn fairy shrimp	E			Present
Lepidurus packardi	vernal pool tadpole shrimp	E			Present
Neotoma fuscipes riparia	riparian woodrat (=San Joaquin Valley)	E		SSC	
Oncorhynchus (=Salmo) mykiss	steelhead (California Central Valley DPS)	E			Present
Oncorhynchus (=Salmo) tshawytscha	chinook salmon (Central Valley spring-run ESU)	E	T		
Orcuttia pilosa	hairy orcutt grass	E	E		
Spirinchus thaleichthys	longfin smelt	PE	T		
Sylvilagus bachmani riparius	riparian brush rabbit	E	E		
Vireo bellii pusillus	least Bell's vireo	E	E		

E = endangered, T = threatened, PE = proposed endangered, SSC = California species of special concern

Table 2. Federally Threatened and Proposed Threatened Species and State Listed Species

Scientific Name	Common Name	Federal Status	State Status	CDFW Status	Critical Habitat
Acipenser medirostris	green sturgeon (Southern DPS)	T			
Actinemys marmorata	northwestern pond turtle	PT		SSC	
Ambystoma californiense	California tiger salamander (Central Valley DPS)	T	T	WL	
Branchinecta lynchi	vernal pool fairy shrimp	T			Present
Chamaesyce hooveri	Hoover's spurge	T			Present
Desmocerus californicus dimorphus	valley elderberry longhorn beetle	T			
Hypomesus transpacificus	delta smelt	T	E		Present
Neostapfia colusana	colusa grass	T	E		Present
Spea hammondii	western spadefoot	PT		SSC	
Thamnophis gigas	giant garter snake	T	T		

E = endangered, T = threatened, PT = proposed threatened, SSC = California species of special concern, WL = watch list

Table 3. Other Protected Species

Scientific Name	Common Name	Federal Status	State Status	CDFW Status
Accipiter cooperii	Coopers hawk			WL
Acipenser transmontanus	white sturgeon			SSC
Agelaius tricolor	tricolored blackbird		T	SSC
Anniella pulchra	Northern California legless lizard			SSC
Archoplites interruptus	Sacramento perch			SSC
Antrozous pallidus	pallid bat			SSC
Asio flammeus	short-eared owl			SSC
Athene cunicularia	burrowing owl			SSC
Branta hutchinsii leucopareia	cackling (=Aleutian Canada) goose	Delisted		WL
Buteo swainsoni	Swainsons hawk		T	
Charadrius montanus	mountain plover			SSC
Circus hudsonius	northern harrier			SSC
Danaus plexippus	monarch butterfly	C		
Elanus leucurus	white-tailed kite			FP
Entosphenus tridentatus	pacific lamprey			SSC
Eremophila alpestris actia	California horned lark			WL
Eryngium racemosum	Delta button-celery		E	
Falco columbarius	merlin			WL
Ixobrychus exilis	least bittern			SSC
Lanius ludovicianus	loggerhead shrike			SSC
Lasiurus frantzii	western red bat			SSC
Lithobates pipiens	northern leopard frog			SSC
Nannopterum auritum	double-crested cormorant			WL
Numenius americanus	long-billed curlew			WL
Oncorhynchus (=Salmo) tshawytscha	chinook salmon (Central Valley fall / late fall-run ESU)			SSC
Phrynosoma blainvillii	coast horned lizard			SSC
Pogonichthys macrolepidotus	Sacramento splittail			SSC
Setophaga petechia	yellow warbler			SSC
Taxidea taxus	American badger			SSC
Xanthocephalus xanthocephalus	yellow-headed blackbird			SSC

C = candidate, T = threatened, SSC = California species of special concern, WL = watch list, FP = fully protected

Portions of the San Luis NWR Complex are designated as critical habitat for Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, delta smelt, steelhead (California Central Valley DPS), colusa grass, and Hoover's spurge. As part of the Complex's conservation efforts, re-establishment of the riparian brush rabbit was initiated in 2002 at the San Joaquin River NWR as part of the species' recovery program, which currently only exists in a few isolated populations.

Fish and Wildlife Species: Environmental Consequences

Alternative A

Alternative A could have long-term, adverse effects on critical habitat, as well as native fish and wildlife species within the San Luis NWR Complex, including species listed as candidate, threatened, endangered, or other special-status species. Without monitoring and management of feral pigs, there could be a decline in native species due to competition for resources, both habitat and food; degradation of native habitats the Complex protects and potential habitat-type conversion through invasion of non-native plants due to feral pigs transporting seeds, as well as their rooting, wallowing, and trampling behavior; direct predation on native species by feral pigs; spread of diseases and parasites to native species; and reduction in water quality (Hanson and Karstad 1959; Sweeney et al. 2003; West et al. 2009; USDA 2020a, 2020b, and 2020c).

This invasive species not only degrades native habitats, but their voracious appetite and ability to quickly reproduce accelerates their detrimental impact to natural resources. This invasive species has a wide and varied diet, preying on reptiles, amphibians, and small mammals, as well as the nests, eggs, and young of ground-nesting birds. Feral pigs even consume the young of larger mammals, such as deer, as they kill and consume whatever is easiest to catch (Finzel and Baldwin 2015, USDA 2020c). To-date, feral pigs have played a part in the decline of nearly 300 native plants and wildlife within the U.S., of which over 250 of these species are listed as threatened or endangered (USDA 2020a).

Feral pigs could continue to damage the Complex's freshwater wetlands that are protected habitat for migratory birds, particularly waterfowl. The riparian and floodplain habitats, as well as the uplands and wetlands, provide important habitat for a variety of wildlife, including birds, mammals, reptiles, amphibians, fish, invertebrates, and plants. Other native species, especially those that are listed, could be more sensitive to the damage caused by feral pigs, although all could be adversely affected. Riparian brush rabbit is a species that could be especially affected by the damage to riparian habitats caused by feral pigs rooting, wallowing, and feeding behaviors. As a species found in only a few locations in the wild with a small home range, this species occurs at San Joaquin River NWR, which is where the majority of feral pigs have been observed to-date.

A variety of special-status species could be directly and indirectly affected by feral pigs. Threatened by habitat loss and flooding due to agriculture and urban development, among others, the San Joaquin Valley woodrat could be more susceptible to the negative impacts caused by this invasive species. The San Joaquin Valley woodrat builds stick nest lodges in riparian woodlands, which could be damaged by an increasing feral pig population within the Complex. Western spadefoots could be susceptible to habitat loss through compaction caused by feral pigs, in addition to feral pigs preying on spadefoots, as 49 spadefoots were found in the stomach of a single feral pig (Finzel and Baldwin 2015). The sensitive vernal pools the Complex serves to protect, which contain Federally listed Conservancy fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, and longhorn fairy shrimp could suffer long-term, adverse effects from feral pig wallowing, rooting, and compaction behaviors. Water quality issues, including turbidity, could adversely affect fish species that swim within the riparian areas of the Complex, including sturgeon, Chinook salmon, and steelhead (Service 2021b).

Alternative B

Implementation of the proposed action, Alternative B, could prevent feral pigs from causing damage to native riparian, wetland, and upland habitats, in addition to preventing potential habitat loss, including

critical habitat; depredation to native species by feral pigs; and competition for food sources that the native fish and wildlife species within the San Luis NWR Complex utilize, including species listed as candidate, threatened, endangered, or other special-status species.

Short-term, minor effects may occur to fish and wildlife species; however, per **Mitigation Measure 1**, *Surveys for Feral Pig Damage and Focused Removals*, surveys for sign of feral pigs prior to removal activities would assist in identifying specific locations impacted by this invasive species, thus focusing feral pig removal efforts to those areas with sign of the species. In addition, as stated in **Mitigation Measure 3**, *Active Traps*, all active traps would be checked daily for feral pigs.

As described under Section 3.2 *Alternatives*, Alternative B would include the use of firearms, which would only be utilized by trained Service, USDA WS staff, or other cooperator following applicable trainings and regulations. According to the USDA, between 2011 and 2015, 0.001 percent of non-target species were killed and 0.0001 percent were dispersed due to gun shots when utilized for wildlife damage management. Also between these years, the USDA dispatched 4,573 feral pigs and dispersed another 168, but did not kill or disperse any non-target species during these feral pig removal efforts (USDA 2019a). The use of firearms would be selective for feral pigs, as identification of an individual would be made prior to shooting. Use of firearms does not usually affect non-target animals, except for the occasion where the sound of a firearm may temporarily startle or scare an animal when the firearm is discharged. Therefore, the use of firearms is expected to only have potential short-term effects on non-target species.

Captured feral pigs would be dispatched quickly with a gunshot to the head using non-lead ammunition, as not to contaminate non-target species, per **Mitigation Measure 4**, *Lead Free Ammunition*. Firearms may be equipped with noise suppressors, although the sound would be temporary in nature, should a suppressor not be utilized, and would not cause any adverse effects to native species (USDA 2019a). Shooting of individual feral pigs may also be conducted without the use of traps, by shooting over bait piles or ground hunting by Service, USDA WS staff, or other cooperator. Shooting feral pigs at night may occur, possibly with the use of night vision and suppressors, and would not adversely affect native species.

Camera systems may be used with remote-activated cage traps to maximize the chance that an entire sounder (i.e. a group of feral pigs) is captured and minimize risks to non-target species, although they would be checked daily while set. Some of the traps proposed may utilize remote trigger, while others may not and may be visually inspected, instead. Tracking feral pigs with dogs that are managed by Service personnel, USDA WS, or other cooperator may be utilized to locate feral pig and the appropriate personnel would be present whenever dogs are utilized. The tracking dogs would be trained to locate feral pigs specifically.

Feral pig management and monitoring under this alternative is expected to result in a variety of beneficial effects, including improved breeding success, recruitment, and total population size for native species within the Complex. Implementing the Plan on the San Luis NWR Complex would also benefit adjacent habitat areas and the efforts of the neighboring landowners to control feral pigs on their own properties. Adverse effects to native fish and wildlife species, including those listed as candidate, threatened, endangered, or other special-status species are not anticipated through implementation of the Plan.

The presence of personnel may indirectly disturb other wildlife in the early morning or evening while conducting management and monitoring activities, as these activities may flush or disturb non-target wildlife from their habitat. However, these activities are expected to be temporary and minor in nature. Overall, feral pig control is expected to result in beneficial, long-term effects for the San Luis NWR Complex's native fish and wildlife populations, as well as protect their sensitive habitats.

Geology and Soils: Affected Environment

Within the Central Valley, the soils are generally Entisols and Alfisols. Schoenherr (1992) provides a broad overview of the soils and geology of California's Central Valley:

> *"The Central Valley is a huge basin filled with sediments. The deepest parts of the gravels and sands are marine sediments that have accumulated since the late Jurassic—145 million years ago. The sea retreated from the Central Valley at about the same time that the southern Coast Ranges were uplifted, and during the long history of accumulation of marine sediments in the valley, the basement rock continued to subside. During most of the Pleistocene the area was occupied by shallow brackish and freshwater lakes. During the last 5 million years, sediments accumulated as alluvial deposits washed out of the mountains. These deposits are only a few thousand feet deep over most of the valley floor."*

Within the San Luis NWR Complex, the land consists primarily of recent alluvial floodplains and basin lands, with soil types generally being mixed alluvium mapped as the soil associations. The basin soils are affected by high water tables through river seepage, in addition to saturation of the landscape through deep penetration of both rain and irrigation water. Generally, most soils exhibit poor drainage and the high water table at a depth of only three to six feet between December and April (Arkley 1964). A majority of the Complex land was leveled and intensively farmed in the past for both row crops and irrigated pastureland, although the San Luis NWR Complex also has areas that retain their historic topography. The Complex's landscape is bisected by the San Joaquin, Bear Creek, and Mariposa Creek drainages, which have flood control levees on the banks. Areas that retain their natural topography include the riparian corridors inside the levees, which were not intensively developed for agriculture (Service 2023).

Geology and Soils: Environmental Consequences

Alternative A

While no effect is anticipated to geology, long-term, adverse effects to soils could occur under Alternative A, as feral pigs would continue to root for food, thus breaking up and loosening the surface and near-surface layers of the soil column. Disturbance could be shallow to substantial, with overturned soil being exposed to sunlight and oxidizing, thus interrupting natural soil processes and destroying microorganisms that promote healthy soil (Cooperative Extension 2019c). The USDA estimates that the uprooted areas can range from small patches up to acres in size, such as at the Savannah Preserve State Park in Florida where feral pigs uprooted a 2.2-acre continuous patch that was approximately 16 inches in depth (2015; Engeman et al. 2007a). It has been documented that feral pigs impact soils through their trampling, rooting, and wallowing behavior (Vtorov 1993, Karlen et al. 1997). This invasive species could continue to damage soils, thus reducing ground vegetative cover and leaf litter, accelerating the leaching of nutrients, interfering with the decomposition cycle, in addition to accelerating erosion and down-gradient sedimentation (Cooperative Extension 2019c).

Alternative B

Alternative B would have no effect to geology and short-term, minor effects to soils through minor vegetation removal to install the feral pig fencing/traps, installing the traps, and feral pigs disturbing the ground while in the traps. The soil disturbance would be temporary and occur in limited areas. Staff would utilize rebar stakes, t-posts, and other earth anchors and cables to secure the fence/trap to the ground to a max depth of three feet, but likely less and small in diameter. There is potential for feral pigs to disturb the soil while temporarily trapped, although the traps would be checked daily while they are set. Traps would be placed preferably in ruderal, non-sensitive habitat. There is also potential for minor, superficial soil disturbance through the use of UTVs by Service staff, USDA WS staff, or other cooperator in order to install and check the traps and cameras. While some disturbance is anticipated, any temporary minor impacts would be outweighed by the benefits to soils through the management of feral pigs within the San Luis NWR Complex.

Climate Change: Affected Environment

The San Luis NWR Complex occurs within the San Joaquin Valley, which lies between the Coastal Range and Sierra Nevada Range, and is classified as a Mediterranean climate consisting of cool, wet winters and hot, dry summers (Service 2006; 2023). Average temperatures range between 38 degrees Fahrenheit (F) to just over 100 degrees F (with extremes between 20 degrees F to 115 degrees F). Precipitation occurs during the winter and spring months, with an annual average of less than five inches of rain in the south to 15 inches in the north (Service 2006; 2023). The frost-free growing season is 270 to 300 days long and the climate promotes widespread grasslands. Due to cold air from the surrounding mountains draining into the San Joaquin Valley, the cold air becomes trapped and forms a persistent inversion layer, which manifests as a dense, ground-hugging fog known as tule fog. The summer days are characterized as hot and hazy, and the air quality is poor (Service 2006).

Within the Central Valley, climate change is anticipated to influence management strategies for both surface water and groundwater, as it may yield changes in streamflow and groundwater storage. In the Central Valley where the San Luis NWR Complex is located, there is demand for water resources for agriculture, the environment, and the public (U.S. Geological Survey 2009). According to California's Fourth Climate Change Assessment's *San Joaquin Valley Region Report*, potential impacts due to climate change for this region include an acceleration in increasing temperatures with more intense and frequent heat waves, more intense and frequent droughts, severe and frequent wildfires, as well as a higher frequency of catastrophic floods. The aforementioned impacts due to climate change are likely to severely impact water resources, as well as negatively impact agriculture and ecosystems within the region (Santiago Fernandez-Bou et al. 2021).

The San Joaquin River water quality is currently below optimum for aquatic life, as groundwater overdraft occurs in the Central Valley. Levees are in place that do not allow flooding of adjacent land, meaning floods are more devastating when they do occur. With armored riverbanks, climate change is likely to have negative impacts on the landscape, particularly if predictions are correct and snow shifts to rain, aggravating flooding and potentially increased levee work (Service 2011b). However, overall climate change impacts to water availability within the Complex, in addition to increased demand for water resources at the regional level, will continue to limit available water resources for the San Luis NWR Complex. Service staff mitigate adverse effects due to drought by prioritizing water allotments to support waterfowl populations, in addition to enhancing water conservation and developing alternative water sources, such as increased groundwater pumping (Service 2023). Rising temperatures cause less precipitation to fall as snow, thus reducing the amount and reliability of water availability within the

Central Valley reservoirs. Increased energy demands leading to increased cost of electricity make it more difficult to manage wetland habitat and the agricultural program through operation of lift pumps and deep wells on the Merced NWR. In order to meet wetland and wildlife management needs within the Complex, it is essential that water quantities are maintained (Service 2023).

Soils can also play a role in climate change, as they hold and release carbon, with over two-thirds of the carbon in terrestrial ecosystems stored within the soil, and there is growing evidence that there are critical feedbacks between climate change and soil processes (USDA 2015; Powlson et al. 2011; Wall et al. 2012). According to Solomon et al. (2009), carbon dioxide can be released from the soil and this greenhouse gas is a major contributor to climate change.

To address the objective related to climate change within the San Luis NWR Complex, some of the strategies to assist wildlife and plants to adapt include:

- Reduce non-climate stressors (i.e., invasive species, wildfires, agriculture conversion, energy development, urbanization, contaminants and wildlife crime) and address interactions among climate and non-climate stressors in priority landscapes.
- Reduce susceptibilities to disease, pathogens and contaminants through improved surveillance and response capabilities and identification and implementation of management measures to reduce wildlife vulnerabilities.
- Identify and monitor wildlife resources that are critically vulnerable to climate change.
- Set strategic priorities and guide tactical efforts to achieve resilience, representation and redundancy of wildlife and plant populations and habitats.
- Identify and prioritize key ecological processes (including pollination, seed dispersal and nutrient cycling) that must be protected or restored to sustain wildlife populations over this century.
- Identify reactive and anticipatory approaches to facilitate adaptations by wildlife.
- Use landscape conservation approaches that identify key areas that must be conserved to account for climate change impacts.
- Identify water management capabilities and needs for wildlife conservation; work with partners, including water management agencies and other water entities, to ensure water resources of adequate quantity and quality to support biological objectives for wildlife (Service 2023).

Climate Change: Environmental Consequences

Alternative A

Under Alternative A, adverse, long-term effects to the sensitive habitats within the San Luis NWR Complex caused by feral pigs could continue and grow in size, as the population of this quickly reproducing species grows, including damage to riparian and wetland areas that are essential to listed species within the Complex. Impacts to soils caused by this destructive species could increase carbon dioxide being released into the atmosphere, in addition to providing a nexus for invasive plants to dominate landscapes these species impact, thereby reducing native habitat and food sources for native wildlife. Alternative A would prevent the Complex from achieving the climate change objective by not allowing for monitoring and management of this invasive species.

Alternative B

As part of reducing non-climate stressors within the San Luis NWR Complex, the Complex has an objective of managing invasive species at the landscape level. This objective includes reducing the area

of coverage of non-native invasive plants and animals within the Complex that adversely affect native plant and wildlife communities, while meeting the Complex's habitat management objectives, and reducing the opportunities for non-native species to colonize within the Complex or on surrounding lands (Service 2023). The rationale behind this objective is that invasive species are now the single greatest threat to the Refuge System, as well as to the Service's wildlife conservation mission, and these non-native species often dominate old agricultural fields, as well as early successional stages of restoration areas (Service 2023).

In addition to adversely effecting native plants and wildlife, feral pigs are large animals that disturb the soil, which can increase carbon being released from soils as carbon dioxide (USDA 2015; Risch et al. 2010). Feral pigs rooting for plants, fungi, and animal matter for food sources can range from an inch of impact to the soil to a yard in depth, depending on soil conditions and the availability of underground food sources (USDA 2015). In addition to adversely effecting native plants and wildlife, feral pigs are large animals that disturb the soil, which can increase carbon being released from soils as carbon dioxide (USDA 2015; Risch et al. 2010).

Feral pigs rooting for plants, fungi, and animal matter for food sources can range from an inch of impact to the soil to a yard in depth, depending on soil conditions and the availability of underground food sources (USDA 2015). As stated in the *Geology and Soils* section above, impacts have been documented from small patches up to acres in size, and occur from trampling, rooting, and wallowing behavior. Through repeated use of wallows by feral pigs, the areas adjacent can become denude of vegetation and have compacted soils, which are generally found in or adjacent to riparian and bottomland habitats. This invasive species natural wallowing behavior in mud or muddy waters also impacts sensitive wetland and riparian habitats within the Complex. Through repeated use of wallows by feral pigs, the areas adjacent can become denude of vegetation and have compacted soils, which are generally found in or adjacent to riparian and bottomland habitats (Mayer 2009, Chavarria et al. 2007).

Implementation of Alternative B, the proposed action, could have beneficial, long-term effects on wildlife in regard to climate change, as it would assist in protecting sensitive habitats, plants, and soils that native species depend on from the destruction of feral pigs.

Air Quality and Greenhouse Gas Emissions: Affected Environment

The Federal Clean Air Act of 1970 (42 U.S.C. §§ 7401, as amended) regulates all sources of air emissions and mandates the establishment of ambient air quality standards. Areas that violate the standards are required to prepare and implement plans to meet them, with the Environmental Protection Agency (EPA) establishing health-based national ambient air quality standards (NAAQS) for six commonly found air pollutants known as "criteria air pollutants". If a geographic area meets or is cleaner than the national standard, it is designated as an "attainment" area, while an area that does not meet the national standard is a "nonattainment" area, with these designations being specific to each pollutant (EPA 2024). The State also establishes California Ambient Air Quality Standards (CAAQS), requiring incremental progress towards attainment status. The six air pollutants are ozone (O_3), particulate matter (PM), carbon monoxide (CO), particulate lead (Pb), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2).

Due to the San Joaquin Valley's topography, the area is known as having some of the United States worst air quality, as the mountain ranges surrounding the Valley trap air pollutants (EPA 2024). Elevated ozone levels also occur within the Valley due to high temperatures, subsidence inversions, and light

winds. In addition to these elements, ground level or higher altitude winds transport pollutants from other air basins in the San Joaquin Valley, as well as from the Valley to downwind areas and other regions (San Joaquin Valley Air Pollution Control District [SJVAPCD or District] 2004). From the years 2020 to 2021, the San Joaquin Valley's O_3 concentrations were largely influenced by emissions from wildfires, thus increasing significantly during these years (SJVAPCD 2022).

California and the EPA are working to reduce fine particulate matter, or $PM_{2.5}$, which is known for causing a wide range of health issues, within the San Joaquin Valley. The District, Central Valley Air Quality Coalition, and California Air Resources Board (CARB) collaborate with the EPA in the goal for reduction of $PM_{2.5}$ in the air (EPA 2024). The District also has adopted numerous State Implementation Plans in order to attain NAAQS (SJVAPCD 2023a). The Federal government and State also established ambient air quality standards, which the District monitors to determine concentrations of regulated pollutants within the San Joaquin Valley. Throughout the eight counties of the San Joaquin Valley there are 38 air monitoring sites, with the District directly operating and maintaining 24 of the sites (SJVAPCD 2023b).

The District analyzes the samples from the air monitoring sites and determines the concentration of O_3, $PM_{2.5}$, PM_{10}, NO_2, CO, and SO_2. Based on air monitoring, the San Joaquin Valley meets the Federal EPA attainment standards for particulate matter less than 10 microns in diameter (PM_{10}); meets attainment/unclassified standards for CO, NO_2, and SO_2; and there is no Federal designation or classification for Pb. There is no designation or classification for lead at the Federal level. At the State level, the San Joaquin Valley meets the attainment standards for NO_2, SO_2, and Pb, as well as attainment/unclassified for CO (SJVAPCD 2023a).

However, the San Joaquin Valley does not meet the Federal EPA attainment standards for O_3 and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), nor meet the State attainment standard for O_3, PM_{10}, and $PM_{2.5}$ (SJVAPCD 2023a). $PM_{2.5}$ and PM_{10} are derived from different emission sources and chemical compositions, including emissions from the combustion of gasoline, oil, diesel fuel, or wood. In addition, PM_{10} includes dust from construction sites and wind-blown dust from open lands, wildfires and brush or waste burning, industrial sources, landfills and agriculture, as well as pollen and fragments of bacteria (CARB 2023a). O_3 is a component of smog and is created through chemical reactions between pollutants emitted from vehicles, industrial sources such as factories, fossil fuels, combustion, and many others (CARB 2023b).

Short and long-term exposure to $PM_{2.5}$ is associated with premature mortality, as well as heart and lung issues, including bronchitis, asthma, and other respiratory symptoms. Short-term exposure to exposure to PM_{10} is associated with worsening of respiratory diseases such as asthma and chronic obstructive pulmonary disease, which can lead to hospital visits, while the long-term exposure effects are less clear (CARB 2023a). Inhalation of O_3 can cause inflammation and irritation of the tissues lining the human airways (CARB 2023b).

Air Quality and Greenhouse Gas Emissions: Environmental Consequences

Alternative A

There is potential for a minor increase in dust (PM_{10}) under this alternative, as feral pigs disturb native vegetation through their rooting, wallowing, and trampling behaviors that expose bare soil. In addition,

as discussed in the *Climate Change* section above, impacts to soils through feral pigs rooting and wallowing behaviors can increase carbon dioxide being released into the atmosphere.

Alternative B

Short-term, minor effects to air quality could occur through Service, USDA WS staff, or other cooperator driving vehicles searching for feral pigs, as well as potentially removing carcasses off of the San Luis NWR Complex, in addition to UTV use for setting, checking, and removing traps, as well as cameras. The management and monitoring of feral pig would occur by existing on-site Service personnel, USDA WS staff or potential cooperator in the future. Increase in dust (PM_{10}) and carbon emissions from vehicles or UTVs (such as nitrous oxides, sulfur oxides or carbon dioxide) would be minimal compared to existing operational use within the Complex and surround landscape, and is not anticipated to have a long-term effect on local air quality.

Minor vegetation removal for installation of feral pig fencing and traps, installation of the fencing and traps, as well as feral pigs impacts to soil while temporarily in the traps may result in temporary, localized dust and primarily hand tools will be utilized. Overall, there will be minor increases in carbon emissions and particulate emissions, as well as a negligible increases in localized dust. These activities will be infrequent in comparison to current management activities within the Complex, with air quality impacts dissipating rapidly.

In addition, leaving feral pig carcasses on-site to decompose will have only short-term impacts on air quality, and impacts are likely minimal to humans as it's anticipated the carcasses would not be in areas where the public are likely to encounter the carcass or associated odor (USDA 2015). In addition, should off-site disposal be utilized, the Service, USDA WS staff, or other cooperator would dispose of the carcasses in compliance with State and local laws. Feral pig control may have beneficial effects long-term in regard to air quality by lowering the population of feral pigs that could potentially increase carbon dioxide through their rooting and wallowing behaviors.

Soundscape: Affected Environment

Soundscape refers to the audible noises within an area. The Noise Control Act of 1972, as amended, was created to promote an environment free from noise that jeopardizes health or welfare (42 U.S.C. 4901). The Grasslands WMA consists predominantly of privately owned easements, but the Refuges within the Complex have portions open to the public for compatible uses. Waterfowl hunting is a compatible use within some of the units of the San Luis and Merced NWRs and does not pose a threat to native wildlife, and is some instances is necessary for wildlife management. Hunting programs can promote understanding and appreciation of natural resources and their management on lands and waters where hunting is a compatible use. Generally, the soundscape within the Complex land consists of natural sounds from the surrounding land.

Soundscape: Environmental Consequences

Alternative A

Increasing urbanization has reduced opportunities for the public to experience quiet acoustic environments, with increasing noise affecting both humans and wildlife alike. Humans seek out protected natural landscapes in order to experience wildlife and the pleasant soundscapes congruent to those areas (Levenhagen et al. 2020). However, feral pigs are known to make loud, high-pitched squeals and screams, in addition to deep growls and grunts (Wildlife Ambience 2023). There could be minor,

long-term effects to the natural soundscape of the San Luis NWR Complex with the no action alternative, as this invasive species does not naturally occur within the land the Complex protects.

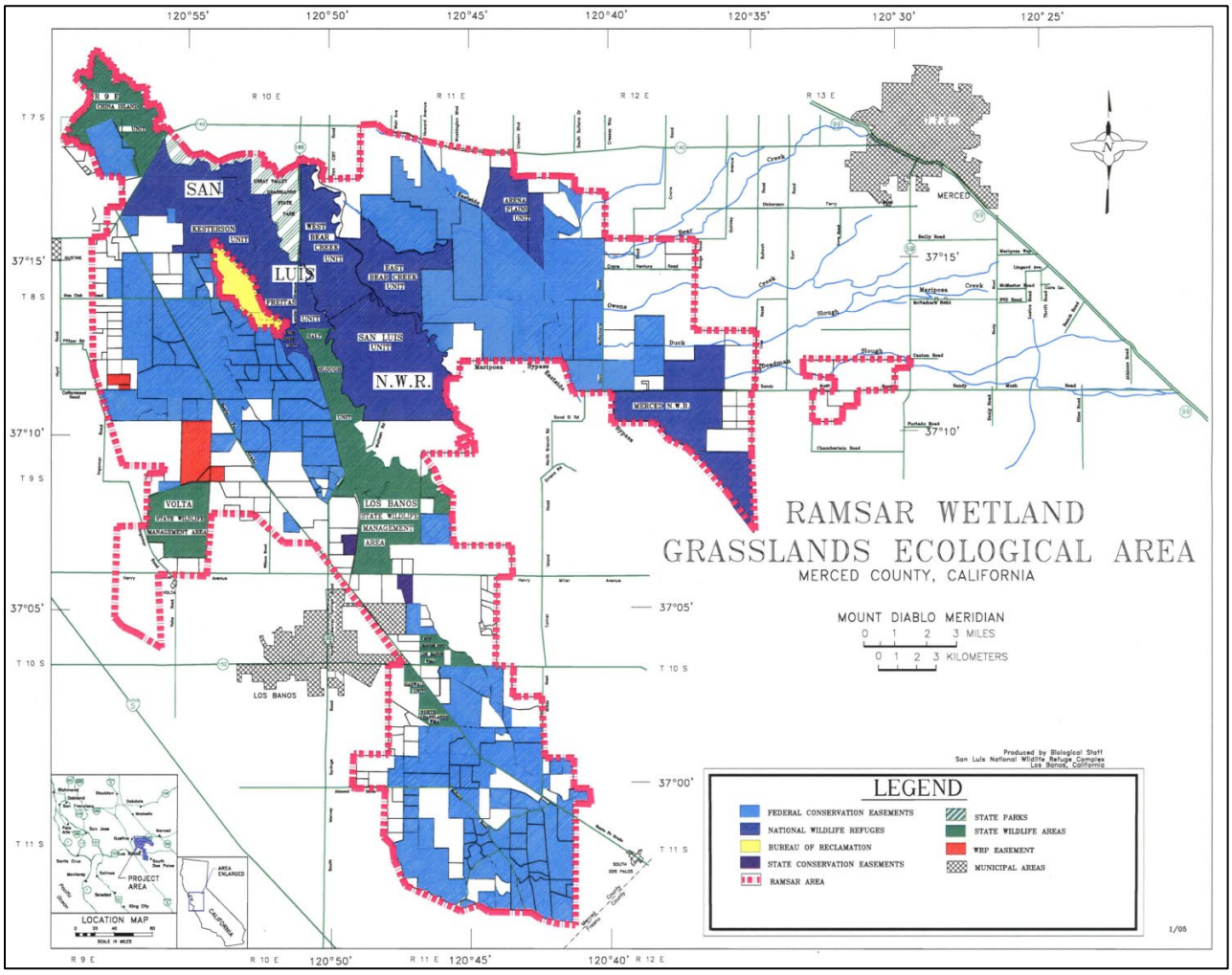
Alternative B

Short-term, minor effects to soundscape may occur when dispatching feral pigs. The use of firearms for hunting is a compatible use within units of the San Luis and Merced NWRs for waterfowl hunt season. Use of firearms also occurs by hunt clubs on privately owned easements in the Grasslands WMA during waterfowl hunting season. Firearms used for dispatching feral pigs under Alternative B would be operated by trained professionals and may be equipped with noise suppressors to avoid disturbance, as well as minimize the potential for feral pigs to flee from the gunfire sound. Noise impacts from implementing the preferred alternative would be temporary and would not occur in proximity to sensitive noise receptors (i.e. residential uses).

Special Land Status Designations: Affected Environment

The land within the San Luis NWR Complex does not contain any of the following special land status designations: Wilderness Areas, Wild and Scenic Rivers, Coastal Zone Management, or Research Natural Area. However, the Complex occurs along the northern boundary of the Grasslands area, which contains the largest expanse of freshwater wetlands within the state. The San Luis NWR, Merced NWR, and Grasslands WMA are also part of the Ramsar Wetlands, which is a designation of wetlands of international importance (see **Figure 13**, *Ramsar Wetlands*, Ramsar 2023).

Figure 13. Ramsar Wetlands



The Complex also occurs within the Western Hemisphere Shorebird Reserve Network and is an Audubon Important Bird Area (Service 2023, California Audubon 2023). The Important Bird Area designation is part of a global initiative to protect land that is important to support bird populations. According to the Audubon, "Important Bird Areas are large enough to safeguard a viable population of a species, group of species, or entire avian community during at least part of its life-cycle but are small enough to be conserved in their entirety" (Audubon 2015).

The importance of these freshwater wetlands for waterfowl and other waterbirds is recognized by the Central Valley Joint Venture (CVJV), as well as the North American Waterfowl Management Plan. The San Luis NWR Complex functions as a northern extension of the Grasslands area, due to its value to wildlife. The freshwater wetlands in this area are of international importance for both shorebirds and migratory waterfowl of the Pacific Flyway. The San Luis NWR Complex provides important habitats for Birds of Conservation Concern (Service 2021). The Central Valley provides wintering habitat for approximately 60 percent of the waterfowl in the Pacific Flyway, as well as critically important migration habitat for other ducks and geese continuing southward to wintering areas in Mexico and Central America (Gilmer et al. 1982, Service 2023).

According to the Central Valley Midwinter Waterfowl Survey, approximately 8.5 million waterfowl were estimated in the CVJV planning area in 2020 (CVJV 2020). Common wintering species include the snow goose (*Chen caerulescens*), Ross's goose (*Chen rossii*), western Canada goose (*Branta canadensis moffitti*), Aleutian cackling goose (*Branta hutchinsii leucopareia*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), green-winged teal (*Anas crecca*), northern shoveler (*Anas clypeata*), gadwall (*Anas strepera*), American wigeon (*Anas americana*), canvasback (*Aythya valisineria*) and ringed-necked duck (*Aythya collaris*) (Root 1988, Service 2023).

The Central Valley is a key region for many other waterbirds and shorebirds, as well. Species of waterbirds that occur in abundance within the Central Valley include sandhill cranes (*Grus canadensis*), great blue heron (*Ardea herodias*), great egret (*Ardea alba*), white-faced ibis, (*Plegadis chihi*), and American coot (*Fulica americana*). Millions of shorebirds either overwinter in the Central Valley or migrate through, including greater yellowlegs (*Tringa melanoleuca*), long-billed curlew (*Numenius americanus*), western sandpiper (*Calidris mauri*), least sandpiper (*Calidris minutilla*), dunlin (*Calidris alpina*), and long-billed dowitchers (*Limnodromus scolopaceus*). Shorebirds such as the killdeer (*Charadrius vociferus*), black-necked stilt (*Himantopus mexicanus*), and American avocet (*Recurvirostra americana*) are local breeding birds (Root 1988, Shuford et al. 1998, Service 2023).

Special Land Status Designations: Environmental Consequences

Alternative A

Alternative A could have long-term, adverse effects on the sensitive wetlands within the San Luis NWR Complex, which are designated as wetlands of international importance and Ramsar Wetlands. As stated under Alternative A in the *Wetlands* section above, the destructive nature of feral pigs through their rooting and wallowing behavior causes erosion and water quality issues and degrades the banks of wetland habitat that is essential for native wildlife, including waterbirds and shorebirds. Without monitoring and management of the feral pig population, it will continue to grow within the Complex, thus rapidly increasing the impacts to native habitats and wildlife caused by this invasive species.

Alternative B

The proposed action, Alternative B, would have long-term, beneficial effects for the special lands designated within the San Luis NWR Complex. This alternative would protect the land designated as an Audubon Important Bird Area, in addition to the Ramsar Wetlands designation. Through monitoring and management of feral pigs, Alternative B would control the feral pig population within the Complex and monitor for sign of feral pigs, especially along sensitive wetland habitat where this invasive species prefers to wallow and root. Through implementation of this alternative, the Service would minimize the loss and degradation of wetlands within the Complex, as this alternative would allow for the preservation of wetlands by managing this destructive species.

4.3 Cultural and Historic Resources

Archeological Resources: Affected Environment

The Central Valley is rich in Native American cultural history, as Native Americans lived in permanent villages above the floodplain. The rivers and tributaries were rich in an abundance of natural resources where the native people of the San Joaquin County, known as the Yokuts, made their homes (Service 2006). Merced County is the homeland of several Native American groups, collectively known as the Northern Valley Yokuts (Service 2023). The adjacent Miwok tribe likely traded with the Yokuts, as well as

potentially intermarried and shared many cultural practices (Silverstein 1978). Dietary staples included valley oak acorns, salmon, as well as tule elk, antelope, and jackrabbit (Levy 1995).

The major Northern Valley Yokuts settlements were nearby the San Joaquin River and major tributaries, usually built on higher ground so as to utilize the natural resources without being flooded (Service 2023). The Yokuts tended to congregate in the wintertime, dispersing in spring, summer, and fall to gather natural resources (Jensen 1996). The villages they created generally consisted of four or five to several dozen structures, with each home serving one family (Service 2023). In 1805, the Spanish cavalry were astonished by the abundance of wildlife within the San Joaquin Valley (Service 2006). Spanish settlement shifted land use away from hunting and gathering and toward agrarian use, with many Native Americans being assimilated in the mission system by the 1820s. The Spanish introduced cattle and sheep, with as many as 400,000 cattle and 300,000 sheep at the peak of the mission period in the State (Schoenherr 1992, Service 2023).

However, conditions started rapidly changing by the 1850s as Europeans began to settle and develop the land. Forests were cut down for lumber and firewood, and by the late 1800s to early 1900s the wetlands were being drained, creeks channelized, and trees removed from floodplains to create agricultural land. Water storage and flood control facilities were built in the San Joaquin Valley in the 1940s to 1950s along the rivers and major tributaries, greatly narrowing the floodplain through the use of flood control levees (Service 2006).

The landscape where the San Luis NWR Complex is located was drastically altered through the alterations of the floodplain and creation of agricultural land. Assessing for archeological activity has become more difficult due to the agricultural history of the landscape, as the soil in many areas has been manipulated through plowing or altering the grade, thus destroying historical evidence. Archaeological sites are fragile and nonrenewable, with most consisting of worked stone, fire-altered rocks, and organically enriched soil either on or close to the surface (Service 2023). Present day there are documented archaeological sites within the San Luis NWR Complex.

Archeological Resources: Environmental Consequences

Alternative A

The uncontrolled presence of feral pigs within the San Luis NWR Complex has the potential to have long-term, adverse effects on both previously recorded and unrecorded cultural resources, as the ground disturbing activities of feral pigs rooting behavior has been documented to uproot soil up to acres in size and a depth of 16 inches (USDA 2015; Engeman et al. 2007). This species could also unearth cultural resources through rooting and wallowing near sensitive water resources, destroying and causing and irreversible degradation of archaeological sites (USDA 2015).

Alternative B

Soil disturbance from implementation of Alternative B has the potential to impact cultural resources; however, Federal legislation (National Historic Preservation Act of 1966) protects cultural resources and requires the Service, to consider, and if necessary, mitigate for the impacts on cultural resources before implementation. The Service is complying by consulting with the Service Region 8 Cultural Resources Team regarding management activities within the San Luis NWR Complex. The Service is not proposing any monitoring or management activities that would result in changes in the character of, or would potentially adversely affect, any archaeological site, as the Service would implement as part of the

proposed project **Mitigation Measure 5**, *Cultural Resources*, **Mitigation Measure 6**, *Discovery of Unknown Cultural Resources*, **Mitigation Measure 7**, *Documented Cultural Resources*, and **Mitigation Measure 9**, *Disposal Sites and Sanitary Landfills*.

Therefore, adverse effects to cultural resources through implementation of this project are not anticipated. In addition, through implementation of the proposed action, potential long-term, adverse effects from an increasing population of feral pigs disturbing soil throughout the San Luis NWR Complex would be avoided, as the Plan would monitor and manage for this invasive species.

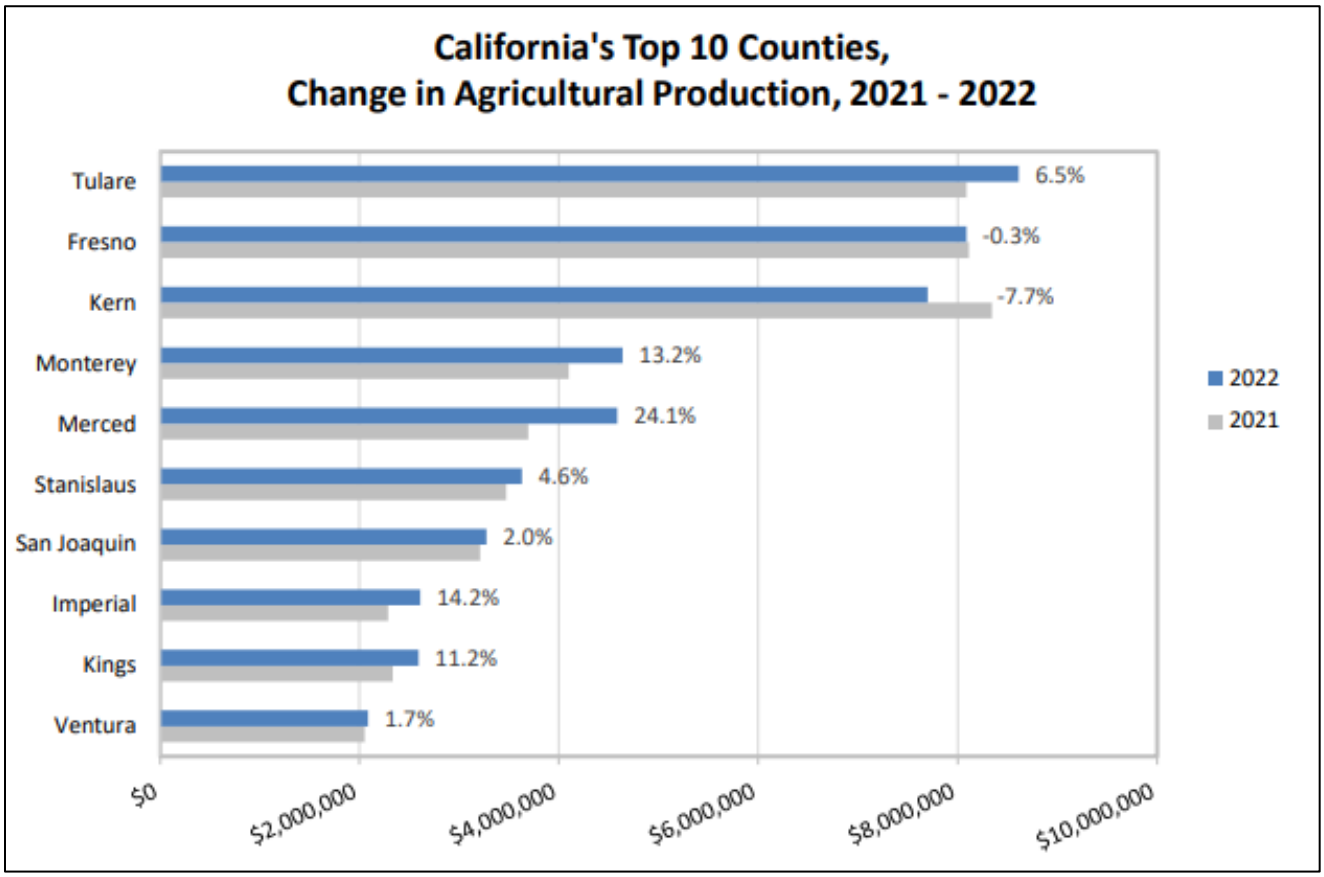
4.4 Socioeconomics

Local and Regional Economies: Affected Environment

Within the San Joaquin, Stanislaus, and Merced counties, the median household incomes range from approximately $66,164 for Merced County, approximately $75,886 for Stanislaus County, and approximately $86,056 for San Joaquin County. Meanwhile, the State average household income is approximately $91,551 (U.S. Census Bureau 2022). Within the San Joaquin Valley, an economic driver and factor in the socioeconomic structure is agriculture (Service 2023). The three counties that the Complex occurs within are all within California's top 10 counties for agricultural production (see **Figure 14**, *California' Top 10 Counties for Agricultural Production*, California Department of Food and Agriculture [CDFA] 2023).

There are 920,000 acres of agricultural land within San Joaquin County alone, and this county is the state's seventh largest producer of agriculture (San Joaquin Council of Governments 2023). As of 2022, the ranches and farms within California received $55.9 billion in cash receipts for their output, which is an eight percent increase from the prior year (CDFA 2023). As stated in the *Climate Change* section above, potential impacts due to climate change is anticipated to negatively impact agriculture, which could impact the local and regional economies given agriculture is a large economic factor within the San Joaquin Valley.

Figure 14. California's Top 10 Counties for Agricultural Production



Local and Regional Economies: Environmental Consequences

Alternative A

Alternative A could have long-term, adverse effects on the local and regional economies that depend on agricultural production through the lack of feral pig control on the San Luis NWR Complex. The local population of this quickly reproducing invasive species would continue to grow on the Complex and the species could continue spreading onto adjacent land. Without monitoring and management within the Complex, this highly destructive species would have the potential to damage and contaminate adjacent landowner's crops, in addition to adversely effecting water quality and potentially spreading parasites and diseases.

Alternative B

Implementation of Alternative B could have long-term, beneficial economic effects on adjacent privately owned agricultural land by decreasing crop damage and contamination caused by the local feral pig population by controlling the population. Through feral pig monitoring and management on the San Luis NWR Complex, control costs for adjacent land managers could be reduced as a result of the feral pig population on the Complex land decreasing. Additionally, reduced potential movement of feral pigs from the Complex onto adjacent agricultural land could result in decreased crop damage, as well as reduced concern for water quality and crop contamination caused by this invasive species, as damage could result in loss of revenues.

Environmental Justice: Affected Environment

Executive Order 12898, as amended by section 220(a) of Executive Order 14008, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* requires all Federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high or adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities.

The San Luis NWR Complex is located in the San Joaquin Valley of Central California and in Stanislaus, San Joaquin, and Merced counties. As of 2022, out of the three counties, the tracts surrounding the Complex in Merced County has the highest population of minorities at 74.79 percent, while Stanislaus County has a 61.46 percent minority population, and San Joaquin County has 71.32 percent minority population. The tracts surrounding the San Luis NWR Complex in Merced County has the highest population living below the poverty level at 15.46 percent, while Stanislaus has 10.78 percent, and San Joaquin has 10.11 percent living below the poverty level. The national average is 41.14 percent for the minority population and 8.78 percent for the population living below the poverty level (Headwaters Economics 2024).

In California, feral pigs predominantly occur on privately owned lands and approximately half of the state is under private ownership (CDFW 2023). The majority of the Complex is surrounded by privately owned grazing and farming operations. California has highest cash crop production in the United States, generating $50.1 billion in 2019 alone (CDFA and USDA 2024). Between 2010 and 2019, approximately $17.1 million in damages to agricultural resources were reported, with 79 percent of the verified losses associated with three species, which included feral pig. This invasive species caused the most damage at approximately $5.3 million in losses from damage to field crops, fruits, nuts, and pastureland (CDFA and USDA 2024). Damage from this invasive species occurs from eating crops and rooting, with the most damage caused by trampling (Cooperative Extension 2019f).

Disease transmission from feral pigs to domestic livestock, such as through water and feed, include foot-and-mouth disease, classical pig fever, and African pig fever and could cause large economic impacts (CDFA and USDA 2024, USDA 2020b). For example, if a foot-and-mouth disease outbreak occurred in California, it could cost between $8.5 and $13.5 billion (USDA 2008).

Environmental Justice: Environmental Consequences

Alternative A

Alternative A could cause long-term, adverse effects on adjacent agricultural land, as the feral pig population would continue to increase within the San Luis NWR Complex, as well as the surrounding lands. One study analyzing damage to six types of crops from feral pigs in 12 states, including California, found that feral pig damage likely costs farmers $272 million per year. However, costs are potentially far higher, as only six crops were analyzed (McKee et al. 2020). Within the U.S., the USDA estimates that $1.5 billion has been spent annually on feral pig damage and control (Glow et al. 2020). Substantial economic losses from feral pig destruction can force agricultural producers to plant less-profitable crops that are less desirable to this invasive species. Rooting behavior by this destructive species not only ruins crops, but also degrades the nutritional quality of pastureland by disturbing the land and allowing invasive plant species to colonize. Feral pigs also damage fences, irrigation systems, levees, residential yards, in addition to compromising the integrity of power poles (Glow et al. 2020, Centner and Shuman 2015).

The lack of feral pig management could also impact adjacent neighboring landowners through disease transmission, as well as the cost of vehicle collisions with this invasive species, which is estimated at $36 million annually in the U.S. from property damage and personal injury (Cooperative Extension 2019e).

Alternative B

Alternative B, the proposed project, would not have adverse effects on minority or low-income populations or communities. Instead, feral pig management and monitoring within the San Luis NWR Complex could have long-term, beneficial effects for the adjacent privately owned agricultural land, as feral pig populations would decrease within the Complex and likely on privately owned adjacent land, as well.

Public Health and Safety: Affected Environment

As stated above, vehicle collisions with feral pigs, which can reach over 200 pounds in size with a relatively low center of gravity, is estimated to cost $36 million annually in property damage and personal injury within the United States (Cooperative Extension 2019e). This invasive species can carry at least 30 diseases and almost 40 various parasites that can impact humans, in addition to transmitting foodborne illnesses with the ability to cause elevated waterborne bacteria levels in water sources (Finzel and Baldwin 2015).

Sounders tend to spend the majority of their day wallowing in water sources, leaving large amounts of excrement that can be washed down stream and potentially carry harmful pathogens. Parasites and bacteria that wallowing behavior can spread include *giardia*, *salmonella*, and pathogenic *E. coli*, which can be transmitted to and sicken humans, livestock, and pets. Rooting or defecating in crops, contaminating irrigation sources for crops, and contaminating water sources in general are ways feral pigs spread these pathogens. For example, feral pigs are suspected of contaminating surface water and spinach fields in California that led to a foodborne illness outbreak that resulted in the death of three people and sickened 205 people (USDA 2016). In addition, this invasive species can also become aggressive toward humans, as well as pets (USDA 2020b).

Since the year 2000, feral pigs have been observed in numerous suburban and urban areas in the United States (see **Figure 15***, Locations with Reported Feral Pig Problems in Suburban and Urban Areas Since 2000*, USDA 2019f). Feral pigs have spread into more heavily urbanized areas utilizing drainage corridors and extensive greenway systems, foraging beyond those areas by consuming natural vegetation and man-made food resources (Cooperative Extension 2019f).

Figure 15. Locations with Reported Feral Pig Problems in Suburban and Urban Areas Since 2000

Public Health and Safety: Environmental Consequences

Alternative A

The lack of feral pig control under Alternative A would allow the population to increase within the San Luis NWR Complex and potentially the surrounding agricultural land, as well. Feral pig females sexually mature at six to nine months of age and can have up to two litters per year of three to 18 piglets per litter, with an average of five or six piglets (Finzel and Baldwin 2015). Therefore, lack of control for this invasive species could allow for an exponential population increases and thus further compound the potential for long-term, adverse effects from this species to public health and safety through disease and parasite transmission, vehicle collisions, water quality issues, and effects to local landscapes.

Alternative B

Under Alternative B, feral pig management and monitoring would decrease the population within the San Luis NWR Complex, as well as potentially on the adjacent lands. Therefore, the proposed project would reduce the potential for adverse effects to public health and safety, such as from vehicle collisions, as well as through the spread of foodborne or water illnesses contaminated by feral pigs. The proposed alternative could have long-term, beneficial effects, as management of the feral pig population could health prevent disease and parasite transmission, vehicle collisions, water quality issues, and effects to local landscapes caused by this invasive species.

4.5 Refuge Resources

Visitor Use and Experience and Aesthetics, Viewsheds and Visual Resources: Affected Environment

The San Joaquin River NWR manages a diverse visitor services program that provides opportunities for wildlife watching, photography, birding, painting and drawing, hiking, and picnicking. Within this Refuge there is an approximately 4-mile Pelican Nature Trail visitors can hike that meanders upland, wetland, and riparian habitat providing views of the San Joaquin River. The San Luis NWR contains over 15 miles of auto tour routes, as well as more than 10 miles of nature trails that lead visitors to wetland, upland, and riparian habitats. Recreation within this Refuge includes wildlife watching, birding, photography, picnicking, hiking, fishing, hunting, and auto tours.

The Merced NWR provides visitors with a 5-mile auto tour, as well as four nature trails to hike. Other activities within this Refuge include birding, photography, picnicking, wildlife watching, and hunting. The Grasslands WMA consists entirely of privately owned land; therefore, there is no public access or visitation for this WMA for the public.

Visitor Use and Experience and Aesthetics, Viewsheds and Visual Resources: Environmental Consequences

Alternative A

Alternative A could have long-term, adverse effects on visitor use and experience, as well as aesthetics, viewsheds, and visual resources as feral pigs would continue to degrade the sensitive habitats within the San Luis NWR Complex. Visitor use and experience could decline as habitats they visit the Complex to view are impacted from feral pigs wallowing and rooting behavior and native species are less likely to be observed near the habitats visitors enjoy viewing.

According to the USDA, outdoor activities such as hiking, bird and wildlife watching, and fishing are the most likely the be impacted by the presence of feral pigs (2015). The USDA also states that the physical damage caused by feral pigs to the environment has the potential to adversely impact recreation in the outdoors, in addition to potentially adversely wildlife distribution and movements, and thus opportunities for viewing wildlife (2015). Since feral pigs are prolific breeders, as the population increases within the Complex it could lead to potential interactions with visitors, and feral pigs can be aggressive (Glow et al. 2020). While rare, attacks to humans by feral pigs generally occur during daylight hours, with the majority of victims being attacked while walking. Interactions with humans include vehicles collisions and is estimated at $36 million in damages annually (Helcel and Cathey 2019). In addition, interactions are more dangerous due to feral pigs being able to carry at least 30 diseases and almost 40 parasites that can impact humans (Finzel and Baldwin 2015).

Alternative B

With the proposed action, Alternative B would monitor and manage for feral pigs where signs are observed within the San Luis NWR Complex. With implementation of **Mitigation Measure 8**, *Closures*, efforts would be made to trap feral pigs away from locations that are publicly accessible within the Complex, and if trapping were necessary near publicly accessible areas, temporary closures may occur. There is potential for minor, short-term effects to visitor use and experience through this alternative; however, the long-term effects would have beneficial effects for both visitor use and experience, as well as aesthetics, viewsheds, and visual resources within the Complex. The sensitive habitats and native

species the public visits the Complex to experience would be protected from feral pig degradation, so that they can be enjoyed for future generations.

Management and Operations: Affected Environment

Management goals within the San Luis NWR Complex on Service land includes conserving, protecting, managing, restoring, and enhancing native habitats, plants, and wildlife species of the San Joaquin Valley, with an added emphasis on supporting the abundance of migratory birds. Maintaining and ideally improving water quality is critical to maintaining the health and productivity of the fish and other native wildlife within the San Luis NWR Complex and is an essential part of Service operations (Service 2023). As part of the Complex's management and operations, the Service has a goal of contributing to the recovery of threatened and endangered species, in addition to protecting endemic Central Valley wildlife and special-status species and their habitats.

To assist in maintaining, enhancing, and restoring natural ecological processes throughout the Complex in order to have healthy and functioning ecosystems for native wildlife, the Service has a management goal of developing strong relationships with other entities, such as research institutions, partners, as well as local, State, and Federal agencies. Coordination with these entities could assist with natural resource management within the larger context of the Central Valley and Pacific Flyway (Service 2006, 2023). In addition, maintaining and enhancing communication with adjacent landowners to identify issues or concerns at an early state and resolve any issues that arise in order to mutually assist one another on projects addressing those concerns is an objective for the Service (Service 2023).

Goals for the Complex on Service land also includes providing the public with opportunities for compatible, wildlife-dependent recreation and other uses in order to enhance visitor's understanding, appreciation, and enjoyment of the native plants, animals, and habitats within the Complex. For the Grasslands WMA, the Service has a goal to manage the Service's easement program to benefit native wildlife on the privately owned land (Service 2023).

Management and Operations: Environmental Consequences

Alternative A

There could be moderate adverse, long-term effects to the management and operations of the San Luis NWR Complex under Alternative A. Without monitoring and management of the quickly reproducing feral pig population, known for their voracious appetites and consumption of whatever is easiest to catch, the native plant and wildlife populations could decrease rapidly. As stated in the *Habitat and Vegetation* section above, feral pigs are capable of converting native habitat to non-native through their rooting, wallowing, trampling, and feeding behaviors and are considered "ecosystem engineers," including negatively affecting water quality on the landscape (USDA 2020a).

Alternative B

Alternative B could have beneficial, long-term effects on the management and operations of the San Luis NWR Complex, as the proposed action would assist the Service in meeting goals and objectives for the protection of the sensitive environmental resources within the Complex. The proposed action would include coordination with adjacent landowners and assist in preventing establishment of feral pigs by actively managing the population. Alternative B would protect native wildlife and their food sources, prevent water quality from being degraded by this invasive species, as well as stop habitat-type conversion caused by their rooting, wallowing, trampling, and feeding behaviors.

4.6 Cumulative Impacts

Cumulative long-term, beneficial effects could occur through the combination of the proposed project, as well as past, present, and future local actions. Garnering $24.5 million in grant funding for riparian and floodplain restoration, the Service has restored approximately 2,700 acres of riparian woodland habitat and 700 acres of wetland habitat, in addition to eight miles of flood refugia on levee slopes since 2002 within the San Joaquin River NWR (Service 2021a). There are also numerous actions within the vicinity of the San Luis NWR Complex that are beneficially affecting the natural resources the proposed project would assist in protecting.

River Partners is preventing further degradation to natural resources by restoring floodplains throughout the Central Valley, in order to protect threatened and endangered wildlife by restoring riverways utilized by these native species. Since 2012, River Partners, in partnership with other entities, has restored approximately 1,500 acres of floodplains at Dos Rios Ranch Preserve and Hidden Valley Ranch, with plans to restore an additional approximately 500 acres in the next three years. This is California' largest floodplain restoration project and is a $40 million endeavor occurring at the confluence of the Tuolumne and San Joaquin Rivers. Within the Grasslands Ecological Area, restoration by River Partners at the nearby Great Valley Grasslands State Park will reactivate a disconnected floodplain ecosystem to support the recovery of endangered salmon and restore floodplain habitat (River Partners 2023, 2024).

Monitoring and managing for feral pigs within the San Luis NWR Complex could assist neighboring agricultural landowners that are currently managing for feral pigs by preventing further damage on their properties, given feral pigs could move between the Complex and neighboring privately owned agricultural land. The USDA is conducting feral pig management efforts throughout California. Due to this invasive species' ability to dominate and damage landscapes quickly, efforts to control feral pig populations within the San Luis NWR Complex could assist USDA and other entities' efforts to stop the spread and damage caused by this species to agricultural resources, as well as natural resources, such as floodplains and other riparian areas. Through implementation of the Plan within the Complex, as well as past, present, and future local actions, there would be beneficial, long-term effects to previously degraded riparian and floodplain habitat, as well as agricultural land by preventing and undoing the damage caused by this invasive species to these resources. The long-term, beneficial effects to these resources would outweigh any temporary, minor effects caused by implementation of the Plan.

Over time the proposed action would result in incremental improvements to floodplain habitats. In combination with other ongoing and planned restoration projects in the area, it would contribute to a positive cumulative impact on these resources.

4.7 Summary of Analysis

Alternative A – Current Management Strategies – No Action Alternative

Natural Resources

Habitat and Vegetation. As described above, this alternative could result in adverse effects in the long-term. Without monitoring or management of feral pigs within the San Luis NWR Complex, this species could cause native habitats within the Complex to convert to non-native through their rooting, wallowing, trampling, and feeding behaviors, in addition to their ability to transport non-native seeds to areas they disturb. Sensitive woodlands within the Complex could be damaged through this species

"tusking" behavior to mature trees, as well as rooting below trees and damaging the roots, and their ability to rapidly consume seedlings.

Floodplains and Water Resources. Long-term, adverse effects could occur to floodplains and water resources, including wetland and riparian habitats. These sensitive areas could be eroded and degraded through this invasive species wallowing and rooting behavior, with the banks being compacted. In addition, water resources could be contaminated with infectious waterborne illnesses by a rapidly reproducing population of feral pigs.

Wetlands. Long-term, adverse effects could occur to wetlands within the Complex, as feral pigs prefer food sources of wetland habitats that are easier to attain, and the soils of wetlands are more sensitive to disturbance from this species rooting and wallowing behavior. Degradation of banks, as well as erosion and water quality issues could occur from this invasive species behavior.

Vegetation of Special Management Concern. Long-term, adverse effects could occur to vegetation of special management concern by this invasive species detrimental impacts caused by feral pigs wallowing, rooting, and trampling behavior. The voracious appetite of this invasive species, consuming three percent of their body weight per day, coupled with their extensive rooting behavior while searching for food can lead to water quality issues and erosion within the sensitive wetlands and riparian areas, as well as allow for invasion by non-native plants.

Fish and Wildlife Species. No action could have long-term, adverse effects on critical habitat, as well as native fish and wildlife species within the San Luis NWR Complex, including species listed as candidate, threatened, endangered, or other special-status species. Without monitoring and management of feral pigs, there could be a decline in native species due to competition for resources, both habitat and food; degradation of native habitats the Complex protects and potential habitat-type conversion through invasion of non-native plants due to feral pigs transporting seeds, as well as their rooting, wallowing, and trampling behavior; direct predation on native species by feral pigs; spread of diseases and parasites to native species; and reduction in water quality.

Geology and Soils. While no effect is anticipated to geology, long-term, adverse effects could occur to soils as feral pigs would continue to root for food, thus breaking up and loosening the surface and near-surface layers of the soil column. This invasive species could continue to damage soils, thus reducing ground vegetative cover and leaf litter, accelerating the leaching of nutrients, interfering with the decomposition cycle, in addition to accelerating erosion and down-gradient sedimentation.

Climate Change. Adverse, long-term effects to the sensitive habitats within the San Luis NWR Complex caused by feral pigs could continue and grow in size, as the population of this quickly reproducing species grows, including damage to riparian and wetland areas that are essential to listed species within the Complex. Impacts to soils caused by this destructive species could increase carbon dioxide being released into the atmosphere, in addition to providing a nexus for invasive plants to dominate landscapes these species impact, thereby reducing native habitat and food sources for native wildlife.

Air Quality and Greenhouse Gas Emissions. With no action, there is potential for a minor increase in dust (PM_{10}) under this alternative, as feral pigs disturb native vegetation through their rooting, wallowing, and trampling behaviors that expose bare soil, in addition to potentially increasing carbon dioxide in the atmosphere.

Soundscape. There could be minor, long-term effects to the natural soundscape of the San Luis NWR Complex with the no action alternative, as this invasive species does not naturally occur within the land the Complex protects.

Special Land Status Designations. Long-term, adverse effects could occur on the Complex land designated as an Audubon Important Bird Area, as well as sensitive wetlands within the San Luis NWR Complex, which are designated as wetlands of international importance and Ramsar Wetlands.

Cultural and Historic Resources

Archeological Resources. The uncontrolled presence of feral pigs within the Complex has the potential to have long-term, adverse effects on both previously recorded and unrecorded cultural resources through their rooting and wallowing behavior.

Socioeconomics

Local and Regional Economies. Long-term, adverse effects could occur to the local and regional economies that depend on agricultural production, as this highly destructive species could damage and contaminate adjacent landowner's crops, in addition to adversely effecting water quality and potentially spreading parasites and diseases.

Environmental Justice. Long-term, adverse effects could occur on adjacent agricultural land, as the feral pig population could continue to increase within the San Luis NWR Complex, as well as the surrounding lands. The lack of feral pig management could also have adverse effects on adjacent neighboring landowners through disease transmission, as well as the cost of vehicle collisions with this invasive species.

Public Health and Safety. Long-term, adverse effects could occur via disease and parasite transmission, vehicle collisions, water quality issues, and effects to local landscapes from this invasive species.

Refuge Resources

Visitor Use and Experience and Aesthetics, Viewsheds and Visual Resources. Long-term, adverse effects on visitor use and experience, as well as aesthetics, viewsheds, and visual resources could occur as feral pigs could continue to degrade the sensitive habitats within the San Luis NWR Complex. Visitor use and experience could decline, as habitats they visit the Complex to view are impacted from feral pigs wallowing and rooting behavior and native species are less likely to be observed near the habitats visitors enjoy viewing.

Management and Operations. There could be moderate adverse, long-term effects due to an increasing and unmanaged feral pig population, potentially causing the native plant and wildlife populations to rapidly decrease and impacting native habitats and water quality.

Alternative B – Implement the San Luis NWR Feral Pig Monitoring and management Plan – Preferred Alternative

As described above, the proposed action may be associated with minor, short-term effects, which may be reduced through Mitigation Measures. Overall, the proposed project could have long-term, beneficial effects by monitoring and managing for feral pigs.

Natural Resources

Habitat and Vegetation. Short-term, minor effects may result to habitat and vegetation through minor soil disturbance; however, they would be temporary in nature and set traps would be checked daily, as stated in **Mitigation Measure 3**, *Active Traps*. In addition, the Service would implement **Mitigation Measure 2**, *Trap Placement and Vegetation Trimming*, to place traps, when feasible, in locations that require minimal to no vegetation trimming and minimal ground disturbance. Long-term, beneficial effects for habitat and vegetation would include protecting the sensitive habitats within the San Luis NWR Complex from degradation due to this invasive species rooting and wallowing behavior, in addition to preventing them from spreading invasive seeds onto Complex land they have disturbed, as well as preventing the destruction of native trees.

Floodplains and Water Resources. The proposed action could result in beneficial, long-term effects to floodplains and water resources within and surrounding the San Luis NWR Complex. The Service would implement **Mitigation Measure 2**, *Trap Placement and Vegetation Trimming*, to avoid water quality impacts. Monitoring and management would prevent feral pigs from causing damage to the banks of these sensitive resources, preventing soil compaction, as well as stop potential erosion and water quality issues caused by this species.

Wetlands. Long-term, beneficial effects could occur for the wetlands contained within the San Luis NWR Complex. Monitoring and management of feral pigs could prevent this species, known for their ability to rapidly reproduce, from causing long-term damage to these sensitive resources that the species prefers rooting and wallowing within or adjacent to.

Vegetation of Special Management Concern. Alternative B could result in beneficial, long-term effects by protecting the sensitive vegetation of special management concern within the San Luis NWR Complex from detrimental impacts caused by feral pigs wallowing, rooting, and trampling behavior. By monitoring and managing for this invasive species, the Refuge staff will be able to prevent potential habitat-type conversion, in addition to protecting water quality and the sensitive habitats contained within the Complex.

Fish and Wildlife Species. Short-term, minor effects may occur to fish and wildlife species; however, per **Mitigation Measure 1**, *Surveys for Feral Pig Damage and Focused Removals*, surveys for sign of feral pigs prior to removal activities would assist in identifying specific locations impacted by this invasive species, thus focusing pig removal efforts to those areas with sign of the species. In addition, as stated in **Mitigation Measure 3**, *Active Traps*, all active traps would be checked daily for feral pigs while set. Captured pigs would be dispatched quickly with a gunshot to the head using non-lead ammunition as not to contaminate non-target species, as per **Mitigation Measure 4**, *Lead Free Ammunition*. Short-term effects to soils could occur through implementation of the proposed action, but temporary minor impacts would be outweighed by the long-term, beneficial effects to soils through the management of feral pig. Overall, feral pig control is expected to result in beneficial, long-term effects for the San Luis NWR Complex's native fish and wildlife populations, as well as protect their sensitive habitats.

Geology and Soils. The proposed action would have no effect to geology and short-term, minor effects to soils through minor vegetation removal to install the feral pig fencing/traps, installing the traps, and feral pigs disturbing the ground while in the traps. While some soil disturbance is anticipated, any temporary minor impacts would be outweighed by the long-term, beneficial effects to soils through the management of feral pig within the San Luis NWR Complex.

Climate Change. Implementation of the proposed action could have beneficial, long-term effects on wildlife in regard to climate change, as it would assist in protecting sensitive habitats, plants, and soils that native species depend on from the destruction of feral pigs.

Air Quality and Greenhouse Gas Emissions. While short-term, minor effects to air quality could occur, the proposed action could have beneficial effects long-term in regard to air quality by lowering the population of feral pigs that could potentially increase carbon dioxide through their rooting and wallowing behaviors.

Soundscape. Short-term, minor effects to soundscape may occur when dispatching feral pigs.

Special Land Status Designations. Long-term, beneficial effects for the special lands designated within the San Luis NWR Complex could occur, as the proposed project could protect the land designated as an Audubon Important Bird Area, in addition to the Ramsar Wetlands designation from detrimental impacts from feral pigs.

Cultural and Historic Resources

Archeological Resources. Soil disturbance from implementation of this alternative has the potential to impact cultural resources; however, the Service is complying by consulting with the Service Region 8 Cultural Resources Team regarding management activities within the San Luis NWR Complex. The Service is not proposing any monitoring or management activities that would result in changes in the character of, or would potentially adversely affect, any archaeological site, as the Service would implement as part of the proposed project **Mitigation Measure 5**, *Cultural Resources*, **Mitigation Measure 6**, *Discovery of Unknown Cultural Resources*, **Mitigation Measure 7**, *Documented Cultural Resources*, and **Mitigation Measure 9**, *Disposal Sites and Sanitary Landfills*. Furthermore, potential long-term, adverse effects from an increasing population of feral pigs disturbing soil and thus disturbing cultural resources could be prevented under this alternative.

Socioeconomics

Local and Regional Economies. Long-term, beneficial economic effects on adjacent privately owned agricultural land could occur through implementation of the proposed project by decreasing the local feral pig population. Control costs for adjacent land managers could be reduced as a result of the feral pig management on the Complex, as well as a decrease in potential damage to crops and potential water quality issues caused by the invasive species.

Environmental Justice. Long-term, beneficial effects for the adjacent private owned agricultural landowners could occur through managing feral pigs within the Complex, as it would reduce the local population of this invasive species. Therefore, the costs associated with feral pig damage could be decreased through the proposed action for adjacent landowners.

Public Health and Safety. Long-term, beneficial effects could occur, as management of the feral pig population could health prevent disease and parasite transmission, vehicle collisions, water quality issues, and effects to local landscapes caused by this invasive species.

Refuge Resources

Visitor Use and Experience and Aesthetics, Viewsheds and Visual Resources. There is potential for short-term, minor effects to visitor use and experience through this alternative; however, the proposed action could have long-term, beneficial effects for both visitor use and experience, as well as aesthetics,

viewsheds, and visual resources within the Complex. The proposed project would implement Mitigation **Measure 8**, *Closures*, and the sensitive habitats and native species the public visits the Complex to experience would be protected from feral pig degradation, so that they can be enjoyed for future generations.

Management and Operations. Long-term, beneficial effects could occur, as monitoring and management of the feral pig population would assist the Service in meeting goals and objectives for the protection of the sensitive environmental resources within the Complex.

Chapter 5: List of Preparers and Sources

5.1 List of Preparers

The following individuals participated in preparing this EA and the associated Plan:

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Appendix A: References

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Appendix B: Acronyms

California Agricultural Statistics Districts	CASD
California Air Resources Board	CARB
California Ambient Air Quality Standards	CAAQS
California Department of Fish and Wildlife	CDFW
Carbon monoxide	CO
Comprehensive Conservation Plan	CCP
Code of Federal Regulations	CFR
Department Manual	DM
Environmental Assessment	EA
Endangered Species Act	ESA
Environmental Protection Agency	EPA
Fahrenheit	F
Fish and Wildlife	FW
Global positioning system	GPS
National ambient air quality standards	NAAQS
National Environmental Policy Act	NEPA
National Wildlife Refuge	NWR or Refuge
National Wildlife Refuge System Administration Act	Administration Act
Natural Resources Conservation Space	NRCS
Nitrogen dioxide	NO_2
NWR System	Refuge System
Ozone	O_3
Particulate lead	Pb
Particulate matter	PM
San Joaquin Valley Air Pollution Control District	SJVAPCD or District
Sulfur dioxide	SO_2
United States	U.S.
United States Code	U.S.C.

U.S. Department of Agriculture Wildlife Services	USDA WS
U.S. Fish and Wildlife Service	Service
Utility Task Vehicle	UTV
Wildlife Management Area	WMA