Environmental Assessment

Management of Aquatic Invasive Plants on Sacramento National Wildlife Refuge Complex, San Luis National Wildlife Refuge Complex, and Stone Lakes National Wildlife Refuge

March 2025

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U.S. Department of Interior
Fish and Wildlife Service
Region 8 (Pacific Southwest Region)
Sacramento National Wildlife Refuge Complex
Butte, Colusa, Contra Costa, Glenn, Placer, San Joaquin, Solano, Sutter, Tehama, Yolo, and Yuba Counties, California
San Luis National Wildlife Refuge Complex
Stanislaus, San Joaquin, and Merced Counties, California
Stone Lakes National Wildlife Refuge
Sacramento County, California

Executive Summary

This Environmental Assessment (EA) evaluates two action alternatives and a no action alternative for the Sacramento National Wildlife Refuge (NWR) Complex, San Luis NWR Complex, and Stone Lakes NWR, collectively referred to as the "Covered Refuges." The Sacramento NWR Complex includes the Butte Sink Wildlife Management Area (WMA), Colusa NWR, Delevan NWR, Sacramento NWR, Sacramento River NWR, Steve Thompson Central Valley WMA, and Sutter NWR. The San Luis NWR Complex includes the Grasslands WMA, Merced NWR, San Joaquin River NWR, and San Luis NWR. The proposed action would implement comprehensive integrated pest management (IPM) methods to manage aquatic invasive plant species on fee-title, easement, and agreement lands[1], as well as on water features within a 0.5-mile radius of the Covered Refuges. The purpose of the proposed action is to contain or suppress the aquatic invasive plants growing on the Covered Refuges to minimize their direct or indirect effects on priority species and habitats. These highly invasive aquatic plants cause problems for boating, agriculture, and public safety and negatively impact natural resources, local economies, and industries (California State Parks Division of Boating and Waterways 2024).

Alternative 2, the Preferred Alternative, involves the implementation of a robust and comprehensive IPM strategy to manage infestations. It could include the use of cultural

[1] Agreement lands are defined as lands and waters owned by the U.S., States, or others for which the Service has entered into a memorandum of agreement, memorandum of understanding, and/or administrative authority to manage the subject lands.

treatment methods, such as water level manipulation; physical (including mechanical and manual) methods, such as biomass removal and growth prevention; and the application of chemical herbicides that may be broadcast aerially, from vehicles on the ground, and from watercraft, or applied by hand with sprayers, hand wands, or injections. Alternative 3 would also implement a robust and comprehensive IPM strategy using cultural, physical, and chemical treatment methods; however, this alternative would limit herbicide treatments to non-broadcast methods, such as hand wands and injections. The No Action Alternative would continue focused IPM treatments that have been implemented on a case-by-case basis, without the flexibility that the methods of a comprehensive IPM approach could provide.

This EA complies with the National Environmental Policy Act (NEPA), in accordance with the Council on Environmental Quality (CEQ) Regulations for Implementing NEPA (40 Code of Federal Regulations [C.F.R.] Parts 1500-1508)[2] and the Department of the Interior (DOI) NEPA regulations (43 C.F.R. Part 46 and 516 Department Manual [DM] 8); the U.S. Fish and Wildlife Service (Service) policies, as outlined in the Service Manual (550 Fish and Wildlife [FW] 3, *NEPA Documenting and Implementing Decisions*; 569 FW 1, *Integrated Pest Management*; and 601 FW 3, *Biological Integrity, Diversity, and Environmental Health*); and other relevant regulations and requirements. A complete list of Federal laws and Executive Orders considered during the preparation of this EA is provided in **Appendix A**, *Applicable Statutes and Executive Orders*.

[2] Executive Order 14154, Unleashing American Energy (Jan. 20, 2025), and a Presidential Memorandum, Ending Illegal Discrimination and Restoring Merit-Based Opportunity (Jan. 21, 2025), require the Department to strictly adhere to NEPA, 42 U.S.C. §§ 4321 et seq. Further, such Order and Memorandum repeal Executive Orders 12898 (Feb. 11, 1994) and 14096 (Apr. 21, 2023). Because Executive Orders 12898 and 14096 have been repealed, complying with such Orders is a legal impossibility. The [bureau] verifies that it has complied with the requirements of NEPA, including the Department's regulations and procedures implementing NEPA at 43 C.F.R. Part 46 and Part 516 of the Departmental Manual, consistent with the President's January 2025 Order and Memorandum.

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Acronyms

ATV	all-terrain vehicle
BAAQMD	Bay Area Air Quality Management District
BCAQMD	Butte County Air Quality Management District
BLM	Bureau of Land Management
BMP	best management practice
C.F.R.	Code of Federal Regulations
CalEPA	California Environmental Protection Agency
CARB	California Air Resources Board
CCAPCD	Colusa County Air Pollution Control District
CCP	Comprehensive Conservation Plan
CDFA	California Department of Food and Agriculture
CDFW	California Department of Fish and Wildlife
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CVRWQCB	Central Valley Regional Water Quality Control Board
dB	decibel
dBA	A-weighted decibels
DDT	Dichlorodiphenyltrichloroethane
DM	Department Manual
DOI	Department of the Interior
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FAV	floating aquatic vegetation
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FICON	Federal Interagency Committee on Noise
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FONSI	Finding of No Significant Impact
FR	Federal Register
FRAQMD	Feather River Air Quality Management District
FW	Fish and Wildlife
GCAPCD	Glenn County Air Pollution Control District
GHG	greenhouse gas
I-5	Interstate 5
IPM	integrated pest management
Ldn	day-night sound level
L_{max}	maximum instantaneous noise level

N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
O_3	ozone
OCSPP	Office of Chemical Safety and Pollution Prevention
OSHA	Occupational Safety and Health Act
Pb	lead
pH	potential of hydrogen
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PPE	personal protective equipment
PUP	Pesticide Use Proposal
RCRA	Resource Conservation and Recovery Act
SAV	submerged aquatic vegetation
SDS	Safety Data Sheets
SHPO	State Historic Preservation Officer
SJVAPCD	San Joaquin Valley Air Pollution Control District
SMAQMD	Sacramento Metropolitan Air Quality Management District
SO_2	sulfur dioxide
SWRCB	State Water Resources Control Board
TCAPCD	Tehama County Air Pollution Control District
THPO	Tribal Historic Preservation Officer
U.S.C.	U.S. Code
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WMA	Wildlife Management Area
YSAQMD	Yolo-Solano Air Quality Management District

Chapter 1: Introduction

1.1 Background

Each refuge is guided by the mission and goals of the National Wildlife Refuge System (Refuge System), the purposes of an individual refuge, Federal laws and Executive Orders, Service policy, and international treaties. Relevant guidance includes, but is not limited to, the National Wildlife Refuge Administration Act 1966 (Administration Act), as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 U.S. Code [U.S.C.] §§668dd et seq.), the Refuge Recreation Act of 1962 and selected portions of the Code of Federal Regulations [C.F.R.] 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."* (16 U.S.C. §668dd)

The Administration Act directs the Secretary of the DOI to ensure that the mission of the Refuge System and purposes of individual refuges are carried out (16 U.S.C. §668dd[5][a][3][A-M]). Therefore, it is a priority of the Service to conserve and manage fish, wildlife, and plants, as well as their habitats consistent with the purposes for which the refuges were established and the mission of the Refuge System. The Service acquires Refuge System lands under a variety of legislative acts and administrative orders. Refuge purposes are specified in or derived from the law, proclamation, Executive Order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, or WMA. **Appendix B**, *Refuge Summaries*, provides a description of the purpose, goals, priority resources of concern, historic conditions, and current management of each of these Covered Refuges. Each of the Covered Refuges are also depicted in **Figures 1** through **5**.

Figure 1. Sacramento and Sacramento River NWRs

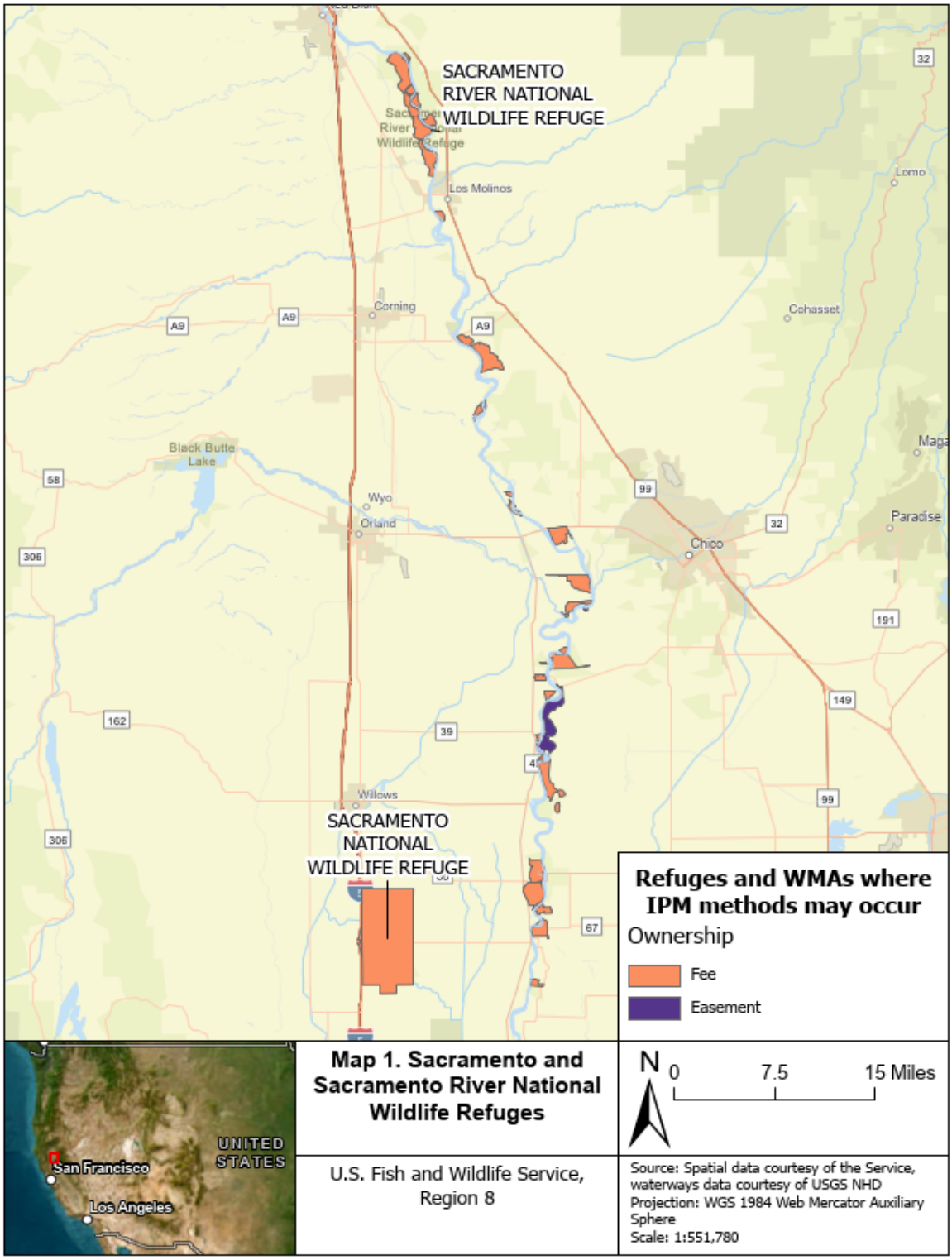


Figure 2. Delevan, Colusa, and Sutter NWRs and Butte Sink and Steve Thompson North Central Valley WMAs

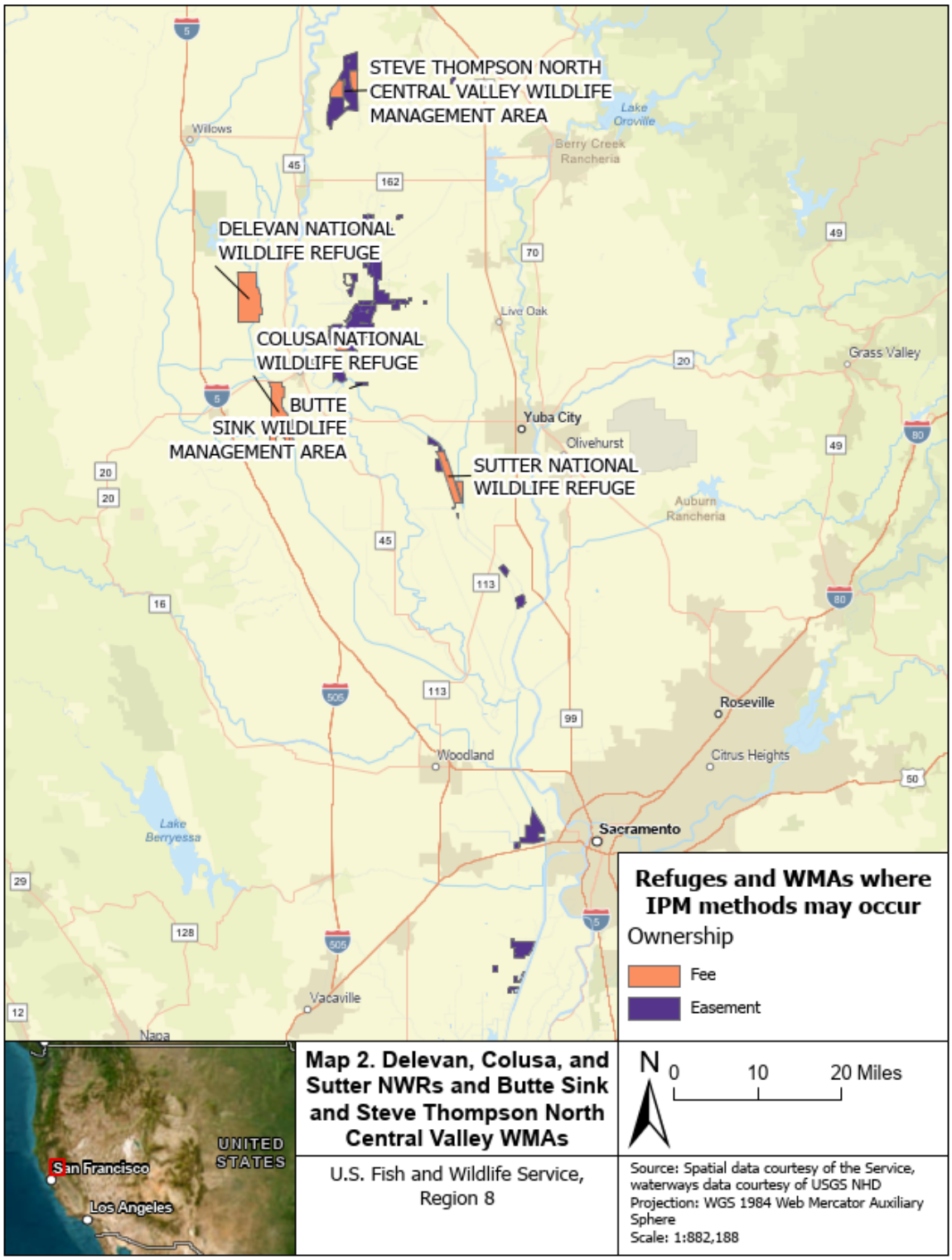


Figure 3. San Joaquin River NWR

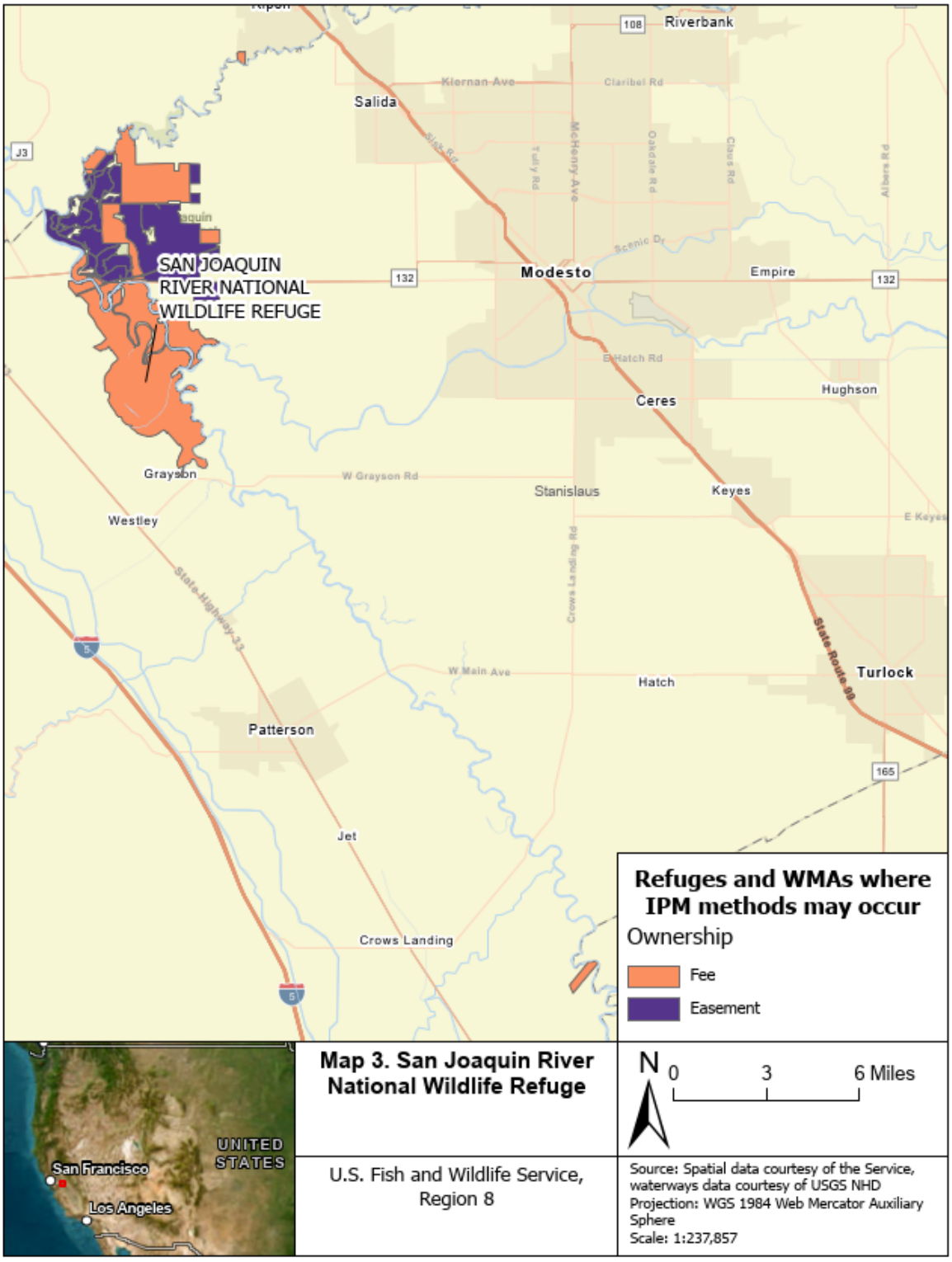


Figure 4. San Luis and Merced NWRs and Grasslands WMA

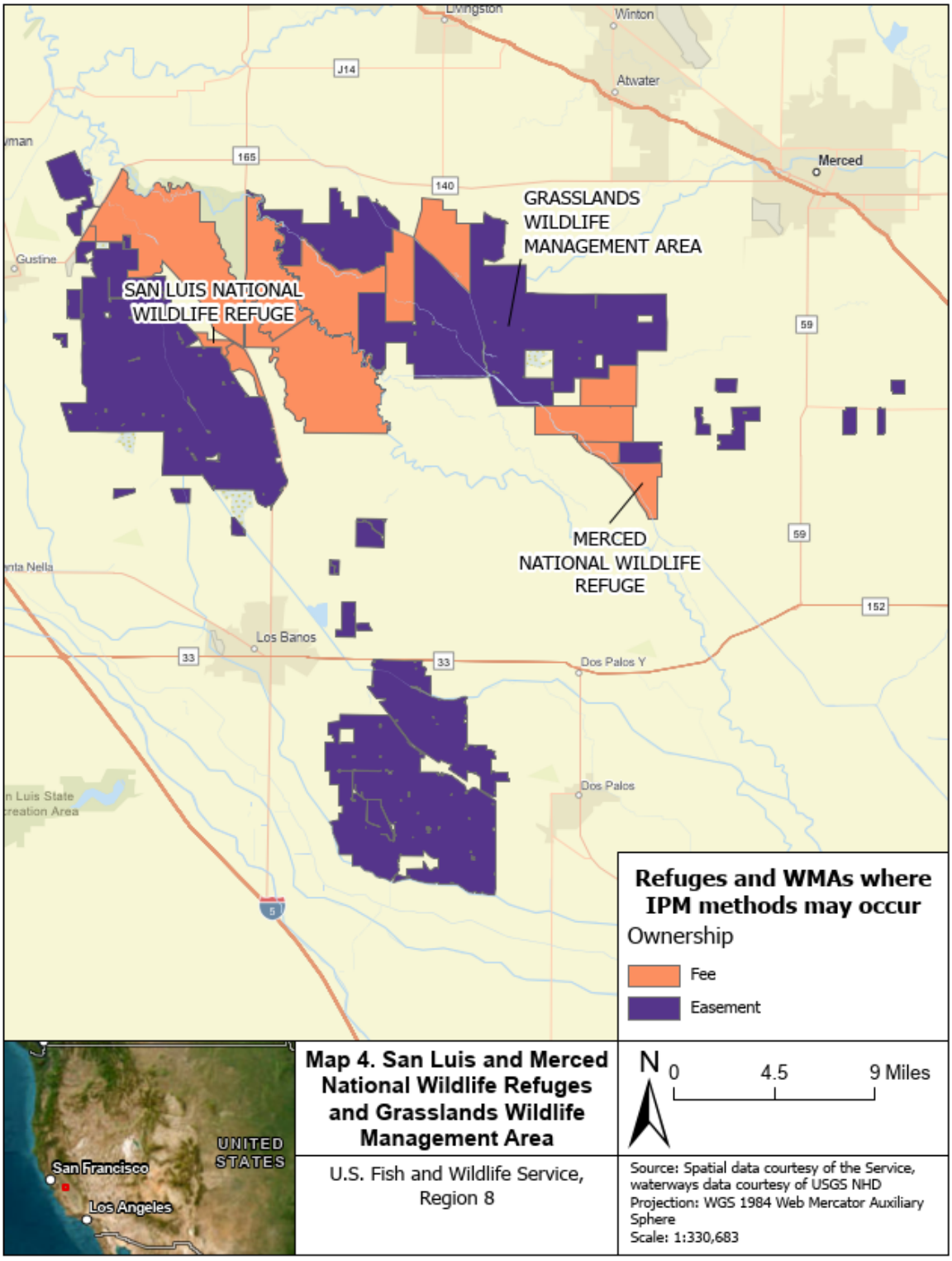
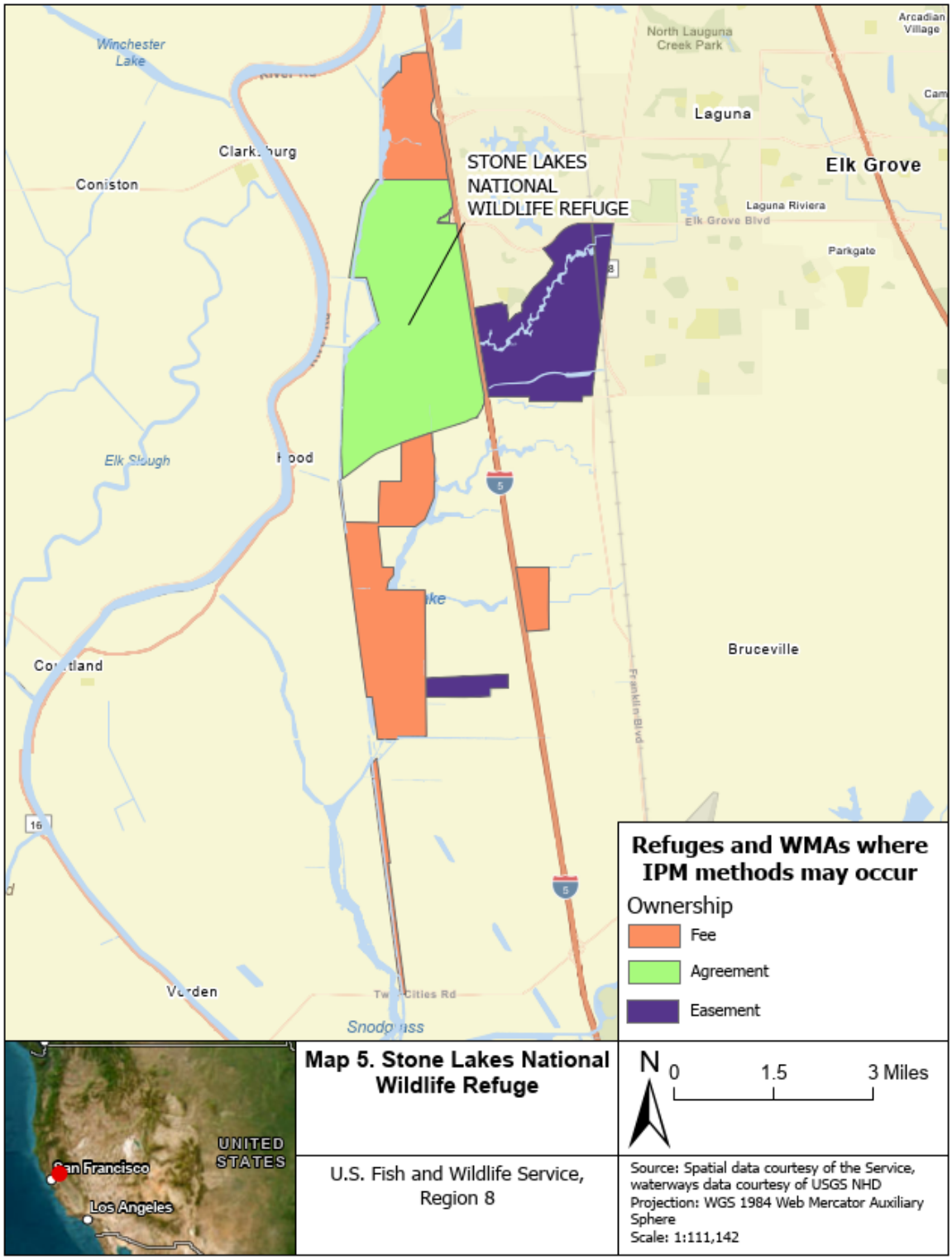


Figure 5. Stone Lakes NWR



Executive Order 13751, *Safeguarding the Nation from the Impacts of Invasive Species*, was established in 2016 and, *"…directs actions to continue coordinated Federal prevention and control efforts related to invasive species."* This Executive Order defines an invasive species as, *"a non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health"* (81 Federal Register [FR] 88609 [2016]). Within this Executive Order, it states:

> *"It is the policy of the United States to prevent the introduction, establishment, and spread of invasive species, as well as to eradicate and control populations of invasive species that are established. Invasive species pose threats to prosperity, security, and quality of life. They have negative impacts on the environment and natural resources, agriculture and food production systems, water resources, human, animal, and plant health, infrastructure, the economy, energy, cultural resources, and military readiness. Every year, invasive species cost the United States billions of dollars in economic losses and other damages.*
>
> *Of substantial growing concern are invasive species that are or may be vectors, reservoirs, and causative agents of disease, which threaten human, animal, and plant health. The introduction, establishment, and spread of invasive species create the potential for serious public health impacts, especially when considered in the context of changing climate conditions. Climate change influences the establishment, spread, and impacts of invasive species."*

The legal definition of IPM is *"…a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks"* (7 U.S.C. §136r-1).

The Service's IPM Policy (569 FW 1) mandates the implementation of a science-based, systematic decision process for pest and invasive species management. The process incorporates: 1) setting management goals; 2) consensus building with partners; 3) understanding the pest (e.g., aquatic invasive plant) biology; 4) understanding environmental factors that promote or inhibit the pest; 5) selection of the best available technology to achieve desired outcomes while minimizing effects to non-target species and the environment and preventing unacceptable levels of pest damage; and 6) post-treatment monitoring. The outcome of the IPM evaluation process is a decision on the method, or combination of methods, which would be applied to manage invasive plant infestations.

1.2 Proposed Action

The Service is proposing to implement a comprehensive IPM strategy to inventory and control aquatic invasive plants within the Covered Refuges, as well as on water features within a 0.5-mile radius with landowner permission. The proposed action would assist in achieving the purposes for which these Refuges and WMAs were established, help in fulfilling the mission of the Refuge System, and ensure that the Refuge System's biological integrity, diversity, and

environmental health are maintained. Proposed IPM tools include cultural, physical, and chemical methods for treating the aquatic invasive plants.

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 will be finalized at the conclusion of the public comment period for the EA.

1.3 Purpose and Need for the Proposed Action

The purpose of this proposed action is to contain or suppress aquatic invasive plants to minimize their direct or indirect effects on priority species and habitats on the Covered Refuges. The Service defines priority species as "…a limited set of populations, subspecies, species, or species groups that provide a strategic focus for a planning unit's conservation efforts…" (602 FW 1). Priority habitats are defined as "[a] limited set of habitats, plant communities, or ecosystems that provide a strategic focus for a planning unit's conservation efforts. In general, priority habitats support priority species, and together they form the basis for setting goals and objectives, selecting strategies, and measuring effectiveness" (602 FW 1).

Aquatic invasive plants, including but not limited to water hyacinth (*Eichhornia crassipes*), hydrilla (*Hydrilla verticillata*), ribbon weed (*Vallisneria australis*), alligator weed (*Alternanthera philoxeroides*), Eurasian watermilfoil (*Myriophyllum spicatum*), parrot feather (*Myriophyllum aquaticum*), floating water primrose (*Ludwigia peploides*), and Uruguay water primrose (*Ludwigia hexapetala*), could adversely affect the priority resources of concern within the Covered Refuges and surrounding waterways. These aquatic plants grow in wetlands, marshes, shallow water bodies, slow-moving waterways, lakes, reservoirs, and rivers.

Figure 6. Water hyacinth is an invasive aquatic plant that floats on water and interlocks into dense, sturdy mats. Photo courtesy of California State Parks Division of Boating and Waterways.

The Service is proposing to implement a more robust and comprehensive IPM strategy involving cultural, physical, and chemical methods for treating the aquatic invasive plants. The purpose of the proposed IPM strategy in the Covered Refuges and adjacent waters is to allow for site-specific management of these aquatic invasive plants in a consistent, feasible, and cost-effective manner, with a goal of helping to maintain functional ecosystems and processes.

The proposed IPM strategy is needed to address the proliferation of invasive floating aquatic vegetation (FAV) and submerged aquatic vegetation (SAV). Invasive plants grow prolifically and reproduce in abundance, outcompeting native plants and creating monocultural stands which do not serve the needs of native fish and wildlife. Without adequate control strategies, these non-native species could disrupt dissolved oxygen cycles, crowd out native plants, shade out or cover crucial shallow-water fish habitat, obstruct waterways and navigational channels, and block agricultural and municipal water intakes (California State Parks Division of Boating and Waterways 2024).

Chapter 2: Involvement, Coordination and Consultation

2.1 Public Involvement

This EA will be available for public review and comment for 30 days. Members of the public will be notified of the availability of the draft documents, which will be posted on the San Luis NWR, the Sacramento NWR, and the Stone Lakes NWR websites. Comments may be submitted in writing via email at: fw8plancomment@fws.gov. Any comments, concerns, suggestions, or other feedback will 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 may request that any personal identifying information be withheld from public review, we cannot guarantee that we will be able to do so.

2.2 State Coordination

The Service received feedback on the initial scoping in April 2024 from the Delta Protection Commission and the Tuolumne River Trust (see **Appendix D**, *Scoping Report*). The Delta Protection Commission expressed concerns that the proposed IPM methods may affect navigability depending on the method of application and asked the Service to consider effects on agricultural operations, water quality, and native flora and fauna. The Tuolumne River Trust described a pending salmon restoration project at La Grange and requested that the Service consider the effectiveness, as well as the undesirable effects of herbicides. The Trust also requested that the Service assess other tools, including manual removal involving active, persistent, multi-year efforts starting at the upper limit of the lower Tuolumne River.

2.3 Tribal Consultation

During the scoping period, the Service sent scoping letters to 51 Federally recognized Native American tribes that are traditionally and culturally affiliated with lands in the potential project area. In response, the Service received a request for consultation from the Paskenta Band of Nomlaki Indians.

Chapter 3: Alternatives

3.1 Decision Framework

The Service will make two decisions based on this EA once the environmental review process is complete. The Service will: 1) select an alternative; and 2) determine whether the proposed action would result in a significant impact to the environment, which would require the preparation of an Environmental Impact Statement (EIS), or if no significant impacts would occur and therefore a Finding of No Significant Impact (FONSI) would be appropriate.

3.2 Alternatives

This section discusses the alternatives that have been considered by the Service. This includes a description of the IPM strategy, comprising the cultural, physical, and chemical treatments that would be employed in the Covered Refuges and within a 0.5-mile radius of adjacent waters with landowner approval. These adjacent waterways, which are depicted in **Figures 1** through **5,** include, but are not limited to, Bear Creek, Bravel Slough, Deadman Creek, Deep Slough, Eastside bypass of the San Joaquin River, Los Banos Creek, Merced River, Mud Slough, Salt Slough, San Joaquin River, Stanislaus River, and Tuolumne River, as well as miscellaneous irrigation supply and delivery canals and unnamed tributaries and waterways. **Appendix C**, *Description of Treatment Types,* provides a description of the anticipated treatment types that would be available to the Covered Refuges.

Treatment Types Being Considered

Cultural and Physical Methods (Non-herbicide)

Some of the proposed non-herbicide treatments could be used in conjunction with herbicides. The Service could also utilize other non-herbicide methods, if they are similar to those analyzed in this EA.

Water Treatment

Manipulating water levels to reduce water availability could help control aquatic invasive plants where it is feasible to do so. These methods would involve pumping or releasing water via a dam or weir to dewater an area and would only occur in managed wetlands and canals.

Growth Prevention

Growth prevention techniques involve shading or solarizing plants. Shading uses staked benthic mats that are denser than water and allow gases to pass through to cover aquatic invasive plants and kill them by depriving them of sunlight. Solarizing uses plastic tarps to cover shoreline aquatic invasive plants to heat the plants and their seeds enough to kill them. Curtains and screens may also be placed in the water to help prevent the spread of aquatic invasive plants or fragments.

Biomass Removal

Biomass removal includes both mechanical and manual removal of entire aquatic invasive plants or parts of them. Specific methods could involve cutting, clipping, or pulling vegetation, as well as surface excavating. These methods could be used to remove emergent (floating or rooted) and/or submergent green growth or roots. Ideally these activities would be timed to prevent aquatic invasive species flowering and seeding. The proposed removal methods would not dig up the sediment, so aquatic invasive plant roots may not be completely removed. Nevertheless, the proposed removal techniques would reduce biomass, including reproductive plant parts, hindering the plants' ability to grow and spread. Biomass removal could also occur with hand nets or by the installation of booms, water-permeable screens, or impermeable curtains.

Figure 7. Biomass removal could include mechanical removal of aquatic invasive plants using heavy equipment on the bank of a water feature.

Chemical Methods

Herbicides

Both herbicides and adjuvants may be used. Herbicides are chemical agents used to kill or inhibit the growth of unwanted plants. Adjuvants are compounds that could be added to herbicides to reduce impacts to non-target species, improve herbicide effectiveness, and reduce the amount of herbicide needed for plant control. Adjuvants could help herbicides penetrate plants by ensuring adequate spray coverage and by keeping the herbicide in contact with plant tissues. The proposed action could make use of the active ingredients presented in **Table 1**, as well as other herbicides if they meet criteria similar to those analyzed in this EA.

Table 1. Summary of Herbicides for Invasive Aquatic Plants

Chemical Family	Analyte Name	Aquatic (freshwater) Use
Arylpicolinate	florpyrauxifen -benzyl	Slow-moving/quiescent waters with little to no continuous flow (ponds, wetlands, river bends)
Bipyridylium, dipyridylium	diquat dibromide	Herbicide/algicide to control algae and aquatic weeds, drainage systems
Carboxylic acid	triclopyr	Wetlands/aquatic areas
Chlorophenoxy	2,4-D (acid, amine, and ester)	Some aquatic uses
Imidazolinone	imazamox	Drainage ditches, irrigation channels, lakes, marshes
Imidazolinone	imazapyr	Potable surface waters, public waters, private waters, livestock watering ponds, and recreational water areas
Organophosphorus, Glysine	glyphosate	Aquatic areas for non-agricultural uses
N-Phenylphthalimides	flumioxazin	Aquatic settings
Phenylpyridine	fluridone	Ponds, lakes, irrigation and drainage canals, drinking water systems, rivers
Sulfonamide	penoxsulam	Aquatic settings

Adjuvants

Adjuvant products, including Bright Dyes and Rhodamine, specifically recommended for use with pesticides in aquatic applications must have aquatic toxicity assessment data generated in accordance with U.S. Environmental Protection Agency's (USEPA's) Office of Chemical Safety and Pollution Prevention (OCSPP) Harmonized Test Guidelines Series 850 – Fish and Invertebrate. Label use rate recommendations must not exceed levels potentially hazardous to aquatic organisms, as determined by the assessment data.

Herbicide Application Methods

Broadcast Aerial (Airplanes and Helicopters)

Herbicide application using sprayers attached to airplanes or helicopters. Utilized for broad treatments of large areas and areas that cannot be as easily accessed by ground vehicles.

Broadcast Aerial (Drones)

Herbicide application using sprayers attached to drones. Similar to application from airplanes or helicopters, this treatment would be used for areas that cannot be as easily accessed by ground vehicles. However, drones, which are considerably smaller than airplanes and helicopters, would allow for a much more targeted application.

Broadcast Ground (All-terrain Vehicle [ATV], Truck, or Tractor)

Herbicide application using manual or motorized sprayers from vehicles. Utilized for blanket treatments of larger areas.

Broadcast Water (Boat Boom)

Aquatic broadcast herbicide application using manual or motorized sprayers from boats. Utilized for blanket treatments of larger areas.

Deep Water (Pellets or Granules)

Application of herbicidal pellets or granules that require moisture so herbicide can stick to target plants. They are often used with broadcast sprayers for efficient application over larger areas. Easier to handle and require no mixing like liquid herbicides.

Ground Wet (Wicking)

Herbicide application using herbicide-soaked wick or blade. The wetted apparatus is used to wipe or brush herbicide over target plants, while avoiding non-target species.

Injection Treatments

Directly injecting herbicide into the stems of woody plants.

Spot Foliar and Spot Water Treatments (ATV or Boat Hand Wand or Backpack)

Herbicide application utilizing hand equipment. Applications could target specific plants and avoid others.

Figure 8. The Stone Lakes NWR has previously received herbicide product donations used to treat aquatic invasive species. Photograph Courtesy of Ducks Unlimited.

In addition to the action alternatives, CEQ regulations (40 C.F.R. §1502.14[c]) require a no action alternative be analyzed to provide a baseline for comparison with the proposed action. The no action alternative for this EA represents the status quo (i.e., if the proposed action were to not be implemented) and is Alternative 1 below.

Alternative 1 – Continue Current Management Strategies - No Action Alternative

Alternative 1 proposes no changes to the present aquatic invasive plant management actions implemented within the Covered Refuges and no new actions would be implemented. This alternative represents the baseline from which other "action" alternatives would be evaluated. Under this alternative, the Service would continue to respond to aquatic invasive plants at the Covered Refuges employing existing methods. This has historically involved occasional, narrowly focused treatments that have been implemented on a case-by-case basis. These treatments have involved a small area of application of a limited number of herbicides, as well as physical treatments. For example, herbicides used at some of the Covered Refuges have included, but are not limited to, 2,4-D, glyphosate, and imazapyr. The physical method of biomass removal and the cultural method of water treatment have been used at some of the Covered Refuges, as well. **Appendix C**, *Description of Treatment Types*, provides a more detailed description of the existing treatment types that would continue to be employed at each of the individual NWRs and WMAs.

The current strategies for managing aquatic invasive plant species are designed and determined by local Service staff. These strategies generally prioritize simple actions, such as hand spraying or ground wet (wicking) limited herbicides in small areas or broadcast ground application of herbicides, such as from an ATV or truck, which are achievable with local staff and resources over those that may be more effective at a regional scale. Due to the constraints of existing treatment methods, localized response plans often allow infestations to go untreated or treat infestations with tools that are not efficient or effective. Using only localized responses can permit invasive species to surpass larger thresholds, negatively impact the local environment, and become more difficult and costly to manage.

Alternative 2 – Management of Aquatic Invasive Plants with Cultural, Physical, and Chemical Methods, Including Broadcast Methods – Preferred Alternative

Alternative 2, the proposed alternative, would involve the implementation of a more robust and comprehensive IPM strategy than Alternative 1, including the use of the following treatment types to manage aquatic invasive plant infestations:

- Cultural practices, such as water level manipulation
- Physical methods, such as removing biomass and preventing growth
- Chemical treatment with herbicides and adjuvants applied using all broadcast and hand-application methods

If the proposed action is adopted, the Region would implement the more robust and comprehensive IPM strategy collaboratively with partners, such as Federal, Tribal, and State agencies, per the Service's IPM Policy (569 Fish and Wildlife [FW] 1), to facilitate conservation of native wildlife and plants. Invasive species management activities would only be undertaken in accordance with Service policy and all applicable land management laws and regulations. Implementation of the proposed action would also include compliance with Section 7 of the Federal Endangered Species Act (ESA).

Alternative 3 – Non-Broadcast Herbicide Application Methods

Alternative 3 also involves the implementation of a comprehensive IPM strategy, including the use of cultural, physical, and chemical treatments to manage infestations. However, this alternative would not include the use of broadcast aerial, broadcast ground, broadcast water, or deep-water treatments. Instead, herbicides would be applied using hand-application techniques, such as hand wands or injection treatments. These limitations on herbicide methods would reduce the potential for secondary effects on non-target species but would limit the ability of the Service to treat larger areas and therefore could limit the overall effectiveness of the treatment(s).

Alternatives Considered, but Dismissed from Detailed Analysis

The Service received feedback on the initial scoping in April 2024 from the Delta Protection Commission and the Tuolumne River Trust (see **Appendix D**, *Scoping Report*). The Tuolumne River Trust described a pending salmon restoration project at La Grange and requested that the

Region consider the effectiveness, as well as the undesirable effects of herbicides. The Tuolumne River Trust also requested that the Service consider treatment of upstream areas located outside of the immediate boundaries of the Refuge.

The Service considered an alternative that would eliminate chemical treatments, thereby limiting IPM strategies to cultural and physical methods. However, due to the geographic scope and the physiological characteristics of the target aquatic invasive species, cultural and physical methods alone would not be effective in reducing the coverage and spread of these invasive species. There are many invasive plants that simply cannot be effectively controlled without herbicides, which are generally more efficient at controlling aquatic invasive plants than other methods (University of Florida 2023). For example, water hyacinth can double its size within 5 to 15 days (Dersseh et al. 2019), and under favorable conditions, it can reach up to 17.5 metric tons per hectare per day (Kunatsa et al. 2013). In addition, due to the nature of physical treatments (i.e. mechanical and manual) removal methods of cutting and pulling, reliance on these methods could result in more potential physical disturbance over time (Mattrick 2006). These treatments are also usually much more expensive and require more staff time, thereby resulting in smaller treatment areas per year. The estimated cost of invasive aquatic species treatment provided by the California Department of Parks and Recreation in July 2023 was:

- Chemical treatment of floating aquatic invasive plants: $700/acre
- Chemical treatment of submerged aquatic invasive plants: $2,000/acre
- Physical treatment of floating aquatic invasive plants: $4,000/acre

Mitigation Measures Applicable to All Alternatives

The following best management practices (BMPs) would be implemented with all alternatives to minimize or avoid negative effects on the environment:

1. **Pesticide Use Proposal (PUP) Process:** The Service would continue to utilize the PUP process, which includes standard BMPs and additional use restrictions to minimize adverse effects to sensitive areas.
2. **USEPA Registered Herbicides:** Only herbicides classified and registered by the USEPA would be utilized and the Service would continue to follow the USEPA's warning labels and application requirements for herbicides.
3. **IPM Treatment Approach:** The Service would implement IPM techniques, including prioritizing use of the least impactful and most effective methods to ensure management of aquatic invasive plants, while limiting potential effects to non-target species and their habitats.
4. **Response to Treatments:** Service staff would informally monitor the effectiveness of the response to treatments.
5. **Cultural Resources:** Where ground disturbance is necessary for aquatic invasive plant control, the Service 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, and could potentially include Tribal cultural advisors and monitors, as needed.

6. **Discovery of Unknown Cultural Resources:** If unanticipated cultural or tribal resources are encountered during the project, the Service would cease any ground-disturbing activities within 50 feet of the resource, and the Service Regional Historic Preservation Officer would be immediately notified. The Service would determine if on-going construction activities would affect a previously unidentified property that may be eligible for the National Register of Historic Places (NRHP) or affect a known historic property in an unanticipated manner and address the discovery or unanticipated effect in accordance with 36 C.F.R. §800.13(b). At its discretion, the Service may, in accordance with 36 C.F.R. §800.13(c), assume any discovered property to be eligible for inclusion in the NRHP. If suspected human remains are discovered during proposed project activities on Service land, all activities within 50 feet of the immediate area would cease, and appropriate precautions would be taken to protect the remains and any associated cultural items from further disturbance. The Service would follow the procedures outlined in 43 C.F.R. §10.4, Inadvertent Discoveries. The Service Regional Historic Preservation Officer would be immediately notified and would take responsibility for the discovery by contacting the appropriate law enforcement and Service officials. Within three working days of confirmation of the discovery (43 C.F.R. §10.4[d][1][iii]), the Regional Historic Preservation Officer would ensure that Indian tribes likely to be affiliated with the discovered human remains (i.e., lineal descendant, culturally affiliated Indian tribe, Indian tribe with other cultural relationship, and Indian tribe that aboriginally occupied the area) would be notified by telephone or in person, with written confirmation. Treatment and handling of the remains would be determined through consultation between the Service and the consulting tribes.
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.

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 C.F.R. §1508.1[i]). 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 CEQ 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 C.F.R. §1508.1[g][3])
- **Direct Effects:** Caused by the action and occur at the same time and place (40 C.F.R. §1508.1[i][1)]
- **Indirect Effects:** Caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 C.F.R. §1508.1[i][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

Impacts that are speculative (i.e., there is a remote possibility that the impact would occur, but no meaningful information exists on which to base a prediction) or indefinite will not be included in the analysis of this environmental assessment (43 C.F.R. §46.30). If a resource is not expected to be affected, a brief justification will be provided as to why it was dismissed.

Visual Resources

Visual resources are not expected to be affected and therefore will not be analyzed further in this EA. The proposed treatment methods would be temporarily noticeable to recreational users within the Covered Refuges. However, these visual disturbances would be short-term and temporary, occurring over a matter of days or weeks. Over the long-term the proposed treatments would remove large swaths of aquatic invasive species. As a result, the views of surface water features, such as from viewing platforms, would be much improved. Additionally, the removal of aquatic invasive species may also make surface water features more accessible by boat, thereby providing access to views from the Covered Refuges and adjacent waters that would otherwise not be available.

Land Use

Land use is not proposed to change and therefore will not be analyzed further in this EA. The proposed treatment activities would last for a matter of days or at most weeks. Following completion, existing public uses, such as hunting, fishing, wildlife observation and photography, environmental education, and interpretation and outreach, would continue at approximately the same levels and types. In fact, the implementation of these treatment methods would improve the ability of the Service to manage for target species as well as address critical issues related to boating, agriculture, and public safety.

4.1 General Description of Affected Environment Applicable to All Affected Resources

The eight NWRs and three WMAs making up the Covered Refuges are located within the Central Valley of California. The Central Valley, which is approximately 50 miles wide and approximately 400 miles long, is bounded by the Cascade Range to the north, the Sierra Nevada to the east, the Tehachapi Mountains to the south, and the Coast Ranges and San Francisco Bay to the west. Generally, most of the Valley is located near sea level and the land surface has very low relief but is higher along the valley margins. The Central Valley is a vast agricultural region drained by the Sacramento and San Joaquin Rivers.

The Central Valley can be divided into two large parts; the northern third is the Sacramento Valley and the southern two-thirds is the San Joaquin Valley. The northern section of the San Joaquin Valley is the San Joaquin Basin and the southern section is the Tulare Basin. The San Joaquin and Sacramento Valleys meet in the Delta area where the combined discharge of the Sacramento and San Joaquin Rivers flows through the Central Valley's one natural outlet, the Carquinez Strait, on its way to San Francisco Bay and the Pacific Ocean. Just east of the Delta, several streams issue from the Sierra Nevada into the Valley and flow to the Delta in an area referred to as the Eastside Streams.

More than 250 different crops are grown in the Central Valley, with an estimated value of $17 billion per year. The predominant crop types are cereal grains, hay, cotton, tomatoes, vegetables, citrus, tree fruits, nuts, table grapes, and wine grapes. Using fewer than one percent of U.S. farmland, the Central Valley supplies eight percent of U.S. agricultural output by value and produces 25 percent of the nation's food, including 40 percent of the nation's fruits, nuts, and other table foods (U.S. Geological Survey [USGS] 2024).

4.2 Biological Resources

Biological Resources include plant and wildlife species and the habitats in which they occur. For this analysis, biological resources have been divided into the following categories: *Habitat and Vegetation*, *Fish and Wildlife Species*, and *Federally and State Listed Species*. *Habitat and Vegetation*, as well as *Fish and Wildlife Species* refer to the plant and wildlife species, both native and introduced, which characterize the region. *Federally and State Listed Species* are plant and wildlife species in need of protection to ensure that the species do not decline to extinction.

Habitat and Vegetation: Affected Environment

Over 95 percent of riparian habitat in the Central Valley has been destroyed due to urbanization and agricultural expansion (Service 2007). The Covered Refuges within the Central Valley are managed by the Service to maintain, enhance, and restore habitats. See **Appendix B**, *Refuge Summaries*, for a summary of habitats within each of the nine refuges and three WMAs comprising the Covered Refuges that could be affected.

Sacramento NWR Complex

Within the Sacramento NWR Complex, the riparian habitat along the Sacramento River is critically important for fish, migratory birds, plants, and river system health. The Service is one of many partners protecting and restoring riparian habitat along the Sacramento River and its watershed (Service 2024a).

The Sacramento River NWR consists of agricultural, wetland, grassland, and riparian habitats. Agricultural areas, which make up approximately one-quarter of the refuge, consist of walnut and almond orchards, pasture, and row crops. Riparian habitats include open water, oxbow wetlands, gravel and sand bars, herbaceous cover, blackberry scrub, Great Valley riparian scrub, Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, Valley oak, Valley freshwater marsh, giant reed, disturbed, and restored riparian areas (Service 2005).

Sacramento, Delevan, Colusa, and Sutter NWRs consist mostly of managed wetlands, with much smaller areas of unmanaged wetlands, vernal pools, alkali meadows, grasslands, riparian forest, and other habitats. Most of the wetlands are seasonally flooded with 10 to 15 percent of them managed as summer wetlands (Service 2009). Most of the habitat found in the Butte Sink WMA consists of managed seasonal semi-permanent wetlands with smaller components of

permanent wetlands, grasslands, and riparian habitats (Service 2020a). The Service-owned lands of the Steve Thompson North Central Valley WMA consist mostly of managed wetlands and grasslands including irrigated pasture, with much smaller areas of unmanaged wetlands, vernal pools, riparian habitats, and other floodplain habitats (Service 2020a).

For more information regarding the habitat and vegetation of the Sacramento, Delevan, Colusa, and Sutter NWRs, please see Section 3 *The Refuge Environment* of the Comprehensive Conservation Plan (CCP).[3] For information on the habitat and vegetation of the Butte Sink and Steven Thompson North Central Valley WMAs, please see Chapter 3 *The Refuge Environment* of the CCP.[4]

San Luis NWR Complex

The San Luis NWR Complex is part of the Grasslands Ecological Area in the San Joaquin Valley, 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 of international importance for migratory waterfowl and shorebirds using the Pacific Flyway (Service 2006).

Within the San Luis NWR Complex, habitat types include wetlands, such as vernal pools, semipermanent wetlands, and seasonal wetlands; riparian woodlands; and upland grasslands, including native grasslands, tilled cropland, fallowed fields, and irrigated pastures. Wetland areas on the Complex are the focus of most active management and restoration activities. (Service 2006 and 2024b).

The three major vegetation communities in the San Joaquin River NWR are riparian, wetland, and grassland habitats. This Refuge supports a variety of native habitats, ranging from Valley oak gallery and mixed riparian forests and woodlands to seasonal and permanent wetlands, and native grasslands. These habitats support a diversity of native anadromous fish, wildlife, and plants (Service 2006).

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, which occurs mainly along the San Joaquin River, its tributaries, and sloughs (Service 2024b). Merced NWR has wetland, riparian, and grassland habitats, as well as cropland. Riparian woodlands are limited to narrow strips along some of the waterways within this Refuge (Service 2024b). Grasslands WMA also has wetland, riparian, and grassland habitats, as well as cropland (Service 2024b).For more information regarding the habitat and vegetation of the San Joaquin River NWR, please

[3] Sacramento, Delevan, Colusa, and Sutter National Wildlife Refuges Final Comprehensive Conservation Plan and Environmental Assessment. Available at: https://iris.fws.gov/APPS/ServCat/DownloadFile/215090.
[4] Butte Sink, Willow Creek-Lurline, and North Central Valley WMAs Final Comprehensive Conservation Plan. Available at: https://ecos.fws.gov/ServCat/DownloadFile/170351.

see Section 3 *Refuge Setting* of the CCP.[5] For information on the habitat and vegetation of the San Luis NWR, Merced NWR, and Grasslands WMA, please see Chapter 3 *Refuge Resources* of the CCP.[6]

Stone Lakes NWR

The Stone Lakes NWR is an urban refuge conserving and enhancing Central Valley habitat and wildlife and is of ecological importance for the floodplain of the Beach-Stone Lakes basin (Service 2007). Stone Lakes NWR is composed of grasslands; riparian areas, including cottonwood, mixed, and Valley oak forests; woodland, and perennial and seasonal wetland habitats. (Service 2007).

For information on the habitat and vegetation of the Stone Lake NWR, please see Chapter 3 *Refuge Resources* of the CCP.[7]

Effects of Aquatic Invasive Plants on Habitat and Vegetation

Aquatic invasive plants can often outcompete and therefore, severely reduce populations of native aquatic plants that have more restrictive habitat requirements (California Department of Fish and Wildlife [CDFW] 2008; Madsen 2020). For example, aquatic invasive plants, such as water hyacinth, are capable of forming dense mats at or near the water surface, which shade out the submerged native plants, as well as interfere with water flow and nutrient cycles (Bullard 2024; Madsen 2020). Others, such as Eurasian watermilfoil, tolerate a wider range of environmental conditions than some native plants, including high- or low-nutrient levels, low light levels, and freezing water temperatures. Many aquatic invasive plants reproduce vegetatively from small fragments that readily root in the sediment the plant traps, as well as produce copious quantities of seed (CDFW 2008). The proportion of seeds from native aquatic plant species in the seed bank tends to decline as aquatic invasive plants take over (de Winton and Clayton 1996). Invasive plants tend to reduce the diversity of plant species growing in wetland habitats, which diminishes the health of these areas.

[5] San Joaquin River NWR Final Comprehensive Conservation Plan. Available at: https://ecos.fws.gov/ServCat/DownloadFile/215093.
[6] San Luis National Wildlife Refuge Complex Final Comprehensive Conservation Plan. Available at: https://ecos.fws.gov/ServCat/DownloadFile/252976.
[7] Stone Lakes National Wildlife Refuge Final Comprehensive Conservation Plan. Available at: https://ecos.fws.gov/ServCat/DownloadFile/219585.

Habitat and Vegetation: Environmental Consequences

Alternative 1 – No Action Alternative

Under Alternative 1, the No Action Alternative, the Service would continue to respond to aquatic invasive plant infestations at each of the Covered Refuges employing existing treatment methods. Riparian and wetland habitats, and the vegetation within them, could continue to experience short-term, minor adverse effects from existing aquatic invasive plant treatment methods the Service is using to respond to infestations. For example, aquatic invasive vegetation removal could affect non-target aquatic plant species. The continued implementation of BMPs and adherence to herbicide label restrictions (see **Section 4.10**, *Public Health and Safety*) would limit minor, short-term adverse effects to non-target species.

However, localized responses under current strategies could allow infestations to go untreated. Overall, under the No Action Alternative, aquatic invasive plants could continue to increase, which could lead to long-term, moderate adverse effects to both habitat quality and native aquatic vegetation within the wetlands, riparian areas, and other water resources of the Covered Refuges.

Alternative 2 – Management of Aquatic Invasive Plants, Including Broadcast Herbicide Treatments (Preferred Alternative)

Under Alternative 2, the Preferred Alternative, the IPM methods that could be utilized to manage aquatic invasive plants would include cultural methods, such as water level manipulations; physical methods, such as hand removal of biomass, surface excavation of biomass, tarping, and benthic mats; and broadcast or hand-applied chemical treatments with herbicides and adjuvants.

The proposed treatment methods in the Preferred Alternative could produce some short-term adverse effects when used on dense growths of aquatic invasive plants. Decaying plant material left in the water could encourage algal blooms and temporarily increase nutrient runoff. Using physical methods to remove aquatic invasive plants could incidentally remove some native aquatic plants, allow other non-native species to invade the treated areas, or temporarily disturb sediment, increasing turbidity (USGS 2024).

However, the implementation of this alternative would allow native species, such as bulrush (*Scirpus* spp.) and cattails (*Typha* spp.) to reestablish, improving habitat for native aquatic and semi-aquatic species, including salmonids and amphibians (California Invasive Plant Council 2012; The Nature Conservancy 2019), and increasing biodiversity. In addition, it would restore the ecosystem services that native plant communities provide, such as nutrient cycling, water filtration, as well as feeding and sheltering wildlife (Zedler 2000). Dissolved oxygen levels and

water turbidity are also likely to improve over time as invasive plants contribute less biomass to the organic matter decaying in the water (Cambridge University Press 2017; Madsen 2020).

The limited use, location, and acreage where herbicides are used by the Service to manage aquatic invasive plants generally confines the potential short-term, minor adverse effects to the area of application (Mullison 1970). Therefore, over the long term, the implementation of this alternative would result in moderate beneficial effects associated with the declogging of waterways and wetlands within and surrounding the Covered Refuges.

Alternative 3 – Non-Broadcast Herbicide Application Methods

With the elimination of broadcast methods of herbicide use under Alternative 3, the potential for short-term, minor adverse effects on non-target aquatic plant species may be reduced compared to the Preferred Alternative, as treatment areas would be smaller in scale.

However, long-term, moderate beneficial effects to native aquatic vegetation may not be realized to the same extent as Alternative 2, since, without broadcast methods, the herbicide application methods would not be able to treat large-scale, rapidly reproducing aquatic invasive plant infestations. Alternative 3 limits the area of treatment and would be less effective in managing the overall infestation of aquatic invasive plants. For example, large-scale hydrilla harvesting is generally regarded as less efficient and more cost-prohibitive than chemical control. Mechanical treatment is often a preferred option where herbicides are prohibited or ineffective, such as near domestic water supply intakes or in rapidly flowing water channels, respectively. Mechanical removal of hydrilla and other aquatic invasive plants is often unable to keep pace with regrowth, particularly in peak summer months where suppressive effects may only last days or weeks (Hetrick and Langeland 2012). If the treatment methods do not achieve control of the aquatic invasive species infestation or reduce coverage to a manageable level, these species could continue to crowd out native species.

Fish and Wildlife Species: Affected Environment

A variety of fish and wildlife species occur within the Covered Refuges. While many species are common year-round, others are present only during migration, during the winter, or during the spring and summer breeding season. The Central Valley has always been a major wintering area for Pacific Flyway waterfowl (Service 2020a).

Sacramento NWR Complex

Birds that use the Sacramento NWR Complex include gulls, terns, wading birds, diving birds, waterfowl, shorebirds, raptors, game birds, and a variety of songbirds. Many of the waterfowl are wintering dabbling ducks and geese which prefer the relatively shallow water in the managed seasonal wetlands where seeds, vegetation, and invertebrates are abundant. A wide variety of raptor species use the Sacramento NWR Complex throughout the year. The most

common breeding species include red-tailed hawks (*Buteo jamaicensis*), red-shouldered hawks (*Buteo lineatus*), Swainson's hawks (*Buteo swainsoni*), northern harriers (*Circus cyaneus*), American kestrels (*Falco sparverius*), common barn owls (*Tyto alba*), and great horned owls (*Bubo virginianus*) (Service 2005, 2009, and 2020).

Wetlands and associated waterways support beaver (*Castor canadensis*), mink (*Mustela vison*), and river otter (*Lontra canadensis*). Reptiles are common residents on the Sacrament NWR Complex and include common garter snakes (*Thamnophis sirtalis*), gopher snakes (*Pituophis catenifer*), western yellow-bellied racers (*Coluber constrictor*), common kingsnakes (*Lampropeltis getulus*), western fence lizards (*Sceloporus occidentalis*), and non-native red-eared sliders (*Trachemys scirpta*). The western toad (*Bufo boreas*), American bullfrog (*Rana catesbeiana*), and Pacific tree frog (*Pseudacris regilla*) are the only amphibians known to occur on the complex (Service 2005, 2009, and 2020).

Fish species are present in the Sacramento NWR Complex throughout the water delivery systems, drainage ditches, natural creeks and rivers, sloughs, oxbow lakes, inundated floodplain, and main river channel. The Sacramento River is important to native anadromous fish, including green sturgeon (*Acipenser medirostris*), white sturgeon (*Acipenser transmontanus*), Pacific lamprey (*Lampetra tridentata*), river lamprey (*Lampetra ayresi*), steelhead (*Oncorhynchus mykiss*), and four distinct runs of Chinook salmon (*Oncorhynchus tshawytscha*). These NWRs also support a wide variety of aquatic and terrestrial invertebrates (Service 2005, 2009, and 2020).

San Luis NWR Complex

Many waterbirds use the San Luis NWR Complex, including the Aleutian Canada goose (*Branta canadensis leucopareia*), snow goose (*Anser caerulescens*), white-fronted goose (*Anser albifrons*), green-winged teal (*Anas crecca*), northern shoveler (*Anas clypeata*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), cinnamon teal (*Anas cyanopters*), gadwall (*Anas strepera*), widgeon (*Anas americana*), and ruddy duck (*Oxyura jamaicensis*). Shorebirds, wading birds, diving birds, birds of prey, game birds, and songbirds are all found on the Complex. Rodent and rabbit species make up approximately one third of all mammals found on the Complex. Rabbits include the desert cottontail (*Sylvilagus audubonii*) and black-tailed hare (*Lepus californicus*). The most easily observable species include the western pond turtle (*Clemmys marmorota*), western fence lizard, western yellow-bellied racer, gopher snake, common garter snake, and introduced bullfrog. The stretch of the San Joaquin River and its tributaries on the San Joaquin River NWR provide habitat and connectivity to aquatic habitats for a wide range of fish, including fall-run chinook salmon, steelhead, and Sacramento splittail (*Pogonichthys macrolepidotus*) (Service 2006 and 2024b).

Stone Lakes NWR

Approximately 90 bird species are confirmed to have nested on the Stone Lakes NWR. Refuge grasslands are important foraging areas for many birds of prey, such as white-tailed kites (*Elanus leucurus*), red-tailed hawks, Swainson's hawks, red-shouldered hawks, northern harriers, golden eagles (*Aquila chrysaetos*), American kestrels, prairie falcons (*Falco mexicanus*), great horned owls, and barn owls. The high-quality riparian vegetation on the Refuge provides excellent habitat for neotropical migrant birds. Waterbirds that make extensive use of the managed wetlands at North Stone Lake and the Bufferlands include grebes, herons, egrets, pelicans, cormorants, rails, cranes, plovers, and other waterbird species. Grassland, Valley oak woodlands, riparian forest, and perennial wetlands support a variety of mammals, including black-tailed deer (*Odocoileus hemionus*), western gray squirrel (*Sciurus griseus*), river otters, and beavers. Common reptiles and amphibians on the Refuge include Pacific treefrogs, bullfrogs, western pond turtles, pond slider turtles (*Trachemys scripta*), western fence lizards, western terrestrial garter snakes (*Thamnophis elegans elegans*), and gopher snakes. Fish are found in all bodies of water on the Refuge, including North and South Stone Lakes (Service 2007).

Effects of Invasive Aquatic Plants on Fish and Wildlife

Although every species is unique in its requirements and its response to invasive plants, fish and wildlife rely on a diverse mix of native vegetation for shelter, food, as well as nesting and breeding sites. Monocultures of aquatic invasive plants, which form dense mats, could block access to these key feeding and nesting areas or alter the habitat in ways that make it inhospitable to native animals, forcing them to relocate if they can or struggle to survive if they cannot (Galatowitsch et al. 1999). Dense mats of water hyacinth reduce contact between the water surface and the air above it, which decreases the amount of dissolved oxygen in the water. Fish species with a high oxygen demand may struggle under water hyacinth mats (Villamagna and Murphy 2010). Invasive plants tend to grow much faster than native plants and take up nutrients the native plants need. When these large masses of non-native aquatic plants die, decomposers break them down, using up dissolved oxygen in the water and releasing quantities of nutrients that could contribute to harmful algal blooms in the process. As the algal blooms die, they provide more food for the decomposers, further reducing dissolved oxygen levels (Durand et al. 2011; Heller 2020; National Oceanic and Atmospheric Administration [NOAA] 2024). This lack of dissolved oxygen could kill native wildlife species, such as fish and amphibians (Ferrell 2024; Dibble 2020).

Moderate densities of a diverse mix of plants are best for fish populations. Hydrilla and water hyacinth overgrowth could lead to slower fish growth, declines in fish condition, and decreases in fish reproduction (Villamagna and Murphy 2010). Dense plant growth could make it more difficult for fish to spot prey and maneuver to catch them (Dibble 2020). Fish foraging efficiency

could be reduced with the proliferation of species like hydrilla, which could occupy most of the water column and cause a decrease in open water and natural vegetation gradients (Colle and Shireman 1980; Service 2021a). Studies have also shown that the diversity and abundance of the aquatic invertebrates that fish consume is lower under invasive water hyacinth mats than at the edges of the mats (Villamagna and Murphy 2010).

Aquatic invasive plants could also create physical barriers within the landscape, further limiting the ability of wildlife to move between suitable habitat areas. This is particularly problematic for species that require contiguous habitats to thrive, such as the giant garter snake (*Thamnophis gigas*), as well as other reptiles and amphibians, which depend on suitable wetlands for their shelter, food, and migratory needs (Service 2024b). Invasive plants and the conditions they create could alter the suitability of breeding grounds, limit timing of breeding, and impact vulnerable life stages of amphibians. For example, a type of cyanobacteria that forms dense colonies on invasive hydrilla has been shown to cause lesions within brain tissue that lead to significant frog tadpole mortality when ingested (Maerz et al. 2019).

Fish and Wildlife Species: Environmental Consequences

Alternative 1 – No Action Alternative

Under the No Action Alternative, native fish and wildlife species could continue to experience short-term adverse effects from the existing treatment methods that the Service is using to respond to aquatic invasive plant infestations. For example, physical removal of aquatic invasive plants could continue to disturb sediment and result in a short-term increase in turbidity (Zhu 2022). Additionally, the continued use of herbicides under the No Action Alternative could result in short-term, minor adverse effects to water quality. However, these minor adverse effects to aquatic fish and wildlife species would be limited with the continued implementation of BMPs and adherence to herbicide label restrictions (see **Section 4.10**, *Public Health and Safety*).

Current strategies may allow infestations to go untreated and local waterways and wetlands to become more inundated by aquatic invasive plants, crowding out native plants and decreasing habitat quality for native fish and wildlife species. Overall, under the No Action Alternative, aquatic invasive plants could continue to increase, which could lead to long-term, moderate adverse effects to habitat quality and native aquatic vegetation within the wetlands, riparian areas, and other water resources of the Covered Refuges.

Alternative 2 – Management of Aquatic Invasive Plants, Including Broadcast Herbicide Treatments (Preferred Alternative)

Under Alternative 2, there may be disturbances to aquatic habitats from the use of cultural, physical, and chemical treatment methods, such as from short-term water draw downs,

temporary noise, and sediment disturbance. Aquatic invasive plant removal methods may result in the loss of some vegetation, which could temporarily displace wildlife or reduce available food sources. Chemical treatments may also have unintended adverse effects. For example, aquatic herbicides, such as glyphosate and fluridone, commonly used to control invasive plants such as water hyacinth, could adversely affect amphibious species through the disruption of amphibian growth, reproduction, and habitat by reducing dissolved oxygen levels and leaving chemical residues in sediments (USEPA 2024a; Center for Biological Diversity 2020). Similar effects could also occur in fish species. The limited use of broadcast herbicide methods has potential to have short-term adverse effects on water quality and could increase water toxicity levels (Mullison 1970). Herbicides could create toxic pulses during rain events that could affect zooplankton, other small aquatic organisms, and nearby wildlife and non-target plants. This could disrupt aquatic food webs. Herbicides could harm native plants, alongside aquatic invasive plants, reducing biodiversity and destabilizing riparian and seasonal wetland zones critical for ecosystem services, such as erosion control and water quality (Bruno et al. 2019). However, these adverse effects would be short-term and would be minimized by adhering to the BMPs, with native plants regrowing and habitat conditions improving over time (Madsen 2020). There could also be temporary, minor adverse effects to species due to noise caused by the proposed methods.

The implementation of the Preferred Alternative could result in long-term, moderate beneficial effects associated with the declogging of waterways and wetlands, as well as the improvement to native habitats. Comprehensive management of aquatic invasive plants could directly benefit native wildlife by restoring natural ecosystem functions and habitat quality through improved water flow and habitat connectivity, as well as reestablishing native vegetation. By removing invasive vegetation from key waterways, migration routes for fish could be restored, as well as access to breeding areas for amphibians and reptiles. Managing dense aquatic invasive plant mats could reduce oxygen depletion and restore nutrient cycles in the long-term, benefiting species sensitive to poor water quality, such as salmonids and amphibians. Active removal of aquatic invasive plants often facilitates the reintroduction of native species, which are critical to the survival of endangered fauna (Bureau of Land Management [BLM] 2024; National Park Service [NPS] 2024). Thus, comprehensive IPM methods are vital for reversing the harmful ecological effects of aquatic invasive plants, ultimately supporting the recovery and continued persistence of the wildlife species occurring in the affected environment.

Alternative 3 – Non-Broadcast Herbicide Application Methods

Under Alternative 3, the potential for short-term, minor adverse effects to fish and wildlife from herbicide application could be less than with the Preferred Alternative, as treatment areas would be smaller. There could also be temporary, minor adverse effects to species due to noise caused by the proposed methods. However, long-term, moderate beneficial effects to fish and wildlife could not be realized to the same extent as Alternative 2, since the treatment methods

would not be as effective. If the treatment methods do not achieve control of aquatic invasive plant species or reduce coverage to a manageable level, these invasive species could continue to crowd out native aquatic plant species, reducing the quality of habitat long-term for fish and wildlife species.

Federally and State Listed Species: Affected Environment

Listed species, as defined for this EA, include candidate, proposed, and federally listed plant and wildlife species as well as State threatened and endangered species. All the Covered Refuges have documented listed species or potential habitat for at least one of these species. See **Appendix B,** *Refuge Summaries*, for a summary of candidate, proposed, and federally listed species with potential to occur in habitats proposed for treatment within each of the Covered Refuges, as well as State listed species. **Table 2**, *Listed Species Within or Potentially Occurring within the Covered Refuges* provides a summary level description of listed species throughout all of the Covered Refuges. A total of 31 candidate, proposed, and Federally listed species are present, have the potential to be present, or have suitable habitat available in at least one refuge within the species' current range ("Suitable Habitat Present Only"; **Table 2**). However, not all of the 31 Federally listed species would be affected by the proposed aquatic invasive treatments. Species that use seasonal and permanent wetland habitats, riparian zones, and other waterways have the highest potential to be affected. These include listed fish, such as the green sturgeon (*Acipenser medirostris*), Delta smelt (*Hypomesus transpacificus*), steelhead, and Chinook salmon, as well as other semi-aquatic inhabitants, such as the giant garter snake and northwestern pond turtle, if present.

Vernal pools, although ephemeral wetlands, are not included in the proposed aquatic invasive treatments. Thus, candidate, proposed, and Federally listed vernal pool-restricted species, such as the Conservancy longhorn shrimp (*Branchinecta conservatio*), longhorn fairy shrimp (*Branchinecta longiantenna*), Colusa grass (*Neostapfia colusana*), and Greene's tuctoria (*Tuctoria greenei*), are not discussed in detail.

Table 2. Listed Species Within or Potentially Occurring within the Covered Refuges

Taxa	Documented Federally-Listed Species	Potential Federally-Listed Species (Suitable Habitat Present Only)	Additional State-Listed Species
Birds	2	1	7
Reptiles	2	1	0
Amphibians	2	1	0
Mammals	3	1	0
Fish	5	1	0
Invertebrates	6	1	0
Plants	5	0	1

Taxa	Documented Federally-Listed Species	Potential Federally-Listed Species (Suitable Habitat Present Only)	Additional State-Listed Species
Total	25	6	8

Note: "Federally-listed" in this table includes Federal candidate and proposed species.

Federally designated critical habitat for listed species also occurs on a number of the Covered Refuges. **Table 3**, *Critical Habitat on Covered Refuges* provides a description of Federally listed species with critical habitat on the Covered Refuges and where that critical habitat occurs.

Table 3. Critical Habitat on Covered Refuges

Listed Species with Critical Habitat	Refuges with Designated Critical Habitat
Green sturgeon, Southern DPS *Acipenser medirostris*	Sutter NWR, Sacramento River NWR
Conservancy fairy shrimp *Branchinecta conservatio*	Merced NWR, San Joaquin River NWR, San Luis NWR (bordering critical habitat)
Longhorn fairy shrimp *Branchinecta longiantenna*	San Luis NWR (bordering critical habitat)
Vernal pool fairy shrimp *Branchinecta lynchi*	Merced NWR, San Joaquin River NWR, San Luis NWR (bordering critical habitat)
Hoover's spurge *Chamaesyce hooveri*	Merced NWR, San Luis NWR
Delta smelt *Hypomesus transpacificus*	Stone Lakes NWR, Steve Thompson North Central Valley WMA
Vernal pool tadpole shrimp *Lepidurus packardi*	Merced NWR, San Luis NWR (bordering critical habitat)
Colusa grass *Neostapfia colusana*	Merced NWR
Steelhead, California Central Valley DPS *Oncorhynchus mykiss*	Sacramento River NWR, Butte Sink WMA, San Joaquin River NWR, Sutter NWR
Chinook salmon, Central Valley spring-run ESU *Oncorhynchus tshawytscha*	Sacramento River NWR, Butte Sink WMA, Sutter NWR
Chinook salmon, Sacramento River ESU (winter run) *Oncorhynchus tshawytscha*	Sacramento River NWR

Effects of Invasive Aquatic Plants on Federally and State Listed Species

Aquatic invasive plants could cause changes to habitat and predator abundance that could adversely affect listed fish. For example, studies have shown that Delta smelt in the Sacramento-San Joaquin Delta hide from predators in turbid water and do not use submerged aquatic vegetation as habitat (Ferrari et al. 2014; Grossman 2016; Conrad et al. 2020) The fish are threatened by the dense colonies of submerged invasive aquatic vegetation growing in the area that have increased water clarity by trapping sediment and reduced suitable habitat (Hestir et al. 2016). In addition, mats of invasive submerged aquatic vegetation and floating aquatic vegetation create habitats favoring non-native fish, such as black bass and sunfish (Brown and Michniuk 2007; Conrad et al. 2011; Conrad et al. 2020). These non-native fish compete with and consume native fish, including the Delta smelt (Schreier et al. 2016; Conrad et al. 2020). Other listed fish species may be similarly affected by decreases in habitat and increases in predation caused by aquatic invasive plants. Aquatic invasive plants also reduce open water habitat and physically obstruct migration corridors of salmonids and green sturgeon (National Marine Fisheries Service [NMFS] 2018).

Aquatic invasive vegetation limits access or decreases habitat suitability for listed amphibians and reptiles, such as the northwestern pond turtle and giant garter snake. For example, water hyacinth, characterized as an invasive habitat modifier, roots in the water column and sprouts leaves above water. Physical barriers within the landscape created by aquatic invasive plants limit the ability of herpetofauna to move between suitable habitat areas. Giant garter snakes depend on suitable wetlands for their sheltering, feeding, and migratory needs, and these barriers from invasive plants would disrupt the contiguous habitat needed by this species to thrive.

Federally and State Listed Species: Environmental Consequences

Alternative 1 – No Action Alternative

Listed species could continue to experience short-term, minor adverse effects as a result of the No Action Alternative despite continued adherence to BMPs and herbicide label restrictions (see **Section 4.10**, *Public Health and Safety*). However, the small-scale and localized treatments used under the No Action Alternative could allow untreated aquatic invasive plants to crowd out native plants, decreasing habitat quality for listed species.

Therefore, under the No Action Alternative, aquatic invasive plant infestations could continue to rapidly increase, leading to moderate long-term, adverse effects to listed species and their habitat.

Alternative 2 – Management of Aquatic Invasive Plants, Including Broadcast Herbicide Treatments (Preferred Alternative)

Managing aquatic invasive plants poses both risks and opportunities for listed species. There could be temporary, minor adverse effects to species due to noise caused by the proposed methods. In addition, chemical treatments could have unintended negative consequences, despite following BMPs. For example, aquatic herbicides, such as glyphosate and fluridone, commonly used to control water hyacinth and other invasive plants, could adversely affect fish species, such as Chinook and Coho salmon (*Oncorhynchus kisutch*), by disrupting their growth and reproduction, and affect their habitat by reducing dissolved oxygen levels and leaving chemical residues in sediments (USEPA 2024a; Center for Biological Diversity 2020). Several types of aquatic herbicides, including glyphosate, have been shown to cause sublethal effects in salmon and steelhead, including changes in behavior and gill tissue damage, which could compromise their ability to transition to seawater or affect their general health (Courter et al. 2012).

Under Alternative 2, the removal of aquatic invasive plants could initially disturb fish habitats and food webs. Many fish species, especially juveniles, rely on the dense cover provided by aquatic plants for protection from predators. The removal of this vegetation may temporarily expose fish to predation risks. Additionally, the sudden change in the habitat may affect water flow, food availability, and oxygen levels, further stressing fish populations (Dibble 2020). Short-term adverse effects from larger-scale treatments could include increases in sediments and turbidity. However, these short-term adverse effects would generally decrease within a few weeks (Thiemer et al. 2021). Surface excavators would only be utilized in select locations to remove floating aquatic vegetation and are not anticipated to directly disturb the soil. Disturbance to soil or roots in the soil during biomass removal would be incidental and short-term, as the Service would not dig into the ground directly when using this method for aquatic invasive plant removal.

To assist in growth prevention, the Preferred Alternative is proposing the use of physical covers (i.e., benthic mats and tarping) to kill aquatic invasive plants, as necessary. The process of placing and removing tarps could cause sediment resuspension, increasing turbidity. High turbidity may clog fish gills or reduce visibility, which is beneficial to prey species and detrimental to predators (Kjelland et al. 2015). Tarping could also limit gas exchange between the water and the atmosphere. Decomposition of organic material beneath the tarp could lead to hypoxic or anoxic conditions, stressing or displacing fish species, such as Delta smelt or steelhead (Simberloff 2021). These methods, when implemented, would be small in scale, although there is potential for short-term adverse effects when implementing.

Under the Preferred Alternative, the limited use of broadcast herbicide and other methods has potential to have short-term, minor adverse effects on water quality and could increase water toxicity levels (Mullison 1970). Herbicides could create toxic pulses during rain events that

could affect zooplankton, other small aquatic organisms, and nearby wildlife and non-target plants. This could disrupt aquatic food webs, which in turn could affect juvenile salmonids and other fish by reducing growth and overall survival rates. Listed fish species, particularly those in larval or juvenile stages, are highly susceptible to poor water quality and herbicide contamination. Herbicidal chemicals could cause physiological stress, sub-lethal effects, such as reduced reproductive success, or direct mortality when concentrations exceed tolerance thresholds (Mullison 1970; Service 2024c). However, by limiting use of broadcast methods to areas with the largest infestations and adhering to BMPs, the Service could further prevent the rapid spread of these aquatic invasive plant species and their long-term, moderate adverse effects to listed species.

Despite potential short-term adverse effects, well-implemented aquatic invasive plant management offers substantial benefits to the environment and its biodiversity. Restoring hydrological flow through invasive plant removal improves water quality and habitat conditions, supporting species such as the giant garter snake, which relies on open waterways and marshlands for hunting and movement (Center for Biological Diversity 2020). Removing invasive plants also encourages the reestablishment of native vegetation, like bulrush (*Schoenoplectus acutus*), which enhances habitat for marsh-dependent species (USEPA 2024a).

For fish species, such as listed salmonids and green sturgeon, aquatic invasive plant management reduces competition and improves survival by addressing water quality and habitat degradation issues. Dense mats of aquatic invasive plants slow water flow and depletes dissolved oxygen, creating unsuitable conditions for salmonids, particularly during spawning and rearing. Removing aquatic invasive plants, such as Brazilian waterweed (*Egeria densa*) and water-primrose (*Ludwigia* spp.), could encourage growth of native aquatic vegetation and open up waterways, which improves water flow, oxygenation, and sunlight penetration. These conditions create a more suitable habitat for juvenile salmonids by supporting the growth of native food sources, such as invertebrates, and maintaining cooler water temperatures (Pellitteri-Rosa et al. 2024). Additionally, these actions could reduce dense plant cover which favors predatory species, such as largemouth bass (*Micropterus nigricans*), which occasionally prey on vulnerable juvenile salmon during their migration through the Sacramento-San Joaquin Delta (Grossman 2016). Additionally, removal efforts often lead to a resurgence in native biodiversity, creating a balanced ecosystem that supports salmonids and other native species essential to aquatic food webs (McNeish et al. 2017).

Similarly, the giant garter snake benefits from better access to basking sites and hunting grounds. Although there could be short-term, minor adverse effects from the Preferred Alternative, by balancing ecological restoration with control methods, aquatic invasive plant management could protect and enhance sensitive habitats, creating long-term, moderate beneficial effects for listed species across the region.

The removal of aquatic invasive plants contributes to the long-term recovery of listed species, offering them better chances of survival. Species such as the Delta smelt, which require specific

water quality and habitat conditions, benefit significantly from long-term improvements to ecosystems and the reduced presence of aquatic invasive plants. Restored riparian habitats support listed semi-aquatic reptiles, such as the northwestern pond turtle, providing necessary basking sites and safe areas for reproduction. These long-term, moderate beneficial effects illustrate the critical role that aquatic invasive plant management plays in the conservation and recovery of listed species.

Alternative 3 – Non-Broadcast Herbicide Application Methods

Alternative 3 would reduce the potential for short-term, minor adverse effects to listed species compared to Alternative 2, as treatment areas would be smaller. However, long-term, moderate beneficial effects may not be realized to the same extent as Alternative 2, since it is difficult to successfully treat large-scale, rapidly reproducing aquatic invasive plant infestations without broadcast methods. If the treatment methods do not achieve control of aquatic invasive plant species or reduce coverage to a manageable level, these invasive species could continue to crowd out native aquatic plant species, reducing habitat quality for listed species long-term, including Federally designated critical habitat.

4.3 Floodplains, Wetlands, and Water Resources

Affected Environment

Water resources are a critical component of the human and natural environments. Surface waters include streams, rivers, lakes, and various other freshwater, estuarine, and marine water bodies. Water quality describes the chemical (e.g., dissolved solids) and physical composition (e.g., temperature) of water as affected by natural and human activities.

Floodplains are areas of low, level ground present on one or both sides of a stream channel and are subject to either periodic or infrequent inundation by floodwater. Inundation dangers associated with floodplains have prompted Federal, State, and local legislation that limits development largely to recreation and open space. Executive Order 11988, *Floodplains Management*, as amended, provides for the support, preservation, and enhancement of the natural and beneficial values of floodplains. In general, riparian and floodplain ecosystems experience seasonal flooding; however, the hydroperiod and flooding regime in the Central Valley have been severely altered by land conversion and hydrological changes to riverine systems (Service 2021b). 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 2020a and 2021b). Flooding is an expensive natural disaster, costing $260 billion between 1980 and 2013 in the U.S. (Federal Emergency Management Agency [FEMA] 2015). Therefore, floodplain management is pertinent to controlling the negative impacts caused by flooding.

Wetlands are defined by the U.S. Army Corps of Engineers (USACE) and USEPA as *"…those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas"* (33 C.F.R. §328.3[b]). Hydric soils are those that are saturated, flooded, or ponded for sufficient periods during the growing season and that develop anaerobic conditions in their upper horizons (i.e., layers). Wetland hydrology is determined by the frequency and duration of inundation and soil saturation; permanent or periodic water inundation or soil saturation is considered an important force in wetland establishment and proliferation.

Sacramento National Wildlife Refuge (NWR) Complex

Due to drastic changes in natural hydrology, nearly all surface waters in the Butte Sink and Steve Thompson North Central Valley WMAs are managed wetlands that require water to be artificially applied and maintained. Managed wetland properties within the WMAs receive water from a variety of sources, depending on their location and water rights. The most common water sources for wetland properties include: 1) water diverted from adjacent rivers and creeks using riparian water rights; 2) water diverted from non-contiguous water bodies under appropriative water rights deeded to the property; 3) water secured and purchased under contract with an irrigation or water district; 4) agricultural drain water from upstream properties; and 5) groundwater pumped from deep wells (Service 2020a).

There are two main water sources used to manage the wetland habitats in the Sacramento, Delevan, Colusa, and Sutter NWRs. The majority of the water used throughout the year is delivered from the Sacramento River from the Bureau of Reclamation's Central Valley Project. In addition, there are some riparian water rights that allow the refuges to divert specific amounts of water from creeks and tributaries during certain times of the year. There has been very little use of ground water on these refuges, other than domestic wells. All water sources depend largely upon gravity flow and are distributed and impounded via a series of delivery and drainage ditches, levees, and water control structures (Service 2009).

The Sacramento River originates as snowmelt, is of excellent water quality at its source, and supports all existing beneficial uses of the Water Quality Control Plan (Basin Plan) for the Central Valley Regional Water Quality Control Board (CVRWQCB), including domestic, agricultural, and industrial water supply; recreation; wildlife habitat; cold and warm freshwater fish habitat; and migration and spawning for salmonids (CVRWQCB 2019). The water is considered soft, moderately alkaline, and low in dissolved solids, with high turbidity during peak runoff periods. However, the Sacramento River, from Cottonwood Creek to the Delta, is

currently listed as impaired in accordance with Section 303(d) of the Clean Water Act[8] for the pesticide diazinon, and trace metals, including mercury, cadmium, copper, and zinc (Service 2005; CVRWQCB 2024).

The Water Resource Inventory Assessment for the Sacramento, Delevan, and Colusa NWRs identified 32 potential contaminant point sources near refuges, most of which are clustered in nearby urban areas, and most of which may contribute to groundwater contamination. Contaminant point sources identified are potential sources of waste with high salt concentrations, wastewater and sewage, petroleum hydrocarbons and associated compounds, lead, and unidentified hazardous waste. There is one wastewater treatment surface water discharge area near Colusa NWR (Service 2018).

Nearby waterbodies contributing to the refuges, including Colusa Drain, Sacramento River, Stone Corral Creek, and other upstream tributaries, were listed as impaired for one or more constituents, including organochlorine and organophosphorus pesticides. Pesticide detections resulting in 303(d) listings were found relatively far from the refuges, making it difficult to determine if pesticides are an immediate threat to refuge water quality (Service 2018).

Wetlands in the Sacramento–San Joaquin River Delta watershed have been found to increase the production of methylmercury (a form of mercury that is more bioavailable and has higher toxicity), as compared to other aquatic habitats. The Delta methylmercury total maximum daily load requires a reduction in the amount of methylmercury loading and residing in the Delta by reducing the amount of salinity, total mercury, and sulfates from discharging waters, which could include refuge drainages (Service 2018).

San Luis NWR Complex

Natural hydrology in the northern San Joaquin Valley has been severely altered due to urbanization and agriculture. The majority of water used on the San Luis NWR Complex is delivered by local water districts through delivery and/or drain canals or is from groundwater at this Complex's units (Service 2024b).

Except for extreme flood events that result in levee failure, water in the San Joaquin River remains within the levee corridor and does not spread across the floodplain. The Complex is located within the river's 100-year floodplain. The Service's goal is to restore the floodplain and riparian habitats on the land west of the San Joaquin River within the San Joaquin River NWR, which mostly consists of abandoned agricultural fields (Service 2006). Human-made levees separate most of this land from river floodwater since the course of the San Joaquin River has been modified and channelized to enhance water delivery and flood control. Aside from

[8] Section 303(d) of the CWA requires the identification of water bodies that do not meet, or are not expected to meet, water quality standards (i.e., impaired water bodies).

extreme flood events that could result in levee failure, river water remains within the levee corridor and does not spread across the floodplain. River modifications have reduced river flows from historic levels, which reduce fluvial processes within the levee corridor including the riparian areas in most years (Service 2006).

Water quality in the San Joaquin River is degraded by irrigation drainage and urban runoff in the summer, as well as by flushing of accumulated pollutants in urban stormwater and other runoff. One hundred miles of the San Joaquin River, including the reach in Merced County, was designated as an impaired water body in 1990 by the State Water Resources Control Board (SWRCB). The lower San Joaquin River, from Mendota Pool to Bear Creek, approximately 88 miles, is currently listed as impaired in accordance with Section 303(d) of the Clean Water Act, for exceeding boron, Dichlorodiphenyltrichloroethane (DDT), and group "A" pesticide water quality objectives (Service 2024b; CVRWQCB 2024). The San Joaquin River NWR is in a reach of the San Joaquin River that has also been identified as the main contributor of nonpoint source sediment in the San Joaquin River. Erosion from agricultural irrigation is the main contributor of the sediment, producing 1.2 million tons of sediment per year. Organochlorine pesticides, such as DDT, are absorbed in the sediment carried by the tailwater and transported to the San Joaquin River (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, surface water from northern California is delivered to the Complex, thus optimizing water quality while not depleting local groundwater and surface water supplies. However, water quality can vary when the delivered water is mixed with lower-quality water from the Salt Slough unit, which has variable water quality. The Complex operates with low-quality water supplies due to changes in the San Joaquin Valley's past and current land use practices, such as urbanization, the severe loss of wetlands, and modern agricultural practices which have changed the natural hydrology and led to variable water quality (Service 2024b).

The Service launched a major initiative at the San Joaquin River NWR to protect floodplain lands starting in 1999. The initiative aims to maximize habitat benefits to riparian- and wetland-dependent native species through acquisition, restoration, and improved function of floodplain habitats (Service 2006). In addition, within the San Luis NWR and Merced NWR, floodplains are a priority resource of concern and actively managed by the Service. 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 waterbird habitat (Service 2021b).

Stone Lakes NWR

Water sources on Stone Lakes NWR include Morrison and Laguna Creeks, Upper and Lower Beach Lakes, urban runoff and agricultural drainage, Southern Pacific Cut (a borrow ditch for

the abandoned railroad levee that borders the refuge on the west), and North and South Stone Lakes. Water quality in North and South Stone Lakes is affected by limited daily tidal flows from the Delta and San Joaquin River moving up Snodgrass Slough through the Lambert Road bridge water control structure. Agricultural activities upstream of the lakes may influence water quality from direct drainage into the lakes and the Southern Pacific Cut. Groundwater discharge and recharge, as well as Mokelumne River up flow via Snodgrass Slough to and from the lakes, may also influence water quality in the lakes (Service 2007).

The Stone Lakes NWR has many drainages that originate in urban and agricultural areas and empty into this Refuge's wetlands and lakes. In addition, a significant portion of land within the Stone Lakes NWR is currently used for agriculture. These areas are likely sources of non-point contaminants, but also provide important habitat for fish, aquatic invertebrates, and foraging areas for birds that feed on these resources (Service 2007).

From 2021 to 2022, water quality sampling occurred at eight locations where water enters the Stone Lakes NWR during the wet season when runoff is active. A contaminant of concern is a parameter that exceeds a water quality target threshold in at least one sample. Barium, cadmium, calcium, lead, manganese, nitrate, and zinc exceeded chronic water quality testing levels. Aluminum, arsenic, cobalt, copper, iron, inorganic mercury, and total phosphorus exceed both chronic and acute water quality testing levels (Esmonde and Esralew 2024).

Effects of Invasive Aquatic Plants on Floodplains, Wetlands, and Water Resources

Aquatic invasive plants often grow quickly enough to choke waterways. For example, water hyacinth has been documented to double the size of the area it covers in five days (Nguyen et al. 2015). This rapid expansion could cause long-term, moderate adverse effects to water quality as the interlocking mats formed by these aquatic invasive plants decrease water flow (Gettys 2020). In addition, aquatic invasive plant mats could clog water intake systems and increase the risk of flooding within and surrounding the Covered Refuges (Purdue 2009; Kiss et al. 2019). These mats also reduce nutrient transport within a water system, which could lead to hypereutrophication, as excess nutrients accumulate in the water (Villamagna and Murphy 2010). Excessive nutrient inputs caused by the decay of aquatic invasive plant infestations could lead to increased plant growth and harmful algal blooms. As the plants and algae photosynthesize, they reduce the amount of dissolved carbon dioxide in the water, which could raise the pH of the water. Once the plants and algae die, their decomposers may deplete the dissolved oxygen supply in the water, as they use it to break down the dead biomass (NOAA 2024). The lack of oxygen in the water could kill native aquatic animal species (Ferrell 2024). Aquatic invasive plants could also affect water quality by increasing water temperatures and causing higher turbidity by blocking water flow (Purdue 2009; Kiyemba et al. 2023; Tobias et al. 2019).

Environmental Consequences

Alternative 1 – No Action Alternative

Under the No Action Alternative, water resources within the Covered Refuges could continue to have short-term, minor adverse effects from the existing treatment methods that the Service is using to respond to aquatic invasive plant infestations. For example, physical removal of aquatic invasive plants could continue to disturb sediment and result in a short-term increase in turbidity (Zhu 2022). In addition, the continued use of herbicides under the No Action Alternative could result in short-term adverse effects to water quality. For example, the use of herbicides could result in short-term decreases in dissolved oxygen as plants die (Lamb et al. 2021). Similarly, it could result in a short-term increase in the amount of dissolved carbon dioxide in the water which could lower the water's the pH, an increase in bacterial populations, or a change in the nutrient status of the water (Newbold 1975).

While the Service would continue to respond to aquatic invasive plant infestations under the No Action Alternative, the limited scope and set of treatment methods available could allow infestations of aquatic invasive plants to continue to expand quite rapidly. Therefore, under the No Action Alternative, aquatic invasive plants could continue to increase rapidly and produce large-scale infestations leading to long-term, moderate adverse effects on the water quality of the floodplains, wetlands, riparian areas, and other water resources within the Covered Refuges.

Alternative 2 – Management of Aquatic Invasive Plants, Including Broadcast Herbicide Treatments (Preferred Alternative)

The multi-pronged, comprehensive IPM approach of the Preferred Alternative presents challenges and opportunities for protecting the floodplains, wetlands, and water resources of the Covered Refuges. Under the Preferred Alternative, the use of broadcast herbicides could have short-term adverse effects on water quality (Mullison 1970). These could include increases in sediments and turbidity. However, these short-term adverse effects would generally decrease within a few weeks (Thiemer et al. 2021). The limited use, location, and acreage where the Service would apply herbicides would generally confine potential short-term, minor adverse effects to the area of application (Mullison 1970). This approach helps prevent the rapid spread of these aquatic invasive species and reduces their potential long-term, moderate adverse effects on water quality.

Biomass removal methods used in concert with other treatment methods could affect water quality. Using physical covers, such as benthic mats and tarps, could prevent growth in small areas. There is potential for short-term, negligible increases in water turbidity when installing the stakes for the mats or tarps. Cutting, pulling, and surface excavating could reduce the volume of invasive plants clogging waterways and could be timed strategically to keep the

invasive plants from producing seeds. Although dense mats of dead or decaying aquatic invasive plants could produce some short-term adverse effects on water quality, the Service has proposed collection methods as part of Alternative 2. Collection methods for the aquatic invasive plants could include using hand nets or installing booms, screens, or curtains, which would be employed temporarily. Barriers such as these are generally used in conjunction with herbicides or other control methods to capture invasive plant fragments that could otherwise disperse. The vegetation could be removed from the water to keep it from blocking the waterway or impeding water flow. Surface excavators would only be utilized in select locations to remove floating aquatic vegetation and are not anticipated to directly disturb the soil. Disturbance to soil or roots in the soil during biomass removal would be incidental and short-term in nature, as the Service would not dig into the ground directly. Additionally, removing the surface plant layer which was shading the water below it could increase the temperature of the deeper water, thus accelerating the release of nutrients from the sediment. This could lead to temporary algal blooms and increased turbidity until plant growth resumes (Zhu et al. 2022).

Zhu et al. (2022) demonstrated that harvesting controlled the growth of *Hydrilla verticillata*, and that medium and low harvesting intensities were best when considering water quality. However, physical methods may not be fully successful in controlling the target invasive species. For example, it is difficult to maintain complete coverage of benthic matting (Cornell Cooperative Extension 2015). Additionally, physical methods are more costly and more time consuming than the use of herbicides (Cornell Cooperative Extension 2015).

Water level manipulation would be limited in scope, as the Service would only implement this method within managed wetlands and canals, as necessary, where there is the ability to control water levels.

Over the long-term, the implementation of the Preferred Alternative would result in moderate beneficial effects to the water resources within and surrounding the Covered Refuges. The control of aquatic invasive plants would reduce the long-term, moderate adverse effects caused by these species, such as lower dissolved oxygen concentration, sediment accumulation, and restrictions on water flow within and adjacent to the Covered Refuges (Florida Fish and Wildlife N.D.).

Alternative 3 – Non-Broadcast Herbicide Application Method

With the elimination of broadcast methods of herbicide use, the potential for short-term, minor adverse effects to water quality as a result of herbicide application would be reduced in size as compared to the Preferred Alternative, as treatment areas would be smaller in scale. However, long-term, moderate beneficial effects on water quality may not be realized to the same extent as Alternative 2, since the herbicide methods would not be able to treat the large-scale, rapidly reproducing aquatic invasive plant infestations without broadcast methods. For example, mechanical removal of hydrilla is often unable to keep pace with regrowth, particularly in peak

summer months where suppressive effects may only last days or weeks (Hetrick and Langeland 2012). Mechanical treatment is often a preferred option where herbicides are prohibited or ineffective, such as domestic water supply intakes or rapidly flowing water channels, respectively (Hetrick and Langeland 2012). Otherwise, hydrilla harvesting on a large scale is generally regarded as less efficient and more cost-prohibitive than chemical control (Hetrick and Langeland 2012). If the treatment methods do not achieve control of the aquatic invasive plant species or reduce coverage to a manageable level, local waterways and wetlands could become more inundated by aquatic invasive plants, crowding out native plants, affecting nutrient cycles, and decreasing water quality.

4.4 Noise

Affected Environment

Noise is defined as unwanted sound or, more specifically, as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise annoying (Federal Interagency Committee on Noise [FICON] 1992). Human response to noise can vary according to the type and characteristics of the noise source, the distance between the noise source and the receptor, the sensitivity of the receptor, and the time of day.

The Noise Control Act of 1972 establishes a national policy to promote an environment free from noise that jeopardizes health and welfare (42 U.S.C. §4901). The USEPA has no regulations governing environmental noise; however, the USEPA has conducted extensive studies to identify the effects of sound levels on public health and welfare. The USEPA "Levels Document" identifies sound levels "requisite to protect the public health and welfare with an adequate margin of safety" (USEPA 1974). However, these levels are guidelines, not regulations or standards. USEPA specifies an outdoor day-night sound level (Ldn) of 55 A-weighted decibels (dBA) for areas where quiet is a basis for use. Ambient background noise in urbanized areas typically varies from 58 to 72 dBA but can be higher; quiet suburban neighborhoods experience ambient noise levels from approximately 48 to 52 dBA (USEPA 1974).

Additionally, guidelines established by FICON are used by the U.S. Department of Housing and Urban Development to determine acceptable levels of noise exposure for various land use categories. Land use categories most sensitive to ambient noise are residential, institutional, cultural, and some recreational uses. Industrial land uses are the least sensitive to surrounding noise, largely due to the inherently high levels of ambient noise associated with industrial activities.

As shown in **Figures 1** through **5**, the Covered Refuges are generally located within rural agricultural areas within the Central Valley. The dominant noise source for the majority of the nine refuges and three WMAs is vehicle noise generated along busy interstates, and to a lesser extent intermittent noise from heavy agricultural equipment. The Sacramento NWR and Stone Lakes NWR are located immediately adjacent to Interstate 5 (I-5). Levels of highway traffic noise typically range from 70 to 80 dBA at a distance of 15 meters (50 feet) from the highway

(Federal Highway Administration [FHWA] 2003). Additionally, the refuges and WMAs making up the San Luis NWR Complex are located near more developed areas, including the cities of Merced, Atwater, and Livingston, with populations ranging from approximately 14,000 (Livingston) to over 87,000 (Merced) (U.S. Census Bureau 2020a and 2020b). While not located along I-5, these refuges and WMAs still experience vehicle noise along rural roads.

While the Grasslands WMA consists predominantly of privately owned easements, other Covered Refuges have portions open to the public for compatible uses and may experience intermittent noise from operational and recreational activities, including noise from vehicles, boats powered by outboard motors, shotguns used for hunting, and other quieter noise sources (e.g., hikers), depending on the compatible uses in the specific refuge or WMA. Generally, the noise within the Covered Refuges consists of natural sounds from the surrounding land.

Environmental Consequences

Alternative 1 – No Action Alternative

Under the No Action Alternative, the small area of application of herbicides and the use of manual methods to respond to aquatic invasive species is anticipated to have no effect on the existing noise environment. However, the use of heavy equipment could continue to have short-term, minor adverse effects on the existing ambient noise environment. For example, according to the FHWA, an excavator could produce a noise level of 85 dBA at a distance of 50 feet (FHWA 2006). While an occasional increase in ambient noise levels could have temporary effects on biological resources and recreational users at the Covered Refuges, increases would be short-term in nature. Additionally, these noise levels would dissipate by 6 decibels (dB) for every doubling of distance from the source. At a distance of approximately 1,580 feet, noise levels would be 55 dBA, which is characteristic of areas where quiet is a basis of use. The dominant noise sources in the area would continue to be vehicle noise along highways and local roadway networks.

Alternative 2 – Management of Aquatic Invasive Plants, Including Broadcast Herbicide Treatments (Preferred Alternative)

Cultural treatment methods are not anticipated to result in measurable effects to noise and would be negligible. Many other physical and chemical treatments would involve manual or hand-operated equipment that would not generate substantial noise levels. For example, the use of hand nets, the installation of booms, screens, or curtains, and the use of physical covers (e.g., benthic mats and tarping), would not result in any measurable increase in noise beyond the immediate vicinity of the treatment area and would be minor and short-term in nature.

Potential noise effects associated with the Preferred Alternative could be produced by heavy equipment, such as surface excavators. In addition, noise effects could occur from the use of

airplanes, helicopters, drones, wheeled vehicles, and boats associated with broadcast herbicide application. Engine noise would be similar to existing agricultural operations in the surrounding vicinity, but would be expected to increase noise levels in the immediate vicinity of the treatment areas. As previously noted, according to the FHWA, a surface excavator could produce a noise level of 85 dBA at a distance of 50 feet (FHWA 2006). Broadcast aerial application of herbicides, which could be used in limited areas with larger infestations, could involve fixed-wing or rotary-wing aircraft flying as low as 8 to 12 feet over the target area (Pesticide Environmental Stewardship 2024). These aircraft operations could generate maximum instantaneous noise levels (L_{max}) in excess of 100 dBA. Drones would generate lower noise levels. For example, some drones have noise levels ranging between 70 and 81 dBA (Nextech 2024). Broadcast ground applications involving the use of ATVs, trucks, and tractors could result in noise levels of 84 dBA at a distance of 50 feet (FHWA 2006). Broadcast water methods would involve the use of boats that could generate noise levels of up to 86 dBA (U.S. Coast Guard N.D.).

While increases in ambient noise levels could affect biological resources and/or recreational users, these increases in noise levels would be short-term. The main noise sources in the vicinity of the Covered Refuges would continue to be vehicle noise along highways and local roadway networks. Therefore, potential adverse noise effects associated with the Preferred Alternative would be minor and short-term in nature.

Alternative 3 – Non-Broadcast Herbicide Application Methods

With the elimination of broadcast methods of herbicide use, Alternative 3 may result in a reduction in noise levels as compared to Alternative 2. However, it should also be noted that without broadcast herbicide application, there would likely be an increased need for mechanical treatment options involving the use of heavy equipment. Therefore, while the maximum instantaneous noise levels during treatment activities may be reduced, the frequency of temporary, albeit slightly smaller, increases in noise levels may be increased. Regardless, as described for Alternative 2, adverse effects from noise would be minor and short-term in nature.

4.5 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. Air quality in a given location is determined by the concentration of various pollutants in the atmosphere. The Clean Air Act defines the USEPA's responsibilities for protecting and improving the Nation's air quality and requires the USEPA and individual States to carry out programs to assure attainment of the National Ambient Air Quality Standards (NAAQS). Under the authority of the Clean Air Act, the USEPA sets primary and secondary NAAQS for the criteria pollutants, which

are sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), lead (Pb), and particulate matter (PM_{10}) (less than 10 microns in diameter) and $PM_{2.5}$ (less than 2.5 microns in diameter). The Clean Air Act identifies primary standards that provide public health protection, including protecting the health of sensitive populations, such as asthmatics, children, and the elderly. It also identifies secondary standards to provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. An attainment area is any area that meets the national primary or secondary NAAQS. A nonattainment area is any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary NAAQS. Local air control districts, the California Air Resources Board (CARB), and the USEPA collaborate for the goal of reducing criteria pollutants (USEPA 2024b).

The Earth's natural warming process is known as the "greenhouse effect." The Earth's atmosphere consists of a variety of gases that regulate the Earth's temperature by trapping solar energy. These gases, such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, nitrogen trifluoride, and sulfur hexafluoride, are cumulatively referred to as greenhouse gases, as they trap heat in the atmosphere (USEPA 2024c). Methane, a potent greenhouse gas, is released when dead plants decompose under low-oxygen conditions, such as those that often occur under dense colonies of water hyacinths (Theus et al. 2023).

Sacramento NWR Complex

The Sacramento NWR Complex is located in California's Sacramento Valley Air Basin, San Francisco Bay Area Air Basin, and San Joaquin Valley Air Basin, which includes the Butte County Air Quality Management District (BCAQMD), Colusa County Air Pollution Control District (CCAPCD), Bay Area Air Quality Management District (BAAQMD), Glenn County Air Pollution Control District (GCAPCD), Sacramento Metropolitan Air Quality Management District (SMAQMD), San Joaquin Valley Air Pollution Control District (SJVAPCD), Yolo-Solano Air Quality Management District (YSAQMD), Feather River Air Quality Management District (FRAQMD), and the Tehama County Air Pollution Control District (TCAPCD).

Non-attainment areas are defined as any area that does not meet ambient air quality standards for a pollutant (USEPA 2024b). Being classified as a non-attainment area means that the State must develop an implementation plan to outline methods for reaching identified air quality standards. **Table 4**, *Sacramento NWR Complex Federal and State Non-Attainment by County* lists the criteria pollutants with a non-attainment status for the Sacramento NWR Complex. $PM_{2.5}$ 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

involving pollutants emitted from vehicles, industrial sources such as factories, fossil fuels, combustion, and many others (CARB 2023b).

Table 4. Sacramento NWR Complex Federal and State Non-Attainment by County

County	Federal Non-Attainment	State Non-Attainment
Butte	O_3[1]	PM_{10} and O_3[2]
Colusa	Attainment	$PM_{2.5}$, PM_{10}, and O_3[3]
Contra Costa	$PM_{2.5}$ and O_3[1]	$PM_{2.5}$, PM_{10}, and O_3[4]
Glenn	Attainment	$PM_{2.5}$, PM_{10}, and O_3[5]
Placer	$PM_{2.5}$ and O_3[1]	O_3[6]
San Joaquin	$PM_{2.5}$ and O_3[1]	$PM_{2.5}$, PM_{10}, and O_3[7]
Solano	$PM_{2.5}$ and O_3[1]	PM_{10} and O_3[8]
Sutter	O_3[1]	PM_{10} and O_3[9]
Tehama	O_3[1]	$PM_{2.5}$, PM_{10}, and O_3[10]
Yolo	$PM_{2.5}$ and O_3[1]	PM_{10} and O_3[11]
Yuba	Attainment	PM_{10} and O_3[12]

Sources: [1]USEPA 2024b; [2]BCAQMD 2024; [3]CCAPCD 2007; [4]BAQMD 2017; [5]GCAPCD 2007; [6]SMAQMD 2024; [7]SJVAPCD 2023a; [8]YSAQMD 2022; [9]FRAQMD 2023; [10]TCAPCD 2007; [11]YSAQMD 2022; [12]FRAQMD 2023

According to California's Fourth Climate Change Assessment's *Sacramento Valley Region Report*, climate change in the region is likely to result in an acceleration in temperature increases, with more frequent and extreme heat waves, reduced snowpack, more extreme floods and greater floodplain vulnerability, more extreme droughts, and more frequent and larger wildfires. These results of climate change are likely to severely impact energy production, agriculture, water supply, and aquatic and terrestrial ecosystems in within the region (Houlton and Lund 2018).

Climate-related threats, such as multi-year drought, extreme heat events, and increased precipitation intensity have the potential to impact Sacramento NWR Complex wetlands in both the near and long-term (Karasov-Olsen et al. 2020; Service 2020b). Multi-year drought and extreme heat events are likely to exacerbate water supply challenges by increasing regional water demand for limited water supplies (Singh 2015; Service 2020b). In 2022, following the third year of drought, the Sacramento, Delevan, and Colusa Refuges received a 55 percent reduction in water allocations. As a result, the Service only had enough water to fill and maintain approximately half of the wetland units at these Refuges. Service staff mitigate adverse effects due to drought by prioritizing wetlands units that maximize efficient water use and provide the best habitat based on documented bird use (Service 2022b). Over the past two decades, the Complex has developed a drought response strategy to mitigate the effects of drought through prioritizing the water supply usage for when it is most critical, which is during the overwintering waterfowl period. Actions under this strategy may include decreasing spring and summer irrigation of moist soil management units, reducing the area of semi-permanent

and permanent wetlands, prioritizing high-use wetlands for water delivery, and implementing a more dramatic staggering of wetland flooding (Service 2020b).

San Luis NWR Complex

Due to the topography of the San Joaquin Valley, the area has some of the worst air quality in the U.S., as the mountain ranges surrounding the Valley trap air pollutants (USEPA 2024b). 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 (SJVAPCD 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).

The San Luis NWR Complex is located in the San Joaquin Valley Air Basin, which includes all of Fresno, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare counties, and portions of Kern County. The SJVAPCD is responsible for ensuring compliance with Federal and State air quality standards within the basin. The San Joaquin Valley Air Basin is currently designated as non-attainment with respect to Federal air quality standards for O_3 and $PM_{2.5}$ and the basin does not meet the State attainment standard for O_3, PM_{10}, and $PM_{2.5}$ (SJVAPCD 2023a).

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 (Fernandez-Bou et al. 2021).

In the Central Valley, there is demand for water resources for agriculture, the environment, and the public. Climate change is anticipated to influence management strategies for both surface water and groundwater within the Central Valley, as it may yield changes in streamflow and groundwater storage (USGS 2009). Currently the San Joaquin River water quality is 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 2011).

Overall, climate change impacts to water availability within the Complex, in addition to increased demand for water resources at the regional level, would 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 2024b). 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 2024b).

Stone Lakes NWR

The Stone Lakes NWR is located in the Sacramento Valley Air Basin, which is managed by the SMAQMD to ensure compliance with Federal and State air quality standards. Sacramento County is classified as a Federal non-attainment area for O_3 and $PM_{2.5}$ and State non-attainment for O_3 (SMAQMD 2024). Additionally, the basin has a maintenance plan for PM_{10} (USEPA 2024b; CARB 2024).

As previously described, the Central Valley could undergo significant climate changes in the future, including increasing temperatures and variable precipitation (Karasov-Olson et al. 2021; Hayhoe et al. 2004; Cayan et al. 2008; Cayan et al. 2012). Threats resulting from the effects of climate change could affect wetland-dependent plants and wildlife through exposure to increased heat events and a reduction of wetland habitat. Additionally, extreme precipitation events may result in flood events, which could degrade infrastructure and transport invasive species to the Refuge (Service 2022b). In addition to these more direct effects, climate change could create institutional challenges by magnifying existing threats like invasive species and water supply shortages (Karasov-Olson et al. 2021; Browne and Dell 2007).

The effects of climate change may affect Stone Lakes NWR wetlands through a variety of stresses. Most notably, climate change could stress Refuge wetlands through increased heat stress, reduction of habitat for wetland-dependent wildlife, reduction of food availability, and increased flooding that could result from dry soil conditions, evaporation from extreme heat, and prolonged drought.

Environmental Consequences

Alternative 1 – No Action Alternative

Under the No Action Alternative, a small area of application of herbicides and many physical methods to respond to aquatic invasive species would have a minor adverse effect on local air quality and would have no effect on the ability of the local air quality control districts to meet attainment for criteria air pollutants. Mechanical and manual treatments involving the use of heavy equipment would continue to generate criteria air pollutant and greenhouse gas emissions. Implementation of the No Action Alternative would have minor and short-term

adverse effects on air quality and greenhouse gas emissions and would not have a measurable effect on the ability of the local air quality control districts to meet attainment for criteria air pollutants.

Climate change will likely create institutional challenges by amplifying existing threats, such as those posed by invasive species and water supply challenges (Karasov-Olson et al. 2021; Browne and Dell 2007). The limited ability to treat and remove invasive aquatic plants under the no action alternative could lead to higher methane releases from decaying plant biomass. Additionally, climate change is likely to result in more extreme floods and greater floodplain vulnerability. Aquatic invasive plant mats could clog water intake systems, exacerbating the risk of flooding within and surrounding the Covered Refuges (see **Section 4.3**, *Floodplains, Wetlands, and Water Resources*). Therefore, implementation of the No Action Alternative could exacerbate the on-going adverse effects associated with climate change, due to the lack of aquatic invasive management.

Alternative 2 – Management of Aquatic Invasive Plants, Including Broadcast Herbicide Treatments (Preferred Alternative)

Cultural treatment methods would be limited to water level manipulation, which would result in negligible effects to air quality and greenhouse gas emissions. However, it should be noted that redirection or reduction of managed water leading to dry conditions could result in temporary exposure of sediments to wind, potentially resulting in additional fugitive dust (see **Section 4.6**, *Geology and Soils*). Many physical and chemical treatments would involve manual or hand-operated equipment that would not generate substantial criteria air pollutant or greenhouse gas emissions. Physical removal of plant biomass could result in fewer methane emissions if the removed plants are composted aerobically. With the exception of access and treatment along the riparian areas, these treatment methods would occur within the aquatic environment and would not generate substantial amounts of fugitive dust. Potential impacts to air quality and greenhouse gas emissions would primarily result from the use of heavy equipment associated with physical and chemical methods. However, the number of treatments at each of the Covered Refuges would be limited in scope and timeframe and thus adverse effects would be short-term. Criteria air pollutants resulting from the use of heavy equipment would be well below *de minimus* levels[9] and would not have the potential to result in any changes to attainment status within any of the air basins.

Treatment activities under Alternative 2 would have minor short-term adverse effects on air quality. These adverse effects would not violate any air quality standard or contribute

[9] The phrase *de minimis* means "of minimum impact." The USEPA has defined *de minimis* thresholds for criteria air pollutants, which indicate that there would be no significant contamination of an air mass. Emissions of criteria air pollutants from Federally sponsored, approved, or funded activities in areas that do not meet the NAAQS are considered to be *de minimis* if they are below established thresholds (40 C.F.R. §93.153).

substantially to an existing or projected air quality violation, would not result in a cumulatively considerable net increase of any criteria pollutant for which the regions the Covered Refuges span are considered non-attainment under applicable Federal or State ambient air quality standards, and would not expose sensitive receptors to substantial pollutant concentrations.

Alternative 3 – Non-Broadcast Herbicide Application Methods

As described for Alternative 2, the implementation of Alternative 3 would also result in short-term, minor increased criteria air pollutant and greenhouse gas emissions. However, this alternative would eliminate criteria air pollutant and greenhouse gas emissions associated with aircraft, wheeled vehicles, and boats applying herbicides. Therefore, this alternative may result in a reduction in emissions as compared to Alternative 2. However, it should also be noted that without broadcast herbicide application, there would likely be an increased need for physical methods involving the use of heavy equipment and therefore a corresponding increase in criteria air pollutant and greenhouse gas emissions. Nevertheless, as described for Alternative 2, adverse effects to air quality, greenhouse gas emissions, and climate change would be minor and short-term.

4.6 Geology and Soils

Affected Environment

Geological resources refer to the geology, soils, and topography, while geological hazards refer to the natural hazards that directly or indirectly arise from the intersection of the underlying geology, soils, and topography with the proposed action. Due to the nature of the proposed action, this analysis generally focuses on soils/sediments. Effects to geology and topography are not anticipated, as no excavation or grading is proposed. Additionally, while the Covered Refuges may be subject to geological hazards (e.g., earthquakes) no habitable structures or other elements that could be affected by any such hazards are included as an element of the proposed action.

Sacramento NWR Complex

The Sacramento NWR Complex is generally underlain by sedimentary and volcanic deposits associated with the Tehama, Tuscan, and Red Bluff formations (Harwood and Helley 1982; Helley and Harwood 1985; Service 2005, 2009, 2020). On top of these formations lie terrace deposits, such as Riverbank and Modesto formations, as well as paleochannel deposits, alluvial fans, meanderbelt deposits, and basin and marsh deposits (Service 2005). The Modesto and Riverbank deposits flank the river steps away from the channel and tend to erode at lower rates than the other young deposits. These areas tend to form higher, more consolidated banks, and have a high proportion of Class I agricultural soils, including the Columbia and Vina loams (Service 2005, 2009, and 2020).

The Butte Sink WMA is located at the southern end of the Butte Basin and lies within the Butte Sink. This area drains Butte Creek and is characterized by low-gradient sloughs and ponds consisting of basin marsh deposits (i.e., fine-textured soils high in organic matter) (Service 2020). The Steve Thompson North Central Valley WMA covers a large area, from Red Bluff to the Delta. Soils in this area are associated with the Sacramento Valley's river floodplains, basins, basin rim, low alluvial fans, low remnant terraces, and organic soils of the Delta (Service 2020). The Sacramento, Delevan, and Colusa NWRs are located in the Colusa Basin. Over 75 percent of these refuges occur on basin deposits. Within the Colusa Basin, the refuge soils are located at the higher elevations, such as the basin rim, where soils are predominately strongly saline-alkali Willows clay, Willows silty clay, and Riz silty clay loam (Begg 1968). The aforementioned soils are wetland soils associated with a high water-table and subjected to occasional to frequent flooding (Service 2020).

San Luis NWR Complex

Physical conditions at the San Luis NWR Complex, especially the geology of the watersheds, are different on lands east and west of the San Joaquin River. A soil survey for eastern and western Stanislaus County used the San Joaquin River to delineate a boundary (McLauglin and Huntington 1968). Refuge lands on both sides of the river consist primarily of recent alluvial floodplains and basin lands. Soil types are often mapped as mixed alluvium soil. Basin soils are affected by high water tables from river water seepage, as well as saturation of the land by deep penetration of rain and irrigation water. Most soils exhibit very poor drainage, with a high water table at a depth of just three to six feet from December through April (Arkley 1964). If the land in this area is irrigated, it provides prime farmland, although it floods approximately every few years.

Stone Lakes NWR

Most of the Stone Lakes NWR is underlain by the Victor alluvial formation, which was deposited in the late Pleistocene (approximately one million years ago) by materials washed from the Sierra Nevada. The Victor formation consists of poorly sorted alluvial materials that vary in size from clays to boulders. Erosion of the Victor Formation has led to accumulation of finer grained basin deposits along the Sacramento and Cosumnes Rivers near the Delta. Intertidal deposits of soft mud and peat accumulated west of Snodgrass Slough at the margin of the Delta. More recently, natural levee and channel deposits have accumulated along the Sacramento and Cosumnes Rivers.

The dominant soil type on the Stone Lakes NWR is Dierssen, which is comprised of somewhat poorly drained soils in areas with a perched water table and are moderately deep to deep over a cemented hardpan. Clear Lake soils, which are present in small areas east of the Dierssen soil unit, are also somewhat poorly drained and underlain by a shallow cemented hardpan. They

have a seasonally high water table perched above the hardpan. Both the Dierssen and Clear Lake general soil map units are nearly level and are found in basins and on basin rims. Both areas are protected by flood control levees (Service 2007).

Effects of Invasive Aquatic Plants and Their Management on Soils and Topography

In general, aquatic vegetation could be highly effective at preventing soil erosion along riverbanks, lakeshores, and wetlands. Extensive root systems could anchor the soil, reducing the effect of water currents that could cause erosion. Some aquatic invasive plants could exhibit allelopathy and change the chemical nature of the soils near them to favor invasive species (Reynolds and Aldridge 2021). For example, phosphorus and nitrogen limitation has been found to prompt the production and release of allelochemicals in certain macrophytes, such as Eurasian watermilfoil (Gross et al. 2003). Aquatic invasive plants could also affect soils by altering transpiration rates, which could lead to changes in soil moisture levels (SWRCB 2021; Macedo 2023). Additionally, as these aquatic invasive plants outcompete native aquatic vegetation and begin to form thick mats, they could obstruct waterways and navigational channels, as well as clog agricultural and municipal water intakes (California State Parks Division of Boating and Waterways 2024). In some cases, when left unchecked, these effects caused by aquatic invasive plants could lead to flooding and soil erosion (North Carolina Environmental Quality 2024). For example, hydrilla greatly reduces flow and can clog waterways, which could result in flooding and damage to canal banks, structures, and pumps (Oklahoma Department of Wildlife Conservation 2024).

Soil compaction due to heavy machinery load has been a concern for decades (Keller et al. 2019) as it has adverse environmental consequences (Alaoui et al. 2018). Change in the soil structure could adversely affect the soil's physical, biological, and chemical features (Pulido-Moncada et al. 2019). Slower infiltration of rainfall into mineral soil could increase water runoff and erosion (Miller et al. 2004). Where soil disturbance results in severely degraded physical conditions or subsequent accelerated erosion or nutrient loss, total site resources or productive capacity are reduced (Miller et al. 2004). Areas that pose a particularly high risk for erosion and productivity loss include unstable slopes, streams, drainageways, depressions, and other particularly sensitive areas (Miller et al. 2004).

Herbicides could be dissolved in the water column or bound to sediments, and the effects they have would depend upon the medium in which they occur (USEPA 2024a). The bioavailability, uptake, and toxicity of herbicides and their metabolites during these exposures depends on factors such as temperature, pH, and dissolved oxygen concentrations (USEPA 2024a). Based on their individual Herbicide PUP Profile, the aquatic half-life (the amount of time it takes for half of the herbicide to break down in the environment) of the herbicides proposed for use ranges broadly. The majority of the proposed herbicides have an aquatic half-life of less than one month in most conditions. For example, glyphosate has an aquatic half-life of less than one week under typical conditions. When used in accordance with USEPA warning labels and

application requirements, the use of aquatic herbicides could result in minor adverse effects on aquatic sediments. Herbicides could have direct effects on soils by influencing soil microbe function and survival (Ruuskanen et al. 2023). Florpyrauxifen-benzyl has a soil half-life 41.5 days. Additionally, diquat dibromide, which has an aquatic half-life of one day, has a soil half-life of 2.7 years. However, other herbicides, such as glyphosate, have a similar half-life in the soil and in aquatic environments.

The potential effects to the physical environment associated with the proposed site, time, and target-specific use of herbicides are evaluated using the chemical profile of the herbicide. These practices and other BMPs would minimize the potential for herbicide drift, such that potential adverse effects to soils would overall be minor and short-term.

Environmental Consequences

Alternative 1 – No Action Alternative

While the Service would continue to respond to aquatic invasive plant infestations under the No Action Alternative, the limited scope and set of treatment methods available could allow infestations of aquatic invasive plants to continue to expand quite rapidly. Aquatic invasive plant mats could clog water intake systems, in addition to increasing the risk of flooding within and surrounding the Covered Refuges (Purdue 2009; Kiss et al. 2019). In the event of a severe flood, there could be long-term, adverse effects to soil through erosion. In addition, a reduction in flowing water velocity could lead to increased sediment deposition (Sand-Jensen and Mebus 1996 and Shivers et al. 2018). Stands of submersed aquatic invasive plants could also reduce nutrient concentrations by assimilating dissolved nitrogen and phosphorus, as well as taking up nitrogen from the sediment (McGlathery et al. 2007; Orth et al. 2017).

Therefore, under the No Action Alternative, aquatic invasive plant infestations could continue to rapidly increase, and large-scale infestations could lead to long-term, moderate adverse effects to soil through erosion of the floodplains, wetlands, riparian areas, and other water resources within the Covered Refuges, as well as sediment accumulation and sediment denitrification.

Alternative 2 – Management of Aquatic Invasive Plants, Including Broadcast Herbicide Treatments (Preferred Alternative)

Cultural treatment methods would be limited to water level manipulation in managed wetlands and canals. Water level manipulation could result in the exposure and potential erosion of sediments (Zucca et al. 2021). However, these water level manipulation treatments would be localized, small-scale, and temporary, thereby limiting the potential for substantial wind erosion.

Many physical and chemical treatments would involve manual or hand-operated equipment that are not anticipated to result in soil erosion. Potential effects to soil could primarily result from the use of heavy equipment, which could result in soil compaction, soil erosion, and/or slope instability. The use of aerial equipment, particularly helicopters and drones, could also result in temporary adverse effects to soils by creating dust from rotor downwash (i.e., the downward airflow that occurs from a helicopter generation thrust). The turbulent air currents created by the helicopter rotor wash drive loose soil particles into the air (Yamada 1998). Airborne dust particles could negatively affect humans and wildlife, including aquatic life and vegetation (Yamada 1998). However, helicopters, drones, and other aircraft with rotors generally only generate dust during take-off, landing, and low and slow flight activities. Low and slow flight activities during the application of herbicides could result in the generation of dust; however, it is anticipated that any dust generation would be short-term and further reduced, as herbicide application would occur over water and generally in heavily vegetated areas.

Large-scale removal of aquatic invasive plants could produce a short-term reduction to water surface coverage, which could temporarily increase the temperature at the bottom of the water body and temporarily accelerate the release of nutrients from the sediment (Zhu 2022). However, over the long term, the nutrient load in the water would be expected to decrease steadily as native plant growth resumes, and return to lower levels with a concomitant increase in water transparency (Zhu 2022). Short-term, minor adverse effects from larger-scale treatments could include increases in sediments and turbidity (Thiemer et al. 2021). However, these short-term, minor adverse effects would generally decrease within a few weeks (Thiemer et al. 2021).

The use of vehicles and other heavy equipment already occurs on the Covered Refuges as a part of typical operations. The Service would generally use existing roadways and established access points to apply treatments. Where access is difficult, the Service would use manual methods or broadcast herbicide applications. The use of aerial application methods could result in herbicide application along adjacent upland soils. Overall, adverse effects to soils as a result of mechanical and manual treatments would be minor.

Alternative 3 – Non-Broadcast Herbicide Application Methods

As described for Alternative 2, the implementation of Alternative 3 could also result in increased potential for soil exposure, soil compaction, soil erosion, and/or slope instability, particularly as a result of heavy equipment use during proposed biomass removal. However, this alternative would eliminate broadcast herbicide application methods, which would minimize overall area and volume of herbicide applications and the contact of herbicides to aquatic sediments. Additionally, this alternative would eliminate the potential for herbicide drift during aerial applications. Therefore, this alternative would reduce the potential for impacts to aquatic sediments and upland soils. However, it should also be noted that the elimination of this treatment method may increase the need for the use of mechanical and

manual treatments involving heavy equipment and increase the short-term, minor adverse effects to soil erosion and turbidity. Nevertheless, as described for Alternative 2, adverse effects would remain minor and short-term.

4.8 Cultural Resources

Archaeological Resources: Affected Environment

Federal laws passed with the aim of protecting historical sites with cultural significance include the Antiquities Act of 1906, Archaeological Resources Protection Act of 1979, Archeological and Historic Preservation Act, Historic Sites Act of 1935, National Historic Preservation Act (NHPA) of 1966, the Archeological Resources Protection Act of 1979, The American Indian Religious Freedom Act of 1978, the Native American Graves Protection and Repatriation Act of 1990, Executive Order 13007, *Indian Sacred Sites*, and Executive Order 11593, *Protection and Enhancement of the Cultural Environment.*

Under Section 106 of the NHPA, the Service is required to review potential effects to cultural and historic resources when an activity or project that the Service is performing, managing, licensing, permitting, or providing Federal assistance for meets the NHPA's definition of an undertaking. Determination of a property as historic (i.e., any "prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on, the NRHP, including artifacts, records, and material remains related to such a property or resource") would be made by a qualified subject matter expert in conformance with 36 C.F.R. §800.4. If no historic properties are identified, Service staff would document that finding and conclude the Section 106 process. If a historic property is identified, Service staff must assess the effect of the undertaking on the property and complete the Section 106 process. To comply with NHPA (614 FW 3), consultation with State Historic Preservation Officers (SHPOs) and Tribal Historic Preservation Officers (THPOs) for affected Federally recognized Native American tribes may be required.

Descriptions of cultural resources within each of the Covered Refuges is provided within each respective CCP, including prehistory and history, as well as known archaeological and historic built resources. A summary-level description is provided below. In the unlikely event that previously unknown cultural resources are inadvertently encountered, the Service would comply with all applicable Federal, State, and local regulations regarding incidental finds. Federal legislation (NHPA) protects cultural resources. The Service is complying by consulting with the Service Region 8 Cultural Resources Team. The Service is not proposing any methods 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 **BMP 5**, *Cultural Resources*, **BMP 6**, *Discovery of Unknown Cultural Resources*, and **BMP 7**, *Documented Cultural Resources*.

Sacramento NWR Complex

The Butte Sink WMA is located two miles west of Sutter Buttes, a landform that figures prominently in the creation myths of several Native American groups and which is considered sacred to those groups (Service 2020). A sample archaeological survey conducted on the unit in 1995 identified no prehistoric or historic resources. However, it was noted that the area should be considered sensitive for the presence of resources associated with Butte Creek and historic hunting activity. Cultural resources could exist at depths below the present surface, as has been demonstrated at other low-lying areas of the valley along the Sacramento River and its tributaries (Service 2020).

The boundary of the Steven Thompson North Central Valley WMA includes an extensive area on either side of the Sacramento River bounded by the Sierra and Coast ranges. While a comprehensive record search has not been conducted for the entire area within the WMA boundaries, there have been numerous surveys conducted and archaeological sites documented, particularly along the banks of the Sacramento River. At least two of these sites are located within one and a half miles of the boundaries of existing conservation easements. The sites provide an indication of the types of sites that might be expected in areas of similar topographic composition (Service 2020).

In 1980, the Service prepared a determination of eligibility for the buildings at the Sacramento NWR headquarters for inclusion in the NRHP based on its association with the California Conservation Corps and early development of the Refuge (Service 2005 and 2009). The California SHPO concurred with the Service's determination of eligibility. Although formal nomination of the district to the NRHP was never completed, the buildings remain "eligible" and therefore continue to be treated as historic properties (Service 2005).

In addition to the Sacramento Refuge California Conservation Corps Headquarters Complex district evaluation, cultural resource investigations conducted to date on the refuges have included three narrow surveys that examined small portions of Delevan, Colusa, and Sutter NWRs prior to the occurrence of management activities being conducted on specific project locations. These surveys generally consisted of single person meandering pedestrian transects which covered the project areas. No cultural resources were identified during these surveys (Service 2009).

San Luis NWR Complex

The 150-year history of agriculture in Merced County has disturbed the underlying soils and may have destroyed archaeological resources in the region. Little formal cultural resources survey work has been conducted on refuge land in Merced County. However, a formal cultural resources survey was conducted at the San Luis NWR by Haversat and Breschini in 1985, which identified 38 archaeological sites at the San Luis NWR. Most of these sites were categorized as

base camps, occupied by several families on a year-round or seasonal basis (Haversat and Breschini 1985). One of the sites was identified as a historic ferry crossing used in the 1800s (Haversat and Breschini 1985; Service 2024b).

The landscape where the San Luis NWR Complex is located was drastically changed through the alterations of the floodplain and creation of agricultural land. Assessing for archaeological 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 2024b). There are documented archaeological sites within the San Luis NWR Complex.

Stone Lakes NWR

Most of the recorded cultural resources at the Stone Lakes NWR are archaeological sites linked with Native American village sites; small, seasonally occupied camps; sites with burials; and other sites considered to be sacred. The material remains of historic activities within the Refuge may include standing structures and foundations, still-occupied dwellings, abandoned trails, ferry sites, extant roadways, and railroad lines. Both prehistoric and historic sites within and around the Refuge tend to be located on high ground near permanent water sources. Determining areas of historic sensitivity is difficult, however, due to a lack of identified historic period sites within the Stone Lakes NWR (Service 2007).

Archaeological Resources: Environmental Consequences

Alternative 1 – No Action Alternative

Under the No Action Alternative, potential effects to soils (e.g., soil compaction, soil erosion, and slope instability) would generally be limited to access points and treatment activities within the riparian areas. However, the Service would continue to avoid known cultural resources within the Covered Refuges. Therefore, the potential for these continued activities to adversely affect cultural resources is low. Implementation of the No Action Alternative is anticipated to have negligible adverse effects on cultural resources.

Alternative 2 – Management of Aquatic Invasive Plants, Including Broadcast Herbicide Treatments (Preferred Alternative)

Under Alternative 2, cultural treatments (e.g., water level manipulation) would not result in ground disturbance. The use of wheeled vehicles as a part of physical and chemical treatments could have potential adverse effects to soils (e.g., soil disturbance, soil compaction, soil erosion, and slope instability). Potential effects to soils are anticipated to be negligible and limited to

access points and treatment activities within riparian areas, and the Service would generally utilize existing boat launches.

The Service would continue to avoid known cultural resources within the Covered Refuges. Therefore, adverse effects to cultural resources through implementation of the Preferred Alternative are anticipated to be negligible.

Alternative 3 – Non-Broadcast Herbicide Application Methods

As described for Alternative 2, the implementation of Alternative 3 could also result in negligible ground disturbance as a result of the proposed treatment methods. However, this alternative would eliminate broadcast herbicide application. While the implementation of this alternative would eliminate the use of wheeled vehicles for herbicide application, the elimination of broadcast herbicide application may increase the need for the use of more mechanical and manual treatments involving heavy equipment. Nevertheless, as described for Alternative 2, adverse effects to cultural resources are anticipated to be negligible.

4.10 Public Health and Safety

Affected Environment

Federal regulations that protect human health from possible negative effects of terrestrial invasive plant management actions include the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA); the Resource Conservation and Recovery Act (RCRA); the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); and the Occupational Safety and Health Act (OSHA). The FIFRA establishes procedures for the registration, classification, and regulation of all pesticides. Before any pesticide may be legally sold, the USEPA must register it.

The USEPA may classify a pesticide for general use if it determines that the pesticide is not likely to cause unreasonable adverse effects to applicators or the environment, or for restricted use if the pesticide must be applied by a certified applicator and in accordance with other restrictions. The RCRA regulates the disposal of toxic wastes, including the disposal of unused herbicides, and provides authority for toxic waste cleanup actions when there is a known operator. The CERCLA regulates how to clean up spills of hazardous materials and when to notify agencies in case of spills. The OSHA sets and enforces protective workplace safety and health standards. The analysis describes the potential effects of the alternatives on public health and safety (e.g., visitors to Service lands engaged in subsistence or recreational use).

Effects of Invasive Aquatic Plants and Their Management on Public Health and Safety

Environments altered by aquatic invasive plants may be associated with rises in disease incidence (Denóbile et al. 2023; Kumar and Singh 2020; Muller et al. 2017). Invasive plants may

provide new and attractive habitats for pathogens, vectors, or hosts by creating a hospitable environment that influences their growth or survival (Kaestli et al. 2012; Agha 2020; Shewhart et al. 2014; Wei et al. 2020). For example, dense colonies of aquatic invasive plants could create an ideal breeding habitat for mosquitos by reducing water flow or, in the case of water hyacinth, providing reservoirs for standing water in the cup formed by the leaves (Stohlgren et al. 2013). Female mosquitoes are attracted to some plants, including hydrilla, more than others and lay more eggs around them (Mangiafico et al. 2017). By providing appropriate sites for oviposition or resources that enhance survival and development of certain life stages (Conley et al. 2011), non-native plants may create habitats for vectors and hosts that increase the possibility of animals' and humans' exposure to diseases (Blosser et al. 2017).

The Service would utilize herbicides classified and registered by the USEPA and would continue to follow the USEPA's warning labels and application requirements. Additionally, consistent with 569 FW 1, the Service would continue to utilize the PUP process, which includes standard BMPs and additional use restrictions to minimize the potential for adverse effects.

Human health and safety during herbicide application would be ensured by following BMPs and by routine application of standards for transportation, storage, and use described in labels and Safety Data Sheets (SDS) for commercial herbicide formulations; job hazard analyses; IPM plans; and the PUP process. Potential hazards would further be minimized by routine maintenance of application equipment, certified pesticide applicator training, applicator use of personal protective equipment (PPE) that meets or exceeds label requirements, and provision of first aid equipment within the treatment areas. Service staff, partner agency staff, and/or their contractors who apply herbicides to manage invasive species would be trained and certified, or directly supervised by someone who is trained and certified, in pesticide use by the State of California. Potential adverse effects to public health and safety would be negligible with worker training and certification requirements; herbicide label stipulations; agency standards for safe herbicide storage, transportation, use, and disposal; following label restrictions and monitoring spray drift; and effective communication with the public, as needed.

Environmental Consequences

Alternative 1 – No Action Alternative

While the Service would continue to respond to aquatic invasive plant infestations under the No Action Alternative, the limited scope and set of treatment methods available could allow infestations of aquatic invasive plants to continue to expand quite rapidly. For example, uncontained growth of water hyacinth, which has the potential to double the area it covers in five days (Nguyen et al. 2015), or hydrilla could alter the environment in ways that favor mosquito breeding (Denóbile et al. 2023; Stohlgren et al. 2013; Mangiafico et al. 2017).

Under the No Action Alternative, a small area of application of herbicides, as well as mechanical and manual methods to respond to aquatic invasive plants would have a negligible effect on public health and safety. Therefore, the long-term adverse effects to public health under the No Action Alternative are expected to be minor.

Alternative 2 – Management of Aquatic Invasive Plants, Including Broadcast Herbicide Treatments (Preferred Alternative)

Under the Preferred Alternative, cultural treatment methods would be limited to water level manipulation, which would result in temporary changes in water levels, but would not be expected to expose contaminated materials or otherwise result in effects to public health and safety. Many mechanical and manual, as well as chemical treatments would involve manual or hand-operated equipment. If necessary for human health and safety or legal requirements, treatment areas would be marked. The removal of aquatic invasive plants would improve the ability of boats to navigate, including emergency vehicles. Furthermore, implementation of the Preferred Alternative could produce long-term, minor beneficial effects to public health by reducing the suitability of breeding habitat for mosquitos and potential adverse effects would be negligible.

Alternative 3 – Non-Broadcast Herbicide Application Methods

As described for Alternative 2, the implementation of Alternative 3 would also include the use of herbicides; however, no broadcast herbicide application would occur under this alternative. As described for Alternative 2, the inherent risk level related to public health and safety would be negligible as a result of the proposed methods. However, this alternative would reduce the ability of the Service to address larger areas of aquatic invasive species infestations and there would be more potential for minor long-term adverse effects due to breeding habitat for mosquitos in these large untreated areas. Therefore, the beneficial effects described for Alternative 2 would not be achieved to the same extent.

4.11 Socioeconomics

Local and Regional Economies: Affected Environment

Socioeconomics is defined as the basic attributes and resources associated with the human environment, particularly population and economic activity. Population is affected by natural growth rates, as well as net regional migration in or out of the region. Economic activity typically comprises employment, personal income, and industrial growth. Impacts on these two fundamental socioeconomic indicators could also influence other components, such as housing availability and public services.

The Covered Refuges all occur within areas of California where agriculture is a large component of the community. 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 (California Department of Food and Agriculture [CDFA] 2023). Potential effects from climate change are anticipated to adversely affect agriculture, which could affect the local and regional economies, given agriculture is a large economic factor within the San Joaquin Valley.

Sacramento NWR Complex

The counties in which the Sacramento NWR Complex are located vary greatly in their demographics. Butte County has a population of more than 211,630 (U.S. Census Bureau 2020c), with the largest employment sectors being service production, private education and health services, and government (Employment Development Department 2024). Glenn County has a population of 20,580 (U.S. Census Bureau 2020d), with the service industry providing the largest number of total non-farming jobs. Tehama County's population is 65,832 (U.S. Census Bureau 2020e), and its major employment sectors are trade services (Employment Development Department 2024). Colusa County has a population of 21,839 (U.S. Census Bureau 2020f), and its major employment sector is agriculture (Employment Development Department 2024). Sutter County's population is 99,633 (U.S. Census Bureau 2020f), and its major employment sector is agriculture (Employment Development Department 2024). Agriculture is the dominant economic enterprise in the Sacramento Valley and rice is a major crop throughout most of the counties for this Complex.

San Luis NWR Complex

Agriculture is the foundation of the economy in Merced County and the San Joaquin Valley. According to the Merced Agricultural Commissioner's Report (2023) agricultural commodities grossed over $4.5 million in 2022. Milk is Merced County's number one leading commodity, followed by almonds, eggs, miscellaneous vegetables, and alfalfa hay (Merced County Department of Agriculture 2023).

Merced County has a population of more than 281,200 (U.S. Census Bureau 2020n), with the largest employment sectors being services and State or local government. Agriculture employs more than 15,000 people in Merced County (Employment Development Department 2024). Merced, San Joaquin, and Stanislaus counties, where the San Luis NWR Complex is located, are all within California's top 10 counties for agricultural production (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 agricultural products (San Joaquin Council of Governments 2023).

Stone Lakes NWR

The Stone Lakes NWR is located within Sacramento County, which has an economy that is defined by agriculture. Sacramento County's top ten farm commodities are grapes, milk,

nursery stock, pears, poultry, vegetable crops, rice, cattle, corn and livestock (Sacramento County Department of Agriculture 2023).

Sacramento County has a population of more than 281,200 (U.S. Census Bureau 2020o) and the largest employment sectors are service providing, private service providing, and State and local government (Employment Development Department 2024).

Effects of Invasive Aquatic Plants and Their Management on Local and Regional Economies

Aquatic invasive plants could adversely affect the environment, industry, and local economies. From a socioeconomic perspective, water hyacinth invasion into freshwater systems presents a problem for many human uses. The most direct adverse effects from aquatic invasive plants are to boating access, navigability, and recreation, as well as obstructing pipe systems used for agriculture, industry, and municipal water supplies (Villamagna 2010). Macedo et al. (2023) synthesized the global economic effects of aquatic and semi-aquatic invasive plants, describing the distributions of these costs across taxa, habitat types, environments, impacted sectors, cost typologies, and geographic regions. Between 1975 and 2020, aquatic and semi-aquatic invasive plants cost the global economy in excess of $32 billion. The majority of the costs (57 percent) were attributed to multiple or unspecified taxa. Submerged invasive plants cost the global economy $8.4 billion (25.5 percent) followed by floating plants costing $4.7 billion (14.5 percent), emergent plants costing $684 million (2.1 percent), and semi-aquatic plants costing $306 million (0.9 percent) (Macedo et al. 2023).

California spends millions of dollars combating water hyacinth and other aquatic invasive species. In the California Bay Delta alone, the Division of Boating and Waterways' budget to manage aquatic invasive plants increased from $7.124 million in 2013 to $7.625 million in 2014, and $13.718 million in 2015. Over the period of 2013 to 2016, the Division of Boating and Water Ways spent over $41 million on aquatic invasive weed management (Jetter and Nes 2018). Agricultural production in California's Central Valley was threatened at one point due to an 80 percent reduction in the efficiency of irrigation channels and pumping equipment caused by invasive aquatic plants (California Invasive Plant Council 2012; The Nature Conservancy 2019).

Local and Regional Economies: Environmental Consequences

Alternative 1 – No Action Alternative

The current strategies for managing aquatic invasive plants within the Covered Refuges generally prioritize simple actions that are achievable with local staff and resources over those that may be more effective at a regional scale. Due to the constraints of existing treatment methods, localized response plans often allow infestations to go untreated, or infestations are treated with tools that are not efficient or effective. Using only localized responses could permit

aquatic invasive species to surpass larger thresholds and become more difficult and costly to manage, as well as cause long-term, minor to moderate adverse effects related to boating access; navigability and recreation; and pipe systems for agriculture, industry, and municipal water supply. As a result, implementation of the No Action Alternative could have long-term, minor to moderate adverse effects on local and regional economies.

Alternative 2 – Management of Aquatic Invasive Plants, Including Broadcast Herbicide Treatments (Preferred Alternative)

Alternative 2 would involve the implementation of a more robust and comprehensive IPM strategy, including the use of cultural, physical, as well as chemical treatment methods. The implementation of these treatment methods could have short-term beneficial effects with regard to materials purchasing and in some cases labor (e.g., if Refuge staff hires contractors to complete the treatments). Depending on the treatment methods (e.g., solarizing using staked benthic mats and tarping, biomass removal, or herbicide application using boats), there could be short-term, minor adverse effects to navigability. However, these treatments would only affect small portions of the channel at a time and would only affect channels that are already adversely impacted by aquatic invasive plants that inhibit or preclude navigability.

More importantly, Alternative 2 would provide the Service with the full complement of treatment methods to clear waterways and navigational channels, as well as unblock agricultural and municipal water intakes. This could result in long-term, minor to moderate beneficial effects to local and regional economies, as the Preferred Alternative could improve commercial and recreational boating, as well as agricultural and municipal water infrastructure.

Alternative 3 – Non-Broadcast Herbicide Application Methods

As described under Alternative 2, the implementation of Alternative 3 would also result the removal of aquatic invasive species that could obstruct waterways and navigation channels, as well as agricultural and municipal water intakes. As with Alternative 2, there could be short-term, minor adverse effects to navigability. However, over the long-term, minor to moderate beneficial effects on the local economy may not be realized to the same extent as Alternative 2, since the herbicide methods would not be able to treat the large-scale, rapidly reproducing aquatic invasive plant infestations without broadcast and deep-water methods. For example, mechanical removal on *Hydrilla* spp. is often unable to keep pace with regrowth, particularly in peak summer months where suppressive effects may only last days or weeks (Hetrick and Langeland 2012). Mechanical treatment is often a preferred option where herbicides are prohibited or ineffective, such as domestic water supply intakes or rapidly flowing water channels, respectively (Hetrick and Langeland 2012). Otherwise, hydrilla harvesting on a large scale is generally regarded as less efficient and more cost-prohibitive than chemical control (Hetrick and Langeland 2012). If the treatment methods do not achieve the control of the

aquatic invasive species infestation or reduce coverage to a manageable level, local waterways and wetlands could become more inundated by aquatic invasive plants. Therefore, the long-term, beneficial effects to local economies described for Alternative 2 would not be achieved to the same extent.

4.12 Cumulative Impacts

Cumulative impacts are defined as "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. Cumulative effects can result from actions with individually minor but collectively significant effects taking place over a period of time" (40 C.F.R. §1508.3). This section describes other past, present, and reasonably foreseeable activities impacting the affected environment.

Past, present, and reasonably foreseeable actions are analyzed to the extent that they are relevant and useful in determining whether the effects of the alternatives may have an additive and significant relationship to other actions being taken. Related past, present, and reasonably foreseeable future actions on and near the Refuge include such activities as visitor use, including hiking, hunting, fishing, boating, and wildlife viewing; infrastructure development and construction; spread and management of invasive species, including use of pesticides; prescribed fire; grazing; mining; regional population growth; and climate change.

Numerous actions occurring within the vicinity of the Covered Refuges are having a beneficial effect on the natural resources the proposed action would assist in protecting. River Partners is preventing further degradation to natural resources by restoring floodplains and riverways utilized by native species throughout the Central Valley in order to protect threatened and endangered wildlife. Since 2012, River Partners, in partnership with other entities, has restored approximately 1,500 acres of floodplain 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).

Previous environmental documentation prepared by DOI agencies for aquatic invasive species management was also reviewed. This included 34 EAs, evaluating physical and chemical methods associated with the control and eradication of invasive aquatic plants similar to those considered under the proposed action. In many cases, the EAs reviewed determined that certain actions, such as pulling, cutting, or mowing, were not sufficient alone to address infestations. In general, these EAs identified the following:

- Potential for long-term, beneficial impacts to native species, habitats, ecological

processes, and human uses, including recreation, resulting from the removal of invasive aquatic plants.

- Potential for short-term, adverse impacts to water quality, soils, native plants, invertebrates, fish, birds associated with bodies of water, and other wildlife, including listed species if in the area. For projects that included endangered species within the project area, no significant adverse impacts were identified in Section 7 consultation. No significant short- or long-term impacts were identified in the EAs.
- Short-term, adverse impacts to the environment could include increased turbidity and noise impacts from boats used for access to the site and during implementation, persistence of herbicides in soil, and dead or dying plant biomass due to herbicide treatment.
- Potential short-term, adverse impacts during treatment could also include disruption of navigation routes or water recreation.

Of the 30 EAs that evaluated the potential impacts associated with the use of mechanical and manual actions to manage invasive aquatic plants, 17 have been implemented. Project size ranged from approximately 0.75 acres to over 1,000 acres controlled annually. Most projects involved the routine control of invasive plant populations, with mechanical and manual actions occurring annually across 5 to 20 acres. The implementing DOI agencies noted no significant impacts resulting from the project implementation; however, several noted beneficial results, including complete eradication of the invasive plant population in some instances.

Of the 30 EAs that analyzed the potential impacts of the use of pesticides to manage invasive aquatic plants, 19 have been implemented. Most projects involve routine control of invasive plant populations, with herbicide application occurring annually. Project size ranged from less than one acre to 1,657 acres annually. Most projects involved annual herbicide use between 40 and 500 acres. Many of the implemented projects utilized a combination of physical and chemical actions. The implementing DOI agencies noted no significant impacts resulting from the project implementation; however, several projects noted beneficial results, including eradication of the invasive plant population in some instances.

Natural Resources

Adverse effects on wildlife from past, present, and foreseeable future actions may include regional and local adverse effects to terrestrial and aquatic habitat, including the loss, fragmentation, and degradation of habitat including corridors and edge habitat; and introduction of invasive species which outcompete native species, particularly vegetation that then alters and degrades wildlife habitat. Climate change, coupled with other factors such as habitat loss, could lead to extirpations and increased risks of extinction later in the century. Listed species may be especially vulnerable because they often need specific habitat components that are not widely available. This could negatively affect their abilities to migrate to suitable areas as environmental conditions change.

As described in **Section 4.2**, *Biological Resources*, the implementation of Alternative 2 or Alternative 3 could result in short-term adverse impacts to vegetation, fish and wildlife, and listed species. However, over the long-term, the implementation of either of these alternatives would result in beneficial impacts. As described in **Section 1.3**, *Purpose and Need for the Proposed Action*, the implementation of these treatment methods would improve the ability of the Service to manage for target species and accomplish the goals of the CCPs for the Covered Refuges.

Cultural and Historic Resources

The geographic scope of cumulative effects to cultural resources is confined to the Covered Refuges. Past, present, and future actions that would contribute cumulative impacts to cultural resources include any ground-disturbing activities that could create adverse, cumulative impacts ranging from negligible to major as these actions may diminish the integrity of the resource or change one or more character defining features of a resource that is listed or eligible for listing on the NRHP. Impacts associated with human activities include exposure of buried sites, changes in artifact condition, destruction of artifacts or structures, loss of context of artifacts, site covering, and contamination of sites.

Natural effects, such as erosion, also contribute to cumulative losses of cultural resources available for scientific study and the practice of traditional tribal activities. Beneficial cumulative impacts could occur from restoring habitats, because desirable vegetation could decrease exposure of surface artifacts and surface erosion.

Under Alternative 2, water draw down and other cultural treatments are anticipated to have a negligible chance for adverse impacts on cultural resources. As described in **Section 4.8**, *Cultural and Historic Resources*, the Service would continue to avoid known cultural resources within the Covered Refuges. In the unlikely event that previously unknown cultural resources are inadvertently encountered, the Service would comply with all applicable Federal, State, and local regulations regarding incidental finds. Federal legislation (NHPA) protects cultural resources. The Service is complying by consulting with the Service Region 8 Cultural Resources Team. The Service is not proposing any methods 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 **BMP** 5, *Cultural Resources*, **BMP 6**, *Discovery of Unknown Cultural Resources*, and **BMP 7**, *Documented Cultural Resources*.

Socioeconomics

Agriculture is the dominant economic enterprise in the vicinity of each of the Covered Refuges. As described in **Section 4.11**, *Socioeconomics,* the implementation of Alternative 2 or Alternative 3 may have short-term, minor adverse impacts within the Covered Refuges regarding navigability. However, the implementation of Alternative 2 and to a lesser extent the implementation of Alternative 3 would provide the Service with the full complement of treatment methods to clear waterways and navigational channels and unblock agricultural and

municipal water intakes. This could result in long-term, minor to moderate beneficial effects to local and regional economies, as the Preferred Alternative could improve commercial and recreational boating, as well as agricultural and municipal water infrastructure.

Refuge Resources

Alternative 2 would involve the implementation of a more robust and comprehensive IPM strategy, including the use of cultural, physical, and chemical treatment methods. These treatment methods could have short-term, minor adverse impacts within the Cover Refuges. However, as described in **Section 1.3**, *Purpose and Need for the Proposed Action*, the implementation of these treatment methods would improve the Service's ability to manage for target species, as well as address critical issues related to boating, agriculture, and public safety. Therefore, the implementation of Alternative 2 could have a long-term beneficial impact.

Chapter 5: List of Preparers and References

5.1 List of Preparers

This EA was prepared by WSP USA, Inc. (WSP) under the direction of the U.S. Department of Interior Fish and Wildlife Service Region 8 (Pacific Southwest Region).

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Appendix A: Applicable Statutes and Executive Orders

Federal Laws

American Indian Religious Freedom Act of 1978 (Public Law 95-341; 42 U.S. Code [U.S.C.] §1196) – Requires the U.S., where appropriate, to protect and preserve religious rights of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

American Antiquities Act of 1906 (Public Law 59-209; 16 U.S.C. §431-433) – Authorizes the President to designate historic and natural resources of national significance, located on Federal lands, as National Monuments for the purpose of protecting items of archeological significance.

Archeological and Historical Preservation Act of 1974 (Public Law 95-96; 16 U.S.C. §469 *et seq*.) – Provides for the preservation of historical and archeological data, including relics and specimens, threatened by Federally funded or assisted construction projects.

Archeological Resources Protection Act of 1979 (16 U.S.C. §470 *et seq*.) – Prohibits the excavation or removal from Federal or Indian lands any archeological resources without a permit.

Clean Air Act of 1970 (42 U.S.C. §7401 *et seq*.) – Regulates air emissions from stationary, area, and mobile sources. This law authorizes the U.S. Environmental Protection Agency to establish National Ambient Air Quality Standards to protect public health and the environment.

Clean Water Act of 1972 (Public Law 92-500; 33 U.S.C. §1251 *et seq*.) – Aims to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. Under Section 401, States have authority to review Federal permits that may result in a discharge to wetlands or water bodies under State jurisdiction. Under Section 404, a program is established to regulate the discharge of dredged or fill material into the Nation's waters, including wetlands.

Endangered Species Act of 1973, as amended (16 U.S.C. §1531 *et seq*.) – Provides for the identification and protection of threatened and endangered plants and animals, including their critical habitats. Requires Federal agencies to conserve threatened and endangered species. This law establishes a consultation process involving Federal agencies to facilitate avoidance of agency action that would adversely affect species or habitat. Further, it prohibits all persons subject to U.S. jurisdiction from taking, including any harm or harassment, endangered species.

Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (Public Law 92-516; 7 U.S.C. §136 *et seq*.) – Governs the use and application of pesticides in natural resource management programs. This law provides the principal means for preventing environmental pollution from pesticides through product registration and applicator certification.

Federal Noxious Weed Act of 1974 (Public Law 93-629; 7 U.S.C. §2801) – Provides for the control and eradication of noxious weeds and their regulation in interstate and foreign commerce.

Fish and Wildlife Conservation Act of 1980 (Public Law 96-366; 16 U.S.C. §2901 *et seq.*) – Encourages management of non-game species and provides for conservation, protection, restoration, and propagation of certain species, including migratory birds threatened with extinction.

Fish and Wildlife Coordination Act of 1934 (16 U.S.C. §661 *et seq*.) – Provides a mechanism for wildlife conservation to receive equal consideration and coordinate with water-resource development programs.

Land and Water Conservation Act of 1965 (16 U.S.C. §4601 *et seq*.) – Assists in preserving, developing, and assuring accessibility to outdoor recreation resources.

Migratory Bird Conservation Act of 1929 (16 U.S.C. §715 *et seq*.) – Establishes a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds.

Migratory Bird Treaty Act of 1918 (Public Law 65-186; 16 U.S.C. §703 *et seq.*) – Provides for regulations to control taking of migratory birds, their nests, eggs, parts, or products without the appropriate permit and provides enforcement authority and penalties for violations.

National Environmental Policy Act of 1969 (Public Law 91-190; 42 U.S.C. §4321 *et seq.*) – Mandates Federal agencies to consider and document environmental impacts of proposed actions and legislation.

National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 668dd *et seq.*) - Provides authority, guidelines and directives for the Service to improve the National Wildlife Refuge System; administers a national network of lands and waters for the conservation, management, and restoration of fish, wildlife and plant resources and habitat; ensures the biological integrity, diversity, and environmental health of refuges is maintained; defines compatible wildlife-dependent recreation as appropriate general public use of refuges; establishes hunting, fishing, wildlife observation and photography, and environmental education as priority uses; establish a formal process for determining compatible uses of refuges; and provide for public involvement in developing comprehensive conservation plans for refuges.

National Wildlife Refuge System Improvement Act of 1997 (16 U.S. Code [U.S.C.] §§668dd *et seq.*) – Spells out wildlife conservation as the fundamental mission of the Refuge System; requires comprehensive conservation planning to guide management of the Refuge System; directs the involvement of private citizens in land management decisions; and provides that compatible wildlife-dependent recreation is a legitimate and appropriate use that should receive priority in refuge planning and management.

Native American Graves Protection and Repatriation Act of 1990 (Public Law 101-601; 25 U.S.C. §§3001-3013) – Addresses the recovery, treatment, and repatriation of Native American and Native Hawaiian cultural items by Federal agencies and museums. It includes provisions for data gathering, reporting, consultation, and issuance of permits.

Refuge Recreation Act of 1962, as amended (16 U.S.C. 460k-460k-4) – The Refuge Recreation Act of 1962, with subsequent amendments, authorizes the Secretary of the Interior to administer refuges, hatcheries and other conservation areas for recreational use, when such uses do not interfere with the primary purpose for which these areas were established.

Resource Conservation and Recovery Act of 1976 (42 USC §6901 *et seq.*) – Establishes a comprehensive program which manages solid and hazardous waste. Subtitle C, Hazardous Waste Management, sets up a framework for managing hazardous waste from its initial generation to its final disposal. Waste pesticides and equipment/containers contaminated by pesticides are included under hazardous waste management requirements.

Soil Conservation Act of 1935 (16 U.S.C. §590a *et seq*.) – Provides for soil conservation practices on Federal lands.

Federal Regulations

40 Code of Federal Regulations [C.F.R.] Parts 1500-1508 – Council on Environmental Quality (CEQ) Regulations on Implementing National Environmental Policy Act (NEPA) Procedures

40 C.F.R. Part 162 – USEPA Regulations on Insecticide, Fungicide, and Rodenticide Use

43 C.F.R. Part 46 – Department of the Interior (DOI) NEPA Regulations

50 C.F.R. §10.13 – List of Migratory Birds

50 C.F.R. Part 17 – USFWS List of Endangered and Threatened Wildlife

33 C.F.R. 328 – Definition of Waters of the U.S.

36 C.F.R. 800 – Protection of Historic Properties

Federal Executive Orders (EOs)

Floodplain Management, as amended (EO 11988) – Provides for the support, preservation, and enhancement of the natural and beneficial values of floodplains.

Indian Sacred Sites (EO 13007) – Provides for the protection of and access to Indian sacred sites.

Invasive Species (EO 13112) – Directs Federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.

Safeguarding the Nation from the Impacts of Invasive Species (EO 13751) – Directs actions to continue coordinated Federal prevention and control efforts related to invasive species. This Executive Order defines invasive species as, "a non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health."

Protection and Enhancement of Environmental Quality (EO 11514) – Provides for environmental protection of Federal lands and enforces requirements of NEPA.

Protection and Enhancement of the Cultural Environment (EO 11593) – States that the Federal government shall provide leadership in preserving, restoring and maintaining the historic and cultural environment of the Nation.

Protection of Wetlands (EO 11990) – Directs all Federal agencies to take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.

U.S. Fish and Wildlife Service Guidance

516 Department Manual (DM) 8 – Department of the Interior (DOI) NEPA Regulations

550 Fish and Wildlife (FW) 3 – NEPA Documenting and Implementing Decisions

569 FW 1 – Integrated Pest Management

601 FW 3 – Biological Integrity, Diversity, and Environmental Health

602 FW 1 – Refuge Planning Overview

State

California Clean Air Act – Establishes requirements for air quality management districts (AQMDs) and the California Air Resources Board (CARB). This Act also establishes numerous requirements for AQMD plans to attain State ambient air quality standards for criteria air contaminants.

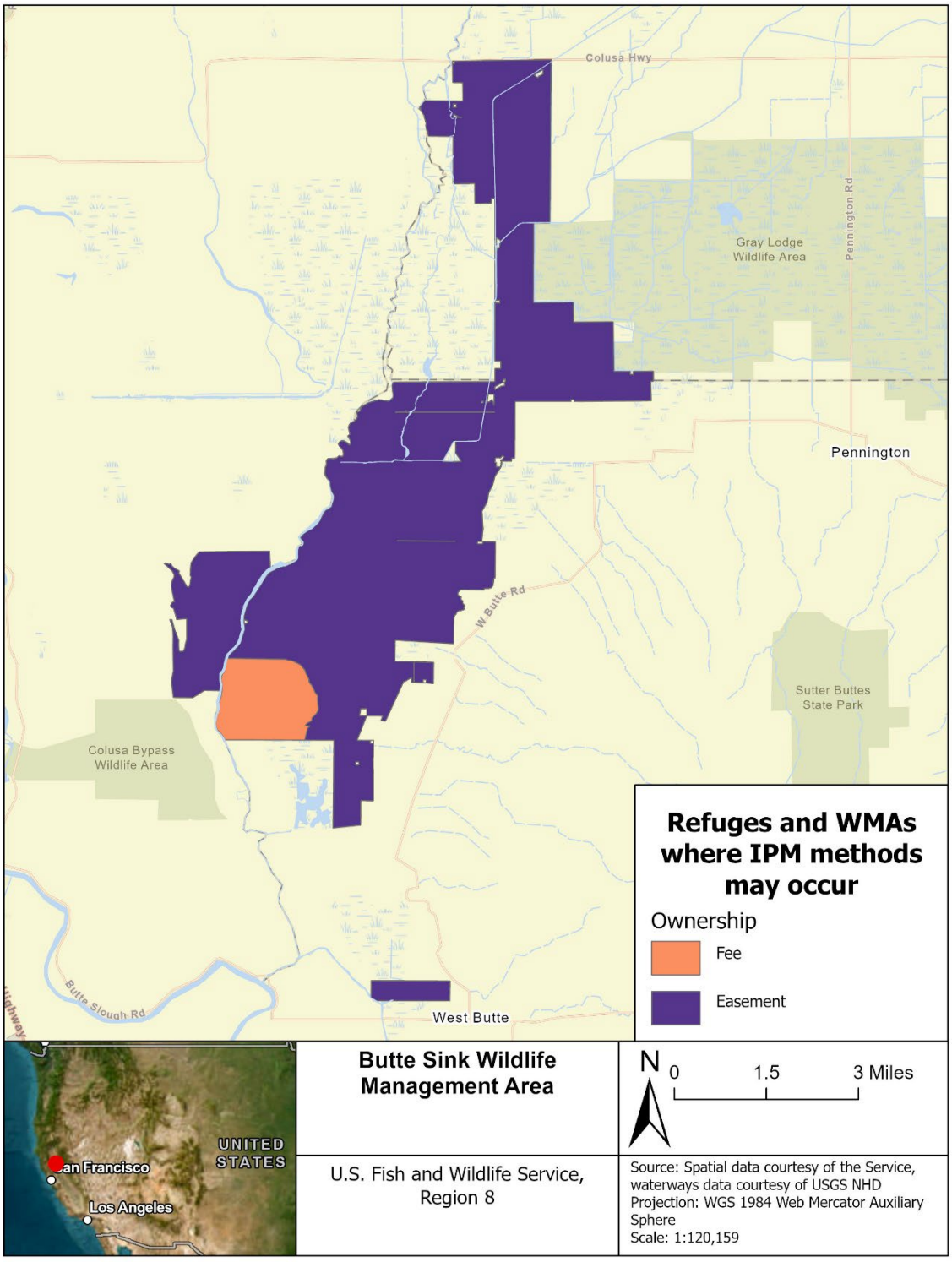
California Endangered Species Act (California Public Resources [Cal. Pub. Res.] Code §2050 et seq.) – Provides for the protection of all threatened and endangered native fish, amphibians, reptiles, birds, mammals, invertebrates, and plants, including their habitats.

Porter-Cologne Water Quality Control Act (Cal. Pub. Res. Code §13000 et seq.) – Assigns overall responsibility for water rights and water quality protects to the State Water Resource Control Board and directs the development and enforcement of water quality standards within regional boundaries.

Appendix B: Refuge Summaries

Butte Sink Wildlife Management Area

Summary for Environmental Assessment



Wildlife Management Area Background, Purposes, and Goals

Butte Sink Wildlife Management Area (WMA) contains a variety of habitats, including managed wetlands, unmanaged wetlands, vernal pools, grasslands, riparian forest, and other riparian and floodplain habitats. The current WMA is approximately 10,969 acres, including 733 fee-title acres and 10,236 easement acres.

Butte Sink WMA was established in 1979 with the primary purpose of preserving wetland habitat to perpetuate the migratory waterfowl resource in the Central Valley and the Pacific Flyway.

The Butte Sink 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)
>
> *"...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 Butte Sink WMA include:

> *"Protect wetlands, wetland-associated uplands and riparian habitats, and productive agricultural lands to support an abundance and natural diversity of wintering and migrating waterfowl, shorebirds, birds of prey, songbirds, and other wetland-dependent species in the Central Valley."*
>
> *"Conserve, manage, restore, and enhance habitats and associated wildlife and plant species, with an emphasis on supporting an abundance and natural diversity of wintering and migrating waterfowl, shorebirds, other waterbirds, birds of prey, and songbirds."*
>
> *"On the Llano Seco Unit and other appropriate Service-owned lands, provide visitors of all ages and abilities with quality wildlife-dependent recreation (wildlife observation, photography, environmental education, and interpretation) and volunteer opportunities to enhance public appreciation, understanding, and enjoyment of fish, wildlife, habitats, and cultural resources."*
>
> *"Support self-sustaining populations of threatened and endangered species on fee-title Service-owned lands and on easement lands with willing landowners."*
>
> *"Maintain and enhance current habitat values under anticipated climate change scenarios in the Central Valley."*

Note that the U.S. Fish and Wildlife Service (Service) is not providing all purposes/goals and is only including those here that are relevant to this project.

The Central Valley vegetation and habitats have been altered by human activity more than any other geomorphic province in California. Prior to the mid-1800s, the Valley contained more than 4 million acres of wetland habitat. Many of these wetlands were bordered by grassland and riparian habitats. Many wetlands were seasonal in nature and filled with rainfall and subsequent over-bank flooding of rivers and streams that inundated large areas of the Valley during the winter and spring. With the development of agriculture during the late 1800s and early 1900s, natural habitat was replaced by rice and other crops. Waterfowl consumed some of these crops as a substitute for their original wetland

foods, resulting in serious crop losses for farmers. Over-bank flooding that once characterized the Valley is gone, with reservoirs and constructed levees harnessing rivers for irrigation and flood control. The Valley is now an extensive agricultural area and lands surrounding the WMA consist primarily of irrigated rice lands, orchards, row crops, safflower, barley wheat, alfalfa, and some dairy production (Butte Sink, Willow Creek-Lurline, and North Central Valley WMAs Final Comprehensive Conservation Plan [CCP] and Environmental Assessment [EA], 2020).

The Butte Sink is located immediately west of the Sutter Buttes Mountain Range and represents the largest contiguous block of wetlands in the Sacramento Valley. These wetlands annually support up to two million wintering waterfowl, with the Butte Sink Unit alone hosting concentrations of up to one million ducks and geese. In addition, the Butte Sink WMA supports large numbers of greater sandhill cranes, which are State-listed as threatened (Butte Sink, Willow Creek-Lurline, and North Central Valley WMAs Final CCP and EA, 2020).

Wildlife Management Area management is determined, guided, and tracked by an annual habitat management planning process. The annual Habitat Management Plan is generated for each unit with input from refuge managers, biologists, work leaders, irrigators, outdoor recreation planner, fire management officers, and law enforcement officers. The habitat management plan identifies habitat objectives, specifies management activities to make any necessary repairs or improvements, and notes species management considerations (such as the presence of special status species or other significant wildlife use) for each unit. It also prioritizes management activities and projects based on the overall condition and functionality of the unit, water management regimes, and available resources (manpower and funding). Examples of management activities include facilities maintenance (e.g., levees, water control structures, roads, fire breaks, fences, gates, boundary signs), vegetation management (e.g., herbicide application, prescribed fire, grazing, mowing and disking, irrigation), biological surveys, habitat restoration, research, visitor service monitoring and facilities maintenance, and law enforcement issues (Butte Sink, Willow Creek-Lurline, and North Central Valley WMAs Final CCP and EA, 2020).

For more information about Butte Sink WMA, see the WMA's CCP.

Federally-Listed, Proposed, and Candidate Species and Habitats Proposed for Treatment on the WMA

Species	Federal Status	Rivers, streams, creeks (Riparian)	Perennial, open water (freshwater) Greater than 8 hectares Wetlands	Seasonal (freshwater) Greater than 8 hectares Managed Wetlands	Ephemeral, seasonal Less than 8 hectares Wetlands	Disturbed
Yellow-billed cuckoo *Coccyzus americanus* Western DPS	Threatened	Yes	No	No	No	No
Northwestern pond turtle *Actinemys marmorata*	Proposed Threatened	Yes	Yes	Yes	Yes	Yes
Giant garter snake *Thamnophis gigas*	Threatened	No	No	Yes	No	No
Western spadefoot *Spea hammondii*	Proposed Threatened	Yes	No	Yes	Yes	No
Steelhead *Oncorhynchus mykiss* California Central Valley DPS	Threatened	Yes	No	No	No	No
Chinook salmon *Oncorhynchus tshawytscha* Central Valley spring-run ESU	Threatened	Yes	No	No	No	No
Chinook salmon *Oncorhynchus tshawytscha* Sacramento River ESU (winter run)	Endangered	Yes	No	No	No	No
Monarch butterfly *Danaus plexippus*	Proposed Threatened	Yes	No	No	No	No

DPS: Distinct population segment, ESU = Evolutionarily significant unit

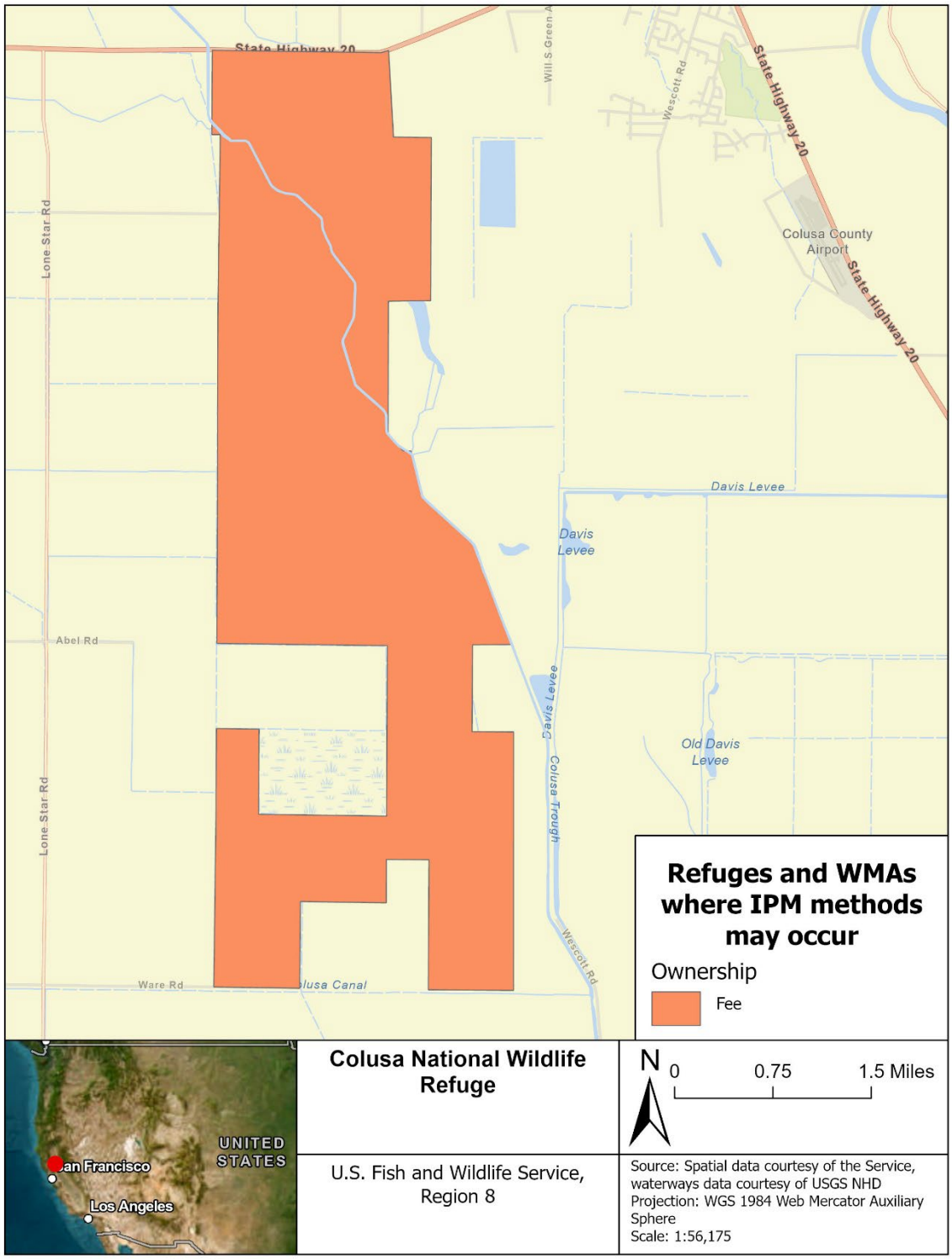
State-Listed Species and Habitats Proposed for Treatment on the WMA

Species	State Status	Rivers, streams, creeks (Riparian)	Perennial, open water (freshwater) Greater than 8 hectares Wetlands	Seasonal (freshwater) Greater than 8 hectares Managed Wetlands	Ephemeral, seasonal Less than 8 hectares Wetlands	Disturbed
Swainson's hawk *Buteo swainsoni*	Threatened	Yes	No	No	No	No
Willow flycatcher *Empidonax traillii*	Endangered	Yes	No	No	No	No
Greater sandhill crane *Grus canadensis tabida*	Threatened	No	Yes	Yes	Yes	No

Species	State Status	Rivers, streams, creeks (Riparian)	Perennial, open water (freshwater) Greater than 8 hectares Wetlands	Seasonal (freshwater) Greater than 8 hectares Managed Wetlands	Ephemeral, seasonal Less than 8 hectares Wetlands	Disturbed
Bald eagle *Haliaeetus leucecophalus*	Endangered	Yes	Yes	Yes	Yes	No

Colusa National Wildlife Refuge

Summary for Environmental Assessment



Refuge Background, Purposes, and Goals

Colusa National Wildlife Refuge (NWR) contains a variety of habitats, including managed wetlands, unmanaged wetlands, grasslands, alkali meadows, vernal pools, and riparian habitats. The current Refuge is approximately 4,040 acres, which are all fee-title acres.

Colusa NWR was established in 1945 with funds made available by the Migratory Bird Hunting and Conservation Stamp Act. Additional land was acquired for the Refuge under the Lea Act.

The Colusa 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. 1534 (Endangered Species Act of 1973).

Goals of Colusa NWR include:

> *"Conserve, manage, restore, and enhance habitats and associated plant and wildlife species, with an emphasis on supporting an abundance and natural diversity of wintering and migrating waterfowl, shorebirds, birds of prey, and songbirds."*
>
> *"Conserve, manage, restore, and enhance threatened and endangered species and their habitats including vernal pool plants and invertebrates, and giant garter snakes."*
>
> *"Provide visitors of all ages and abilities with quality wildlife-dependent recreation (hunting, wildlife observation, photography, environmental education, and interpretation), and volunteer opportunities to enhance public appreciation, understanding, and enjoyment of fish, wildlife, habitats, and cultural resources."*
>
> *"Promote partnerships to preserve, restore, and enhance a diverse, healthy, and productive ecosystem in which the Refuges play a key role."*
>
> *"Adequately protect and maintain all natural and cultural resources, staff and visitors, equipment, facilities, and other property on the Refuges."*

Note that the U.S. Fish and Wildlife Service (Service) is not providing all purposes/goals and is only including those here that are relevant to this project.

Priority resources of concern at Colusa NWR are (in order of priority):

- Managed wetlands
- Vernal pool and alkali meadow complexes
- Riparian areas
- Grasslands (Priority Resources of Concern and Conservation Summary of Managed Wetlands at Sacramento NWR Complex, 2020).

The Sacramento Valley is an extensive agricultural area that has historically been a major wintering area for millions of ducks and geese. Lands surrounding Colusa NWR are mostly irrigated rice lands with some dairy and crop production. Colusa NWR represents a small portion of the vast seasonal wetlands and

grasslands that once existed in the Sacramento Valley. Natural habitat was replaced with crops during the late 1800s and early 1900s, and waterfowl substituted some of these farm crops for their original wetland foods (Sacramento, Delevan, Colusa, and Sutter NWRs Final Comprehensive Conservation Plan [CCP] and Environmental Assessment [EA], 2009).

Colusa NWR was established to provide sanctuary for migratory birds and to alleviate crop depredation. Today, depredation problems have decreased in magnitude due in part to reduced numbers of waterfowl, changes in agricultural practices, and increases in wetland quality and quantity. The Refuge lies in the Colusa Basin and is bisected by the Colusa Basin Drain, which drains the Basin southeast to the Sacramento River. The low topography and presence of the Colusa Basin Drain makes Refuge lands subject to regular winter flooding (Sacramento, Delevan, Colusa, and Sutter NWRs Final CCP and EA, 2009).

Refuge management is determined, guided, and tracked by an annual habitat management planning process. The annual Habitat Management Plan identifies individual management units within the Refuge. The Habitat Management Plan identifies habitat objectives, specifies management activities to make any necessary repairs or improvements, and notes species management considerations (such as the presence of special status species or other significant wildlife use) for each unit. It also prioritizes management activities and projects based on the overall condition and functionality of the unit, water management regimes, and available resources (manpower and funding). Examples of management activities include facilities maintenance (levees, water control structures, roads, fire breaks, fences, boundary signs, etc.), vegetation management (herbicide application, prescribed fire, grazing, mowing and disking, irrigation, etc.), biological surveys, habitat restoration, research, public use monitoring and facilities maintenance, and law enforcement issues (Sacramento, Delevan, Colusa, and Sutter NWRs Final CCP and EA, 2009).

For more information about Colusa NWR, see the Refuge's CCP.

Federally-Listed, Proposed, and Candidate Species and Habitats Proposed for Treatment on the Refuge

Species	**Federal Status**	**Rivers, streams, creeks (Riparian)**	**Perennial, open water (freshwater) Greater than 8 hectares Wetlands**	**Seasonal (freshwater) Greater than 8 hectares Managed Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Disturbed**
Yellow-billed cuckoo *Coccyzus americanus* Western DPS	Threatened	Yes	No	No	No	No
Northwestern pond turtle *Actinemys marmorata*	Proposed Threatened	Yes	Yes	Yes	Yes	Yes
Giant garter snake *Thamnophis gigas*	Threatened	No	No	Yes	No	No
Western spadefoot *Spea hammondii*	Proposed Threatened	Yes	No	Yes	Yes	No
Monarch butterfly *Danaus plexippus*	Proposed Threatened	Yes	No	No	No	No

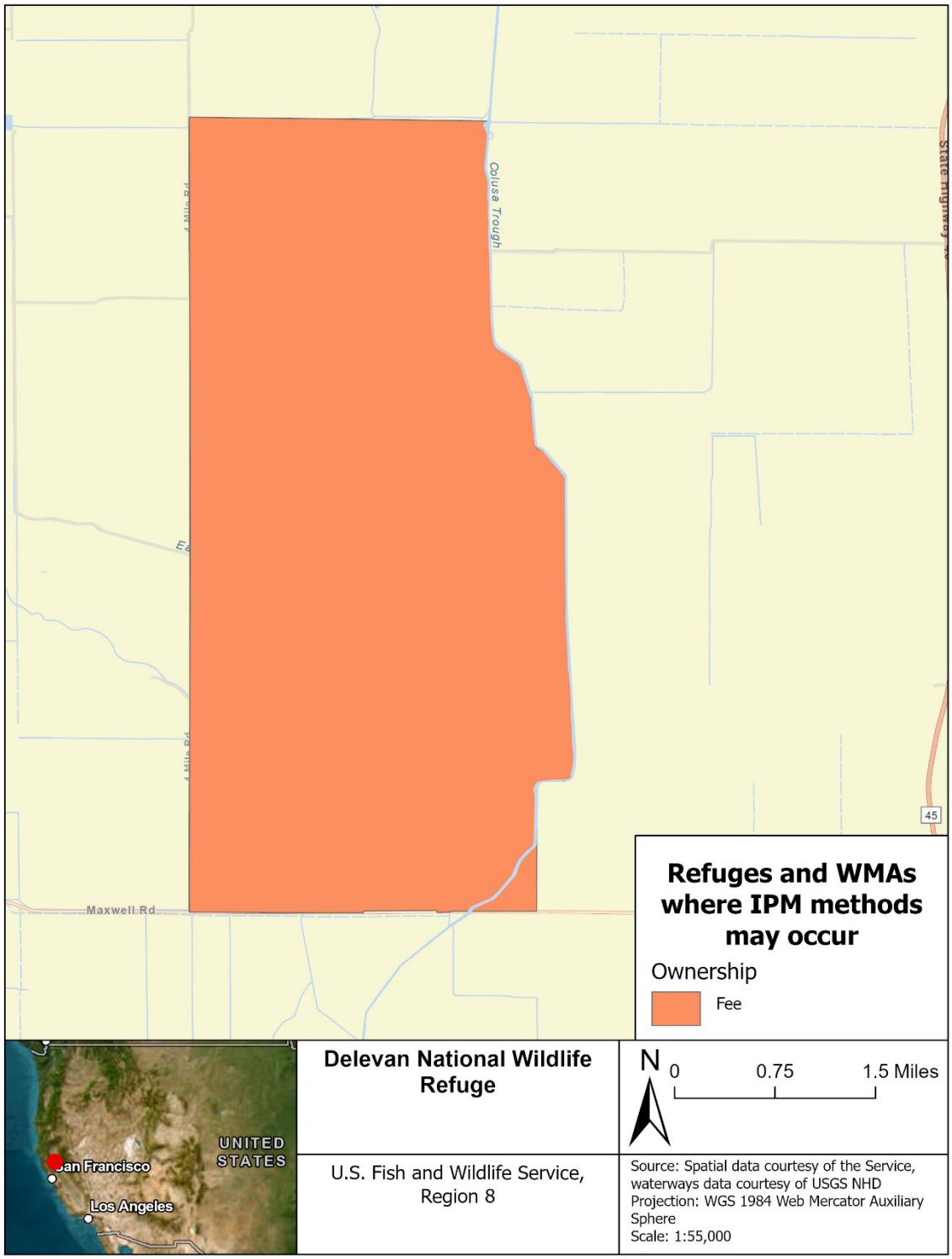
State-Listed Species and Habitats Proposed for Treatment on the Refuge

Species	**State Status**	**Rivers, streams, creeks (Riparian)**	**Perennial, open water (freshwater) Greater than 8 hectares Wetlands**	**Seasonal (freshwater) Greater than 8 hectares Managed Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Disturbed**
Swainson's hawk *Buteo swainsoni*	Threatened	Yes	No	No	No	No
Willow flycatcher *Empidonax traillii*	Endangered	Yes	No	No	No	No
Greater sandhill crane *Grus canadensis tabida*	Threatened	No	Yes	Yes	Yes	No

Species	**State Status**	**Rivers, streams, creeks (Riparian)**	**Perennial, open water (freshwater) Greater than 8 hectares Wetlands**	**Seasonal (freshwater) Greater than 8 hectares Managed Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Disturbed**
Bald eagle *Haliaeetus leucecophalus*	Endangered	Yes	Yes	Yes	Yes	No

Delevan National Wildlife Refuge

Summary for Environmental Assessment



Refuge Background, Purposes, and Goals

Delevan National Wildlife Refuge (NWR) contains a variety of habitats, including managed wetlands, unmanaged wetlands, grasslands, alkali meadows, riparian, and vernal pools. The current Refuge is approximately 5,797 acres, which are all fee-title acres.

Delevan NWR was authorized in 1962 by the Migratory Bird Conservation Commission and purchased with funds made available by the Migratory Bird Hunting and Conservation Stamp Act.

The Delevan NWR **purpose**, as stated in the law, is:

> *"... 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).

Goals of Delevan NWR include:

> *"Conserve, manage, restore, and enhance habitats and associated plant and wildlife species, with an emphasis on supporting an abundance and natural diversity of wintering and migrating waterfowl, shorebirds, birds of prey, and songbirds."*
>
> *"Conserve, manage, restore, and enhance threatened and endangered species and their habitats including vernal pool plants and invertebrates, and giant garter snakes."*
>
> *"Provide visitors of all ages and abilities with quality wildlife-dependent recreation (hunting, wildlife observation, photography, environmental education, and interpretation), and volunteer opportunities to enhance public appreciation, understanding, and enjoyment of fish, wildlife, habitats, and cultural resources."*
>
> *"Promote partnerships to preserve, restore, and enhance a diverse, healthy, and productive ecosystem in which the Refuges play a key role."*
>
> *"Adequately protect and maintain all natural and cultural resources, staff and visitors, equipment, facilities, and other property on the Refuges."*

Note that the U.S. Fish and Wildlife Service (Service) is not providing all purposes/goals and is only including those here that are relevant to this project.

Priority resources of concern at Delevan NWR are (in order of priority):

- Managed wetlands
- Vernal pool and alkali meadow complexes
- Riparian areas
- Grasslands (Priority Resources of Concern and Conservation Summary of Managed Wetlands at Sacramento NWR Complex, 2020).

The Sacramento Valley is an extensive agricultural area that has historically been a major wintering area for millions of ducks and geese. Lands surrounding Delevan NWR are mostly irrigated rice lands with some dairy and crop production. Delevan NWR represents a small portion of the vast seasonal wetlands and grasslands that once existed in the Sacramento Valley. Natural habitat was replaced with crops during the late 1800s and early 1900s, and waterfowl substituted some of these farm crops for their original wetland foods (Sacramento, Delevan, Colusa, and Sutter NWRs Final Comprehensive Conservation Plan [CCP] and Environmental Assessment [EA], 2009).

Delevan NWR was created on an open plain of short grasses, shrubs, and forbs known as Colusa Plains.

This area has a gradual slope toward the Sacramento River to the southeast. Much of the land was flooded during the winter, and at one time there were even two lakes on the Refuge area. These historic flood patterns continue today as a major drain for the western Sacramento Valley, the Colusa Basin Drain. The Colusa Basin Drain runs along much of Delevan's eastern boundary, often resulting in significant annual flooding of the Refuge from December through February (Sacramento, Delevan, Colusa, and Sutter NWRs Final CCP and EA, 2009).

Refuge management is determined, guided, and tracked by an annual habitat management planning process. The annual Habitat Management Plan identifies individual management units within the Refuge. The Habitat Management Plan identifies habitat objectives, specifies management activities to make any necessary repairs or improvements, and notes species management considerations (such as the presence of special status species or other significant wildlife use) for each unit. It also prioritizes management activities and projects based on the overall condition and functionality of the unit, water management regimes, and available resources (manpower and funding). Examples of management activities include facilities maintenance (levees, water control structures, roads, fire breaks, fences, boundary signs, etc.), vegetation management (herbicide application, prescribed fire, grazing, mowing and disking, irrigation, etc.), biological surveys, habitat restoration, research, public use monitoring and facilities maintenance, and law enforcement issues (Sacramento, Delevan, Colusa, and Sutter NWRs Final CCP and EA, 2009).

For more information about Delevan NWR, see the Refuge's CCP.

Federally-Listed, Proposed, and Candidate Species and Habitats Proposed for Treatment on the Refuge

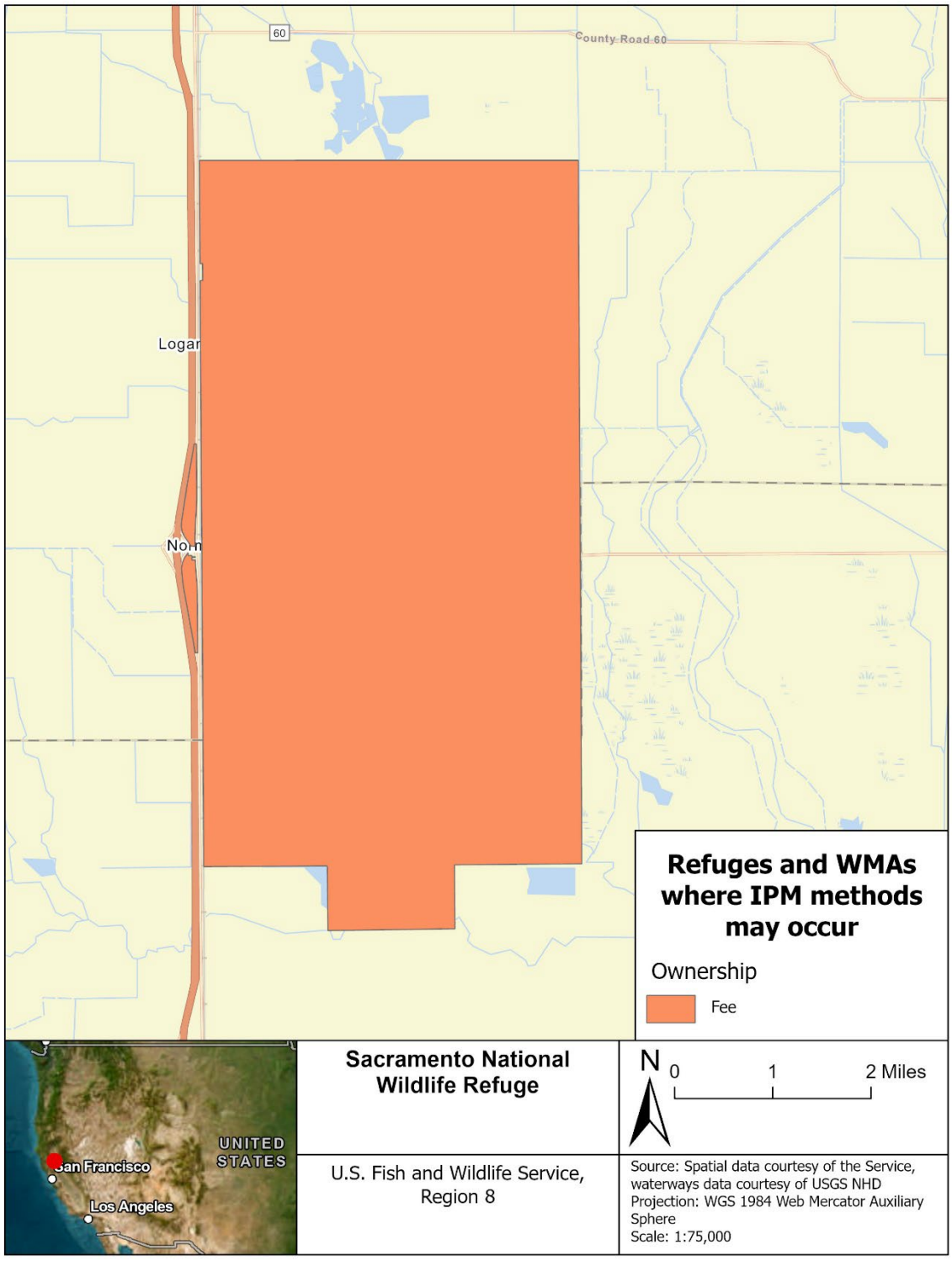
Species	**Federal Status**	**Rivers, streams, creeks (Riparian)**	**Seasonal (freshwater) Greater than 8 hectares Managed Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Disturbed**
Northwestern pond turtle *Actinemys marmorata*	Proposed Threatened	Yes	Yes	Yes	Yes
Giant garter snake *Thamnophis gigas*	Threatened	No	Yes	No	No
Western spadefoot *Spea hammondii*	Proposed Threatened	Yes	Yes	Yes	No
Monarch butterfly *Danaus plexippus*	Proposed Threatened	Yes	No	No	No
Palmate-bracted bird's beak *Cordylanthus palmatus*	Endangered	No	Yes	No	No

State-Listed Species and Habitats Proposed for Treatment on the Refuge

Species	**State Status**	**Rivers, streams, creeks (Riparian)**	**Seasonal (freshwater) Greater than 8 hectares Managed Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Disturbed**
Swainson’s hawk *Buteo swainsoni*	Threatened	Yes	No	No	No
Willow flycatcher *Empidonax traillii*	Endangered	Yes	No	No	No
Greater sandhill crane *Grus canadensis tabida*	Threatened	No	Yes	Yes	No
Bald eagle *Haliaeetus leucecophalus*	Endangered	Yes	Yes	Yes	No

Sacramento National Wildlife Refuge

Summary for Environmental Assessment



Refuge Background, Purposes, and Goals

Sacramento National Wildlife Refuge (NWR) contains a variety of habitats, including summer wetlands, seasonally flooded wetlands, unmanaged wetlands, alkali meadows, vernal pools, grasslands, and riparian forests. The current Refuge is approximately 10,856 acres, which are all fee-title acres.

Sacramento NWR was established by Executive Order 7562 and was acquired with funds from the Emergency Conservation Fund Act of 1933 to provide refuge and breeding habitat for migratory birds and other wildlife.

The Sacramento NWR **purposes**, as stated in the law, are:

> *"... as a refuge and breeding ground for migratory birds and other wildlife..."* (Executive Order 7562, February 27, 1937).
>
> *"... 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).
>
> *"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species.... or (B) plants ..."* 16 U.S.C. § 1534 (Endangered Species Act of 1973)
>
> *"... suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ...*" 16 U.S.C. 460k-1 *"... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ...*" 16 U.S.C. 460k-2 (Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4), as amended).
>
> *"... 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 Sacramento NWR include:

> *"Conserve, manage, restore, and enhance habitats and associated plant and wildlife species, with an emphasis on supporting an abundance and natural diversity of wintering and migrating waterfowl, shorebirds, birds of prey, and songbirds."*
>
> *"Conserve, manage, restore, and enhance threatened and endangered species and their habitats including vernal pool plants and invertebrates, and giant garter snakes."*
>
> *"Provide visitors of all ages and abilities with quality wildlife-dependent recreation (hunting, wildlife observation, photography, environmental education, and interpretation), and volunteer opportunities to enhance public appreciation, understanding, and enjoyment of fish, wildlife, habitats, and cultural resources."*
>
> *"Promote partnerships to preserve, restore, and enhance a diverse, healthy, and productive ecosystem in which the Refuges play a key role."*
>
> *"Adequately protect and maintain all natural and cultural resources, staff and visitors, equipment, facilities, and other property on the Refuges."*

Note that the U.S. Fish and Wildlife Service (Service) is not providing all purposes/goals and is only

including those here that are relevant to this project.

Priority resources of concern at Sacramento NWR are (in order of priority):

- Managed wetlands
- Vernal pool and alkali meadow complexes
- Riparian areas
- Grasslands (Priority Resources of Concern and Conservation Summary of Managed Wetlands at Sacramento NWR Complex, 2020).

The Sacramento Valley is an extensive agricultural area that has historically been a major wintering area for millions of ducks and geese. Lands surrounding Sacramento NWR are mostly irrigated rice lands with some dairy and crop production. Sacramento NWR represents a small portion of the vast seasonal wetlands and grasslands that once existed in the Sacramento Valley. Natural habitat was replaced with crops during the late 1800s and early 1900s, and waterfowl substituted some of these farm crops for their original wetland foods (Sacramento, Delevan, Colusa, and Sutter NWRs Final Comprehensive Conservation Plan [CCP] and Environmental Assessment [EA], 2009).

Sacramento NWR was created on an open plain of short grasses, shrubs, and forbs known as Colusa Plains. The Colusa Plains was generally a vacant, windswept plain with the exception of "The Willows," a small tree-abundant watering hole. Refuge lands primarily consisted of a dry alkaline plain, with fewer than 1,000 wetland and 4,800 deteriorated crop aces present. During the late 1930s with the Civilian Conservation Corp's "Camp Sacramento," levees, water control structure, and delivery ditches were constructed to create and sustain wetlands across most of the Refuge. Many of the habitats on Sacramento NWR today do not reflect the original landscape, but management programs do attempt to mimic the natural conditions that once occurred throughout the Sacramento Valley on a much grander scale (Sacramento, Delevan, Colusa, and Sutter NWRs Final CCP and EA, 2009).

Refuge management is determined, guided, and tracked by an annual habitat management planning process. The annual Habitat Management Plan identifies individual management units within the Refuge. The Habitat Management Plan identifies habitat objectives, specifies management activities to make any necessary repairs or improvements, and notes species management considerations (such as the presence of special status species or other significant wildlife use) for each unit. It also prioritizes management activities and projects based on the overall condition and functionality of the unit, water management regimes, and available resources (manpower and funding). Examples of management activities include facilities maintenance (levees, water control structures, roads, fire breaks, fences, boundary signs, etc.), vegetation management (herbicide application, prescribed fire, grazing, mowing and disking, irrigation, etc.), biological surveys, habitat restoration, research, public use monitoring and facilities maintenance, and law enforcement issues (Sacramento, Delevan, Colusa, and Sutter NWRs Final CCP and EA, 2009).

For more information about Sacramento NWR, see the Refuge's CCP.

Federally-Listed, Proposed, and Candidate Species and Habitats Proposed for Treatment on the Refuge

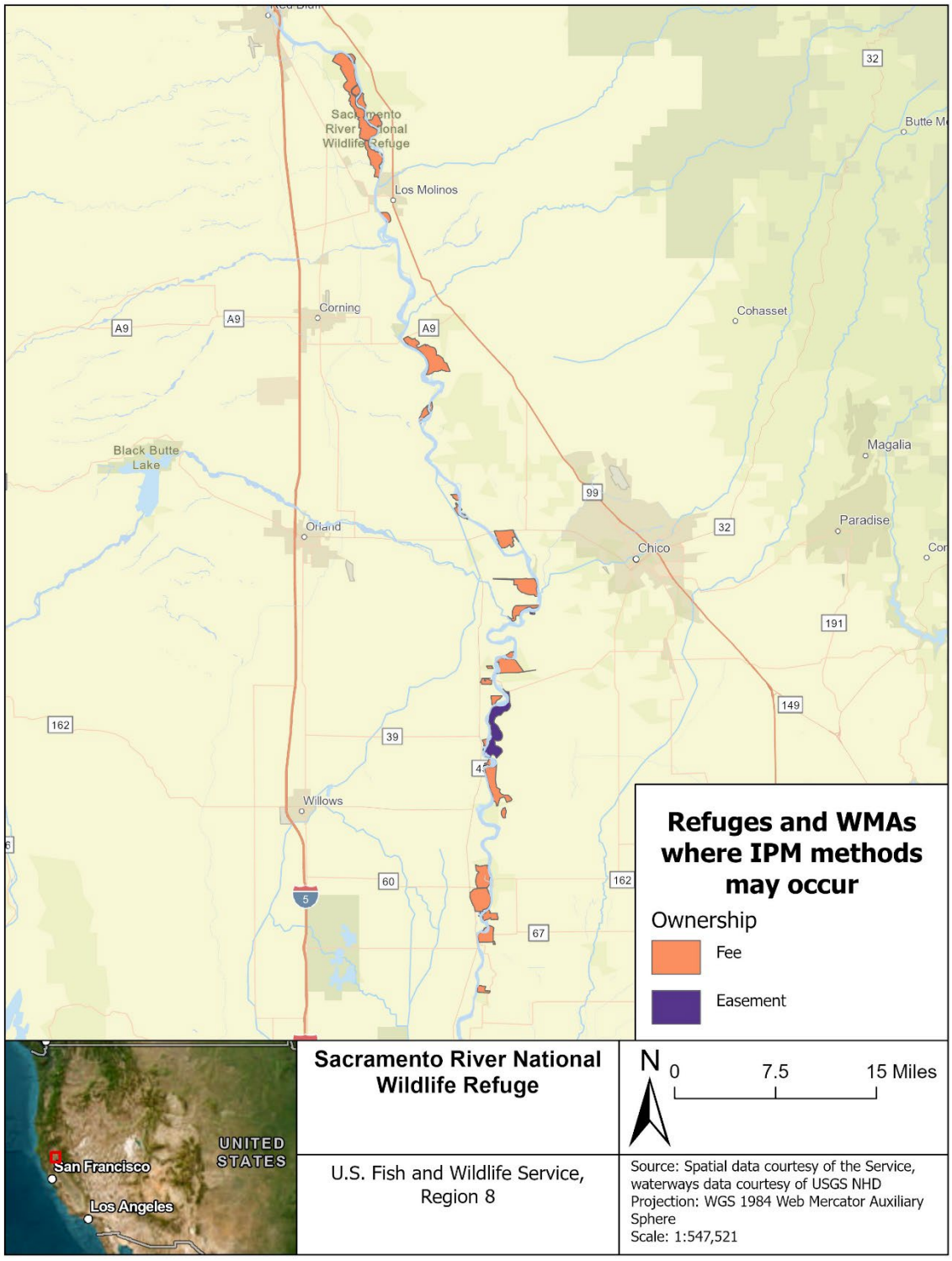
Species	**Federal Status**	**Rivers, streams, creeks (Riparian)**	**Perennial, open water (freshwater) Greater than 8 hectares Wetlands**	**Seasonal (freshwater) Greater than 8 hectares Managed Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Disturbed**
Northwestern pond turtle *Actinemys marmorata*	Proposed Threatened	Yes	Yes	Yes	Yes	Yes
Giant garter snake *Thamnophis gigas*	Threatened	No	No	Yes	No	No
Western spadefoot *Spea hammondii*	Proposed Threatened	Yes	No	Yes	Yes	No
Monarch butterfly *Danaus plexippus*	Proposed Threatened	Yes	No	No	No	No

State-Listed Species and Habitats Proposed for Treatment on the Refuge

Species	**State Status**	**Rivers, streams, creeks (Riparian)**	**Perennial, open water (freshwater) Greater than 8 hectares Wetlands**	**Seasonal (freshwater) Greater than 8 hectares Managed Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Disturbed**
Swainson's hawk *Buteo swainsoni*	Threatened	Yes	No	No	No	No
Willow flycatcher *Empidonax traillii*	Endangered	Yes	No	No	No	No
Greater sandhill crane *Grus canadensis tabida*	Threatened	No	Yes	Yes	Yes	No
Bald eagle *Haliaeetus leucecophalus*	Endangered	Yes	Yes	Yes	Yes	No

Sacramento River National Wildlife Refuge

Summary for Environmental Assessment



Refuge Background, Purposes, and Goals

Sacramento River National Wildlife Refuge (NWR) contains a variety of habitats, including sand and gravel bars, willow scrub, cottonwood forest, herbaceous, mixed riparian forest, valley oak woodlands and savannas, grasslands, freshwater wetlands, pastures, cover crops, and almond and walnut orchards. The current Refuge is approximately 11,754 acres with 10,448 fee-title acres and 1,306 easement acres.

Sacramento River NWR was established in 1989 by the authority provided under the Endangered Species Act of 1973, Emergency Wetlands Resources Act of 1986, and the Fish and Wildlife Act of 1956.

The Sacramento 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. Sec. 1534 (Endangered Species Act of 1973)
>
> *".. 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)
>
> *"... 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. Sec. 742f (b) (1) (Fish and Wildlife Act of 1956)

Goals of Sacramento River NWR include:

> *"Contribute to the recovery of endangered and threatened species and provide a natural diversity and abundance of migratory birds and anadromous fish through the restoration and management of viable riparian habitats along the Sacramento River using the principles of landscape ecology."*
>
> *"Encourage visitors of all ages and abilities to enjoy wildlife-dependent recreational and educational opportunities and experience, appreciate, and understand the Refuge history, riparian ecosystem, fish, and wildlife."*
>
> *"Promote partnerships to preserve, restore, and enhance a diverse, healthy and productive riparian ecosystem in which the Sacramento River Refuge plays a key role."*
>
> *"Adequately protect all natural and cultural resources, staff and visitors, equipment, facilities, and other property on the Refuge from those of malicious intent, in an effective and professional manner."*

Note that the U.S. Fish and Wildlife Service (Service) is not providing all purposes/goals and is only including those here that are relevant to this project.

Priority resources of concern at Sacramento River NWR are (in order of priority):

- Riparian areas
- Grasslands (Priority Resources of Concern and Conservation Summary of Managed Wetlands at Sacramento NWR Complex, 2020).

The Sacramento Valley is an extensive agricultural area that has historically been a major wintering area for waterfowl along the Pacific Flyway. Lands surrounding Sacramento River NWR are mostly orchards

and irrigated rice lands with some livestock, safflower, barley, wheat, and alfalfa crops. Sacramento River NWR represents a small portion of the vast seasonal wetlands and grasslands that once existed in the Sacramento Valley. Natural habitat was replaced with crops during the late 1800s and early 1900s, and waterfowl substituted some of these farm crops for their original wetland foods (Sacramento River NWR Final Comprehensive Conservation Plan [CCP], 2005).

There has been a large reduction of riparian vegetation throughout the Sacramento Valley and foothills region, especially along this area's major river systems. Sacramento River NWR was established to help protect and restore riparian habitat along the Sacramento River as it meanders through the Sacramento Valley from Red Bluff to Colusa. Numerous plans have identified riparian habitat along the Sacramento River as critically important for various endangered and threatened species, fisheries, migratory birds, plants, and to the functional processes of the river ecosystem. Habitat today is managed for natural diversity of indigenous flora and fauna (Sacramento River NWR Final CCP, 2005).

Refuge management is guided and tracked by annual habitat management plans. The habitat management plan identifies individual cells within each unit of the Refuge that have common management issues, conditions, and activities. It then identifies the problems and needs of each cell and specifies rehabilitation and other activities to address these concerns. Management activities include facilities maintenance (e.g., roads, fire breaks, fences, gates, boundary signs), vegetation management (i.e., herbicide application, prescribed fire and grazing, mowing and discing, irrigation), vegetation, plant, and wildlife inventory and monitoring surveys, habitat restoration and restoration monitoring, public use monitoring and facilities maintenance, and law enforcement issues (Sacramento River NWR Final CCP, 2005).

For more information about Sacramento River NWR, see the Refuge's CCP.

Federally-Listed, Proposed, and Candidate Species and Habitats Proposed for Treatment on the Refuge

Species	**Federal Status**	**Rivers, streams, creeks (Riparian)**	**Perennial, open water (freshwater) Greater than 8 hectares Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Perennial and springs Less than 8 hectares**	**Disturbed**
Yellow-billed cuckoo *Coccyzus americanus* Western DPS	Threatened	Yes	No	No	No	No
Northwestern pond turtle *Actinemys marmorata*	Proposed Threatened	Yes	Yes	Yes	Yes	Yes
Giant garter snake *Thamnophis gigas*	Threatened	No	Yes	No	No	No
Western spadefoot *Spea hammondii*	Proposed Threatened	Yes	No	Yes	No	No
Green sturgeon *Acipenser medirostris* Southern DPS	Threatened	Yes	No	No	No	No
Steelhead *Oncorhynchus mykiss* California Central Valley DPS	Threatened	Yes	No	No	No	No
Chinook salmon *Oncorhynchus tshawytscha* Central Valley spring-run ESU	Threatened	Yes	No	No	No	No
Chinook salmon *Oncorhynchus tshawytscha* Sacramento River ESU (winter run)	Endangered	Yes	No	No	No	No
Monarch butterfly *Danaus plexippus*	Proposed Threatened	Yes	No	No	No	No
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	Threatened	Yes	No	No	No	No

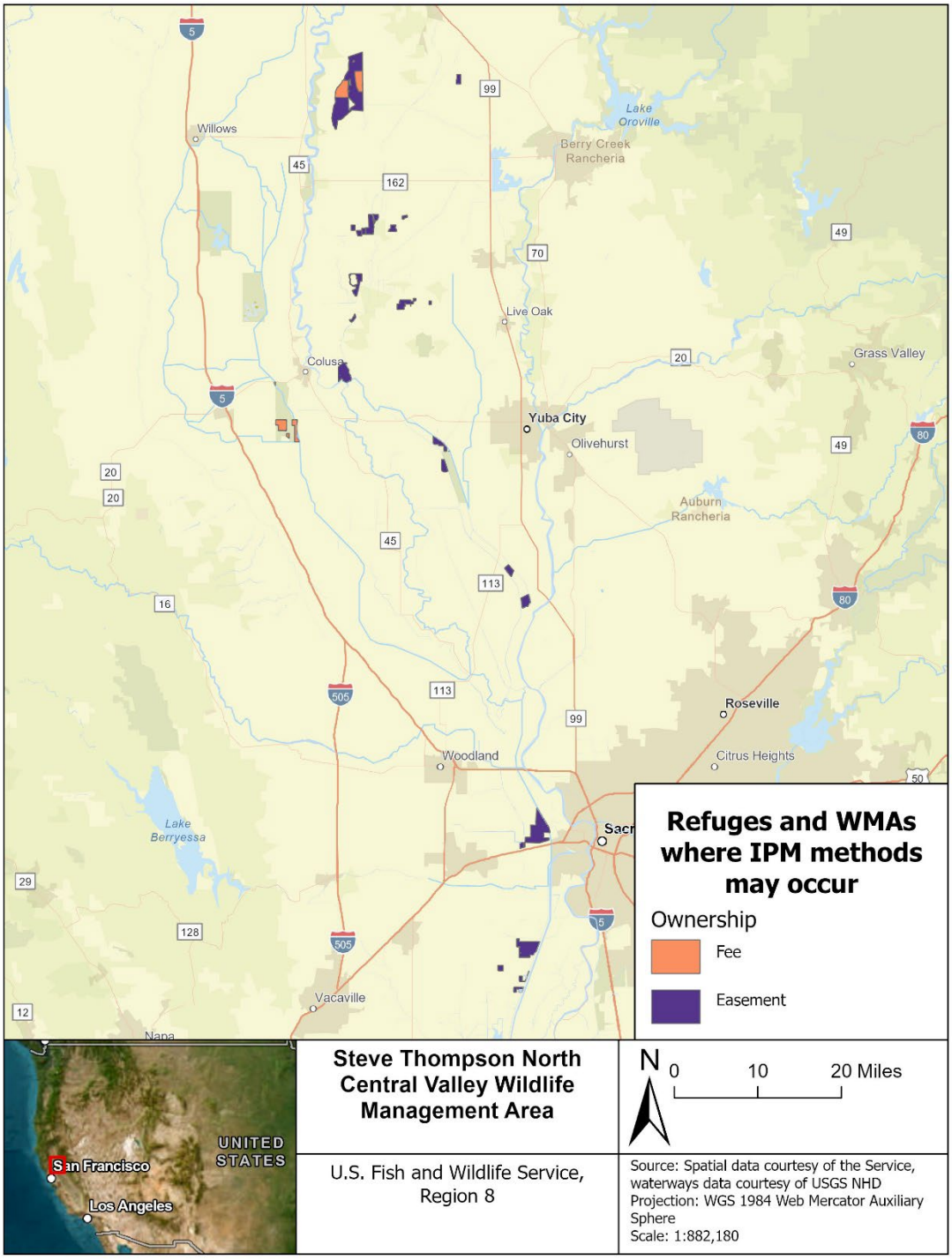
DPS: Distinct population segment, ESU: Evolutionarily significant unit

State-Listed Species and Habitats Proposed for Treatment on the Refuge

Species	**State Status**	**Rivers, streams, creeks (Riparian)**	**Perennial, open water (freshwater) Greater than 8 hectares Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Perennial and springs Less than 8 hectares**	**Disturbed**
Swainson's hawk *Buteo swainsoni*	Threatened	Yes	No	No	No	No
Willow flycatcher *Empidonax traillii*	Endangered	Yes	No	No	No	No
Bald eagle *Haliaeetus leucecophalus*	Endangered	Yes	Yes	Yes	No	No
Bank swallow *Riparia riparia*	Threatened	Yes	No	No	No	No

Steve Thompson North Central Valley Wildlife Management Area

Summary for Environmental Assessment



Wildlife Management Area Background, Purposes, and Goals

Steve Thompson North Central Valley Wildlife Management Area (WMA) contains a variety of habitats, including managed wetlands, unmanaged wetlands, vernal pools, grasslands, riparian forest, and other riparian and floodplain habitats. The current WMA is approximately 17,846 acres, including 2,765 fee-title acres and 15,081 easement acres.

Steve Thompson North Central Valley WMA was established in 1991 to preserve existing and restored wetlands for waterfowl and other wetland-dependent plants and wildlife.

The Steve Thompson North Central Valley 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)
>
> "*...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)
>
> *"...the conservation of wetlands 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. 3921 (Emergency Wetland Resources Act of 1986)
>
> *"...protection, restoration, and management of wetland ecosystems..."* 16 U.S.C. 4401-4412 (North American Wetlands Conservation Act of 1989)

Goals of Steve Thompson North Central Valley WMA include:

> *"Protect wetlands, wetland-associated uplands and riparian habitats, and productive agricultural lands to support an abundance and natural diversity of wintering and migrating waterfowl, shorebirds, birds of prey, songbirds, and other wetland-dependent species in the Central Valley."*
>
> *"Conserve, manage, restore, and enhance habitats and associated wildlife and plant species, with an emphasis on supporting an abundance and natural diversity of wintering and migrating waterfowl, shorebirds, other waterbirds, birds of prey, and songbirds."*
>
> *"On the Llano Seco Unit and other appropriate Service-owned lands, provide visitors of all ages and abilities with quality wildlife-dependent recreation (wildlife observation, photography, environmental education, and interpretation) and volunteer opportunities to enhance public appreciation, understanding, and enjoyment of fish, wildlife, habitats, and cultural resources."*
>
> *"Support self-sustaining populations of threatened and endangered species on fee-title Service-owned lands and on easement lands with willing landowners."*
>
> *"Maintain and enhance current habitat values under anticipated climate change scenarios in the Central Valley."*

Note that the U.S. Fish and Wildlife Service (Service) is not providing all purposes/goals and is only including those here that are relevant to this project.

The Central Valley vegetation and habitats have been altered by human activity more than any other geomorphic province in California. Prior to the mid-1800s, the Valley contained more than 4 million

acres of wetland habitat. Many of these wetlands were bordered by grassland and riparian habitats. Many wetlands were seasonal in nature and filled with rainfall and subsequent over-bank flooding of rivers and streams that inundated large areas of the Valley during the winter and spring. With the development of agriculture during the late 1800s and early 1900s, natural habitat was replaced by rice and other crops. Waterfowl consumed some of these crops as a substitute for their original wetland foods, resulting in serious crop losses for farmers. Over-bank flooding that once characterized the Valley is gone, with reservoirs and constructed levees harnessing rivers for irrigation and flood control. The Valley is now an extensive agricultural area and lands surrounding the WMA consist primarily of irrigated rice lands, orchards, row crops, safflower, barley wheat, alfalfa, and some dairy production (Butte Sink, Willow Creek-Lurline, and North Central Valley WMAs Final Comprehensive Conservation Plan [CCP] and Environmental Assessment [EA], 2020).

When established in 1991, the Steve Thompson North Central Valley WMA was seen as an integral component in accomplishing the wetland protection goals of the 1990 Central Valley Habitat Joint Venture Implementation Plan. Most of the WMA's conservation easements lie within the Butte, Yolo, and Sutter Basins. Made up of mostly managed wetlands, these easements support hundreds of thousands of wintering waterfowl, as well as tens of thousands of migrating and wintering shorebirds and thousands of State-listed threatened greater sandhill cranes. Included in these easements are some of the most important privately-owned waterfowl sanctuaries in the Central Valley (Butte Sink, Willow Creek-Lurline, and North Central Valley WMAs Final CCP and EA, 2020).

Wildlife Management Area management is determined, guided, and tracked by an annual habitat management planning process. The annual Habitat Management Plan is generated for each unit with input from refuge managers, biologists, work leaders, irrigators, outdoor recreation planner, fire management officers, and law enforcement officers. The habitat management plan identifies habitat objectives, specifies management activities to make any necessary repairs or improvements, and notes species management considerations (such as the presence of special status species or other significant wildlife use) for each unit. It also prioritizes management activities and projects based on the overall condition and functionality of the unit, water management regimes, and available resources (manpower and funding). Examples of management activities include facilities maintenance (e.g., levees, water control structures, roads, fire breaks, fences, gates, boundary signs), vegetation management (e.g., herbicide application, prescribed fire, grazing, mowing and disking, irrigation), biological surveys, habitat restoration, research, visitor service monitoring and facilities maintenance, and law enforcement issues (Butte Sink, Willow Creek-Lurline, and North Central Valley WMAs Final CCP and EA, 2020).

For more information about Steve Thompson North Central Valley WMA, see the WMA's CCP.

Federally-Listed, Proposed, and Candidate Species and Habitats Proposed for Treatment on the WMA

Species	Federal Status	Rivers, streams, creeks (Riparian)	Seasonal (freshwater) Greater than 8 hectares Managed Wetlands	Ephemeral, seasonal Less than 8 hectares Wetlands	Disturbed
Yellow-billed cuckoo *Coccyzus americanus* Western DPS	Threatened	Yes	No	No	No
Northwestern pond turtle *Actinemys marmorata*	Proposed Threatened	Yes	Yes	Yes	Yes
Giant garter snake *Thamnophis gigas*	Threatened	No	Yes	No	No
Delta smelt *Hypomesus transpacificus*	Threatened	Yes	No	No	No
Longfin Smelt *Spirinchus thaleichthys* San Francisco Bay-Delta DPS	Endangered	Yes	No	No	No
Monarch butterfly *Danaus plexippus*	Proposed Threatened	Yes	No	No	No
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	Threatened	Yes	No	No	No

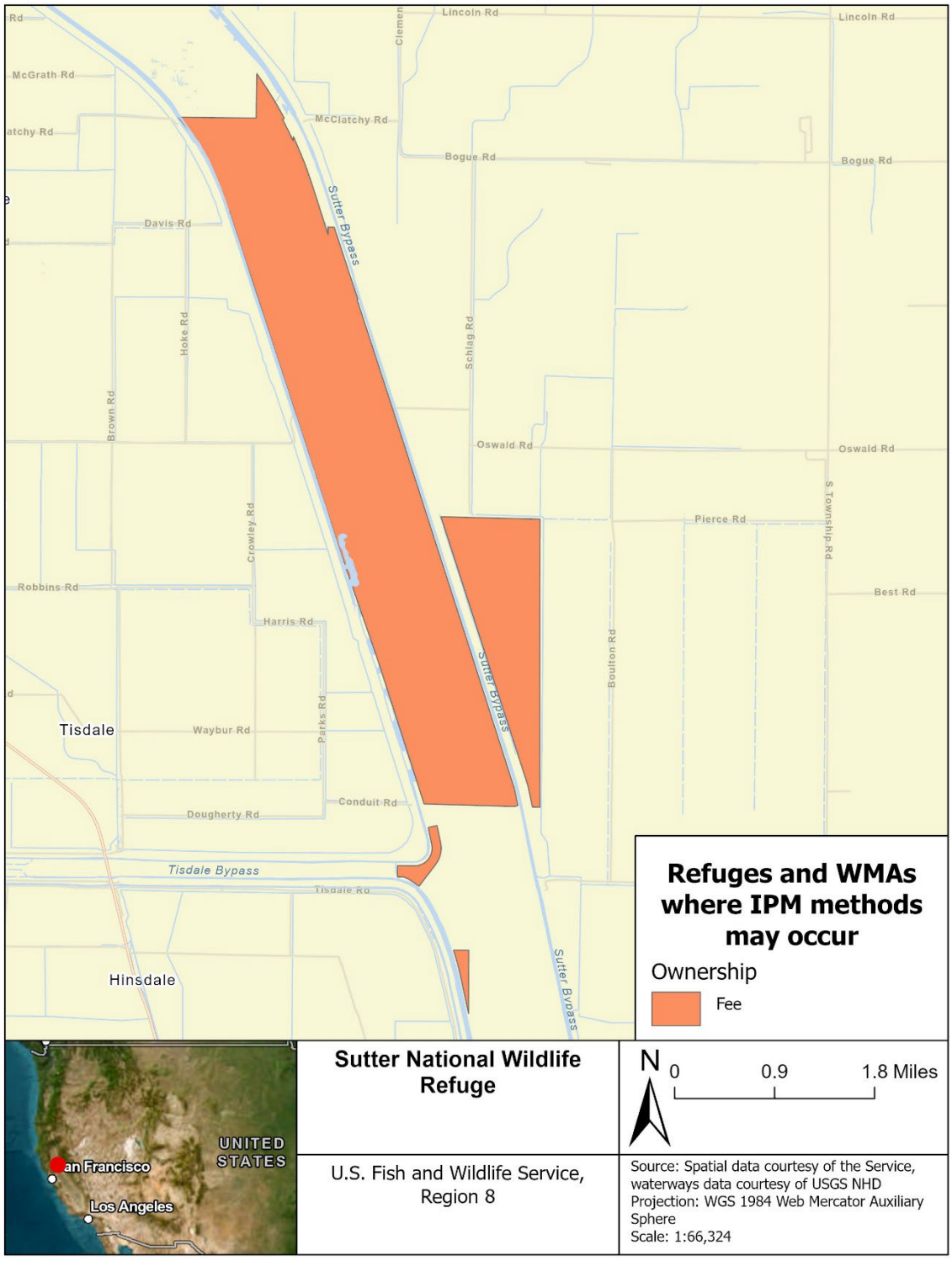
DPS: Distinct population segment

State-Listed Species and Habitats Proposed for Treatment on the WMA

Species	State Status	Rivers, streams, creeks (Riparian)	Seasonal (freshwater) Greater than 8 hectares Managed Wetlands	Ephemeral, seasonal Less than 8 hectares Wetlands	Disturbed
Swainson's hawk *Buteo swainsoni*	Threatened	Yes	No	No	No
Willow flycatcher *Empidonax traillii*	Endangered	Yes	No	No	No
Greater sandhill crane *Grus canadensis tabida*	Threatened	No	Yes	Yes	No
Bald eagle *Haliaeetus leucecophalus*	Endangered	Yes	Yes	Yes	No

Sutter National Wildlife Refuge

Summary for Environmental Assessment



Refuge Background, Purposes, and Goals

Sutter National Wildlife Refuge (NWR) contains a variety of habitats, including seasonal and summer wetlands, unmanaged wetlands, grasslands, and riparian habitat. The current Refuge is approximately 2,590 acres, which are all fee-title acres.

Sutter NWR was established in 1944 with funds made available by the Migratory Bird Hunting and Conservation Stamp Act. Funds provided for by the Lea Act were used to acquire more land within the Refuge.

The Sutter 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).
>
> *"... suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ..."* 16 U.S.C. 460k-1 *"... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ..."* 16 U.S.C. 460k-2 (Refuge Recreation Act of 1962), 16 U.S.C. 460k-460k-4, as amended).
>
> *"... 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 Sutter NWR include:

> *"Conserve, manage, restore, and enhance habitats and associated plant and wildlife species, with an emphasis on supporting an abundance and natural diversity of wintering and migrating waterfowl, shorebirds, birds of prey, and songbirds."*
>
> *"Conserve, manage, restore, and enhance threatened and endangered species and their habitats including vernal pool plants and invertebrates, and giant garter snakes."*
>
> *"Provide visitors of all ages and abilities with quality wildlife-dependent recreation (hunting, wildlife observation, photography, environmental education, and interpretation), and volunteer opportunities to enhance public appreciation, understanding, and enjoyment of fish, wildlife, habitats, and cultural resources."*
>
> *"Promote partnerships to preserve, restore, and enhance a diverse, healthy, and productive ecosystem in which the Refuges play a key role."*
>
> *"Adequately protect and maintain all natural and cultural resources, staff and visitors, equipment, facilities, and other property on the Refuges."*

Note that the U.S. Fish and Wildlife Service (Service) is not providing all purposes/goals and is only including those here that are relevant to this project.

Priority resources of concern at Sutter NWR are (in order of priority):

- Managed wetlands
- Vernal pool and alkali meadow complexes
- Riparian areas
- Grasslands (Priority Resources of Concern and Conservation Summary of Managed Wetlands at Sacramento NWR Complex, 2020).

The Sacramento Valley is an extensive agricultural area that has historically been a major wintering area for millions of ducks and geese. Lands surrounding Sutter NWR are mostly irrigated rice lands with some dairy and crop production. Sutter NWR represents a small portion of the vast seasonal wetlands and grasslands that once existed in the Sacramento Valley. Natural habitat was replaced with crops during the late 1800s and early 1900s, and waterfowl substituted some of these farm crops for their original wetland foods (Sacramento, Delevan, Colusa, and Sutter NWRs Final Comprehensive Conservation Plan [CCP] and Environmental Assessment [EA], 2009).

Sutter NWR was established to provide sanctuary for migratory birds and alleviate crop depredation. Today, depredation problems have decreased due in part to reduced numbers of waterfowl, changes in agricultural practices, and increases in wetland quality and quantity. Sutter NWR is in the Suter Basin between the Sacramento and Feather rivers. Historically, these rivers and Butte Creek flooded the Sutter Basin in the winter and spring. In the 1920s, the Sutter Bypass levees were constructed to channel these floodwaters. Much of the Refuge is within the northern portion of the Bypass. When floodwaters flow in the Bypass, the Refuge can be under at least 10 feet of water (Sacramento, Delevan, Colusa, and Sutter NWRs Final CCP and EA, 2009).

Refuge management is determined, guided, and tracked by an annual habitat management planning process. The annual Habitat Management Plan identifies individual management units within the Refuge. The Habitat Management Plan identifies habitat objectives, specifies management activities to make any necessary repairs or improvements, and notes species management considerations (such as the presence of special status species or other significant wildlife use) for each unit. It also prioritizes management activities and projects based on the overall condition and functionality of the unit, water management regimes, and available resources (manpower and funding). Examples of management activities include facilities maintenance (levees, water control structures, roads, fire breaks, fences, boundary signs, etc.), vegetation management (herbicide application, prescribed fire, grazing, mowing and disking, irrigation, etc.), biological surveys, habitat restoration, research, public use monitoring and facilities maintenance, and law enforcement issues (Sacramento, Delevan, Colusa, and Sutter NWRs Final CCP and EA, 2009).

For more information about Sutter NWR, see the Refuge's CCP.

Federally-Listed, Proposed, and Candidate Species and Habitats Proposed for Treatment on the Refuge

Species	**Federal Status**	**Rivers, streams, creeks (Riparian)**	**Perennial, open water (freshwater) Greater than 8 hectares Wetlands**	**Seasonal (freshwater) Greater than 8 hectares Managed Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Disturbed**
Yellow-billed cuckoo *Coccyzus americanus* Western DPS	Threatened	Yes	No	No	No	No
Northwestern pond turtle *Actinemys marmorata*	Proposed Threatened	Yes	Yes	Yes	Yes	Yes
Giant garter snake *Thamnophis gigas*	Threatened	No	Yes	Yes	No	No
Western spadefoot *Spea hammondii*	Proposed Threatened	Yes	No	Yes	Yes	No
Green sturgeon *Acipenser medirostris* Southern DPS	Threatened	Yes	No	No	No	No
Steelhead *Oncorhynchus mykiss* California Central Valley DPS	Threatened	Yes	No	No	No	No
Chinook salmon *Oncorhynchus tshawytscha* Central Valley spring-run ESU	Threatened	Yes	No	No	No	No
Chinook salmon *Oncorhynchus tshawytscha* Sacramento River ESU (winter run)	Endangered	Yes	No	No	No	No
Monarch butterfly *Danaus plexippus*	Proposed Threatened	Yes	No	No	No	No
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	Threatened	Yes	No	No	No	No

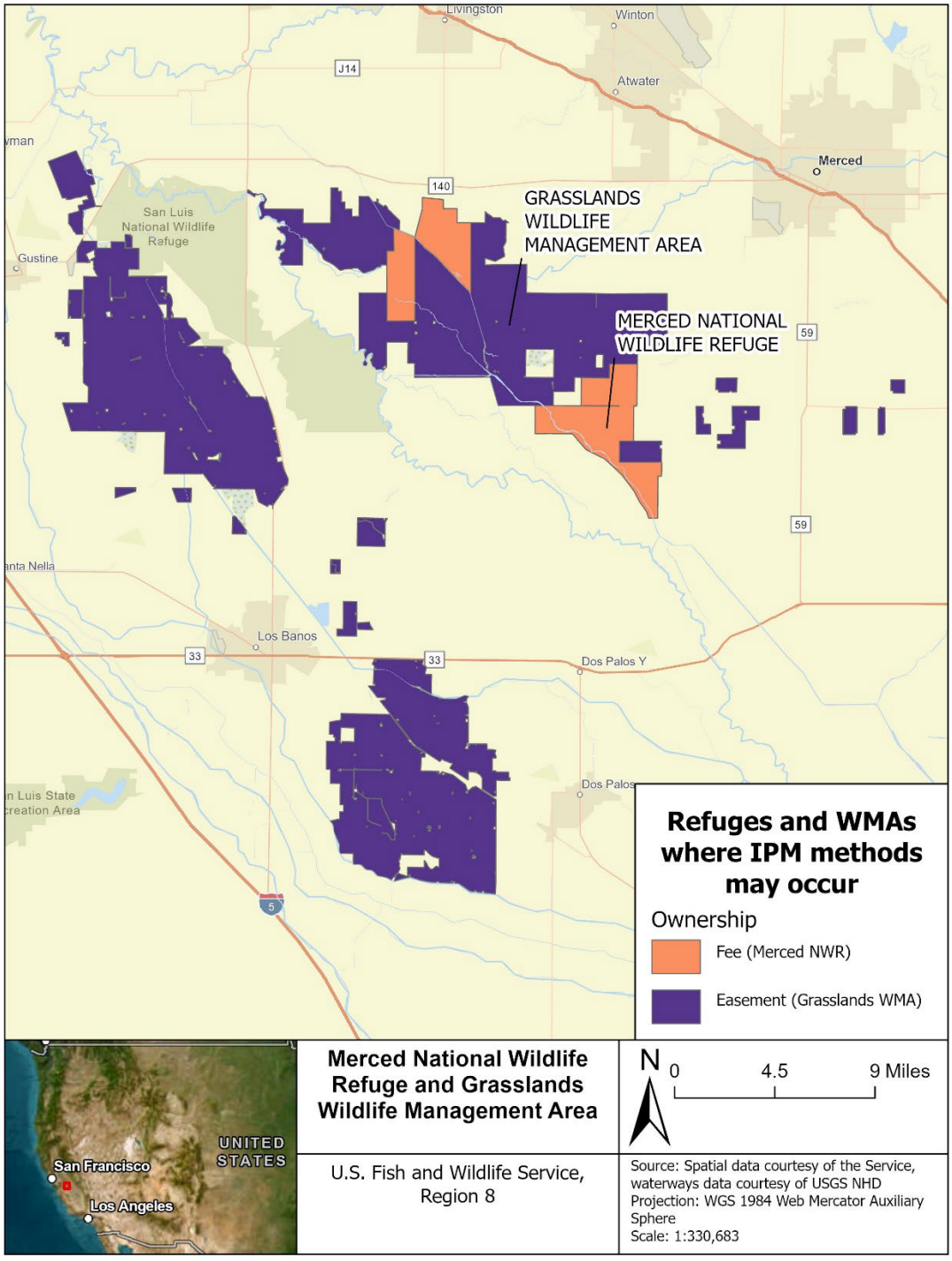
DPS: Distinct population segment, ESU: Evolutionarily significant unit

State-Listed Species and Habitats Proposed for Treatment on the Refuge

Species	**State Status**	**Rivers, streams, creeks (Riparian)**	**Perennial, open water (freshwater) Greater than 8 hectares Wetlands**	**Seasonal (freshwater) Greater than 8 hectares Managed Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Disturbed**
Swainson's hawk *Buteo swainsoni*	Threatened	Yes	No	No	No	No
Willow flycatcher *Empidonax traillii*	Endangered	Yes	No	No	No	No
Greater sandhill crane *Grus canadensis tabida*	Threatened	No	Yes	Yes	Yes	No
Bald eagle *Haliaeetus leucecophalus*	Endangered	Yes	Yes	Yes	Yes	No

Merced National Wildlife Refuge and Grasslands Wildlife Management Area

Summary for Environmental Assessment



Refuge and Wildlife Management Area Background, Purposes, and Goals

Merced National Wildlife Refuge (NWR) contains wetland, riparian, grassland, and cropland habitat. The current Refuge is approximately 10,329 acres, which are all fee-title acres. Grasslands Wildlife Management Area (WMA) contains wetland, riparian, grassland, cropland, and other upland habitats and is approximately 80,027 easement acres. There are also some fee-title acres of Grasslands WMA that are managed under Merced NWR.

Merced NWR was established in 1951 to provide natural feeding grounds for waterfowl and thereby reduce their depredations upon farmers' crops, to provide a refuge for migratory waterfowl on the Pacific Flyway, and to provide public waterfowl hunting opportunities. Grasslands WMA was established in 1979 through perpetual conservation easements on private landowners' lands.

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

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

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 USC Sec 715d (Migratory Bird Conservation Act)
>
> *"… 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 USC Sec 3901(b), 100 Stat. 3583 (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 USC Sec 1534 (Endangered Species Act of 1973)

Goals of 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 and 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, enhance and restore natural ecological processes to promote healthy, functioning ecosystems for wildlife on Complex lands by developing strong relationships 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."

Goals of Grasslands WMA include:

> *"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."*

Note that the U.S. Fish and Wildlife Service (Service) is not providing all purposes/goals and is only including those here that are relevant to this project.

Priority resources of concern at Merced NWR and Grasslands WMA are (in order of priority):

- Vernal pool ecosystems (Merced NWR and Grasslands WMA)
- Wetland ecosystems (Merced NWR and Grasslands WMA)
- Riparian and floodplain ecosystems (Merced NWR)
- Upland ecosystems (Merced NWR and Grasslands WMA) (Conservation Summary of Priority Resources of Concern and the Riparian and Floodplain Ecosystems at San Luis NWR Complex, 2021).

Historically, the Central Valley contained vast grasslands that graded up the sides of the foothills of the surrounding mountains and provided rich foraging or breeding habitat for grazers, seed predators, and grassland-dependent birds. Woodlands meandered across these grasslands in belts varying from half a mile to six miles wide across rivers. Extensive marshes were a dominant feature along the water courses of the valley. These wetlands hosted one of the largest concentrations of wintering waterfowl in the world. During the last 150 years, the natural resources of the Central Valley have been severely altered with the increase in cultivation, ranching, urban centers and industry. These changes significantly altered or reduced a majority of the valley's native habitats and ecological processes. Former native grasslands are now composed of "weedy," non-native annual grasses, and large herbivores are no longer present on the landscape. Much of the riparian forest along river corridors has been eliminated. Wildfire suppression efforts and changing land use have reduced fire as a natural process within much of the Central Valley. Both water demands and flood control activities for urban centers and agriculture have drastically transformed the natural hydrology. As a result, these changes have destroyed or modified over 95 percent of the historic wetlands in California (San Luis NWR Complex Final Comprehensive Conservation Plan [CCP] and Environmental Assessment [EA], 2024).

The Refuge and WMA are actively managing upland and wetland habitats, as well as restoring the riparian floodplain, for the benefit of endangered species, migratory birds, and resident wildlife species. This includes water management for wetlands. Management of upland habitats includes cattle and sheep grazing by cooperators, planting and seeding native plant species, prescribed burning, invasive weed control, and custom farming by cooperators. Riparian forest management includes herbicide application, wildfire suppression, restoration planting, and excluding grazing. Other general management includes invasive plant management, monitoring, fire management, easement management, wildlife management and monitoring, and research studies (San Luis NWR Complex Final CCP and EA, 2024).

For more information about Merced NWR and Grasslands WMA, see the Refuge's and WMA's CCP.

Federally-Listed, Proposed, and Candidate Species and Habitats Proposed for Treatment on the Refuge and WMA

Species	**Federal Status**	**Rivers, streams, creeks (Riparian)**	**Perennial, open water (freshwater) Greater than 8 hectares Wetlands**	**Seasonal (freshwater) Greater than 8 hectares Managed Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Disturbed**
Western snowy plover *Charadrius nivosus nivosus* Pacific Coast Population DPS	Threatened	No	Yes	No	No	No
Yellow-billed cuckoo *Coccyzus americanus* Western DPS	Threatened	Yes	No	No	No	No
Southwestern Willow Flycatcher *Empidonax traillii extimus*	Endangered	Yes	No	No	No	No
Least Bell's vireo *Vireo bellii pusillus*	Endangered	Yes	No	No	No	No
Northwestern pond turtle *Actinemys marmorata*	Proposed Threatened	Yes	Yes	Yes	Yes	Yes
Giant garter snake *Thamnophis gigas*	Threatened	No	Yes	Yes	No	No
California red-legged frog *Rana draytonii*	Threatened	Yes	Yes	Yes	Yes	No
Western spadefoot *Spea hammondii*	Proposed Threatened	Yes	No	Yes	No	No
Steelhead *Oncorhynchus mykiss* California Central Valley DPS	Threatened	Yes	No	No	No	No
Chinook salmon *Oncorhynchus tshawytscha* Central Valley spring-run ESU	Threatened	Yes	No	No	No	No
Monarch butterfly *Danaus plexippus*	Proposed Threatened	Yes	No	No	No	No

Species	Federal Status	Rivers, streams, creeks (Riparian)	Perennial, open water (freshwater) Greater than 8 hectares Managed Wetlands	Seasonal (freshwater) Greater than 8 hectares Managed Wetlands	Ephemeral, seasonal Less than 8 hectares Wetlands	Disturbed
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	Threatened	Yes	No	Yes	Yes	No

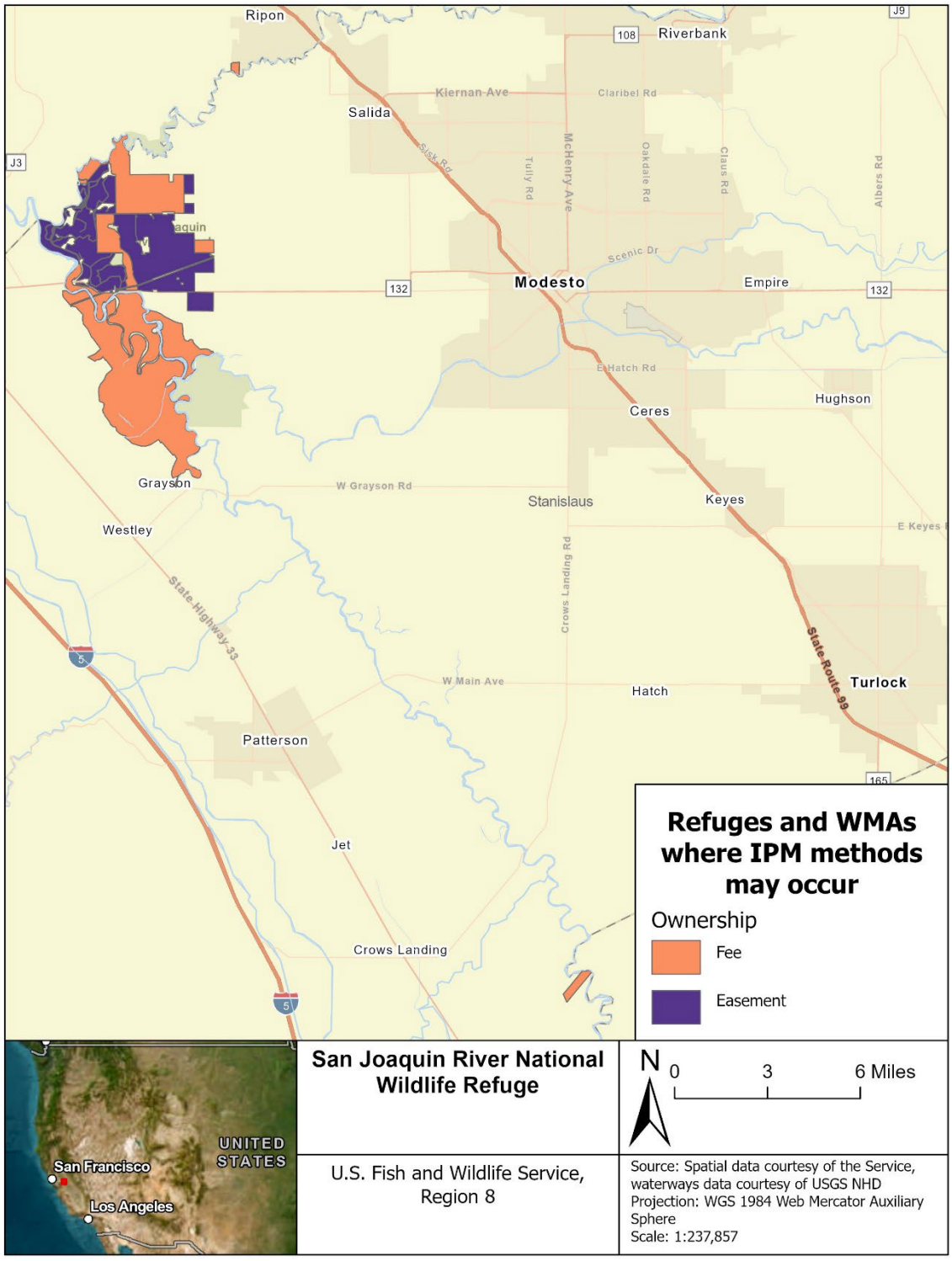
DPS: Distinct population segment, ESU: Evolutionarily significant unit

State-Listed Species and Habitats Proposed for Treatment on the Refuge and WMA

Species	State Status	Rivers, streams, creeks (Riparian)	Perennial, open water (freshwater) Greater than 8 hectares Managed Wetlands	Seasonal (freshwater) Greater than 8 hectares Managed Wetlands	Ephemeral, seasonal Less than 8 hectares Wetlands	Disturbed
Tricolored blackbird *Agelaius tricolor*	Threatened	No	Yes	Yes	Yes	No
Swainson's hawk *Buteo swainsoni*	Threatened	Yes	No	No	No	No
Willow flycatcher *Empidonax traillii*	Endangered	Yes	No	No	No	No
Greater sandhill crane *Grus canadensis tabida*	Threatened	No	Yes	Yes	Yes	No
Bald eagle *Haliaeetus leucecophalus*	Endangered	Yes	Yes	Yes	No	No
Bank swallow *Riparia riparia*	Threatened	Yes	No	No	No	No
Delta button celery *Eryngium racemosum*	Endangered	Yes	Yes	Yes	Yes	No

San Joaquin River National Wildlife Refuge

Summary for Environmental Assessment



Refuge Background, Purposes, and Goals

San Joaquin River National Wildlife Refuge (NWR) contains a variety of habitats including great valley oak riparian, black willow riparian forest, permanent wetland, semipermanent wetlands, seasonal wetland, vernal pool, tilled cropland, irrigated pasture, and native grassland. The current Refuge is approximately 11,793 acres, with 7,420 fee-title acres and 4,239 easement acres.

San Joaquin River NWR was established in 1987 under the authority of the Endangered Species Act of 1973, Migratory Bird Conservation Act of 1929, and the Fish and Wildlife Act of 1956.

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

> *"To conserve fish or wildlife which are listed as endangered species or threatened species or plants..."* 16 U.S.C. § 1534 (Endangered Species Act 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)
>
> *"...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 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."*

Note that the U.S. Fish and Wildlife Service (Service) is not providing all purposes/goals and is only including those here that are relevant to this project.

Priority resources of concern at San Joaquin River NWR are (in order of priority):

- Vernal pool ecosystems
- Wetland ecosystems
- Riparian and floodplain ecosystems
- Upland ecosystems (Conservation Summary of Priority Resources of Concern and the Riparian and Floodplain Ecosystems at San Luis NWR Complex, 2021).

Refuge lands were historically a mosaic of riverine channels, broad riparian floodplains, wetlands, and grassland savannas dominated by valley oaks. This area was bisected by the main stem of the San

Joaquin River and was bounded to the north by the Stanislaus River and to the south by the Tuolumne River. Historically, the San Joaquin River and its tributaries would overtop natural levees and inundate the floodplain following winter rains and Sierra snow melt. This system was dynamic, depositing rich alluvium, creating and cutting streambanks, creating and maintaining riparian forests, creating oxbow lakes and backwater sloughs by changing the rivers' course, clearing and depositing debris, scouring streambeds, and exposing and depositing gravel and sand. European expansion to the area created the need for lumber and farmland, and riparian forests were cut down and wetlands drained. Flood control levels were constructed along the river's course to narrow the floodplain in the 1940s and 1950s. The San Joaquin Valley landscape today is dominated by agriculture and is now one of the most intensely farmed regions in North America. The Refuge area was drastically altered, but to a lesser extent than most of the lands along the San Joaquin River (San Joaquin River National Wildlife Refuge Final Comprehensive Conservation Plan (CCP), 2006).

The Refuge is actively managing upland and wetland habitats, as well as restoring the riparian floodplain, for the benefit of endangered species and migratory birds. This includes water management for wetlands. Management of upland habitats includes cattle and sheep grazing by cooperators, sharecropping and custom farming, invasive weed control, prescribed burning and floodplain riparian restoration by staff, cooperators and contractors. Other management includes wetland and riparian habitat restoration, wildlife management and monitoring (including avian disease control, Aleutian Canada goose monitoring, riparian brush rabbit reintroduction, and other migratory bird monitoring), and fire management.

For more information about San Joaquin River NWR, see the Refuge's CCP.

Federally-Listed, Proposed, and Candidate Species and Habitats Proposed for Treatment on the Refuge

Species	**Federal Status**	**Rivers, streams, creeks (Riparian)**	**Perennial, open water (freshwater) Greater than 8 hectares Wetlands**	**Seasonal (freshwater) Greater than 8 hectares Managed Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Disturbed**
Riparian woodrat *Neotoma fuscipes riparia*	Endangered	Yes	No	No	No	No
Riparian brush rabbit *Sylvilagus bachmani riparius*	Endangered	Yes	No	No	No	No
Yellow-billed cuckoo *Coccyzus americanus* Western DPS	Threatened	Yes	No	No	No	No
Southwestern Willow Flycatcher *Empidonax traillii extimus*	Endangered	Yes	No	No	No	No
Least Bell's vireo *Vireo bellii pusillus*	Endangered	Yes	No	No	No	No
Northwestern pond turtle *Actinemys marmorata*	Proposed Threatened	Yes	Yes	Yes	Yes	Yes
Giant garter snake *Thamnophis gigas*	Threatened	No	No	Yes	No	No
California red-legged frog *Rana draytonii*	Threatened	Yes	No	Yes	Yes	No
Western spadefoot *Spea hammondii*	Proposed Threatened	Yes	No	Yes	No	No
Green sturgeon *Acipenser medirostris* Southern DPS	Threatened	Yes	No	No	No	No
Longfin Smelt *Spirinchus thaleichthys* San Francisco Bay-Delta DPS	Endangered	Yes	No	No	No	No
Steelhead	Threatened	Yes	No	No	No	No

Species	Federal Status	Rivers, streams, creeks (Riparian)	Perennial, open water (freshwater) Greater than 8 hectares Managed Wetlands	Seasonal (freshwater) Greater than 8 hectares Managed Wetlands	Ephemeral, seasonal Less than 8 hectares Wetlands	Disturbed
Oncorhynchus mykiss California Central Valley DPS						
Chinook salmon *Oncorhynchus tshawytscha* Central Valley spring-run ESU	Threatened	Yes	No	No	No	No
Monarch butterfly *Danaus plexippus*	Proposed Threatened	Yes	No	No	No	No
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	Threatened	Yes	No	No	No	No

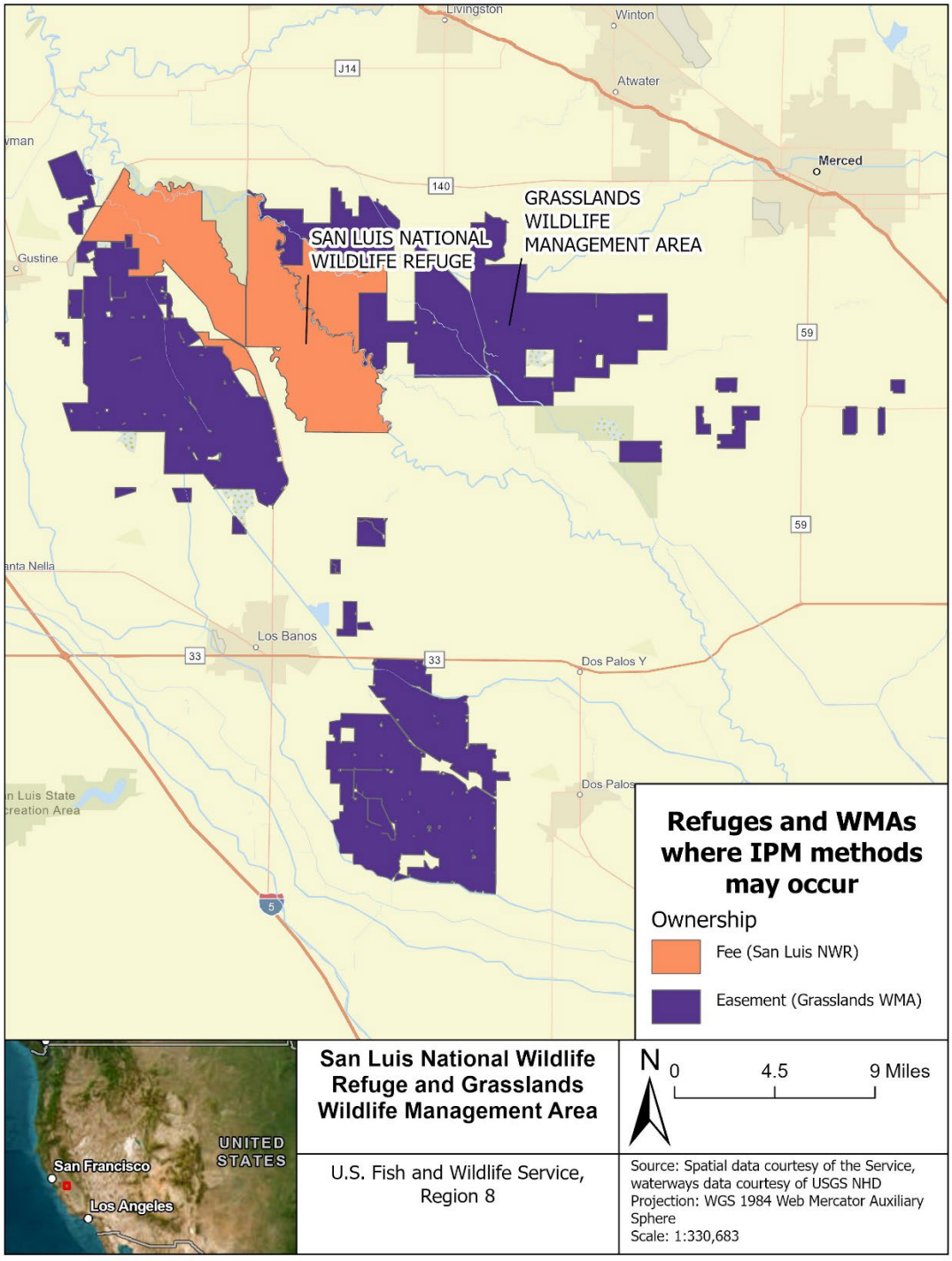
DPS: Distinct population segment, ESU: Evolutionarily significant unit

State-Listed Species and Habitats Proposed for Treatment on the Refuge

Species	State Status	Rivers, streams, creeks (Riparian)	Perennial, open water (freshwater) Greater than 8 hectares Managed Wetlands	Seasonal (freshwater) Greater than 8 hectares Managed Wetlands	Ephemeral, seasonal Less than 8 hectares Wetlands	Disturbed
Swainson's hawk *Buteo swainsoni*	Threatened	Yes	No	No	No	No
Willow flycatcher *Empidonax traillii*	Endangered	Yes	No	No	No	No
Greater sandhill crane *Grus canadensis tabida*	Threatened	No	Yes	Yes	Yes	No
Bald eagle *Haliaeetus leucecophalus*	Endangered	Yes	Yes	Yes	No	No
Bank swallow *Riparia riparia*	Threatened	Yes	No	No	No	No

San Luis National Wildlife Refuge and Grasslands Wildlife Management Area

Summary for Environmental Assessment



Refuge and Wildlife Management Area Background, Purposes, and Goals

San Luis National Wildlife Refuge (NWR) contains wetland, riparian, and grassland habitat. The current Refuge is approximately 26,410 acres, which are all fee-title acres. Grasslands Wildlife Management Area (WMA) contains wetland, riparian, grassland, cropland, and other upland habitats and is approximately 80,027 easement acres. There are also some fee-title acres of Grasslands WMA that are managed under San Luis NWR.

San Luis NWR was established in 1967 to provide habitat for migratory birds and is currently the largest contiguous NWR in California's Central Valley. Grasslands WMA was established in 1979 through perpetual conservation easements on private landowners' lands.

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 USC Sec 715d (Migratory Bird Conservation Act)
>
> *"…shall be administered by [the 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 USC Sec 664 (Fish and Wildlife Coordination Act)

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 USC Sec 715d (Migratory Bird Conservation Act)
>
> *"… 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 USC Sec 3901(b), 100 Stat. 3583 (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 USC Sec 1534 (Endangered Species Act of 1973)

Goals of 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 and 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, enhance and restore natural ecological processes to promote healthy, functioning ecosystems for wildlife on Complex lands by developing strong relationships 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."*

Goals of Grasslands WMA include:

> *"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."*

Note that the U.S. Fish and Wildlife Service (Service) is not providing all purposes/goals and is only including those here that are relevant to this project.

Priority resources of concern at San Luis NWR and Grasslands WMA are (in order of priority):

- Vernal pool ecosystems (San Luis NWR and Grasslands WMA)
- Wetland ecosystems (San Luis NWR and Grasslands WMA)
- Riparian and floodplain ecosystems (San Luis NWR)
- Upland ecosystems (San Luis NWR and Grasslands WMA) (Conservation Summary of Priority Resources of Concern and the Riparian and Floodplain Ecosystems at San Luis NWR Complex, 2021).

Historically, the Central Valley contained vast grasslands that graded up the sides of the foothills of the surrounding mountains and provided rich foraging or breeding habitat for grazers, seed predators, and grassland-dependent birds. Woodlands meandered across these grasslands in belts varying from half a mile to six miles wide across rivers. Extensive marshes were a dominant feature along the water courses of the valley. These wetlands hosted one of the largest concentrations of wintering waterfowl in the world. During the last 150 years, the natural resources of the Central Valley have been severely altered with the increase in cultivation, ranching, urban centers and industry. These changes significantly altered or reduced a majority of the valley's native habitats and ecological processes. Former native grasslands are now composed of "weedy," non-native annual grasses, and large herbivores are no longer present on the landscape. Much of the riparian forest along river corridors has been eliminated. Wildfire suppression efforts and changing land use have reduced fire as a natural process within much of the Central Valley. Both water demands and flood control activities for urban centers and agriculture have drastically transformed the natural hydrology. As a result, these changes have destroyed or modified over 95 percent of the historic wetlands in California (San Luis NWR Complex Final Comprehensive Conservation Plan [CCP] and Environmental Assessment [EA], 2024).

The Refuge and WMA are actively managing upland and wetland habitats, as well as restoring the riparian floodplain, for the benefit of endangered species, migratory birds, and resident wildlife species. This includes water management for wetlands. Management of upland habitats includes cattle and sheep grazing by cooperators, planting and seeding native plant species, prescribed burning, invasive weed control, and custom farming by cooperators. Riparian forest management includes herbicide application, wildfire suppression, restoration planting, and excluding grazing. Other general management includes invasive plant management, monitoring, fire management, easement management, wildlife management and monitoring, and research studies (San Luis NWR Complex Final CCP and EA, 2024).

For more information about San Luis NWR and Grasslands WMA, see the Refuge's and WMA's CCP.

Federally-Listed, Proposed, and Candidate Species and Habitats Proposed for Treatment on the Refuge and WMA

Species	**Federal Status**	**Rivers, streams, creeks (Riparian)**	**Perennial, open water (freshwater) Greater than 8 hectares Wetlands**	**Seasonal (freshwater) Greater than 8 hectares Managed Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Disturbed**
Riparian woodrat *Neotoma fuscipes riparia*	Endangered	Yes	No	No	No	No
Riparian brush rabbit *Sylvilagus bachmani riparius*	Endangered	Yes	No	No	No	No
Western snowy plover *Charadrius nivosus nivosus* Pacific Coast Population DPS	Threatened	No	Yes	No	No	No
Yellow-billed cuckoo *Coccyzus americanus* Western DPS	Threatened	Yes	No	No	No	No
Least Bell's vireo *Vireo bellii pusillus*	Endangered	Yes	No	No	No	No
Northwestern pond turtle *Actinemys marmorata*	Proposed Threatened	Yes	Yes	Yes	Yes	Yes
Giant garter snake *Thamnophis gigas*	Threatened	No	Yes	Yes	No	No
California red-legged frog *Rana draytonii*	Threatened	Yes	Yes	Yes	Yes	No
Western spadefoot *Spea hammondii*	Proposed Threatened	Yes	No	Yes	No	No
Chinook salmon *Oncorhynchus tshawytscha* Central Valley spring-run ESU	Threatened	Yes	No	No	No	No
Monarch butterfly *Danaus plexippus*	Proposed Threatened	Yes	No	No	No	No

Species	Federal Status	Rivers, streams, creeks (Riparian)	Perennial, open water (freshwater) Greater than 8 hectares Managed Wetlands	Seasonal (freshwater) Greater than 8 hectares Managed Wetlands	Ephemeral, seasonal Less than 8 hectares Wetlands	Disturbed
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	Threatened	Yes	No	No	No	No

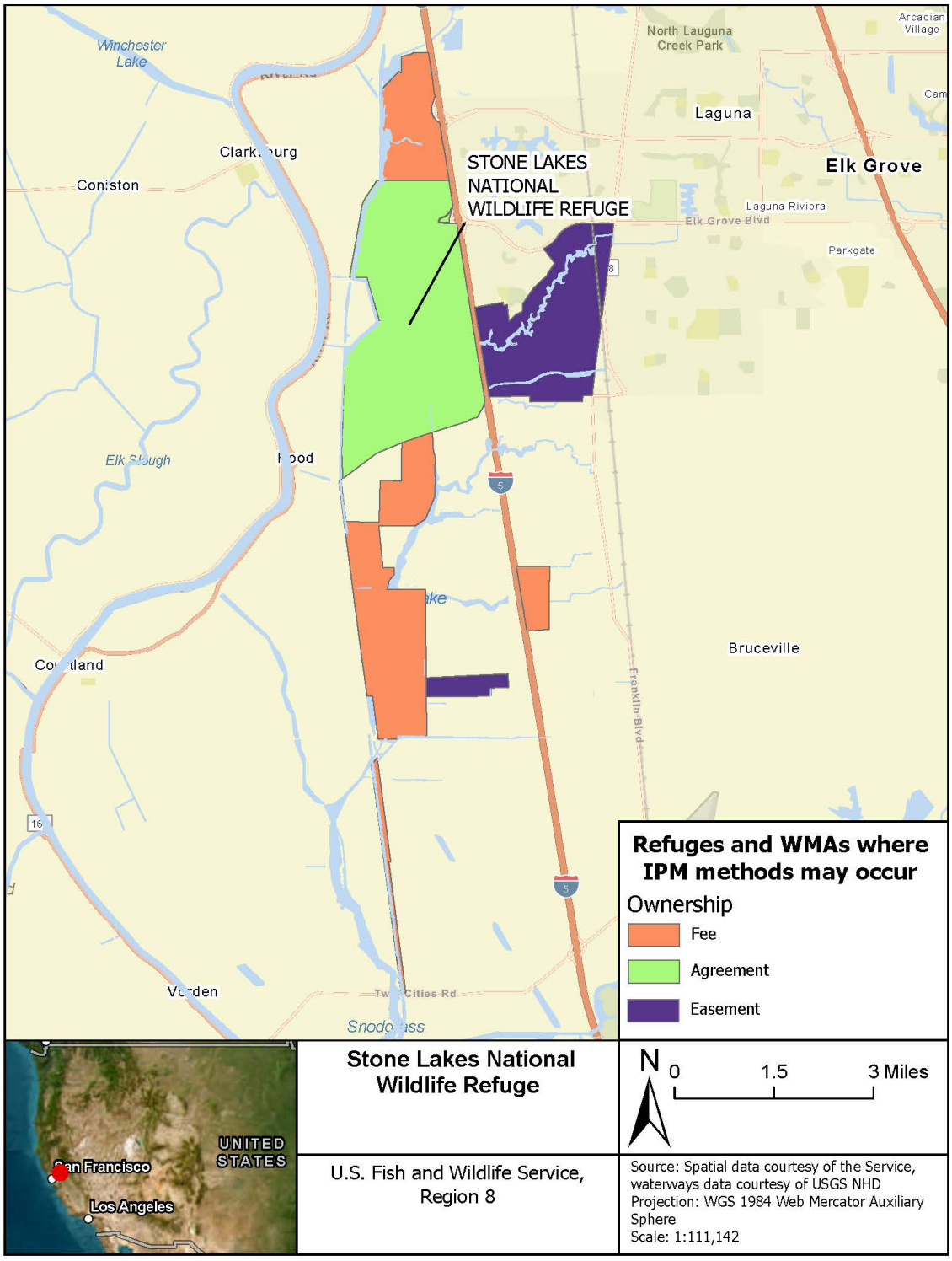
DPS: Distinct population segment, ESU: Evolutionarily significant unit

State-Listed Species and Habitats Proposed for Treatment on the Refuge and WMA

Species	State Status	Rivers, streams, creeks (Riparian)	Perennial, open water (freshwater) Wetlands	Seasonal (freshwater) > 8 ha Managed Wetlands	Ephemeral, seasonal <8 ha Wetlands	Disturbed
Tricolored blackbird *Agelaius tricolor*	Threatened	No	Yes	Yes	Yes	No
Swainson's hawk *Buteo swainsoni*	Threatened	Yes	No	No	No	No
Willow flycatcher *Empidonax traillii*	Endangered	Yes	No	No	No	No
Greater sandhill crane *Grus canadensis tabida*	Threatened	No	Yes	Yes	Yes	No
Bald eagle *Haliaeetus leucecophalus*	Endangered	Yes	Yes	Yes	No	No
Bank swallow *Riparia riparia*	Threatened	Yes	No	No	No	No
Delta button celery *Eryngium racemosum*	Endangered	Yes	Yes	Yes	Yes	No

Stone Lakes National Wildlife Refuge

Summary for Environmental Assessment



Refuge Background, Purposes, and Goals

Stone Lakes National Wildlife Refuge (NWR) contains a variety of ecosystems, including grassland communities, vernal pools, riparian forest, valley oak woodland, as well as perennial and seasonal wetlands. The current Refuge is approximately 6,684 acres, with 2,233 fee-title acres, 2,917 agreement acres, and 1,534 easement acres.

Stone Lakes NWR was established under the authority of the Emergency Wetlands Resources Act of 1986, the Fish and Wildlife Act of 1956, the Migratory Bird Conservation Act of 1929, and the Endangered Species Act of 1973.

The Stone Lakes NWR **purposes**, as stated in the law, are:

> *"... for 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)
>
> *"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..."* 16 U.S.C. § 742f(a)(4) (Fish and Wildlife Act of 1956)
>
> *"... 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)
>
> *"... 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)
>
> *"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..."* 16 U.S.C. § 1534 (Endangered Species Act of 1973)

Goals of Stone Lakes NWR include:

> *"Conserve, enhance, restore and manage Central Valley wetland, riparian, grassland and other native habitats to benefit their associated fish, wildlife, plants and special status species."*
>
> *"Conserve, enhance, and restore high quality migrating, wintering and breeding habitat for migratory birds within the Sacramento San Joaquin Delta of the Central Valley."*

Note that the U.S. Fish and Wildlife Service (Service) is not providing all purposes/goals and is only including those here that are relevant to this project.

Priority resources of concern at Stone Lakes NWR are (in order of priority):

- Wetland ecosystem
- Grasslands and vernal pools
- Riparian forest and valley oak woodland (Conservation Summary of Priority Resources of Concern and the Wetland Ecosystem at Stone Lakes NWR, 2022).

Prior to large scale disturbances in the Central Valley of California, natural processes dominated the four million acres of wetland with associated grasslands and riparian areas. Periodic floods and regular fires were drivers of ecosystem change within this region. However, over time, wetlands were reduced due to flood control, water conveyance, and agricultural conversion; over 95 percent of the riparian habitat in the Central Valley has been destroyed due to agricultural expansion and urbanization. Most of the open water, wetland, and riparian areas present on the Refuge in 1910 have since been drained and converted to agricultural uses (Stone Lakes NWR Comprehensive Conservation Plan (CCP), 2007).

The primary management focus of the Refuge is enhancing, restoring and maintaining wetlands, riparian woodlands, grasslands, and valuable agricultural lands. This includes water management, habitat manipulations, and mosquito control for wetlands. Restoration, such as planting, irrigation, and weeding of riparian trees helps enhance riparian woodlands. Grasslands management focuses on maintaining and expanding existing native grasses and sedges, minimizing fire hazard posed by accumulated dead grasses, controlling the spread of noxious weeds, and providing habitats for grassland-dependent species. The grazing program is being developed to protect and enhance seasonal wetlands. Other management includes weed control, implementing a farming program, and conducting monitoring and surveys (Stone Lakes NWR CCP, 2007).

For more information about Stone Lakes NWR, see the Refuge's CCP.

Federally-Listed, Proposed, and Candidate Species and Habitats Proposed for Treatment on the Refuge

Species	**Federal Status**	**Rivers, streams, creeks (Riparian)**	**Perennial, open water (freshwater) Greater than 8 hectares Wetlands**	**Seasonal (freshwater) Greater than 8 hectares Managed Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Disturbed**
Yellow-billed cuckoo *Coccyzus americanus* Western DPS	Threatened	Yes	No	No	No	No
Northwestern pond turtle *Actinemys marmorata*	Proposed Threatened	Yes	Yes	Yes	Yes	Yes
Giant garter snake *Thamnophis gigas*	Threatened	No	Yes	Yes	No	No
Delta smelt *Hypomesus transpacificus*	Threatened	Yes	No	No	No	No
Western spadefoot *Spea hammondii*	Proposed Threatened	Yes	No	Yes	Yes	No
Steelhead *Oncorhynchus mykiss* California Central Valley DPS	Threatened	Yes	No	No	No	No
Chinook salmon *Oncorhynchus tshawytscha* Central Valley spring-run ESU	Threatened	Yes	No	No	No	No
Monarch butterfly *Danaus plexippus*	Proposed Threatened	Yes	No	No	No	No
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	Threatened	Yes	No	No	No	No

DPS: Distinct population segment, ESU: Evolutionarily significant unit

State-Listed Species and Habitats Proposed for Treatment on the Refuge

Species	**State Status**	**Rivers, streams, creeks (Riparian)**	**Perennial, open water (freshwater) Greater than 8 hectares Wetlands**	**Seasonal (freshwater) Greater than 8 hectares Managed Wetlands**	**Ephemeral, seasonal Less than 8 hectares Wetlands**	**Disturbed**
Swainson's hawk *Buteo swainsoni*	Threatened	Yes	No	No	No	No
Greater sandhill crane *Grus canadensis tabida*	Threatened	No	Yes	Yes	Yes	No

Appendix C: Description of Treatment Types

This appendix aims to provide an overview of all IPM methods proposed in this EA. The Covered Refuges have, in the past, conducted IPM treatments; however, they have not been systematic in their efforts and this EA aims to coordinate these efforts across three complexes: Sacramento NWR Complex, San Luis NWR Complex, and Stone Lakes NWR. The existing IPM treatments in each habitat type are detailed in **Table C-5** below. All methods proposed in the EA could be used in all of the aquatic environments.

Non-Herbicide

These IPM methods include any technique that does not involve herbicide, although some are used in conjunction with herbicides. **Table C-1** provides a summary of the methods by category and identifies whether there are manual or mechanical elements within the category.

Table C-1. Summary of non-herbicide invasive plant methods as part of proposed action.

Non-Herbicide Category	Examples	Manual	Mechanical
Biomass removal (Physical)	cutters, surface excavators, nets, hand removals	Yes	Yes
Growth prevention (Physical)	benthic mats, curtains, tarps, screens	Yes	No
Water treatment (Cultural)	Water level decreases	Yes	No

Biomass Removal

Biomass removal, a physical removal method, includes both mechanical and manual removal of some or all of aquatic invasive plants. Removal methods include cutting or pulling vegetation, as well as excavating. These techniques could be used to remove emergent (floating or rooted) or submergent green growth or roots and are timed to prevent invasive species flowering and seeding. Although the roots may not be completely removed during the implementation of these techniques, these methods reduce biomass and reproductive plant parts and can interrupt the plant's ability to photosynthesize by continually removing as much material as possible. Larger mechanical equipment in aquatic systems includes surface excavators. Surface excavators are used in select locations to remove floating aquatic vegetation. Collection of trimmed vegetation could also occur by hand nets or by the installation of booms, screens (water permeable), or curtains (non-permeable).

Growth Prevention

Growth prevention, which is a physical method, involves shading or solarizing, including the use of staked benthic mats and tarping, to prevent photosynthesis. Benthic mats are denser than water but allow gases to pass through. These techniques aim to alter growing conditions, making conditions unfavorable for invasive seed germination and further green growth. This is typically achieved by either decreasing the availability of oxygen and sunlight to seeds and plants (e.g., shading) or by increasing the intensity of sunlight to harmful levels (e.g., solarizing). Additionally, curtains and screens may be used to help prevent the spread of invasive plants or fragments. Curtains can be used independently as well to contain living plants within a particular location.

Water Treatment

Water treatments, including water level manipulation, is a cultural method of control to decrease water availability for invasive plants and easier access for crews to conduct biomass removal efforts. This method will not be utilized in all aquatic environments, and will be focused in anthropogenically influenced wetland areas, such as managed wetlands and canals.

Herbicide

Application Methods

The following herbicide application methods could be used alone, in conjunction with each other, or in conjunction with non-herbicide methods. **Table C-2** provides a summary of the herbicide methods by category and identifies whether there are manual or mechanical elements within the category**. Tables C-3** and **C-4** provide examples of herbicides that may be used during the proposed action and their proposed uses.

Table C-2. Summary of herbicide application types included as part of proposed action.

Herbicide Application Category	Manual	Mechanical
Broadcast Aerial (Airplane or Helicopter)	No	Yes
Broadcast Aerial (Drone)	No	Yes
Broadcast Ground (ATV, Truck, or Tractor)	No	Yes
Broadcast Water (Boat Boom)	No	Yes
Deep Water (Pellets or Granules)	Yes	Yes
Ground Wet (Wicking)	Yes	Yes
Spot Foliar and Spot Water (ATV or Boat Hand Wand or Backpack)	Yes	Yes

Broadcast Aerial (Airplane or Helicopter)

Herbicide application using sprayers attached to airplanes or helicopters. Utilized for broad treatments of large areas and areas that cannot be as easily accessed by ground vehicles.

Broadcast Aerial (Drone)

Herbicide application using sprayers attached to drones. Utilized for broad treatments of large areas and areas that cannot be as easily accessed by ground vehicles.

Broadcast Ground (ATV, Truck, or Tractor)

Herbicide application using motorized sprayers from vehicles. Used for blanket treatments of larger areas.

Broadcast Water (Boat Boom)

Aquatic broadcast herbicide application using motorized sprayers from boats (e.g., boom sprayer). Used for blanket treatments of larger areas.

Deep Water (Pellets or Granules)

Application of herbicidal pellets or granules require moisture so herbicide can stick to target plants. They are often used with broadcast sprayers for efficient application over larger areas. Easier to handle and require no mixing like liquid fertilizers.

Ground Wet (Wicking)

Herbicide application using herbicide-soaked wick or blade. The wetted apparatus is used to wipe or brush herbicide over targets.

Injection Treatments

Directly injecting herbicide into the stems of woody plants.

Spot Foliar and Spot Water (ATV or Boat Hand Wand or Backpack)

Herbicide application utilizing hand equipment (e.g., boat hand wand or backpack). Applications could target specific plants and avoid others.

Table C-3. Examples of herbicides included as part of proposed action to treat invasive plants.

Analyte Name	Aquatic (freshwater)
2,4-D (acid, amine, and ester)	Yes
diquat dibromide	Yes
florpyrauxifen-benzyl	Yes
flumioxazin	Yes
fluridone	Yes
glyphosate	Yes

Analyte Name	Aquatic (freshwater)
imazamox	Yes
imazapyr	Yes
penoxsulam	Yes
triclopyr	Yes

Table C-4. Examples of herbicides included as part of proposed action to treat invasive plants

Chemical Family	Analyte Name	Aquatic (freshwater) Use
Chlorophenoxy	2,4-D	Broadleaf selective. Labels of amine salt allow aquatic applications of emerged and submerged vegetation
Bipyridylium, dipyridylium	diquat dibromide	Herbicide/algicide to control algae and aquatic weeds, drainage systems. Labeled only for use in non-moving waters with restrictions for waters that access public waterways. Has some limited labeled non-aquatic uses.
Arylpicolinate	florpyrauxifen-benzyl	Slow-moving/quiescent waters with little to no continuous flow (from ponds, to wetlands to river bends).
N-phenylphthalimide	flumioxazin	Labeled uses for slow moving or quiescent waters.
Phenylpyridine	fluridone	Ponds, lakes, irrigation and drainage canals, drinking water systems, rivers. Labeled for freshwater, ponds, lakes, reservoirs, drainage canals and irrigation canals, may not be applied to tidal saltwater sites.
Organophosphorus	glyphosate	Non-selective, systemic, prevents protein formation. Several formulations, most commonly being isopropylamine salt and potassium salt. Many aquatic approved products exist.

Chemical Family	Analyte Name	Aquatic (freshwater) Use
Imidazolinone	imazamox	Labeled for pond, lake, wetland, ditch, canals, streams etc.
Imidazolinone	imazapyr	Rapidly degrade in water and many labels allow aquatic applications to emerged and floating vegetation. Does not control submerged vegetation.
Sulfonamide	penoxsulam	Freshwater and slow-moving aquatic systems including ponds, lakes, reservoirs, marshes, wetlands, and drainage ditches.
Carboxylic acid	triclopyr	Wetlands/aquatic areas. Amine formulations are soluble in water and can degrade quickly in aquatic environments.

Adjuvants

Adjuvant products specifically recommended for use with pesticides in aquatic applications must have aquatic toxicity assessment data generated in accordance with USEPA's Office of Chemical Safety and Pollution Prevention Harmonized Test Guidelines Series 850 - Fish and Invertebrate. Label use rate recommendations must not exceed levels potentially hazardous to aquatic organisms, as determined by the assessment data.

Table C-5. Existing IPM Methods for Each Refuge Complex by Habitat Type[1][2][3]

IPM Method	**Rivers, streams, creeks** Riparian	**Perennial, open water (freshwater) Greater than 8 hectares** Wetlands	**Seasonal (freshwater) Greater than 8 hectares** Managed wetlands	**Ephemeral, seasonal Less than 8 hectares** Wetlands	**Perennial and springs Less than 8 hectares** Wetlands	**Canals, Ditches, and Other Man-Made Bodies of Water**
2,4-D:	SAX	SAX	SAX	SAX	SAX	SAX
diquat dibromide:		SLW				
florpyrauxifen-benzyl:						
flumioxazin:						
fluridone:						
glyphosate:	SAX	SAX; SLW	SAX; SLW	SAX	SAX	SAX; SLX; SLW
imazamox:		SAX; SLW	SAX			
imazapyr:	SAX; SLX	SAX; SLX	SAX; SLX	SAX		
penoxsulam:						
triclopyr:						
Broadcast aerial (e.g., airplane or helicopter):						
Broadcast aerial (e.g., drone):						SAX
Broadcast ground (e.g., ATV, truck, or tractor):	SAX	SAX	SAX; SLX	SAX	SAX	SAX; SLX
Broadcast water (e.g., boat boom):						
Deep water (e.g., pellets or granules):						
Ground wet (e.g., wicking):	SLX	SLX	SLX			SAX; SLX
Spot foliar and spot water (e.g., ATV, boat hand wand, or backpack):	SAX	SAX; SLW	SAX; SLW; SLX	SAX	SAX	SAX; SLX
Biomass Removal (e.g., green trimming, root management)	SAX; SLW; SLX	SAX; SLX	SAX; SLW; SLX	SAX	SAX	SAX; SLX
Growth prevention (e.g., benthic mats, curtains, tarps, screens):			SLX			SAX; SLX
Water treatment (e.g. water level decreases):	SAX	SAX	SAX; SLX	SAX		

[1] Refuge Complex Codes:
SAX = Sacramento NWR Complex
SLW = Stone Lakes NWR
SLX = San Luis NWR Complex
[2] These herbicide products are examples of herbicides that could be used and are not all-inclusive.
[3] Preferred Alternative methods could occur in any of these habitat types in the future.

Appendix D: Scoping Report

Scoping Report

Management of Aquatic Invasive Plants on Sacramento National Wildlife Refuge Complex, San Luis National Wildlife Refuge Complex, and Stone Lakes National Wildlife Refuge

U.S. Department of Interior
Fish and Wildlife Service
Region 8 (Pacific Southwest Region)
Sacramento National Wildlife Refuge Complex
Butte, Colusa, Contra Costa, Glenn, Placer, San Joaquin, Solano, Sutter, Tehama, Yolo, and Yuba Counties, California
San Luis National Wildlife Refuge Complex
Stanislaus, San Joaquin, and Merced Counties, California
Stone Lakes National Wildlife Refuge
Sacramento County, California

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1.0 INTRODUCTION

1.1 Summary of the Proposed Action and Alternatives

The U.S. Fish and Wildlife Service (Service) is proposing management of invasive aquatic plants on the Sacramento National Wildlife Refuge (NWR) Complex, San Luis NWR Complex, and Stone Lakes NWR. The proposed action would involve the implementation of integrated pest management (IPM) methods to manage aquatic invasive plant species on fee-title, easement, and agreement lands, as well as water features within a 0.5-mile radius of the Sacramento NWR Complex, including the Butte Sink Wildlife Management Area (WMA), Colusa NWR, Delevan NWR, Sacramento NWR, Sacramento River NWR, Steve Thompson Central Valley WMA, and Sutter NWR; the San Luis NWR Complex, including the Grasslands WMA, Merced NWR, San Joaquin River NWR, and San Luis NWR; and the Stone Lakes NWR (collectively referred to as the "Covered Refuges").

Alternative 2 (Preferred Alternative) would include the use of cultural (e.g., water level manipulation), physical (i.e. mechanical and manual, such as biomass removal and growth prevention), and chemical (e.g., herbicides) treatment methods within the Covered Refuges, as well as water features within a 0.5-mile radius, with prior landowner approval. Alternative 3 would involve the implementation of these same treatment methods within the Covered Refuges; however, this alternative would not permit the use of broadcast aerial (e.g., airplane, helicopter, or drone), broadcast ground (e.g., all-terrain vehicle [ATV], truck, or tractor), broadcast water (e.g., boat boom), or deep water (e.g., pellets or granules) methods for herbicide application. Instead, herbicides would be applied using hand wands or injection methods only. Alternative 1 (No Action Alternative) would continue focused treatments that have been implemented on a case-by-case basis, without the flexibility that the methods of an IPM approach could provide.

1.2 Purpose and Need for the Proposed Action

Aquatic invasive plants, including but not limited to water hyacinth (*Eichhornia crassipes*), hydrilla (*Hydrilla verticillata*), ribbon weed (*Vallisneria australis*), alligator weed (*Alternanthera philoxeroides*), Eurasian watermilfoil (*Myriophyllum spicatum*), parrot feather (*Myriophyllum aquaticum*), floating water primrose (*Ludwigia peploides*), and Uruguay water primrose (*Ludwigia hexapetala*), could adversely affect the priority resources of concern within the Covered Refuges and surrounding waterways. These aquatic plants grow in wetlands, marshes, shallow water bodies, slow-moving waterways, lakes, reservoirs, and rivers.

The proposed IPM strategy in the Covered Refuges and adjacent waters would allow for site specific management of these aquatic invasive plants in a consistent, feasible, and cost-effective manner, with a goal of helping to maintain functional ecosystems and processes.

The proposed IPM strategy is needed to address invasive floating and submerged aquatic vegetation. These aquatic plants are highly invasive and negatively impact natural resources, cause problems for boating, agriculture, and public safety, as well as negatively impact local economies and industries. Aquatic invasive plants de-stabilize dissolved oxygen cycles, crowd out native plants, shade out crucial shallow-water fish habitat, obstruct waterways and navigational channels, and block agricultural and municipal water intakes.

2.0 SUMMARY OF SCOPING PROCESS

Through the scoping process, the Service solicited input on the scope of the environmental impact analysis from elected officials, Federal, State, and local government agencies, non-governmental organizations, and interested members of the public. Scoping letters were distributed to parties known to be interested in the Covered Refuges (see **Appendix A**). The letter requested input to help identify the scope of issues and potential alternatives to be analyzed in the Draft Environmental Assessment (EA), as well as regulatory concerns and any other relevant information (see **Appendix A**). Notification was given that written comments would be received for a 30-day period from March 25th, 2024 until April 25th, 2024 through either U.S. mail or email.

In addition to the scoping letters, the Service also posted notices on the Sacramento NWR Complex, San Luis NWR Complex, and Stone Lakes NWR websites and Facebook pages.

Comment letters were received from one State agency, one Native American tribe, one non-governmental organization, and three interested members of the public.

2.1 Elected Officials

No communication/written responses were received from elected officials.

2.2 Federal, State, and Local Agencies

Communication/written responses were received from the Delta Protection Commission (May 21st, 2024), which addressed the following items:

- The Delta Protection Commission noted that the proposed action includes the Stone Lakes NWR, which is in the Delta Primary Zone.
    - *Alternative 2 (Management of Aquatic Invasive Plants with Cultural, Physical, and Chemical Methods – Preferred Alternative) and Alternative 3 (Non-Broadcast Herbicide Application Methods) both include proposed treatments within the Stone Lakes NWR and adjacent waters within a 0.5-mile radius (with land-owner permission).*

- The Delta Protection Commission generally offered support for the management and removal of invasive species, but encouraged the Service to consider impacts on the following resources and items during environmental review:
    - The Delta Protection Commission asserted that IPM methods may affect navigability depending on the method of application.
        - *As described in Section 1.3, Purpose and Need for the Proposed Action and Section 4.11, Socioeconomics, aquatic invasive plants are known to obstruct waterways and navigational channels. Depending on the treatment methods (e.g., solarizing using stake benthic mats and tarping, biomass removal, or herbicide application using boats), there could be short-term, minor adverse effects on navigability. However, these treatments would only affect small portions of the channel at a time and would only affect channels that are already adversely impacted by aquatic invasive plants that inhibit or preclude navigability. Over the long-term the aquatic invasive plant treatments would improve the ability of boats to navigate, including emergency vehicles.*
    - The Delta Protection Commission requested the impact of IPM on adjacent agricultural operations, be considered and suggested that the Service engage agricultural stakeholders, as necessary.
        - *Public involvement is described above and summarized in Chapter 2, Involvement, Coordination and Consultation. The EA acknowledges the presence and the importance of existing agricultural operations (e.g., Section 4.11, Socioeconomics) within the immediate vicinity of the Covered Refuge and addresses potential effects to soils and water resources. As described in Section 4.11, Socioeconomics, Agricultural production in California's Central Valley was threatened at one point due to an 80 percent reduction in the efficiency of irrigation channels and pumping equipment (California Invasive Plant Council 2024). Over the long-term, implementation of Alternative 2 could have beneficial effects on agricultural operations.*
    - The Delta Protection Commission also requested that effects on water quality and native flora and fauna be considered.
        - *Effects on water quality are addressed in Section 4.3, Floodplains, Wetlands, and Water Resources and effects on native flora and fauna are address in Section 4.2, Biological Resources.*

5.2.4 Native American Tribes

Communication/written responses were received from the Paskenta Band of Nomlaki Indians, which addressed the following items:

- On May 7th, 2024, Andrew Cherna requested Geographic Information System (GIS) files for the Covered Refuges, which were provided by the Service on May 17th, 2024.
- On May 31st, 2024, Laverne Bill (Tribal Historic Preservation Officer) confirmed receipt of the project notification letter and stated that the Cultural Resources Department has reviewed the proposed project and concluded that it is within the Aboriginal territories of the Paskenta Band of Nomlaki Indians. The tribe requested consultation with the Service.
- On November 20th, 2024, the Service had a meeting with Laverne Bill to discuss the proposed action and future coordination between the Service and the Paskenta Band of Nomlaki Indians.
- On January 10th, 2025, the Service sent the draft Best Management Practices (BMPs) and a letter summarizing the meeting.

5.2.4 Local Non-Governmental Organization/Private Sector

Communication/written responses were received from the Tuolumne River Trust (TRT) on May 23rd, 2024, which addressed the following items:

- TRT described that water hyacinth has had a major impact on the Tuolumne and San Joaquin Rivers, especially in dry water years when flows in both rivers are lower. TRT notes that in some years, hyacinth matts can establish that completely block the river from bank to bank and can extend for half a mile or more downstream. TRT described that this complete blockage can prevent enjoyment of the river for people and may create a barrier for passage of aquatic organisms.
    - *As described in Section 1.3, Purpose and Need for the Proposed Action, the Service recognizes that aquatic invasive plants are adversely affecting the priority resources of concern within the Covered Refuges. These aquatic plants grow in wetlands, marshes, shallow water bodies, slow moving waterways, lakes, reservoirs, and rivers. They de-stabilize dissolved oxygen cycles, crowd out native plants, shade out crucial shallow-water fish habitat, obstruct waterways and navigational channels, and block agricultural and municipal water intakes.*
- TRT described that it is strongly supportive of efforts to minimize, and preferably, eliminate water hyacinth. TRT acknowledged that herbicides are a common tool to use in managing water hyacinth; however, TRT described that when California Department of Boating and Waterways applies herbicides, it seems to be of limited impact. TRT has observed that the plant seems to rebound, and the treatment can also leave behind dense matts of dead and decaying hyacinth.

TRT encouraged the Service to carefully analyze the effectiveness of herbicides and to also carefully analyze undesirable affects from the herbicide.

  - *As described in Chapter 3, Alternatives, the Service is considering different alternatives, including Alternative 2 (Management of Aquatic Invasive Plants with Cultural, Physical, and Chemical Methods) and Alternative 3 (Non-Broadcast Herbicide Application Methods).*

- TRT encouraged the Service to assess other tools, including manual removal of the plant. TRT believes that an active, persistent multi-year effort to remove hyacinth, starting at the upper limit of the lower Tuolumne River (La Grange Dam) and working downstream would significantly improve the situation.

  - *The non-herbicide and herbicide treatments are described in Section 3.2, Alternatives and includes cultural (e.g., water level manipulation), physical (e.g., biomass removal and growth prevention), and chemical (e.g., herbicides) treatments.*

- TRT believes that following a wet year when the hyacinth population is low, workers could scour the river, its banks, and backwater channels to manually remove the plant, starting at La Grange and working down to the San Joaquin River. TRT stated that this would significantly reduce the plant and its ability to spread in dry years. Following an initial "surge" of manual removal activities, TRT stated that the Service could then easily keep the plant at bay through regular monitoring and removal.
  - *As previously described, non-herbicide and herbicide treatments are described in Section 3.2, Alternatives and includes cultural (e.g., water level manipulation), physical (e.g., biomass removal and growth prevention), and chemical (e.g., herbicides) treatments. These methods would be used to manage aquatic invasive plant species on the Covered Refuges, as well as water features within a 0.5-mile radius, with land-owner permission.*

- TRT acknowledged that these upstream areas are outside the immediate boundaries of the Refuge, but stated that this approach would reduce and minimize the plant in and around the Refuge while also improving the river for many other fish and wildlife and improve recreational resources. TRT encouraged the Service to analyze this approach as an option.
  - *The proposed methods would be used to manage aquatic invasive plant species on the Covered Refuges, as well as water features within a 0.5-mile radius, with land-owner permission.*

5.2.4 Interested Members of the Public

Communication/written responses were received from the following interested members of the public:

- Briona Blanco (May 27th, 2024):

- Briona Blanco described that they are a resident behind Beach Lake and have noticed that the water hyacinth and primrose have gotten worse over the last 3 years.
    - *As described in Section 1.2, Proposed Action, the Service is proposing to implement a comprehensive IPM strategy involving cultural, physical, and chemical methods for treating the invasive aquatic plants. The purpose of the proposed IPM strategy in the Covered Refuges and adjacent waters is to allow for site specific management of these aquatic plants in a consistent, feasible, and cost-effective manner, with a goal of helping to maintain functional ecosystems and processes.*
- Briona Blanco described that the canopy is now so dense that it's blocking the waterways and water surface. They stated that it is pushing away mammals, waterfowl, fish, and native plants.
    - *As described in Section 4.2, Biological Resources, local waterways and wetlands can be inundated by aquatic invasive plants, crowding out native plants and decreasing habitat quality for native fish and wildlife species using these aquatic habitats. Invasive species could form dense mats that blocks access to key feeding and nesting areas, forcing wildlife to relocate. As discussed in Section 4.3, Floodplains, Wetlands, and Water Resources, these dense mats could also reduce the transportation of nutrients within the water system, leading to increased plant matter and harmful algal blooms. Algal blooms could cause excess carbon dioxide in the water through decomposition and lower the amount of oxygen in the water. This lack of oxygen could kill native wildlife species, such as fish and amphibians.*
- Briona Blanco also described personal observations of endangered milkweed, sandhill cranes, blue herons, snowy egrets, hawks, otters, beavers, coyotes, fish, and migratory waterfowl that are extremely important to the delta.
    - *As described in Section 4.2, Biological Resources, the Covered Refuges are important for fish, migratory birds, plants, and river system health.*
- Briona Blanco described that the man made dam at the end of the slough is cracked and has holes in it. They observed that the water level reaches the height of the holes the direction of the water flow changes, which allows the stagnant water to flow through the holes. They stated that these holes have allowed enough water flow to create pockets where the hyacinth doesn’t reproduce.
    - *The Service notes this observation.*

- Briona Blanco acknowledged that aerial herbicide is one of the options that has been considered at the Stone Lakes NWR. However, they also proposed other ideas for prevention, including buoy devices that could be used to block hyacinth from flowing past. They stated that if the buoy devices could successfully keep the hyacinth away from the stagnant water, the hyacinth could be redirected into the flowing areas, which would minimize growth in the lake. They described that if there are less plants in the lake then manual removal and seed control could be much more manageable and have a healthier impact on the ecosystem then aerial herbicides. They noted that no boats come to the area so the buoy devices wouldn't block boats.
    - *As described in Section 1.2, Proposed Action, the Service is proposing to implement a comprehensive IPM strategy involving cultural, physical, and chemical methods for treating the invasive aquatic plants within the Covered Refuges, as well as water features within a 0.5-mile radius, with land-owner permission.*
- Briona Blanco also asked if an organization would fund manual removal for yearly maintenance and does the Stone Lake NWR have a program in place for free composting?
    - *The Refuge does not have a program for free composting and currently lacks the resources to implement such a program.*
    - *The complete menu of non-herbicide and herbicide treatments are described in Section 3.2, Alternatives, for treating the invasive aquatic plants within the Covered Refuges, as well as water features within a 0.5-mile radius, with land-owner permission. The proposed methods include cultural (e.g., water level manipulation), physical (e.g., biomass removal and growth prevention), and chemical (e.g., herbicides) treatments.*

- Ben King (May 23rd, 2024):
    - Ben King described that their family own a portion of the channel and riparian levee that extends approximately 1.5 miles in the stretch of the Colusa Basin Drain just below the bridge crossing for the Grimes Arbuckle/Hahn Roads. Their family have been farming this land for over 160 years and have had a dedication to preserving the ecology of this natural waterway that has historically provided drainage for the area that encompasses the Sacramento NWR Complex. Ben King's family is converting approximately 260 acres of our farmland into a permanent wetland reserve easement with the Natural Resources Conservation Service (NRCS).

- *The Service notes this comment.*

- Ben King acknowledged the need to control invasive aquatic plants, but suggested that the problem of having to manage invasive aquatic plants is in large part due to decades of poor drainage practices for the Colusa Basin, which have been aggravated in the last decade. They also suggest that the problem of invasive aquatic plants is not only on the Refuge, but on adjacent private lands that are also impacted by poor drainage, so that the impact of any IPM strategy could be diluted by the natural spread of the invasive plants from adjacent habitat that is not also controlled with IPM practices.

    - *As described in Section 3.2, Alternatives, the proposed methods would be used to manage aquatic invasive plant species on the Covered Refuges, as well as water features within a 0.5-mile radius, with land-owner permission.*

- Ben King described how the proper drainage infrastructure for the Colusa Basin Drain was never completed after the channel was dug in the historical natural waterway of the Colusa Trough in the 1921 time period. They went on to describe that Colusa Basin Drain was intended to be constructed as a full bypass with two levees, but due to the financial duress of RD 2047 soon after the channel was dug the bypass plans were delayed and later abandoned in 1951, when the local irrigation companies agreed on a water management plan where agricultural water would be recycled and reused all the way downstream the Colusa Basin Drain until all the drainage waters are held back at the Colusa National Wildlife Refuge. According to Ben King, Colusa Basin Drain and several of its immediate tributaries at the Colusa NWR are U.S. Environmental Protection Agency (USEPA) 303(d) impaired waterbodies and may possibly be the source of the mercury contamination for the groundwater of the Colusa NWR and mercury and the hexavalent form of chromium groundwater contamination at the Sacramento NWR.

    - *The Service notes this comment. Discussions related to water quality, including a description of waters that are on the USEPA 303(d) list, are described in Section 4.3, Floodplains, Wetlands, and Water Resources.*

- Ben King asked how the Service will assess the efficacy of the intended IPM practice and potential unintended chemical and biotic responses of the IPM practice.

    - *As described in Chapter 3, Alternatives, the Service is considering different alternatives, including Alternative 2 (Management of Aquatic Invasive Plants with Cultural, Physical, and Chemical Methods) and Alternative 3 (Non-Broadcast Herbicide Application Methods). As part of these alternatives, BMPs would be implemented.*

- Ben King attached a U.S. Bureau of Reclamation (USBR) EA for the water transfer agreement between Glen Colusa Irrigation District (GCID) and the Colusa Drain Mutual Water Company. They urged the Service to consider the relationship of the USBR and GCID in context of the proper water management and proper drainage for the Sacramento NWR Complex and how that relates to the cause and management of aquatic invasive plants. Ben King described that GCID is the sole supplier of surface water to the Sacramento NWR Complex and, due to the fact that groundwater for the Refuges is contaminated with mercury and the hexavalent form of chromium, Refuge Management may not have any choice but to comply with the limitations imposed by GCID. When it comes to managing invasive aquatic plants or other practices, Ben King described that the Service may be fighting an unfair losing battle until the overarching drainage problems are identified and managed properly. They stated that it may be time to have a coordinated interagency plan and response regarding the drainage and water management issues for the Sacramento NWR Complex.
    - *As described in Chapter 3.2, Alternatives, the proposed action would utilize non-herbicide and herbicide treatments to address existing aquatic invasive species within the Covered Refuges and waterways within a 0.5-mile radius, with land-owner permission. Nevertheless, the Service appreciates this input on the potential underlying drainage issues. Other issues related to water quality are addressed in Section 4.3, Floodplains, Wetlands, and Water Resources.*

- Chris Guptill (May 23rd, 2024):
    - Chris Guptill described that water hyacinth has had a significant impact on the Tuolumne River over the past 12 years. They went on to describe that there is a great need for more treatments to prevent blockages, protect native species, and protect the riparian habitat.
        - *As described in Section 1.3, Purpose and Need for the Proposed Action, aquatic invasive plants are adversely affecting the priority resources of concern within the Covered Refuges. These aquatic plants grow in wetlands, marshes, shallow water bodies, slow moving waterways, lakes, reservoirs, and rivers. They de-stabilize dissolved oxygen cycles, crowd out native plants, shade out crucial shallow-water fish habitat, obstruct waterways and navigational channels, and block agricultural and municipal water intakes.*
    - Chris Guptill summarized his work over the past decade coordinating monthly volunteer river cleanups in Modesto called Operation 9-2-99. This group has conducted 102

cleanups with over 5,000 volunteers who have helped remove 650 tons of material including thousands of shopping carts and tires. The group does not work on the water hyacinth issue; however, due to that nature of doing river work small groups have gone into the river to break up the blockages that form and prevent boating and recreational passage. Chris Guptill described that over the past 10 years volunteers have broken up 30 to 40 significant blockages, with no other efforts at the state or local level.

- *As described under the No-Action Alternative, the current strategies for managing invasive aquatic plant species are designed and determined by local Service staff. These strategies generally prioritize simple actions that are achievable with local staff and resources over those that may be more effective at a regional scale. However, due to the constraints of existing treatment methods, localized response plans often allow infestations to go untreated, or infestations are treated with tools that are not efficient or effective. Using only localized responses can permit invasive species to surpass larger thresholds, negatively impact the local environment, and become more difficult and costly to manage.*

- Chris Guptill described that the Tuolumne is a navigable river and needs to be open to public use. He noted that there are two new boat launches in Modesto and Ceres that are susceptible to blockages during the low flow/drought years when hyacinth grows quickly and forms large mats that sink to the bottom of the river. Chris Guptill stated that the boom and bust cycle of river flows means that in high flow years like the last two cold, fast water has moved out most of the visible hyacinth. However, they described that it is still there and as soon as we get back to low warm flows this summer it will return.
  - *As described in Section 1.3, Purpose and Need for the Proposed Action, aquatic invasive plants are known to obstruct waterways and navigational channels. Over the long-term, the aquatic invasive plant treatments would improve the ability of boats to navigate, including emergency vehicles.*
- Chris Guptill receives the alerts from the California State Parks Department of Boating and Waterways about their efforts to treat both floating and submersed invasive species of plants. Occasionally the maps with show the Tuolumne River as "additional areas to be treated when time permits," but they described that little to no treatment has occurred the past few years. Chris Guptill stated that if the hyacinth that grows almost all the way up to La Grange is not treated it will end up at the San Joaquin River

NWR. They urged the USFWS to treat water hyacinth at the five locations listed, but also to treat the hyacinth that is upstream of those 5 locations as well.

- *As described under the No-Action Alternative, the current strategies for managing invasive aquatic plant species are designed and determined by local Service staff. These strategies generally prioritize simple actions that are achievable with local staff and resources over those that may be more effective at a regional scale. Due to the constraints of existing treatment methods, localized response plans often allow infestations to go untreated, or infestations are treated with tools that are not efficient or effective. Using only localized responses can permit invasive species to surpass larger thresholds, negatively impact the local environment, and become more difficult and costly to manage. The proposed action would utilize non-herbicide and herbicide treatments to address existing aquatic invasive species within the Covered Refuges and waterways within a 0.5-mile radius, with land-owner permission.*

APPENDIX A OF SCOPING REPORT

SCOPING LETTER

APPENDIX A

SCOPING LETTER

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Southwest Region – Refuges
Federal Building
2800 Cottage Way
Sacramento, California 95825
Email: fw8plancomments@fws.gov

April 25, 2024

Subject: Request for Scoping Comments for the Draft Environmental Assessment for the Sacramento National Wildlife Refuge Complex, San Luis National Wildlife Refuge Complex, and Stone Lakes National Wildlife Refuge for Management of Aquatic Invasive Plants

The U.S. Fish and Wildlife Service (Service) is preparing a Draft Environmental Assessment (EA) to evaluate the potential physical, environmental, cultural, and socioeconomic effects associated with the management of aquatic invasive plants within and surrounding the Butte Sink Wildlife Management Area (WMA), Colusa National Wildlife Refuge (NWR), Delevan NWR, Sacramento NWR, Sacramento River NWR, Steve Thompson North Central Valley WMA, Sutter NWR, San Joaquin River NWR, San Luis NWR, Merced NWR, Grasslands WMA, and Stone Lakes NWR (hereto referred to as the "Covered Refuges").

Water hyacinth (*Eichhornia crassipes*), South American spongeplant (*Limnobium laevigatum*), alligatorweed (*Alternanthera philoxeroides*), floating yellow primrose (*Ludwigia peploides*), and Uruguay water primrose (*Ludwigia hexapetala*) (referred to together as "primrose") are floating aquatic invasive plants that are not native to California. These non-native species grow in wetlands, marshes, shallow water bodies, slow moving waterways, lakes, reservoirs, and rivers. Water hyacinth, South American spongeplant, alligatorweed, and primrose can be a problem for boating, agriculture, as well as public safety, and can negatively impact the environment, industry, and local economies. These non-native, highly invasive plants can de-stabilize dissolved oxygen cycles, crowd out native plants, shade out crucial shallow-water fish habitat, obstruct waterways and navigational channels, and block agricultural and municipal water intakes.

Aquatic invasive plants are adversely affecting the priority resources of concern within the Covered Refuges; therefore, suppressing or containing these invasive species is necessary to reduce or eliminate the threat they cause to these sensitive environmental resources. The Service is proposing the use of integrated pest management (IPM) methods to manage aquatic invasive plants, as necessary, within and adjacent to the Covered Refuges within California's Central Valley. Proposed methods could include physical, mechanical, cultural, and chemical treatments, which will be analyzed in the Draft EA. Potential waterways adjacent to the Covered Refuges where IPM methods could also be utilized include, but are not limited to, Bear Creek, Bravel Slough, Deadman Creek, Deep Slough, Eastside bypass of the San Joaquin River, Los Banos Creek, Merced River, Mud Slough, Salt Slough, San Joaquin River, Stanislaus River, Tuolumne River, as well as miscellaneous irrigation supply and delivery canals and unnamed tributaries.

The Service respectfully requests that you consider the proposed action and provide any comments and/or available information that you may have regarding resources within and adjacent to the Covered Refuges. At this time, we are seeking input to help identify the scope of issues and potential alternatives to be analyzed in the Draft EA, as well as regulatory concerns and any other relevant information. Please provide any comments in writing via email by **5:00 P.M.** on **May 25, 2024** to **fw8plancomments@fws.gov**. Before including your address, phone number, email address, or other personal identifying information in your comment, please 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 will be able to do so.

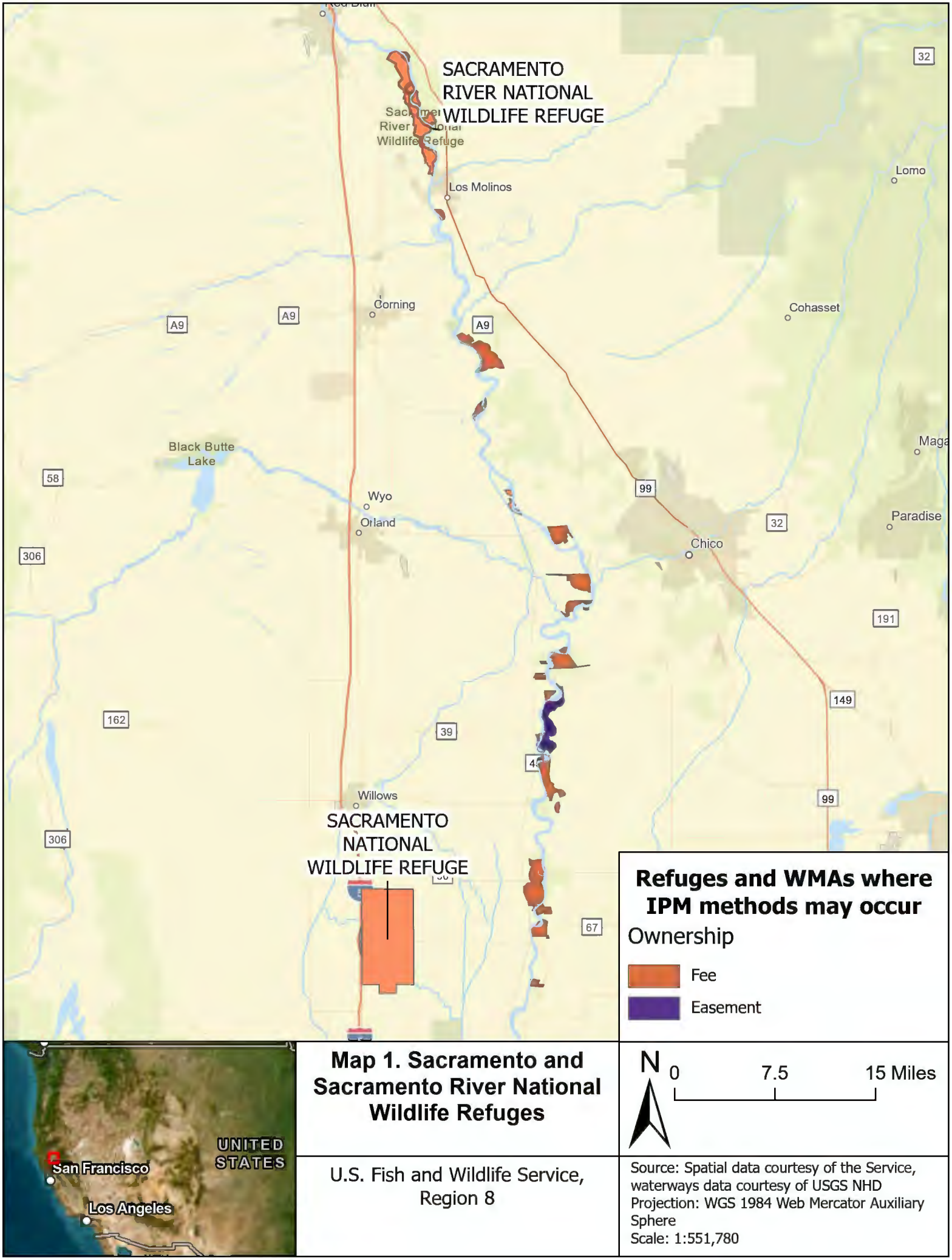
Sincerely,

MARK PELZ Digitally signed by MARK PELZ Date: 2024.04.24 15:23:52 -07'00'

Mark Pelz
Chief, Natural Resources Division
Pacific Southwest Region

Enclosures:

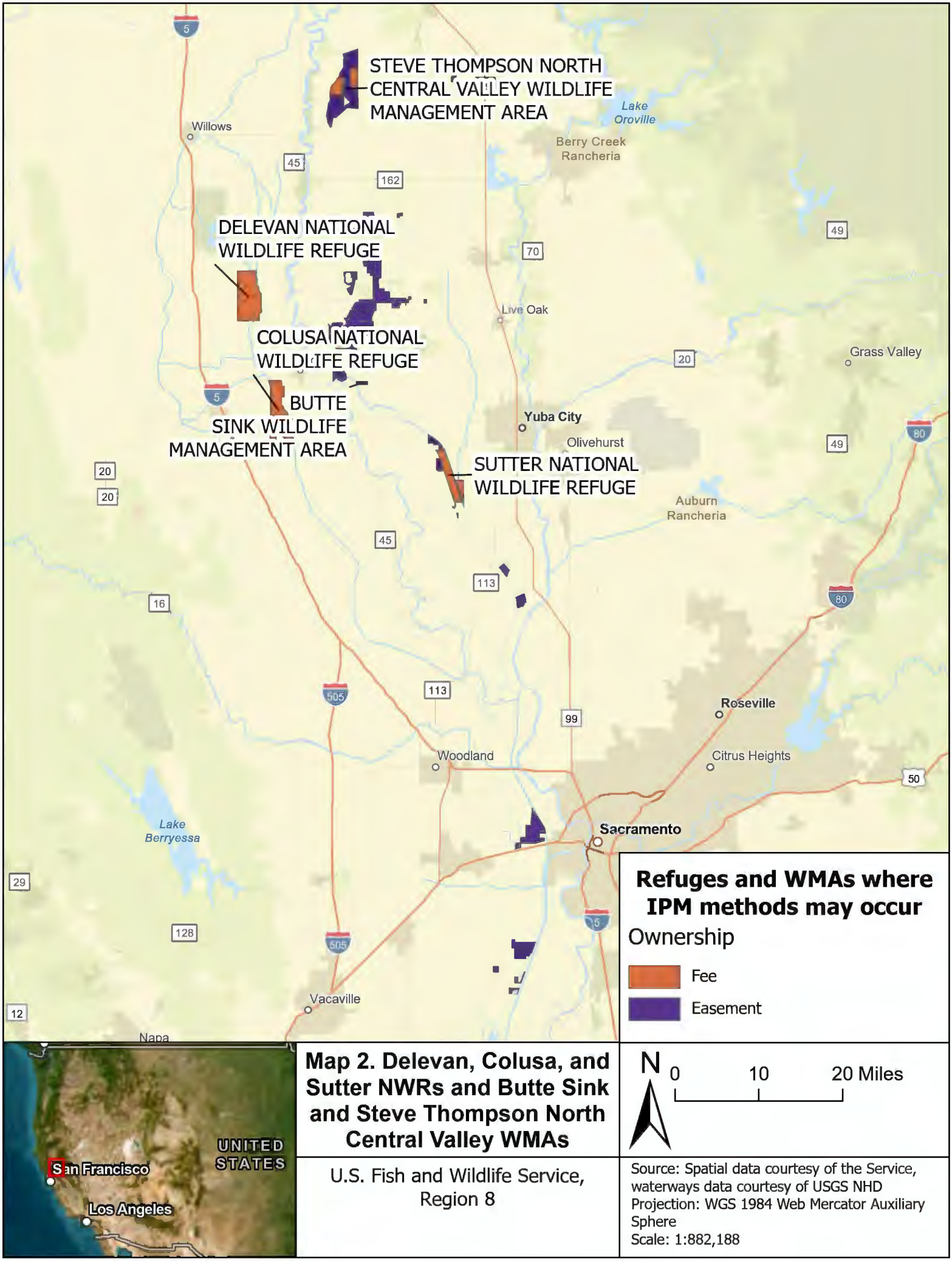
Map 1. Sacramento and Sacramento River NWRs
Map 2. Delevan, Colusa, and Sutter NWRs and Butte Sink and Steve Thompson North Central Valley WMAs
Map 3. San Joaquin River NWR
Map 4. San Luis and Merced NWRs and Grasslands WMAs
Map 5. Stone Lakes NWR



Map 1. Sacramento and Sacramento River National Wildlife Refuges

U.S. Fish and Wildlife Service, Region 8

Source: Spatial data courtesy of the Service, waterways data courtesy of USGS NHD
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Scale: 1:551,780



Map 2. Delevan, Colusa, and Sutter NWRs and Butte Sink and Steve Thompson North Central Valley WMAs

U.S. Fish and Wildlife Service, Region 8

Source: Spatial data courtesy of the Service, waterways data courtesy of USGS NHD
Projection: WGS 1984 Web Mercator Auxiliary Sphere
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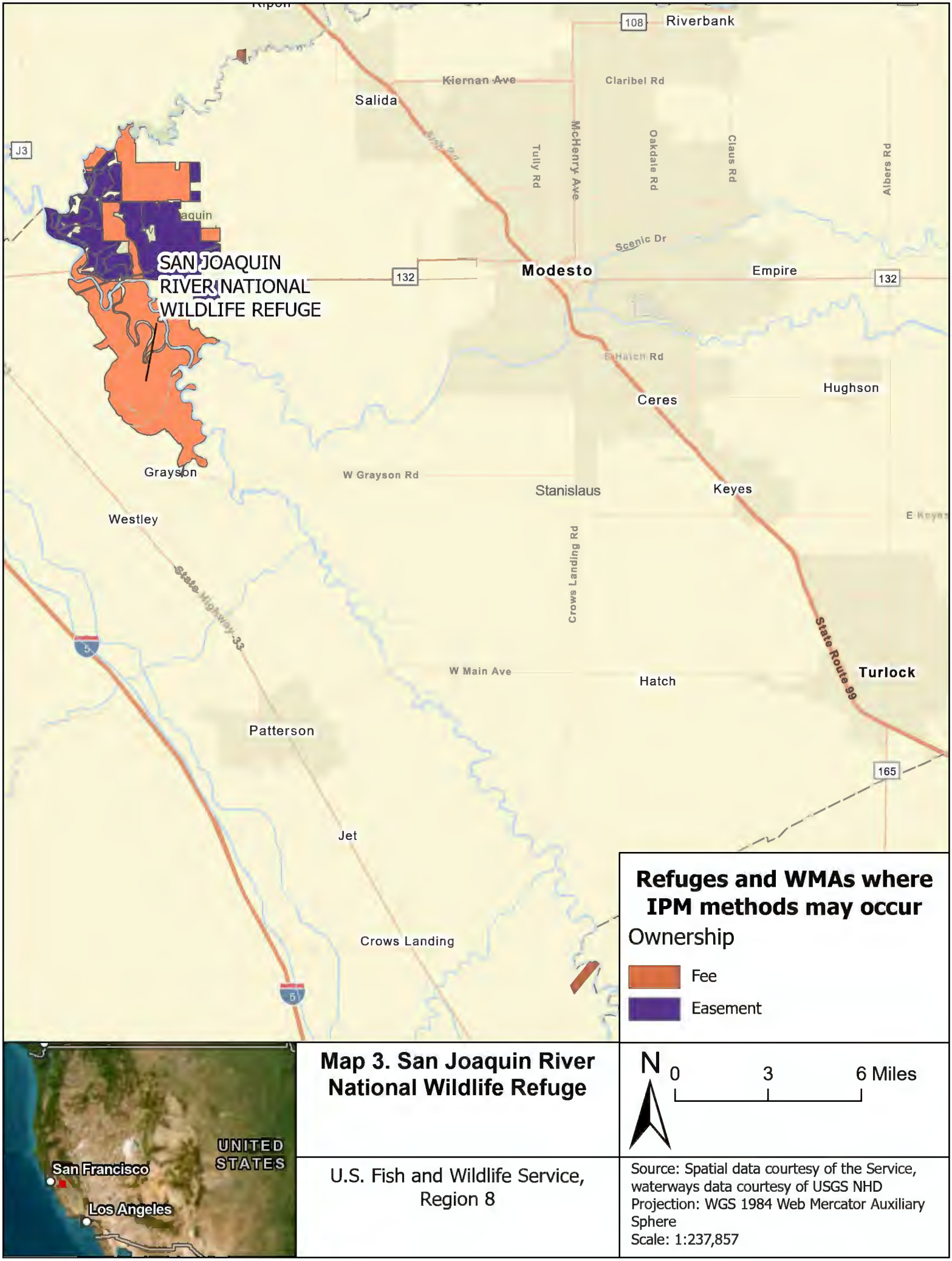
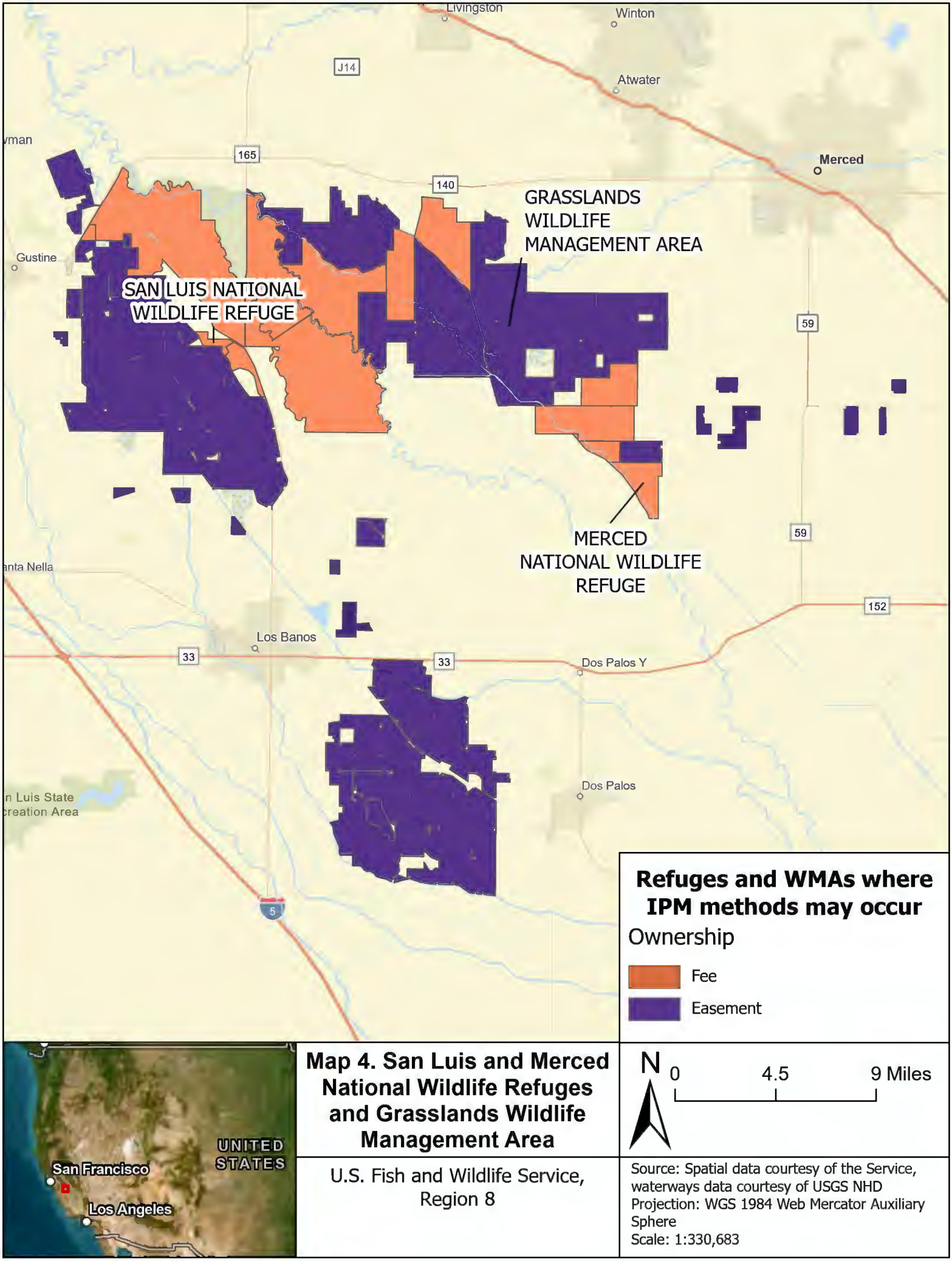

SAN JOAQUIN RIVER NATIONAL WILDLIFE REFUGE
Riverbank
108
Kiernan Ave
Claribel Rd
Salida
McHenry Ave
Tully Rd
Oakdale Rd
Claus Rd
Albers Rd
J3
Scenic Dr
132
Modesto
Empire
E Hatch Rd
Hughson
Ceres
Grayson
W Grayson Rd
Stanislaus
Keyes
Westley
Crows Landing Rd
State Highway 33
State Route 99
W Main Ave
Hatch
Turlock
Patterson
165
Jet
Crows Landing
5
Refuges and WMAs where IPM methods may occur
Ownership
Fee
Easement
UNITED STATES
San Francisco
Los Angeles
Map 3. San Joaquin River National Wildlife Refuge
U.S. Fish and Wildlife Service, Region 8
N
0
3
6 Miles
Source: Spatial data courtesy of the Service, waterways data courtesy of USGS NHD
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Scale: 1:237,857



Map 4. San Luis and Merced National Wildlife Refuges and Grasslands Wildlife Management Area

U.S. Fish and Wildlife Service, Region 8

Source: Spatial data courtesy of the Service, waterways data courtesy of USGS NHD
Projection: WGS 1984 Web Mercator Auxiliary Sphere
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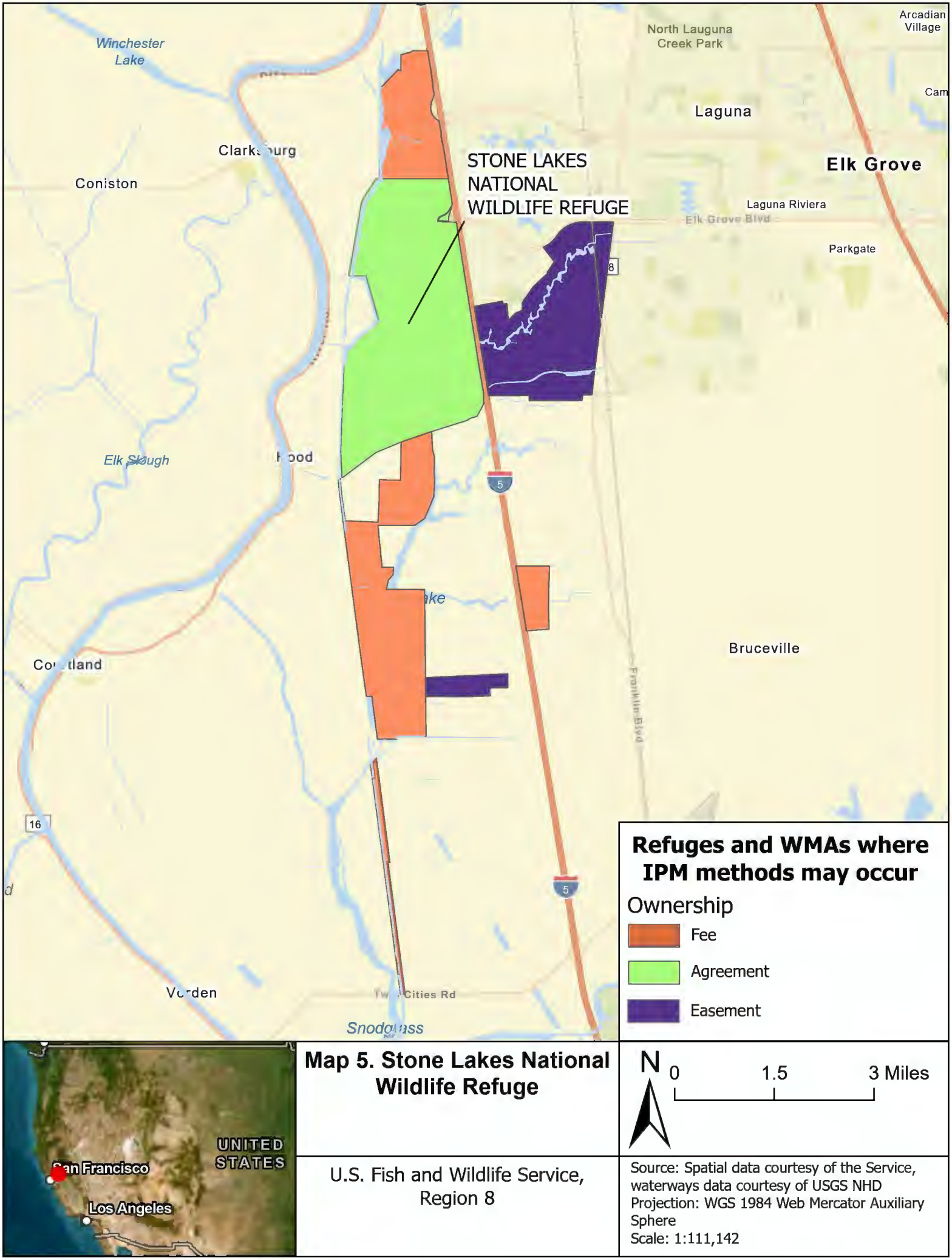

Map 5. Stone Lakes National Wildlife Refuge

U.S. Fish and Wildlife Service, Region 8

Source: Spatial data courtesy of the Service, waterways data courtesy of USGS NHD
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Scale: 1:111,142