Appendices

Appendix A. Compatibility Determinations

Compatibility Determination for Recreational Fishing on the Stone Lakes National Wildlife Refuge

Use: Fishing

Refuge Name:
Stone Lakes National Wildlife Refuge
Sacramento County, California

Establishing and Acquisition Authority(ies):
Stone Lakes National Wildlife Refuge (NWR) was established in 1994 under the authority of the Emergency Wetlands Resources Act of 1986, the Fish and Wildlife Act of 1956, the Migratory Bird Conservation Act, and the Endangered Species Act of 1973. The approved refuge boundary contains about 18,000 acres, of which the Service owns or manages approximately 6,000 acres. Additional acquisition authorities can be found in the funding sources used to acquire land. These sources include: the California Environmental License Plate Fund, the Cigarette and Tobacco Product Surtax (California Proposition 99, 1988), the North American Wetland Conservation Act, the Land and Water Conservation Fund, the Sacramento County Environmental Mitigation Grant/Packard Foundation, the Central Valley Improvement Act, the National Fish and Wildlife Fund, the Trust for Public Land Grant/Packard Foundation, the City of Sacramento and the CalFed Bay Delta Program.

Refuge Purpose(s):
Stone Lakes NWR purposes include:

"... 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)

"... 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)

National Wildlife Refuge System Mission: The mission of the National Wildlife Refuge System (System) is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use:

Fishing is one of six priority public uses (i.e., hunting, fishing, wildlife observation, photography, environmental education and interpretation) identified in the National Wildlife Refuge System Improvement Act of 1997. Fishing has occurred within the Stone Lakes Basin and surrounding Delta waterways since prior to European settlement of the region. The visitor use program in the CCP proposes to open portions of the Refuge to fishing from boats from June through September and to expand visitor opportunities for wildlife-dependent recreation (USFWS 2006a). Due to limitations in parking space, launching sites, and the navigability of Refuge waterways, only cartop, hand-launched boats, such as canoes and kayaks will be permitted. Gas-powered outboard motors will not be allowed and a no wake zone will be enforced but use of electric motors will be possible in the South Stone Lake unit. Fishing will not include take of frogs or crayfish and will only be with rod and reel. The Service does not intend to allow bank fishing on the Refuge, due to a number of concerns, including: erosion of banks and other habitat impacts from trampling of vegetation, lack of staff to monitor use, and lack of infrastructure such as piers or platforms.

Game fish species to be allowed for legal take will include all native and introduced species listed in the California Freshwater Sport Fishing Regulations (e.g., bass, catfish, crappie, bluegill, sunfish, shad, carp). Fishing will be permitted in accordance with State and Federal regulations to ensure it will not interfere with conservation of fish and wildlife and their habitats. An informational kiosk with maps and brochures on regulations, health warnings, species identification, and Refuge boundaries will be available near the boat launch area. Chapter 5 of the Comprehensive Conservation Plan, Refuge Vision, Goals and Objectives, is herein incorporated by reference.

Availability of Resources:

Staff necessary to oversee the Refuge fishing program will be shared with other programs as described in the Draft Stone Lakes NWR CCP (USFWS 2006a). Shared staff member(s) would be sufficient to operate the modest program described in this plan. Facilities to support the program will require capital outlays and recurring costs however, some of the costs will be available through other visitor use programs, such as wildlife observation and photography. If unexpected costs arise, such as the need for more enforcement or higher than expected maintenance needs, we will reevaluate the program and make necessary adjustments, such as seeking volunteers or other partnerships to maintain facilities and administer the program.

Item	One Time Cost	Recurring Costs
Boat Ramp	$30,000	$5,000
Parking Area	$20,000	$5,000
Maintenance of Parking Lots and Boat Launches	N/A	$5,000
Maintenance (0.50 FTE)	$26,000	$26,000
Restroom	$50,000	$2,000
Law Enforcement (0.50 FTE)	$25,000	$25,000
Administration	$2,000	$2,000
TOTAL	**$153,000**	**$70,000**

Anticipated Impacts of the Use(s):

Impacts are discussed in detail in the Environmental Assessment for the Draft Comprehensive Conservation Plan (USFWS 2006). Fishing and other human activities may cause disturbance to wildlife (Burger 1981) and the cumulative effects of this expanded use will likely have effects on habitat and the fisheries resource (Buckley and Buckley 1976, Glinski 1976, Miller et al. 1998, Reijnen and Foppen 1994, Smith and Hunt 1995). Fishing

may result in increased problems with vandalism and litter such as discarded monofilament line and tackle. Because few native fish species are found at Stone Lakes, and non-native game species are plentiful, the impact on the native fishery is not expected to be significant.

Federally-listed species that may occur on the Refuge include the giant garter snake, valley elderberry longhorn beetle, and the vernal pool tadpole and fairy shrimp (USFWS 2006b). No impacts to vernal pool species are anticipated from fishing because fishing will be permitted only on waterways of the Beach Lake, North Stone Lake and South Stone Lake units where there are no vernal pools. State-listed species that may inhabit the Refuge include greater sandhill crane and Swainson's hawk. The most sensitive period for Swainson's hawk is during the nesting season, typically mid-February through July. Likely nesting areas would be closed to visitors during the nesting season. Impacts to greater sandhill cranes are not anticipated since the fishing season does not coincide with wintering crane use at the Refuge.

The following measure will be taken to avoid impacts to fish and wildlife:
- Provide printed materials to inform anglers about fishing regulations and boundaries of fishing areas;
- Maintain parking areas, roads, and boat launches to prevent erosion or habitat damage;
- Monitor fishing to ensure that facilities are adequate and wildlife disturbance is minimal;
- Prohibit gas-powered watercraft to protect water quality and submerged vegetation;
- Implement a seasonal closure from October through May to reduce disturbance to wintering, nesting, resting, and foraging birds and other wildlife, their habitats, and public engaged in other wildlife-dependent uses;
- Prohibit watercraft within 0.25 miles of occupied Swainson's hawks nests until the young have fledged (i.e., 2nd half of July);
- Refuge law enforcement staff will randomly check anglers for compliance with state fishing laws and refuge-specific fishing regulations; and
- Comply with all measures identified in the CCP Section 7 Consultation to minimize or eliminate conflicts with federally-listed or non-target species.

Public Review and Comment:

Public review and comments will be solicited in conjunction with distribution of the Draft CCP for Stone Lakes NWR. The public will be provided 30 days to review and comment on the CCP and this CD. Following the public review and comment period, comments and actions taken to address comments will be summarized here.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility:

Fishing will be permitted at Stone Lakes NWR with the following stipulations:
- Fishing will be conducted exclusively from boats
- No trailered boats will be permitted. Cartop, hand-launched boats with or without electric motors will be permitted; gas motor boats will not allowed;
- No vehicles will be allowed in boat launch areas;
- All closed areas will be identified in printed materials provided to anglers and posted and patrolled to prevent trespass through adjacent properties;
- Littering regulations will be strictly enforced;
- Use or possession of alcohol while sport fishing will be prohibited;

• No building or maintaining of fires will be permitted on the Refuge;
• The Sun River Unit will be closed to fishing during the waterfowl hunting season; and
• Fishing will be allowed during daytime hours only.

The Refuge Manager will have authority to close certain areas during critical wildlife use periods and cancel any activities deemed necessary to fulfill Refuge purposes or ensure visitor safety. Sensitive nesting areas will be protected from disturbance by visitors with signs and barriers. Visitors will be directed away from areas where major habitat restoration or management projects are under way.

Justification:

Fishing is an appropriate wildlife-dependent recreational activity. Based upon biological impacts described in the Refuge Draft Comprehensive Conservation Plan and Environmental Assessment, it is determined that fishing within the Refuge will not materially interfere with or detract from the purposes for which the Refuge was established.

Fishing is a priority wildlife-dependent visitor use provided for in the National Wildlife Refuge System Improvement Act of 1997. By facilitating this use on the Refuge, we hope to increase the visitors' knowledge and appreciation of fish and wildlife, which may lead to increased public stewardship of wildlife and their habitats on the Refuge. Increased public stewardship will support and complement the Service's actions in achieving the Refuge's purposes and the mission of the National Wildlife Refuge System. This program as described is determined to be compatible and will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Reevaluation Date (provide month and year):

Aug 2021 Mandatory 15-year Reevaluation Date (for priority public uses)

_____ Mandatory 10-Year Reevaluation Date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Conducted with Comprehensive Conservation Plan

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

__X__ CCP Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

References Cited:

Buckley, P. A. and F. G. Buckley. 1976. Guidelines for protection and management of colonially nesting waterbirds. North Atlantic Regional Office, National Park Service, Boston, MA. 52pp.

Burger, J. 1981. The effect of human activity on birds at a coastal bay. Biol. Cons. 21:231-241.

Glinski, R. L. 1976. Bird watching etiquette: the need for a developing philosophy. Am. Bird 30(3):655-657.

Miller, S. G., R. L. Knight, and C. K. Miller. 1998. Influence of recreational trails on breeding bird communities. Ecol. Appl. 8:162-169.

Reijnen, R. and R. Foppen. 1994. The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for willow warbler (*Pylloscopus trochilus*) breeding close to a highway. J. Appl. Ecol 31: 85-94.

Smith, L. and J. D. Hunt. 1995. Nature tourism: impacts and management. Pp. 203-219 in Knight, R. L.; Gutzwiller, K. J. (Wildlife and recreationists: coexistence through management and research, eds.). Island Press, Washington, D. C.

U.S. Fish and Wildlife Service (USFWS). 2006a. Stone Lakes National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment, 2006. U. S. Fish and Wildlife Service, Sacramento, California.

U.S. Fish and Wildlife Service (USFWS). 2002b. Biological Opinion for the Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan. U.S. Fish and Wildlife Service, Sacramento, California.

Refuge Determination:

Prepared by: _____ (Signature) _____ (Date)

Refuge Manager/ Project Leader Approval: _____ (Signature) _____ (Date)

Concurrence:

Refuge Supervisor: _____ (Signature) _____ (Date)

Assistant Manager, Refuges, California/Nevada Operations: _____ (Signature) _____ (Date)

California/Nevada Operations Manager: _____ (Signature) _____ (Date)

Compatibility Determination for Wildlife Observation and Photography on the Stone Lakes National Wildlife Refuge

Use: Wildlife Observation and Photography

Refuge Name:
Stone Lakes National Wildlife Refuge
Sacramento County, California

Establishing and Acquisition Authority:
Stone Lakes National Wildlife Refuge (NWR) was established in 1994 under the authority of the Emergency Wetlands Resources Act of 1986, the Fish and Wildlife Act of 1956, the Migratory Bird Conservation Act, and the Endangered Species Act of 1973. The approved refuge boundary contains about 18,000 acres, of which the Service owns or manages approximately 6,200 acres. Additional acquisition authorities can be found in the funding sources used to acquire land. These sources include: California Environmental License Plate Fund, Cigarette and Tobacco Product Surtax (California Proposition 99, 1988), North American Wetland Conservation Act, Land and Water Conservation Fund, Sacramento County Environmental Mitigation Grant/Packard Foundation, Central Valley Project Improvement Act, National Fish and Wildlife Foundation, Trust for Public Land Grant/ Packard Foundation, the City of Sacramento, and CalFed Bay Delta Program.

Refuge Purpose(s):
Stone Lakes NWR purposes include:

"... 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)

"... 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)

National Wildlife Refuge System Mission:
The mission of the National Wildlife Refuge System (System) is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use(s):
Wildlife observation and photography are two of the six priority visitor uses (e.g., hunting, fishing, wildlife observation and photography, environmental educations and interpretation)

identified in the National Wildlife Refuge System Improvement Act of 1997. Currently, visitor access to Stone Lakes National Wildlife Refuge (Refuge) is limited to two days per month and as a result the expectations of the visiting public are not being met. The Refuge proposes to provide adequate facilities to observe, photograph and enjoy wildlife and natural habitats during daylight hours in all seasons of the year

The Refuge would provide opportunities for wildlife observation and photography by constructing approximately 4.6 miles of universally accessible trails on the Headquarters, North Stone Lake and South Stone Lake Units, two photography blinds and two viewing platforms, expanding entrance roads and parking areas, and by offering boat access and guided tours to areas of interest, including vernal pools and wetlands. For additional details about this proposed use, please see the Stone Lakes National Wildlife Refuge Final Comprehensive Conservation Plan (USFWS, 2006) which is herein incorporated by reference.

Availability of Resources:

Staff necessary to oversee the wildlife observation and photography programs will be shared with other programs described in the 2006 Draft CCP for Stone Lakes NWR. To fully implement this program as described in the CCP, significant increases in staff and, capital outlays, and recurring costs will be necessary. Facilities and materials to support the program will require capital outlays and recurring costs, however, some of the costs will be shared with other visitor used programs. If unanticipated costs arise, the program will be reevaluated and necessary adjustments made such as seeking volunteer or cooperator assistance to maintain facilities or applying for educational grants.

Item	One Time Cost	Annual Costs
Photo Blinds (HQ, North Stone Lake)	$ 30,000	$ 2,500
Viewing Platforms (HQ, North Stone Lake)	$620,000	$ 5,000
Parking Areas (HQ, North Stone Lake)	$520,000	$ 5,000
Trails		
2.6 miles at South Stone Lake Unit	$150,000	$15,000
2 miles at Headquarters Unit	$400,000	$10,000
Boardwalks		
1500 feet at Sun River	$1,590,000	$ 7,000
200 feet at HQ	$200,000	$ 2,500
Entrance Road Sun River Property	$400,000	$ 5,000
Restrooms (HQ, Sun River, Lewis)	$150,000	$ 6,000
Park Ranger (0.5 FTE)	$ 25,000	$ 5,000
Maintenance Staff (0.5 FTE)	$ 26,000	$26,000
Administration	$2,000	
TOTAL	**$4,113,000**	**$89,000**

Anticipated Impacts of the Use(s):

Human activity may disturb migratory birds utilizing the Refuge's habitats for feeding or nesting. Off-trail human activity in habitat restoration areas can slow restoration efforts through soil compaction, vegetation trampling and the introduction of invasive plants. Litter discarded by visitors can entangle wildlife or be ingested, resulting in injury or death. The construction and maintenance of trails and boardwalks may impact soils, vegetation, and in some instances hydrology around the trails. This could include an increased potential for erosion, soil compaction (Liddle 1975), reduced seed emergence (Cole and Landres 1995), alteration of vegetative structure and composition and sediment loading (Cole and Marion 1988).

Federally-listed species that may occur on the Refuge include the giant garter snake, valley elderberry longhorn beetle, vernal pool tadpole and fairy shrimp. No impacts to vernal pool species are anticipated from wildlife observation and photography. California state-listed species that inhabit the Refuge include greater sandhill crane and Swainson's hawk. The primary disturbance season for Swainson's hawk is during their nesting season, typically mid-February through July. Prime nesting habitat would be closed to visitors during the nesting season.

Of the wildlife observation techniques, wildlife photographers tend to have the largest disturbance impacts (Klein 1993, Morton 1995, Dobb 1998). While wildlife observers frequently stop to view species, wildlife photographers are more likely to approach wildlife (Klein 1993). Even slow approach by wildlife photographers tends to have behavioral consequences to wildlife species (Klein 1993). Other impacts include the potential for photographers to remain close to wildlife for extended periods of time, in an attempt to habituate the wildlife subject to their presence (Dobb 1998) and the tendency of casual photographers, with low-power lenses, to get much closer to their subjects than other activities would require (Morton 1995), including wandering off trails. This usually results in increased disturbance to wildlife and habitat, including trampling of plants. Impacts of wildlife observation and photography are also discussed in the Compatibility Determination for environmental education and interpretation.

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP for Stone Lakes NWR. The public will be provided 30 days to review and comment upon the CCP and this CD. Following the public review and comment period, comments and Service responses will be summarized here.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility:

To allow visitor access to the Refuge for wildlife observation and photography, the following measurers would be taken:

- By 2008, interpretive signs and an orientation kiosk will be installed on the Headquarters Unit of the Refuge to inform visitors about Refuge habitats and wildlife and how to minimize adverse impacts. Access to the Refuge will be allowed only between sunrise and sunset, unless a permit for alternative hours is issued by the Refuge Manager in advance.

- The main kiosks on the Headquarters Unit and South Stone Lake units will clearly state the regulations governing wildlife observation and photography on the Refuge and will include the following information:
  (1) a trail map, trail information and regulations;
  (2) a description of the National Wildlife Refuge System; and
  (3) an interchangeable sign for any closures during the waterfowl hunting or Swainson's hawk nesting seasons.

- Trails will be well marked and symbolic fencing will be installed to guide visitor access through sensitive habitats. This will minimize trespass into closed areas and reduce disturbance to nesting birds and other sensitive species.

- The Refuge will maintain an active law enforcement presence to ensure visitor compliance with all Refuge rules and regulations. Refuge law enforcement and other Refuge staff presence will be increased to ensure compliance with Refuge regulations.

Justification: The National Wildlife Refuge System Improvement Act of 1997 identifies wildlife observation and wildlife photography as priority visitor uses for national wildlife refuges, along with hunting, fishing, environmental education and interpretation. In Refuge planning and management, priority uses take precedence over other potential visitor uses. The Service strives to provide priority visitor uses when compatible with the purpose(s) and goals of the Refuge and the mission of the National Wildlife Refuge System (System).

Expanding existing wildlife observation and photography opportunities on the Refuge would allow visitors to experience, enjoy, and learn about native wildlife and plant species in the Central Valley. The Refuge has one of the few remaining natural riparian areas in the valley as well as wetlands, vernal pools, and open water habitats harboring many species of migratory waterfowl, raptors and other wildlife species. Due to its proximity to urban areas, the Refuge attracts a high number of visitors. With management consistent with the stipulations herein, expanding wildlife observation and photography opportunities would substantially increase visitor use and would be compatible with Refuge purposes and the System mission.

Mandatory Reevaluation Date (provide month and year):
__2021__Mandatory 15-year Reevaluation Date (for priority visitor uses)

_____Mandatory 10-Year Reevaluation Date (for all uses other than priority visitor uses)

NEPA Compliance for Refuge Use Decision (check one below):

Conducted with Comprehensive Conservation Plan

_____Categorical Exclusion without Environmental Action Statement

_____Categorical Exclusion and Environmental Action Statement

__X___Environmental Assessment and Finding of No Significant Impact

_____Environmental Impact Statement and Record of Decision

References Cited:

Cole, D. N. and P. B. Landres. 1995. Indirect effects of recreation on wildlife. Pages 183-201 in R. L.

Cole, D. N. and J. L. Marion. 1988. Recreation impacts in some riparian forests of the eastern United States. Env.Manage. 12:99-107.

Dobb, E. 1998. Reality check: the debate behind the lens. Audubon: Jan.-Feb.

Klein, M. L. 1993. Waterbird behavioral responses to human disturbances. Wildl. Soc. Bull. 21:31-39.

Liddle, M. J. 1975. A selective review of the ecological effects on human trampling on natural ecosystems. Biol.Conserv. 7:17-36.

Morton, J. M. 1995. Management of human disturbance and its effects on waterfowl. Pages F59-F86 in W. R.

U.S. Fish and Wildlife Service (USFWS). 2006. Stone Lakes National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment, 2006. U. S. Fish and Wildlife Service, Sacramento, California.

Refuge Determination

Prepared by:	_____ (Signature)	_____ Date)
Refuge Manager/ Project Leader Approval:	_____ (Signature)	_____ (Date)

Concurrence

Refuge Supervisor:	_____ (Signature)	_____ (Date)
Assistant Manager, Refuges, California/Nevada Operations:	_____ (Signature)	_____ (Date)
California/Nevada Operations Manager:	_____ (Signature)	_____ (Date)

Compatibility Determination for Environmental Education and Interpretation on the Stone Lakes National Wildlife Refuge

Use: Environmental Education and Interpretation

Refuge Name:
Stone Lakes National Wildlife Refuge
Sacramento County, California

Establishing and Acquisition Authority:
Stone Lakes National Wildlife Refuge (NWR) was established in 1994 under the authority of the Emergency Wetlands Resources Act of 1986, the Fish and Wildlife Act of 1956, the Migratory Bird Conservation Act, and the Endangered Species Act of 1973. The approved refuge boundary contains about 18,000 acres, of which the Service owns or manages approximately 6,200 acres. Additional acquisition authorities can be found in the funding sources used to acquire land. These sources include: California Environmental License Plate Fund, Cigarette and Tobacco Product Surtax (California Proposition 99, 1988), North American Wetland Conservation Act, Land and Water Conservation Fund, Sacramento County Environmental Mitigation Grant/Packard Foundation, Central Valley Project Improvement Act, National Fish and Wildlife Foundation, Trust for Public Land Grant/ Packard Foundation, City of Sacramento, and CalFed Bay Delta Program.

Refuge Purpose(s):
Stone Lakes NWR purposes include:

"... 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)

"... 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)

National Wildlife Refuge System Mission:
The mission of the National Wildlife Refuge System (System) is "to administer a national network of lands and waters for the conservation, management and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use(s):
Environmental education and interpretation are two of the six priority public uses (e.g., hunting, fishing, wildlife observation and photography, environmental educations and

interpretation) identified in the National Wildlife Refuge System Improvement Act of 1997. Stone Lakes National Wildlife Refuge (Refuge) is one of the few urban refuges in the western region and has the potential to attract thousands of visitors annually from the greater Sacramento area to experience Central Valley habitats including wetlands, grasslands and riparian habitats. Currently, public access to the Refuge is limited to two days per month and as a result expectations of the visiting public are not being addressed.

The Refuge proposes to provide for expanded environmental educational use by: (1)offering staff and/or docent led tours on the Refuge,(2) conducting teacher workshops, (3) developing a class or group staging area, (4) developing a Refuge relevant elementary school curriculum, and (5) exploring the feasibility of a Refuge fee demonstration area.

The Refuge plans to develop an interpretive program by: (1) developing a self-guided trail system, (2) developing interpretive panels and exhibits, and (3) by building an open air interpretive shelter on the Headquarters Unit as part of the Blue Heron Trails project. In addition, the Refuge would develop environmental education and interpretive materials, including fact sheets on particular species and habitats, and an education guide for educators on Central Valley habitat conservation and restoration issues. Additional information about this proposed use are in the Stone Lakes National Wildlife Refuge Draft Comprehensive Conservation Plan (USFWS, 2006) which is herein incorporated by reference.

Availability of Resources: Staff necessary to oversee the Refuge Environmental Education and Interpretation program will be shared with other programs as described in the 2006 Draft CCP for Stone Lakes NWR. Additional staff will be required to fully implement this program, such as an Interpretative Specialist. Facilities and materials to support the program will require capital outlays and recurring costs, however, some of the costs will be shared with other visitor programs. If unanticipated costs arise, the program will be reevaluated and necessary adjustments made, such as securing additional volunteers or financial assistance.

Item	One Time Cost	Recurring Costs
Interpretive Panels	$210,000	$15,000
Kiosks (1 main + 4 small)	$300,000	$5,000
Trails*	$1,630,000	$10,000
Outdoor Rec Planner	$50,000	$50,000
Maintenance Staff	$26,000	$26,000
Administration	$2,000	$2,000
Total	**$2,118,000**	**$108,000**

**Includes "Junior Biologist Trail" at Headquarters Unit, complete with entrance signs, universally accessible trails, entrance kiosk, and interpretive panels.*

Contingent on increased funding and staff identified in the CCP, the Refuge would expand interpretation and environmental education opportunities, as well as generate additional educational materials.

Anticipated Impacts of the Use(s):

Disturbances to wildlife resulting from environmental education and interpretation activities are considered to be of minimal impact because: (1) the total number of students permitted through the reservation system will be limited, (2) students and teachers will be trained in trail etiquette and how to minimize wildlife disturbance, (3) educational groups will be required to have a sufficient adult to student ratio for adequate supervision, (4) trail design will provide adequate cover for wildlife, and (5) observation areas and scopes will be provided to view wildlife at a distance

Human activity may disturb migratory birds utilizing Refuge habitats for feeding or nesting activities. Off-trail human activity in habitat restoration areas can slow restoration efforts through soil compaction, vegetation trampling, and the introduction of invasive plants . Litter discarded by visitors can entangle wildlife or be ingested, resulting in injury or death. The construction and maintenance of trails and boardwalks will impact soils, vegetation and in some instances hydrology around the trails. This could include an increased potential for erosion, soil compaction (Liddle 1975), reduced seed emergence (Cole and Landres 1995), alteration of vegetative structure and composition and sediment loading (Cole and Marion 1988).

Federally-listed species that may occur on the Refuge include the giant garter snake, valley elderberry longhorn beetle, vernal pool tadpole and fairy shrimp. . No significant impacts to vernal pool species are anticipated from environmental education and interpretation as visitors to vernal pools areas (e.g., Wetland Preserve) will be confined to established trails or led by docents or Refuge staff. California-listed species that inhabit the Refuge include greater sandhill crane and Swainson's hawk. The primary disturbance season for Swainson's hawk is during the nesting season, typically mid-February through July. Prime nesting habitat would be closed to visitors during the nesting season. Impacts are also discussed in Chapter 5 of the Stone Lakes National Wildlife Refuge Draft Comprehensive Conservation Plan (USFWS, 2006).

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP for Stone Lakes NWR. The public will be provided 30 days to review and comment upon the CCP and this CD. Following the public review and comment period, comments and Service responses will be summarized here.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility: In order to allow public access to the Refuge for environmental education and interpretation, the following measurers will be taken:

- Access to the Refuge will be allowed only during daylight hours unless a permit for alternative hours is issued by the Refuge manager. The Refuge manager will have the authority to close certain areas to interpretive programs or to cancel activities to fulfill Refuge purposes.
- Public access will be restricted to areas where the least disruption to wildlife and their habitats would occur. Visitors will be directed to remain a safe distance from nesting areas with signs and barriers. Visitors will be directed away from areas where sensitive habitat restoration projects are underway
- Educators or groups who wish to visit or learn about the Refuge would receive interpretive materials in advance.
- Trails from parking lots to viewing areas will be well marked to minimize trespass through closed areas and reduce disturbance to nesting migratory birds and other sensitive resources.
- The Refuge will maintain an adequate law enforcement capability to ensure public safety and compliance with all rules and regulations.

Justification:
The goals of the National Wildlife Refuge System (System) include providing an understanding and appreciation of fish and wildlife ecology and the human role in the environment and providing Refuge visitors with high quality and safe recreational experiences oriented toward wildlife, to the extent that these activities are compatible with the purposes for which a refuge was established and the mission of the System. Moreover, the National Wildlife Refuge System Improvement Act of 1997 identifies environmental education and interpretation as priority public uses for National Wildlife Refuges, along with hunting, fishing, wildlife observation and photography. As expressed priority uses of the Refuge system, these uses take precedence over other potential public uses in Refuge planning and management. The Service strives to provide priority public uses when compatible with the purpose and goals of the Refuge and the mission of the System.

Environmental education and interpretive programs provide opportunities for the visiting public to learn about and experience native plants, fish and wildlife in their natural habitat. The Refuge can also educate the public about its role within the agency and the National Wildlife Refuge System, developing better community awareness, volunteer involvement and advocacy. The Refuge also has the opportunity to provide the community educational information on habitat restoration, migratory waterfowl and wetland conservation in the Central Valley.

Mandatory Reevaluation Date (provide month and year):

__2021__Mandatory 15-year Reevaluation Date (for priority public uses)

_____Mandatory 10-Year Reevaluation Date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Conducted with Comprehensive Conservation Plan

_____Categorical Exclusion without Environmental Action Statement

_____Categorical Exclusion and Environmental Action Statement

__X____Environmental Assessment and Finding of No Significant Impact

_____Environmental Impact Statement and Record of Decision

References Cited:

Cole, D. N. and P. B. Landres. 1995. Indirect effects of recreation on wildlife. Pages 183-201 in R. L.

Cole, D. N. and J. L. Marion. 1988. Recreation impacts in some riparian forests of the eastern United States. Env. Manage. 12:99-107.

Liddle, M. J. 1975. A selective review of the ecological effects on human trampling on natural ecosystems. Biol.Conserv. 7:17-36.

U.S. Fish and Wildlife Service (USFWS). 2006. Stone Lakes National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment, 2006. U. S. Fish and Wildlife Service, Sacramento, California.

Refuge Determination

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: _____ _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____ _____
(Signature) (Date)

Assistant Manager,
Refuges,
California/Nevada
Operations: _____ _____
(Signature) (Date)

California/Nevada
Operations Manager: _____ _____
(Signature) (Date)

Compatibility Determination for High-Speed Boating on the Stone Lakes National Wildlife Refuge

Use: High-Speed Boating

Refuge Name:
Stone Lakes National Wildlife Refuge
Sacramento County, California

Establishing and Acquisition Authority(ies):
Stone Lakes National Wildlife Refuge (NWR) was established in 1994 under the authority of the Emergency Wetlands Resources Act of 1986, the Fish and Wildlife Act of 1956, the Migratory Bird Conservation Act, and the Endangered Species Act of 1973. The approved refuge boundary encompasses about 18,000 acres, of which the Service owns or manages 6,200 acres. Additional acquisition authorities can be found in the funding sources used to acquire land. These sources include: California Environmental License Plate Fund, Cigarette and Tobacco Product Surtax (California Proposition 99, 1988), North American Wetland Conservation Act, Land and Water Conservation Fund, Sacramento County Environmental Mitigation Grant/Packard Foundation, Central Valley Project Improvement Act, National Fish and Wildlife Foundation, Trust for Public Land Grant/Packard Foundation, City of Sacramento, and CalFed Bay Delta Program.

Refuge Purpose(s):
Stone Lakes NWR purposes include:

"... 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)

"... 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)

National Wildlife Refuge System Mission:
The mission of the National Wildlife Refuge System (System) is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use:
High-speed boating, primarily associated with waterskiing, has occurred on Refuge waterways since before lands and waterways were incorporated into the National Wildlife

Refuge System as part of Stone Lakes NWR. The high-speed boaters are members of a private club, Beach Lake Ski Club, who launch power boats from privately-owned land within the approved Refuge boundary. Approximately 85 percent of the 2.6 miles of waterway used for waterskiing lies within Stone Lakes NWR in the Beach Lake and North Stone Lake units. The waterway consists of portions of Lower Beach Lake and Southern Pacific Railroad (SP) Cut and is bounded to the west by the abandoned railroad levee and primarily by Refuge lands to the east. Most of the channel is relatively narrow, approximately 200 to 250 feet across but it expands to approximately 750 feet at its widest point. Boaters first pass through 0.47 miles of a privately-owned portion of SP Cut. The remainder of the waterski route lies in 1.0 mile of water owned in fee title by the Refuge and 1.2 miles owned by the state of California and managed by the Refuge under cooperative agreement (see Figure 1).

Standard waterskiing, slalom, wake board, and barefoot waterskiing all occur on Refuge waters. Boats travel up to 45 mph for barefoot waterskiing (American Barefoot Club 2005) and up to 35 mph for slalom waterskiing (USA Waterskiing 2005). Waterskiers modify Refuge aquatic habitat by removing floating and submerged woody snags and debris presenting a navigational and/or safety hazard and by anchoring a slalom course marked by floats and a covered float for docking boats.

Availability of Resources: No additional funding required.

Anticipated Impacts of Use:
Riparian habitat adjacent to Lower Beach Lake and SP Cut on the Beach and North Stone Lake units provides crucial foraging, resting, and breeding habitat for wide variety of migratory songbirds, raptors, and waterbirds including waterfowl, waders, and shorebirds. Raptors such as the California Endangered Species Act listed Swainson's hawk, red-tailed hawk, red-shouldered hawk, and white-tailed kite and colonially-nesting species such as great blue heron, great egret, black-crowned night-heron, snowy egret, and double-crested cormorant, may all nest in the woody riparian habitat adjacent to Refuge waterways and may be affected by high-speed boating. Though motorized boats generally have a greater effect on wildlife, even non-motorized boat use can alter use patterns, reduce use of particular habitats, alter feeding behavior and nutritional status, and cause premature departure by migratory birds from areas (Knight and Cole 1995). In England, an increased rate of disturbance from boats partly caused a decline in roosting numbers of shorebird species (Burton et al. 1996). In addition, boaters have been observed to cause massive flights of diving ducks on the Mississippi River (Thornburg 1973). Motorized boats within 100 meters of shore caused all wintering waterfowl and shorebirds to flush between the craft and shore in south San Diego Bay, regardless of speed (Huffman 1999). Bow wakes of power boats have been reported to tip over free-floating grebe nests as well as other nests near the fringe of reeds (Reichholf 1976). However, disturbance to birds, in general, was reduced when boats traveled at or below the 5 mph speed limit (Huffman 1999).

The visitor use program proposed in the Comprehensive Conservation Plan (CCP) for Stone Lakes NWR (USFWS 2006) includes wildlife viewing and fishing from non-motorized boats in the South Stone Lake, Beach Lake, and North Stone Lake units, including the same portion of the Refuge currently utilized for waterskiing (Beach Lake and North Stone Lake units). High-speed boating will likely not be feasible alongside non-motorized boaters because wakes created while traveling at high speed may represent a significant safety risk to non-motorized boaters (American Canoe Association 2004). Wakes generated by high-speed boaters within SP Cut's narrow, shallow channel cannot readily dissipate and increase in height and steepness as they pass over the shallow nearshore zone that kayakers and canoeists are likely to frequent. Even in cases where high-speed boat wakes do not actually capsize smaller, non-motorized boats, the waves can create instability sufficient to

discourage other boaters using the channel and diminish their experience of the Refuge (C. Courtright, USFWS, pers. comm.). Boats traveling at high speeds in the narrow channel could experience difficulty in ceding the right of way to smaller vessels because they may lack space in which to give an adequate berth to other boats. In order to drive responsibly, previous studies have indicated that waterskiing boats should allow a safety area of 100 feet on either side of the boat (Bostian 2005. USCG 2006). Where Refuge channels are less than 250 feet wide, a high-speed boat would not be expected to be able to safely share the waterway with non-motorized craft.

Opportunities for wildlife observation and photography the Refuge proposes to offer visitors on waterways in the Beach and North Stone Lake units would also be negatively impacted by waterskiing because the noise and speed associated with high-speed boating disturbs and displaces wildlife. Moreover, visitors to wildlife refuges and natural areas typically seek a natural experience and their wildlife observation experience would be diminished by noise. Previous monitoring has indicated that non-motorized boaters find power boats to be obtrusive and disruptive of their experience (Pinto, A. 2002).

Wakes generated by power boats are also known to cause levee erosion (U.S. Army Corps of Engineers 1997). In non-flow dominated channels, such as SP Cut, boat-generated waves exert the greatest erosive energy against levee banks (Ellis 2002). As a result, concerns have been expressed regarding wakes generated by motorized boats in SP Cut causing significant erosion to the abandoned railroad levee which provides flood protection to Reclamation District 744 (Van Loben Sels 2005, Baxter 2005). Continued high-speed boat traffic could lead to the need for extensive levee repair or even levee failure. Moreover, erosion of the SP Cut levee has resulted in the undermining and toppling of mature riparian trees such as valley oaks, eliminating habitat for an array of wildlife species. Therefore, a no-wake speed limit is warranted to ensure a quality experience for visitors engaging in wildlife-dependent uses, reduce levee erosion, and prevent further loss of property and wildlife habitat.

As part of engaging in high-speed boating within Refuge waters, members of the waterski club periodically remove navigational hazards that may constitute valuable wildlife habitat. These hazards consist largely of submerged snags and floating woody debris which, while hazardous for motorized, high-speed boats, provide valuable basking habitat for western pond turtles (a State and Federal species of concern). In addition submerged snags and floating woody debris provide cover and foraging areas for fish and other wildlife.

Western pond turtle populations are declining throughout most of their range, particularly in Southern California, and the major cause of the decline appears to be the destruction of suitable habitat (Brattstrom 1988, Brattstrom and Messer 1988). The only extensive populations of turtles currently occur in Northern California and Southern Oregon. Despite its name, the western pond turtle is only rarely a pond dweller and prefers the deep, slow-flowing waters of sloughs or pools in rivers (Brury 1986). The quiet waters of SP Cut and Lower Beach Lake are ideal pond turtle habitat. Moreover, recent graduate studies have confirmed that successful nesting by western pond turtles has occurred in tributaries of Lower Beach Lake (S. Oliver, pers. comm.). Other components of optimal turtle habitat include emergent basking sites, emergent vegetation, mud, rocks and logs (Holland 1992). Research conducted on the Trinity River suggests that the preservation and restoration of structural features, such as underwater cover and emergent basking sites, is of prime importance for promoting pond turtle survival (Reese 1998). Removal of snags and floating woody debris for navigational safety purposes degrades the quality of the riparian habitat and is therefore not consistent with Stone Lakes NWR purposes or the National Wildlife Refuge System mission.

Public Review and Comment:
Public review and comments will be solicited in conjunction with distribution of the Draft CCP for Stone Lakes NWR. The public will be provided 30 days to review and comment on the CCP and this CD. Following the public review and comment period, comments and actions taken to address comments will be summarized here.

Determination:

__X____Use is Not Compatible

_____Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility: Not applicable.

Justification:
High-speed boating is not a wildlife-dependent recreational public use. In light of its adverse effects on Refuge natural resources and the ability of Refuge visitors to engage in wildlife-dependent uses, high-speed boating should not be allowed on Refuge waters. Instead, it is proposed that a no-wake speed limit be enforced for the following reasons:

1) High-speed boaters represent as safety risk to non-motorized boaters within the narrow confines of this waterway.

2) High-speed boating disturbs and displaces wildlife because of noise and wake.

3) Wave action from high-speed boating, in narrow waterways, erodes shorelines and levees and causes loss of woody riparian habitat.

4) High-speed boating may adversely affect wildlife-dependent visitor uses.

5) High-speed boating within Refuge waters necessitates removal of navigational hazards that constitute valuable habitat for special status species and other fish and wildlife.

Refuge staff will cooperate with high-speed boaters to seek alternative sites for waterskiing and to phase out the incompatible use. Other waterskiing sites are available outside the approved Refuge boundary that do not have significant adverse effects on visitors to the Refuge, wildlife and their habitats, or levee integrity.

Mandatory Reevaluation Date (provide month and year): N/A.

_____ Mandatory 15-Year Reevaluation Date (for priority public uses)

_____ Mandatory 10-Year Reevaluation Date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____Conducted with Comprehensive Conservation Plan

_____Categorical Exclusion without Environmental Action Statement

_____Categorical Exclusion and Environmental Action Statement

__X__ Environmental Assessment and Finding of No Significant Impact

_____Environmental Impact Statement and Record of Decision

References Cited:

American Barefoot Club. 2005. 2002 ABC Rulebook. http://barefoot.org/documents/2002ABCRuleBook.PDF

American Canoe Association. 2004. Critical Judgment II: Understanding and Preventing Canoe and Kayak Fatalities. 1996-2002.

Baxter, R. D. 2005. Letter to Stone Lakes National Wildlife Refuge, U.S. Fish and Wildlife Service. California Department of Parks and Recreation. Sacramento, California.

Bostian, Julie. About.com Waterskiing/Wakeboarding. How to Drive a Boat and Ski Responsibly in Traffic. http://waterski.about.com/cs/driverscorner/ht/DriveRespons.html

Brattstrom, B.H. 1988. Habitat destruction on California with special reference to *Clemmys marmorata*: a perspective. pp. 13-24. *In*: H. F. DeLisle, P. R. Brown, B. Kaufman and B. M. McGurty (eds.). Proceedings of the Conference on California Herpetology. Southwestern Herpetological Society, Van Nuys, California.

Brattstrom, B.H. and D.F. Messer. 1988. Current status of the southwestern pond turtle, *Clemmys marmorata pallida*, in southern California. Final Report for California Department of Fish and Game, Contract C-2044. 47 pp. + xii.

Bury, R.B. 1986a. Feeding ecology of the turtle, *Clemmys marmorata*. J. Herpetol. 20(4): 515-521.

Burton, N.H.K., P.R. Evans, and M.A. Robinson. 1996. Effects on shorebird numbers of disturbance, the loss of a roost site and its replacement by an artificial island at Harlepool, Cleveland. Biol. Conserv. 77:193-201.

Ellis, J.T., D.J. Sherman, B.O. Bauer, and J. Hart. 2002. Assessing the Impact of an Organic Restoration Structure on Boat Wake Energy. Journal of Coastal Research. 36:256-265

Holland, D. C. 1991. Distribution and current status of the western pond turtle (*Clemmys marmorata*) in Oregon. Report to the Oregon Department of Fish and Wildlife.

Huffman, K. 1999. San Diego South Bay survey report-effects of human activity and water craft on wintering birds in South San Diego Bay. USFWS report.

Pinto, A. 2002. A case study of the nature of conflict between boaters on the lower Salmon River in Idaho. Master's Thesis. The University of Idaho. May 2002.

Kahlert, J. 1994. Effects of human disturbance on broods of red-breasted mergansers *Mergus serrator*. Wildfowl 15:222-231.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. in Wildlife and Recreationists R.L. Knight and K.J. Gutzwiller, eds.). Island Press, Covelo, California.

Reese, D.A. and H.H. Welsh. 1998a. Habitat use by western pond turtles in the Trinity river, California. Journal of Wildlife Management. 62(3): 842-853.

Reichholf, J. 1976. The influence of recreational activities on waterfowl. Pages 364-369 in M. Smart, ed. Proceedings of the International Conference on the Conservation of Wetlands and Waterfowl, Heiligenhafen, Federal Republic of Germany, 2-6 December 1974. Slimbridger, England: International Waterfowl Research Bureau.

Thornburg, D.D. 1973. Diving duck movements on Keokuk Pool, Mississippi River. J. Wildl. Manage. 37:382-389.

USA Water Ski. 2005. American Water Ski Association, Official Tournament Rules. 2005 http://www.usawaterski.org/pages/divisions/3event/2005AWSARulebook.pdf

U.S. Army Corps of Engineers. 1997. Draft Project Modification Report Prospect Island. Sacramento, California.

U.S. Fish and Wildlife Service (USFWS). 2006. Stone Lakes National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment. U. S. Fish and Wildlife Service, Sacramento, California.

Van Loben Sels, R. 2005. Letter to the US Fish and Wildlife Service. Reclamation District #744 Sacramento, California.

Personal Communications

Clay Courtright, US Fish and Wildlife Service, Sacramento, California, June 4, 2003.

Refuge Determination

Prepared by:	_____ (Signature)	_____ (Date)
Refuge Manager/ Project Leader Approval:	_____ (Signature)	_____ (Date)

Concurrence

Refuge Supervisor:	_____ (Signature)	_____ (Date)
Assistant Manager, Refuges, California/Nevada Operations:	_____ (Signature)	_____ (Date)
California/Nevada Operations Manager:	_____ (Signature)	_____ (Date)

Compatibility Determination for Recreational Boating on the Stone Lakes National Wildlife Refuge

Use: Recreational Boating Associated with Hunting, Fishing, Wildlife Observation, and Photography

Refuge Name:
Stone Lakes National Wildlife Refuge
Sacramento County, California

Establishing and Acquisition Authority(ies):
Stone Lakes National Wildlife Refuge (NWR) was established in 1994 under the following authorities: Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b)), Fish and Wildlife Act of 1956 (16 U.S.C. 742f(a)(4)), Migratory Bird Conservation Act (16 U.S.C. 715d), and Endangered Species Act of 1973 (16 U.S.C. 1534). Additional acquisition authorities can be found in the funding sources used to acquire land. These sources include: the California Environmental License Plate Fund, the Cigarette and Tobacco Product Surtax (California Proposition 99, 1988), the North American Wetland Conservation Act (add USC citation), the Land and Water Conservation Fund (add USC citation),, the Sacramento County Environmental Mitigation Grant/Packard Foundation, the Central Valley Improvement Act (add USC citation), the National Fish and Wildlife Fund (add USC citation), the Trust for Public Land Grant/Packard Foundation, the City of Sacramento, and CalFed Bay Delta Program (add USC citation).

Refuge Purpose(s):
Stone Lakes NWR purposes include the following.

"... 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 ..." (Emergency Wetlands Resources Act of 1986)

"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." (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 ..." (Fish and Wildlife Act of 1956)

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.' (Migratory Bird Conservation Act)

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." (Endangered Species Act of 1973)

National Wildlife Refuge System Mission:
"The mission of the National Wildlife Refuge System (System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use:

The visitor use program proposed in the Comprehensive Conservation Plan (CCP) for Stone Lakes NWR (USFWS 2006a) includes recreational boating that supports priority visitor uses, including hunting, fishing, wildlife observation, photography, environmental education, and interpretation. The recreational boating uses addressed in this compatibility determination consist of car-top, hand-launched boats, such as kayaks and canoes and boats with electric motors, with some restrictions.

Regulation of recreational boating on the Refuge will be managed to minimize safety risks, as well as adverse effects on wildlife, habitat, and other recreational users, particularly those engaged in wildlife-dependent uses. These restrictions will include a no-wake speed limit throughout Refuge waters, seasonal closures, and limitations on use of electric motors. No gas-powered outboard motors will be permitted. The no-wake zone is intended to protect non-motorized boaters, wildlife and wildlife habitat. The restrictions are also intended to protect levees from deterioration by wave action (Baxter 2005, Van Loben Sels 2005) and to reduce noise levels that could adversely affect wildlife.

Waterways open to boating will include South Stone Lake, Southern Pacific Railroad (SP) Cut, and Lower Beach Lake. Boat launch, access, and parking for Lower Beach Lake and SP Cut on the Beach Lake Unit will be from the west end of Elliott Ranch Road. Current facilities are limited to a gravel parking area and an unimproved boat launch. Parking for a maximum of 10 cars and an improved boat launch will be constructed at Elliot Ranch Road, contingent upon available funding. The second boat launch site is on the Sun River property of the South Stone Lake Unit where parking will be expanded to accommodate up to 20 cars. Depending on availability of staff and funding, a new boat haul-out and associated trail and observation blind will be provided at the Lodi Gun club property of the South Stone Lake Unit to be accessible only by boat.

All Refuge waterways will be open for recreational boating from June through September only. Waterways will be closed to recreational boating for the remainder of the year to minimize disturbance to nesting waterbirds and raptors such as herons, egrets, grebes, and Swainson's hawks. Waterways being treated for invasive aquatic weeds (e.g., water hyacinth, Egeria densa) will be closed to boating during herbicide applications. Temporary closures to boating may also be required during particular habitat restoration or management projects. Private vendors wishing to lead boating groups will be required to apply for a Refuge Special Use Permit. Chapter 5 of the Comprehensive Conservation Plan, Refuge Vision, Goals and Objectives, are herein incorporated by reference.

Availability of Resources:

The following funding/annual costs would be required to administer and manage boating activities as described above:

Activity	One-time Costs	Recurring Costs
Improvement of boat ramp and parking LOT	$30,000	
Maintenance of Parking Lots and Boat Launches		$5,000
Maintenance (0.50 FTE)	$26,000	$26,000
Law Enforcement (0.5 FTE)	$25,000	$25,000
Install Signs (includes all public use signs)	$10,000	
Maintain Signs		$5,000
Administration	$2,000	$2,000
TOTAL	**$93,000**	**$63,000**

Funding will be sought through the Service budget process. Other opportunities may include: expanded partnerships with the State and recreational user groups, grants, coordination with other law enforcement agencies, and additional Refuge operations. All funding will be utilized to support a safe, quality public use program as described above.

Anticipated Impacts of Use:

Stone Lakes NWR provides crucial foraging and breeding habitat for wintering migratory birds, including waterfowl, shorebirds, and other waterbirds. Great blue herons, great egrets, double-crested cormorants, and Swainson's hawks, in particular, may be affected by recreational boating since they nest in tall riparian trees adjacent to waterways used by boaters. Though motorized boats generally have a greater effect on wildlife, even non-motorized boat use can alter distribution, reduce use of particular habitats by waterfowl and other birds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995). In the Ozark National Scenic Riverway, green heron activity declined on survey routes when canoes and boat use increased on the main river channel (Kaiser and Fritzell 1984). Canoes or slow moving boats have also been observed to disturb nesting great blue herons (Vos et al. 1985). However, compared to motorboats, canoes and kayaks appear to have less disturbance effects on most wildlife species (Jahn and Hunt 1964, Huffman 1999, DeLong 2002) and disturbance to birds, in general, is reduced when boats travel at or below the 5 mph speed limit (Huffman 1999). To protect waterbirds and raptors that nest in riparian trees, the Beach Lake and South Stone Lake units will be closed to recreational boating from October through May, during nesting and breeding seasons. Monitoring of nesting great blue herons, Swainson's hawks and other waterbirds will be periodically conducted to assess the impact of recreational boating use.

Federally-listed species that may occur on the Refuge include the giant garter snake, valley elderberry longhorn beetle, vernal pool tadpole, and vernal pool fairy shrimp (USFWS 2006b). No effects on the beetle or vernal pool species are anticipated because recreational boating will occur outside of the habitats of these species. However, giant garter snakes could be affected by vehicular use of the area if they happen to be crossing a roadway. Vehicular speed limits will therefore be enforced within the Refuge to reduce effects to wildlife.

Western pond turtle populations are declining throughout most of their range, particularly in Southern California, and the major cause of the decline appears to be the destruction of suitable habitat (Brattstrom 1988, Brattstrom and Messer 1988). Because of its precipitous decline in numbers, the Western pond turtle has been designated as a Federal and State species of concern. The only extensive populations of turtles currently occur in Northern California and Southern Oregon. Despite its name, the western pond turtle is only rarely a pond dweller and prefers the deep, slow-flowing waters of sloughs or pools in rivers (Brury 1986). The quiet waters of the Beach Lake and South Stone Lake units are ideal pond turtle habitat. Recent graduate studies have confirmed that western pond turtles successfully nest on the Refuge (S. Oliver, pers. comm.). Other components of optimal turtle habitat include emergent basking sites, emergent vegetation, mud, rocks, and logs (Holland 1992). Research conducted on the Trinity River suggests that the preservation and restoration of structural features, such as underwater cover and emergent basking sites, is of prime importance for promoting pond turtle survival (Reese 1998). To occur safely, high-speed boating necessitates removal of snags and other underwater hazards that also provide valuable turtle habitat. However, no such alteration of habitat is necessary to provide no-wake boating opportunities. Nevertheless, canoes, kayaks, and car-top boats with electrical motors can still be expected to have some disturbance effect on turtles by displacing them from basking sites.

Public Review and Comment:
Public review and comments will be solicited in conjunction with distribution of the Draft CCP for Stone Lakes NWR. The public will be provided 30 days to review and comment upon the CCP and this CD. Following the public review and comment period, comments and actions taken to address comments will be summarized here.

Determination:

_____ Use is Not Compatible

___X___Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:
The following stipulations are required to ensure that recreational boating is compatible:

- A no-wake speed limit will be implemented throughout Refuge waters. Only human-powered canoes and kayaks, and electric-powered car-top boats (that is, non-trailered boats which can be carried on top of, inside of, or in the back of a vehicle and can be hand-launched into the water) will be permitted throughout Refuge waters.

- A seasonal closure from October through May will be implemented to reduce disturbance to wintering, nesting, resting, foraging, and breeding birds and other wildlife, their habitats, and other recreational users, especially those participating in wildlife-dependent visitor uses.

- Removal of snags and floating woody debris for navigational safety purposes will not be permitted.

- Signs will be installed and maintained to mark closed areas, convey seasonal closures, and indicate no-wake regulations on the Refuge.

- Periodic law enforcement will help ensure compliance with speed limit regulations and area closures. Regulations will be described in brochures and posted at Refuge headquarters and at boat launch sites. Recreational boaters are required to be in compliance with all applicable Refuge, U.S. Coast Guard and State of California regulations and laws.

- Boating activities and associated effects will be monitored with regard to waterfowl, shorebirds, birds of prey, other wildlife and their habitats, and other recreational users, especially those participating in wildlife-dependent visitor uses.

- Monitoring data will be used by the Refuge manager in making necessary adjustments in regulations or other aspects of the Refuge boating program and in the periodic reevaluation of this Compatibility Determination.

Justification: Boating itself is not wildlife-dependent recreation, but many wildlife dependent recreational activities (waterfowl hunting, fishing, wildlife observation, photography, and environmental education and interpretation) are associated with boating. A carefully regulated boating program would help the Refuge provide opportunities for wildlife-dependent priority visitor uses, which would contribute toward fulfilling provisions under the National Wildlife Refuge System Administration Act as amended in 1997.

Although boating has a potential to impact wildlife, implementing the prescribed stipulations listed above will reduce many of these impacts. Adequate habitat will be available for

wintering and breeding waterfowl, birds of prey, and other wetland-dependent species because high wildlife use areas will be closed to boating during critical periods. Boating regulations will be maintained and enforced in order to minimize the impact of visitor use on wildlife and wildlife habitat. Thus, migratory birds will find sufficient food resources and resting places so their abundance and use of the Refuge will not be measurably lessened; their physiological condition and production will not be impaired; their behavior and normal activity patterns will not be dramatically altered; and their overall status will not be impaired. The Refuge will also implement a monitoring program to help assess disturbance effects on wildlife and habitat. The impacts associated with boating activities can be reduced through improved outreach and educational information for Refuge visitors involved in these activities.

Mandatory Reevaluation Date (provide month and year):

_____Mandatory 15-Year Reevaluation Date (for priority public uses)

__2016__Mandatory 10-Year Reevaluation Date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

__X___CCP Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

References Cited:

Baxter, R. D. 2005. Letter to Stone Lakes National Wildlife Refuge, U.S. Fish and Wildlife Service. California Department of Parks and Recreation. Sacramento, California.

Brattstrom, B.H. 1988. Habitat destruction on California with special reference to *Clemmys marmorata*: a perspective. Pp. 13-24 *In:* H. F. DeLisle, P. R. Brown, B. Kaufman and B. M. McGurty (eds.). Proceedings of the Conference on California Herpetology. Southwestern Herpetological Society, Van Nuys, California.

Brattstrom, B.H. and D.F. Messer. 1988. Current status of the southwestern pond turtle, *Clemmys marmorata pallida*, in southern California. Final Report for California Department of Fish and Game, Contract C-2044. 47 pp. + xii.

Bury, R.B. 1986a. Feeding ecology of the turtle, *Clemmys marmorata*. J. Herpetol. 20(4): 515-521.

Burton, N.H.K., P.R. Evans, and M.A. Robinson. 1996. Effects on shorebird numbers of disturbance, the loss of a roost site and its replacement by an artificial island at Harlepool, Cleveland. Biol. Conserv. 77:193-201.

DeLong, A. 2002. Managing Visitor Use & Disturbance of Waterbirds. A Literature Review of Impacts and Mitigation Measures.

Holland, D. C. 1991. Distribution and current status of the western pond turtle (*Clemmys marmorata*) in Oregon. Report to the Oregon Department of Fish and Wildlife.

Huffman, K. 1999. San Diego South Bay survey report-effects of human activity and water craft on wintering birds in South San Diego Bay. USFWS report.

Jahn, L.R. and R.A. Hunt. 1964. Duck and coot ecology and management in Wisconsin. Wisconsin Conserv. Dep. Tech. Bull. No. 33. 212pp.

Kahlert, J. 1994. Effects of human disturbance on broods of red-breasted mergansers *Mergus serrator*. Wildfowl 15:222-231.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. J. Wildl. Manage. 48: 561-567.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. in Wildlife and Recreationists R.L. Knight and K.J. Gutzwiller, eds.). Island Press, Covelo, California.

Reese, D.A. and H.H. Welsh. 1998a. Habitat use by western pond turtles in the Trinity River, California. Journal of Wildlife Management. 62(3): 842-853.

Thornburg, D.D. 1973. Diving duck movements on Keokuk Pool, Mississippi River. J. Wildl. Manage. 37:382-389.

U.S. Fish and Wildlife Service (USFWS). 2006a. Stone Lakes National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment, September 2005. U. S. Fish and Wildlife Service, Sacramento, California.

U.S. Fish and Wildlife Service (USFWS). 2006b. Biological Opinion for the Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan (1-8-01-FW-66). U.S. Fish and Wildlife Service, Sacramento, California.

Van Loben Sels, R. 2005. Letter to Stone Lakes National Wildlife Refuge, U.S. Fish and Wildlife Service. Reclamation District #744. Sacramento, California.

Vos, D.K., R.A. Ryder, and W.D. Graul. 1985. Response of breeding great blue herons to human disturbance in North-central Colorado. Colonial Waterbirds 8:13-22.

Refuge Determination

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: _____ _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____ _____
(Signature) (Date)

Assistant Manager,
Refuges,
California/Nevada
Operations: _____ _____
(Signature) (Date)

California/Nevada
Operations Manager: _____ _____
(Signature) (Date)

Compatibility Determination for Research on the Stone Lakes National Wildlife Refuge

Use: Research

Refuge Name:
Stone Lakes National Wildlife Refuge
Sacramento County, California

Establishing and Acquisition Authority:
Stone Lakes National Wildlife Refuge (NWR) was established in 1994 under the authority of the Emergency Wetlands Resources Act of 1986, the Fish and Wildlife Act of 1956, the Migratory Bird Conservation Act and the Endangered Species Act of 1973. The approved Refuge boundary contains about 18,000 acres, of which the Service owns or manages approximately 6,200 acres. Additional acquisition authorities can be found in the funding sources used to acquire land. These sources include: California Environmental License Plate Fund, Cigarette and Tobacco Product Surtax (California Proposition 99, 1988), North American Wetland Conservation Act, Land and Water Conservation Fund, Sacramento County Environmental Mitigation Grant/Packard Foundation, Central Valley Project Improvement Act, National Fish and Wildlife Foundation, Trust for Public Land Grant/ Packard Foundation, City of Sacramento, and CalFed Bay Delta Program.

Refuge Purpose(s):
Stone Lakes NWR purposes include:

"... 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)

"... 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)

National Wildlife Refuge System Mission:
The mission of the National Wildlife Refuge System (System) is "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use(s):
Stone Lakes National Wildlife Refuge (Refuge) periodically reviews proposals for scientific research to be conducted on the Refuge or may recommend possible research topics

to professors or students from nearby academic institutions. Although research is not identified as a priority public use by the National Wildlife Refuge System Improvement Act of 1997, scientific research can benefit Refuge resources and support the purpose of the Refuge and mission of the System. The Refuge proposes to give priority to studies that contribute to the conservation, enhancement, , management, or use of native Refuge fish and wildlife populations and their habitats. Research proposals would be reviewed by Refuge staff or other specialists, as appropriate. Research proposals that met the following criteria, would be given priority consideration for approval:

- Research that would contribute to Refuge conservation, enhancement, management, or visitor use programs;
- Research that would not conflict with other ongoing management, monitoring, or research programs;
- Research that could only be conducted on the Refuge;
- Research that did not result in undue disturbance to Refuge fish and wildlife and their habitats; and
- Research that could be monitored by the Refuge within existing staffing or logistical constraints.

Availability of Resources:
Adequate funding and staff exist to manage research at the Stone Lakes NWR. .

Anticipated Impacts of the Use(s):
Some level of disturbance is expected from many research activities since they commonly occur in areas normally closed to the public and may involve collecting samples or handling fish and wildlife. However, minimal impact to Refuge resources would be anticipated since research studies would be governed by a Special Use Permit (SUP) annually issued by the Refuge. SUP conditions would ensure that impacts to wildlife and habitats are minimized. All projects would be reviewed annually to assess compliance with SUP conditions. Prior to their approval, research proposals would be evaluated to ensure their study design resulted in the least possible level of disturbance to sensitive Refuge resources.

Public Review and Comment:
Public review and comments will be solicited in conjunction with distribution of the Draft CCP for Stone Lakes NWR. The public will be provided 30 days to review and comment upon the CCP and this CD. Following the public review and comment period, comments and Service responses will be summarized here.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility:
Research applicants would be required to submit a proposal summarizing:
(1) Objectives of the study;
(2) Justification for the study;
(3) Description of study methodology and schedule;
(4) Description of potential impacts on Refuge fish and wildlife and/or habitats, including short-term and long-term disturbance, injury, or mortality;

(5) Summary of research personnel required and their qualifications/experience;
(6) Status of necessary permits (e.g., scientific collecting permits, endangered species permit),;
(7) Anticipated costs to the Refuge and any requests for Refuge staff assistance; and
(8) Planned deliverables and end products (e.g., reports, publications).

If proposed research methods adversely affect or have the potential to adversely affect Refuge resources, the researcher will be required to implement mitigation measures to minimize potential impacts. Mitigation measures will be included as conditions on the Special Use Permit. Refuge staff will monitor and inspect research projects to assess any unanticipated environmental effects and will have authority to terminate any research project, if necessary. All Refuge rules and regulations will be adhered to by researchers, unless specifically waived under a Special Use Permit issued by Refuge management.

Justification: Well-defined research projects developed in consultation with Service staff, would contribute directly to the conservation, enhancement, protection, management, and use of native Refuge fish and wildlife populations and their habitats. Adequate SUP conditions will be imposed on any research project to ensure that short and long-term impacts on Refuge resources are minimized, Only research that is compatible with the purposes of the Refuge and mission of the System would be permitted on the Refuge

Mandatory Reevaluation Date (provide month and year):

_____ Mandatory 15-Year Reevaluation Date (for priority public uses)

__2016__ Mandatory 10-Year Reevaluation Date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Conducted with Comprehensive Conservation Plan

_____Categorical Exclusion without Environmental Action Statement

_____Categorical Exclusion and Environmental Action Statement

__X___Environmental Assessment and Finding of No Significant Impact

_____Environmental Impact Statement and Record of Decision

References Cited:

U.S. Fish and Wildlife Service (USFWS). 2006. Stone Lakes National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment, 2006. U. S. Fish and Wildlife Service, Sacramento, California.

Refuge Determination

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: _____ _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____ _____
(Signature) (Date)

Assistant Manager,
Refuges,
California/Nevada
Operations: _____ _____
(Signature) (Date)

California/Nevada
Operations Manager: _____ _____
(Signature) (Date)

Compatibility Determination for Plant Gathering on the Stone Lakes National Wildlife Refuge

Use: Plant Gathering

Refuge Name:
Stone Lakes National Wildlife Refuge
Sacramento County, California

Establishing and Acquisition Authority:
Stone Lakes National Wildlife Refuge (NWR) was established in 1994 under the authority of the Emergency Wetlands Resources Act of 1986, the Fish and Wildlife Act of 1956, the Migratory Bird Conservation Act, and the Endangered Species Act of 1973. The approved refuge boundary contains about 18,000 acres, of which the Service owns or manages approximately 6,200 acres. Additional acquisition authorities can be found in the funding sources used to acquire land. These sources include: the California Environmental License Plate Fund, Cigarette and Tobacco Product Surtax (California Proposition 99, 1988), North American Wetland Conservation Act, Land and Water Conservation Fund, Sacramento County Environmental Mitigation Grant/Packard Foundation, Central Valley Project Improvement Act, National Fish and Wildlife Foundation, Trust for Public Land Grant/ Packard Foundation, City of Sacramento, and CalFed Bay Delta Program.

Refuge Purpose(s):
Stone Lakes NWR purposes include:

"... 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)

"... 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)

National Wildlife Refuge System Mission:
The mission of the National Wildlife Refuge System (System) is "To administer a national network of lands and waters for the conservation, management and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use(s):
The gathering of plants in and around Stone Lakes National Wildlife Refuge by Native Americans occurred historically and continues to be an ongoing use today. Plants are

gathered for a variety of uses; for medicinal uses, ceremonial uses, as food stuffs and for utilitarian or artistic purposes such as basket weaving or cord making. Plants gathered for traditional uses may include; willow bark and branches (*Salix* spp.), mugwort (*Artemisia douglasiana*), tule (*Schoenoplectus acutus* var. *occidentalis*, syn. *Scirpus acutus*), Santa Barbara sedge (*Carex barbarae*), wild rose (*Rosa californica*), indian hemp (*Apocynum cannabinum*), oak acorns (*Quercus* spp.) and others. Plants are gathered during various seasons; acorns, bulbs and berries are gathered in the late summer or fall, while medicinal or ceremonial herbs and basketweaving materials may be gathered in spring. The amount of plant material being harvested is traditionally low and is not expected to increase. Special Use Permits will be issued by the Refuge for plant gathering and access regulated to ensure protection of critical habitat during nesting or breeding periods. The use of Refuge lands for collections is considered to be of vital importance to Native American cultural groups such as the California Indian Basketweavers Association.

For additional details about this proposed use, please see the Environmental Assessment (Appendix C) for the Stone Lakes National Wildlife Refuge Draft Comprehensive Conservation Plan (USFWS 2006) which is herein incorporated by reference.

Availability of Resources: No additional resources will be needed to support this use.

Anticipated Impacts of the Use(s):

Impacts are also discussed in the Environmental Assessment (Appendix C) for the Stone Lakes National Wildlife Refuge Draft Comprehensive Conservation Plan (USFWS 2006) Impacts to habitat and wildlife associated with plant gathering on the Refuge are minimal. The amount of plant material being harvested is small enough not to constitute any meaningful impact on habitat. The level of disturbance to wildlife will vary depending on the season, but is considered to be low overall. The gathering of acorns, berries, bulbs and other plant materials that occurs from late summer through fall will have little or no impact on migratory or nesting birds. Gathering of new plant growth in springtime, herbs for medicinal/ceremonial purposes and willow twigs and bark for basket weaving may coincide with use of the refuge by migratory waterfowl, but as gathering activities are limited, impact is also expected to be limited.

Disruptions to Refuge management may occur if routine herbicide applications for invasive terrestrial weeds require modification due to plant gathering activities. Refuge staff avoid application of herbicides to plants known to be valuable for food, medicinal, ceremonial, and ornamental or other cultural uses. However, this adjustment of management practices is not considered burdensome and will not adversely affect control of invasive weeds or habitat restoration projects.

Federally listed species that may occur on the Refuge include the giant garter snake, valley elderberry longhorn beetle, vernal pool tadpole and fairy shrimp. No impacts to vernal pool species are anticipated from plant gathering since gathering activities will not be occurring on or near the vernal pool Wetland Preserve Unit of the Refuge. State listed species that inhabit the refuge include greater sandhill crane and Swainson's hawk. The primary disturbance season for Swainson's hawk is during the nesting season, typically mid-February through July. Prime nesting habitat would be closed to visitors during the nesting season.

Public Review and Comment:

Public review and comments will be solicited in conjunction with distribution of the Draft CCP for Stone Lakes NWR. The public will be provided 30 days to review and comment upon the CCP and this CD. Following the public review and comment period, comments and Service responses to address comments will be summarized here.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible With Following Stipulations

Stipulations Necessary to Ensure Compatibility:
In order to accommodate access to the Refuge for plant gathering, the following measurers will be taken:

Plant gathering activities will be reviewed as part of annual coordination with tribal representatives. If monitoring by the Refuge reveals that impacts from plant gathering have increased so the activity is adversely affecting wildlife or habitat, then permitees will be required to adjust their activities to avoid impacts. Adjustments may include reductions in harvest, changes in timing of gathering, or reductions in numbers of visitors or frequency of visitors.

The Refuge manager will have the authority to close areas within the Refuge during sensitive wildlife use periods and cancel any collecting activities deemed necessary to fulfill Refuge purposes or ensure visitor safety. Sensitive nesting areas will be protected from disturbance by visitors with signs and barriers. Visitors will be directed away from areas where major habitat restoration or management projects are under way.

Justification:
One of the goals of the National Wildlife Refuge System (System) is providing the public an understanding and appreciation of fish and wildlife ecology, wildlife habitat and the human role in the environment. The Service strives to provide priority visitor uses when compatible with the purpose and goals of the Refuge and the mission of the System. The National Wildlife Refuge System Improvement Act of 1997 identifies environmental education and interpretation as priority public uses for National Wildlife Refuges, along with hunting, fishing, wildlife observation and photography. Though plant gathering is not a wildlife-dependent recreational use, it is an activity that contributes to environmental education and awareness. An understanding of plant ecology is essential to successful plant harvesting, thus this activity helps to educate participants about Central Valley habitats, while sustaining cultural practices.

Mandatory Reevaluation Date (provide month and year):

_____ Mandatory 15-year Reevaluation Date (for priority public uses)

__2016__ Mandatory 10-Year Reevaluation Date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Conducted with Comprehensive Conservation Plan

_____Categorical Exclusion without Environmental Action Statement

_____Categorical Exclusion and Environmental Action Statement

__X____Environmental Assessment and Finding of No Significant Impact

_____Environmental Impact Statement and Record of Decision

References Cited:

U.S. Fish and Wildlife Service (USFWS). 2006. Stone Lakes National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment, 2006. U. S. Fish and Wildlife Service, Sacramento, California.

Refuge Determination

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: _____ _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____ _____
(Signature) (Date)

Assistant Manager,
Refuges,
California/Nevada
Operations: _____ _____
(Signature) (Date)

California/Nevada
Operations Manager: _____ _____
(Signature) (Date)

Compatibility Determination for Mosquito Control on the Stone Lakes National Wildlife Refuge

Use: Monitor and Control Mosquitos

Refuge Name:
Stone Lakes National Wildlife Refuge
Sacramento County, California

Establishing and Acquisition Authority(ies):
Stone Lakes National Wildlife Refuge (NWR) was established in 1994 under the authority of the Emergency Wetlands Resources Act of 1986, the Fish and Wildlife Act of 1956, the Migratory Bird Conservation Act, and the Endangered Species Act of 1973. The approved refuge boundary contains about 18,000 acres, of which the Service owns or manages 4,065 acres. Additional acquisition authorities can be found in the funding sources used to acquire land. These sources include: the California Environmental License Plate Fund, the Cigarette and Tobacco Product Surtax (California Proposition 99, 1988), the North American Wetland Conservation Act, the Land and Water Conservation Fund, the Sacramento County Environmental Mitigation Grant/Packard Foundation, the Central Valley Improvement Act, the National Fish and Wildlife Fund, the Trust for Public Land Grant/Packard Foundation, the City of Sacramento, CalFed Bay Delta Program.

Refuge Purpose(s):
Stone Lakes NWR purposes include:

"... 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)

"... 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)

National Wildlife Refuge System Mission:
The mission of the National Wildlife Refuge System (System) is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use:
Stone Lakes National Wildlife Refuge (Refuge) proposes to continue to collaborate with Sacramento-Yolo Mosquito Vector Control District (District) in monitoring and controlling

mosquitos to address the human health concerns of neighboring communities. The Refuge is located within Sacramento County, 10 miles south of downtown Sacramento and bordered by the city of Elk Grove on the east. The potential for mosquito production in Refuge waters is worrisome to residents, and indeed, urbanized areas adjacent to the Refuge are within the flying range of many species of mosquitos. Because of this, Refuge staff and SYMVCD (District) entered into a Memorandum of Understanding (MOU) in 1993, to establish a framework within which the District may continue to control and abate mosquitos within the Refuge, consistent with the goals and objectives of the Refuge. Both the Refuge and the District agree that biological, cultural and physical mosquito control methods are preferred over chemical methods and that wetlands can be designed and managed to avoid or minimize mosquito breeding. In summary, the MOU provides for: 1) allowing the District to comment on planned Refuge wetland projects, 2) providing the District an annual summary of planned Refuge water management and notification of flood-ups and irrigations, 3) the District providing a proposed annual mosquito abatement operating plan to the Refuge, 4) the Refuge submitting pesticide use permits (PUP's) for mosquito control chemicals requested by the District, 5) providing access for mosquito monitoring and biological control measures such as mosquito fish planting as defined in a Special Use Permit (SUP) and 6) with notification and coordination, application of larvicides or adulticides, when specified thresholds are exceeded.

Many species of mosquitos are known vectors of serious diseases in California. Although 12 mosquito-borne viruses are known to occur in California, only western equine encephalomyelitis virus (WEE) and St. Louis encephalitis virus (SLE) have caused significant outbreaks of human disease (CDHS 2003). WEE tends to be most serious in very young children, whereas elderly people are most at risk to SLE and WNV (CDHS 2003). California is also at risk for West Nile virus (WNV) which was first detected in the summer of 2003 in adult mosquitos in Imperial County and in crows in Orange County. WNV was detected within Sacramento County in 2004, though it has principally affected birds and horses. In 2005, West Nile Virus (WNV) became established in Sacramento and Yolo counties, triggering aggressive and widespread mosquito control efforts. In August of 2005 the number of human WNV cases and rate of infected adult mosquitos were so high that the District conducted aerial applications of pyrethrin over a major portion of Sacramento County (Sacramento County 2006). WEE and WNV can cause serious diseases in horses and emus and WNV kills a wide variety of endemic and imported birds. Mosquito control is the only known practical method of protecting people and animals from WEE, SLE, and WNV (CDHS 2003). With the exception of available vaccines to protect horses against WEE and WNV, there are no known specific treatments or cures for diseases caused by these viruses (CDHS 2003).

Mosquito control at the Refuge follows an ordered succession, using nonchemical treatments first (e.g., water control strategies, vegetation management, mosquitofish, etc.), resorting to chemical treatment only when necessary, as determined through standard mosquito monitoring procedures. Among chemical treatments, adulticides will be used as a last resort. For example, wetlands that have produced large mosquito populations in the past will be flooded as quickly as possible to minimize multiple emergencies that may cause a need for adulticiding. Refuge staff work closely with the District to reduce or eliminate mosquitos on the refuge by means of biological controls and habitat management. The MOU signed by the District and the Refuge outlines an effective biological mosquito suppression program that includes wetland design, water level management recommendations, research partnerships, and the introduction of native and non-native fish that prey on mosquito larvae.

The mosquito species identified by SYMVCD for monitoring and control are *Culex tarsalis*, *Anopheles freeborni*, *Aedes vexans*, *Ochlerotatus melanimon*, *Ochlerotatus nigromaculis*, and *Aedes increpitus*. *Culex tarsalis* is the primary vector of WEE and SLE in California and is also considered to be a significant vector of WNV (CDHS 2003). *Anopheles freeborni* can transmit the malaria parasite to humans and is common in the rice growing regions of California. *Ochlerotatus melanimon* is involved in the encephalitis virus (sleeping sickness) cycle and is a severe outdoor pest (SYMVCD 2004).

Mosquito Monitoring

The District's monitoring activities are designed to estimate the abundance of immature (larvae and pupae) and adult mosquito populations. Monitoring activities that may be conducted on the Refuge include, larval sampling, adult light traps and host-seeking traps, leg counts, wild bird sera testing and chicken sera testing (off the Refuge). The wild bird sera testing is part of an ongoing cooperative program between the District and the Refuge to assess populations of resident and migratory songbirds and their role in the transmission of disease.

Monitoring visits by District staff may occur as often as 3-4 times per week during the summer irrigation (May 1 - July 31) and fall flood-up (August 1 - October 15). If temperatures are above average beyond October 15, District staff may continue to require access to the Refuge for additional monitoring.

Dip counts are used to estimate the numbers of immature mosquitos and to determine the need for mosquito control. The dipper method entails using a long-handled ladle (ca 500 ml) called a dipper to collect water samples from pools potentially serving as mosquito sources. Captured immature mosquitos would be identified taxonomically by skilled technicians. All Refuge wetland units could potentially be monitored using the dipper method. However, the areas of Refuge wetland units that are potential mosquito habitat would be targeted. Target areas would include wetland margins, shorelines and riparian areas.

Light and carbon dioxide traps are used to capture adult mosquitos for monitoring purposes. Light traps are cylinders with a light, fan and collecting jar. The mosquitos are attracted to the light and enter the cylinder. The fan creates an air current that moves the mosquitos into the collecting jar. Carbon dioxide (CO_2) baited traps are used to monitor density of adult mosquitos and to identify adults to species. The trap used is baited with 1-2 kg (2.2–4.4 lbs.) of dry ice next to the trap. A motor and fan on the three inch diameter trap sucks mosquitos down into a container like a modified gallon ice cream carton with tubular surgical stockinet attached to the bottom of the motor housing unit to retain the collected mosquitos.

As part of monitoring conducted by the District for the presence of these viruses, a sentinel chicken flock is maintained in a pen nearby, but not on, Refuge lands. Sentinel chickens are exposed to the environment and to mosquitos moving through the area that may choose to feed on them. Regular blood samples are periodically taken from the chickens to detect any mosquito-vector pathogen activity.

The monitoring activities described above are conducted under a SUP between the Refuge and SYMVCD. The Refuge proposes to allow the SYMVCD to continue these activities under an annual SUP.

Mosquito Control with larvicides/pupacides:

The District proposes to control mosquitos by treating areas infested with larval stages of *Culex tarsalis*; *Ochlerotatus melanimon*, *Oc. nigromaculis*, *Anopheles freeborni* and *Aedes* spp. The threshold for initiating a larval control response will be a density of 0.1 mosquito

larva per 350-ml dipper of water for all species. The District would use the biological larvicides *Bacillus thuringiensis isrealensis* (Bti) and *Bacillus sphaericus* (Bsp) and the insect growth inhibitor methoprene. Use of the petroleum distillate GB1111 as a pupacide was discontinued after 2000 and has been replaced with the monomolecular film Agnique. These treatments would be applied via ground methods.

Bti is a microbial insect pathogen used to control larval stages of mosquitos and black flies. It is a naturally occurring anaerobic spore forming bacteria that is mass produced using modern fermentation technology. Bti produces protein endotoxins that are activated in the alkaline mid-gut of insect species and subsequently binds to protein specific receptors of susceptible insect species resulting in the lethal response (Lacey and Mulla 1990). Bti must therefore be ingested by the target insect to be effective. It is most effective on younger mosquito larval instars but does not affect pupae or adult mosquitos. The District prefers to use Bti because of the low impacts to the environment and non-target organisms and its effectiveness in reducing the numbers of target pests. The Bti formulations Vectobac 12AS or Vectobac G would be employed at the Refuge by the District.

Like Bti, Bsp is a microbial insect pathogen with a similar mode of action (Walton, 1998). Formulated Bsp products used as mosquito larvicides consist of bacterial spores and protein endotoxins. The granular formulation of Bsp, Vectolex CG, would be applied by the District. Both Bti and Bsp may be applied as a spot treatment to small areas or broadcast over larger areas.

Methoprene is a synthetic insect growth regulator (IGR) that mimics juvenile hormones (Tomlin, 1994). It interferes with the insect's maturation stages preventing the insect from transforming into the adult stage, thereby precluding reproduction. Methoprene is a contact insecticide that does not need to be ingested. It is most effective on early larval instars but does not affect pupae or adult mosquitos (ETN 1996). Treated larvae will pupate, but will not emerge as adults. The District proposes to use the formulated methoprene product Altosid in pellets or A.L.L. Growth Regulator.

The monomolecular film, Agnique, reduces water surface tension. This interferes with larval orientation at the air-water interface and/or increases wetting tracheal surfaces, thus suffocating the organism. As the film spreads over the water surface, it tends to concentrate mosquito pupae, which may increase mortality from crowding stress (Dale and Hulsman 1990).

Applications of larvicides may occur anywhere in the wetland and moist soil units of the Refuge. The potential wetland areas for mosquito breeding and consequently mosquito treatment include managed permanent wetlands (106 acres), irrigated pastures (490 acres) and occasionally perennial wetlands (193 acres), totaling approximately 790 acres. The shorelines of open water areas may be treated. In addition, the District will treat ditches, culverts and low areas not classified as wetlands.

The total area of the Refuge that is treated varies with the conditions of each year. Annual precipitation amounts have a direct effect on mosquito populations. During drought years mosquito populations tend to be low, and during wet years mosquito populations tend to be high. The range in area treated in the last five years varied from a low of 104 acres in 2000 to a high of 477 acres in 2004. The majority of the treatments occur from August to October, but applications of larvicides can begin as early as March and extend into November.

Mosquito control with adulticides

The thresholds for adult control are 10 *Culex tarsalis* female mosquitos per light trap night or 100 per CO_2 baited trap per night. Adult mosquitos of the genus *Aedes* are generally determined by landing (leg) counts and adult light trap counts. Landing count thresholds are reached when two or more *Aedes* spp. mosquitos land on an individual during a one-minute interval. Adult mosquito thresholds are generally determined through historical levels of adult mosquitos in the area.

If efforts to control immature mosquitos fail to prevent the adult mosquito population from exceeding thresholds, and WNV and/or WEE or SLE are detected within or near the Refuge, the District proposes to treat infested areas with a mosquito adulticide. The District proposes to continue to use the adulticides Pyrocide 7338 or Scourge (resmethrin), which have synthetic pyrethrins as the active ingredient. Though the District has also proposed usage of the adulticide Trumpet (Naled) if necessary, this particular chemical has not been used at the Refuge to date.

Pyrethrins are non-systemic contact poisons which quickly penetrate the nerve system of the insect and cause paralysis and subsequent death (ETN 1994, Tomlin 1994). A few minutes after application, the insect cannot move or fly away. But, a "knockdown dose" does not mean a killing dose. Pyrethrins are swiftly detoxified by enzymes in the insect. Thus, some pests will recover. To delay the enzyme action so a lethal dose is assured, commercial products are formulated with synergists such as piperonyl butoxide, which inhibit detoxification (Tomlin, 1994). Trumpet (Naled) is a non-systemic, broad-spectrum organophosphate insecticide which affects the nervous system of adult mosquitos and other insects by cholinesterase inhibition. The products SYMVCD proposes, Pyrocide 7338, Scourge and Trumpet, are applied as an ultra-low volume (ULV) fog by ground. To minimize pesticide drift, dispersing vehicles will follow routes on existing roads set up to fog downwind or outside buffers of 300 feet from areas supporting listed or proposed special status species. All chemical applications will occur when wind speeds are between 2 and 8 mph.

Adult mosquito control measures were applied only once in 1998 to 5 acres (0.09 gallons of Scourge) and once in 1999 to 4 acres (0.05 gallons of Pyrocide 7338). Both adulticide applications were performed at the same location, at a drain in an agricultural field. That these adulticides have not been necessary in subsequent years can be attributed to the cooperation between Refuge staff and The District, working together to initiate water management procedures and larval control measures, suppressing mosquito larvae populations and preventing adult emergence.

Availability of Resources: Monitoring and control will not require refuge personnel. The District is responsible for coordination of monitoring and control through the Refuge Manager or the Assistant Refuge Manager. In order to monitor treatment of wetland, moist soil and riparian areas, it is estimated that 5% of a full-time employee's time would be required. Monitoring of treatments would include observations of sprayed areas before and after treatment and coordination of permitting, documentation and record keeping. Additional funding would be required if a detailed, long-term study were to be conducted to determine effects of mosquito treatment on Refuge resources.

Anticipated Impacts of the Use: The impacts of monitoring will be confined to pathways to shorelines where dip net samples will be taken. Small areas of vegetation may be crushed in transit to pools of water, but the vegetation will likely spring back after it has been bent under foot. Placing and checking of light or CO_2 traps may also create a transient impact from footsteps on the vegetation going to and from the traps.

Toxicity and Effects to Non-target Organisms

The dominant impact of mosquito control will relate to the toxicity and effects of the treatments on non-target organisms. The possible effects of the larvicides *Bacillus* spp. and methoprene, the pupacide Agnique, and the adulticides will be discussed separately.

Bti

Bti has practically no acute or chronic toxicity to mammals, birds, fish or vascular plants (USEPA 1998). Extensive acute toxicity studies indicated that Bti is virtually innocuous to mammals (Siegel and Shadduck, 1992). These studies exposed a variety of mammalian species to Bti at moderate to high doses and no pathological symptoms, disease, or mortality were observed. Laboratory acute toxicity studies indicated that the active ingredient of Bti formulated products is not acutely toxic to fish, amphibians or crustaceans (Brown et al. 2002, Brown et al. 2000, Garcia et al. 1980, Lee and Scott 1989, Wipfli et al. 1994). However, other ingredients in formulated Bti products are potentially toxic. The acute toxicity response of fish exposed to the formulated Bti product Teknar® HPD was attributed to xylene (Fortin et al. 1986, Wipfli et al. 1994). Field studies indicated no acute toxicity to several fish species exposed to Bti (Merritt et al. 1989, Jackson et al. 2002); no detectable adverse effects to breeding red-winged blackbirds using and nesting in Bti treated areas (Niemi et al. 1999, Hanowski 1997); and no detectable adverse effects to tadpole shrimp 48 hours post Bti treatment (Dritz et al. 2001).

In addition to mosquitos (Family Culicidae), Bti affects some other members of the suborder Nematocera within the order Diptera. Also affected are members of the Family Simuliidae (black flies) and some chironomids midge larvae (Boisvert and Boisvert 2000, Garcia et al. 1980). The most commonly observed Bti effects to non-target organisms were to larvae of some chironomids in laboratory settings when exposed to relatively high doses (Boisvert and Boisvert 2000, Lacey and Mulla 1990, Miura et al. 1980). In field studies, effects to target and susceptible nontarget invertebrates have been variable and difficult to interpret. Field study results are apparently dependent on the number, frequency, rate and aerial extent of Bti applications; the Bti formulation used; the sample type (e.g., benthic, water column or drift); the sampling interval (e.g., from 48 hrs to one or more years after treatment); the habitat type (e.g., lentic or lotic); the biotic (e.g., aquatic communities), and abiotic factors (e.g., suspended organic matter or other suspended substrates, temperature, water depth); the mode of feeding (e.g., filter feeder, predator, scraper or gatherer); the larval development stage and larval density (Ali 1981, Boisvert and Boisvert 2000, Lacey and Mulla 1990). Bti activity against target and susceptible nontarget invertebrates is also related to Bti persistence and environmental fate which are in turn affected by the factors associated with field study results (Dupont and Boisvert 1986, Mulla 1992). Simulated field studies resulted in the suppression of two unicellular algae species, *Closterium* sp. and *Chlorella* sp. resulting in secondary effects to turbidity and dissolved oxygen of aquatic habitats, with potential trophic effects (Su and Mulla, 1999). For these reasons, Bti effects to target and susceptible nontarget organisms and potential indirect trophic impacts in the field are difficult to predict.

Bsp

Bsp has slight to practically no acute mammalian toxicity, practically no acute avian toxicity, slight to practically no acute fish toxicity, and slight aquatic invertebrate toxicity (U.S. Fish and Wildlife Service, 1984, and FCCMC, 1998). Insecticidal activity may persist longer than 20 days because Bsp can reproduce and sporulate in larval cadavers and can retain its larvicidal properties after passing through the gut of a mosquito. Bsp is insoluble in water. Spores and toxin become suspended in the water column and retain insecticidal activity in water with high organic matter content and suspended solids. Because Bsp is a more recently developed larvicide than Bti, there are fewer studies that have examined the

non-target effects of this pesticide. The data available, however, indicate a high degree of specificity of Bsp for mosquitos, with no demonstrated toxicity to chironomid larvae at any mosquito control application rate (Mulla, 1984, Ali, 1986, Lacey, 1990). Therefore risks to sensitive wildlife resources resulting from direct exposure to a single Bsp application and indirect food chain effects are expected to be negligible. However, the ability for a population to re-colonize a wetland following multiple larvicide treatments would depend on the intensity and frequency of applications at different spatial scales.

Agnique (Monomolecular film)

Monomolecular film has practically no acute mammalian or avian toxicity, and slight acute fish toxicity (USEPA 2000, USFWS 1984). The risk quotient for mammals is well below the EPA endangered species level of concern (LOC) indicating negligible risk resulting from direct exposure, Table 1 (Urban and Cook 1986). Risk quotients for birds and fish exceed EPA endangered species LOCs indicating a hazard to those taxa resulting from direct exposure. Risk to fish will be limited by the insolubility of monomolecular film in water. Monomolecular film is insoluble in water, average persistence in the environment is 5 to 14 days (Borgerding 2001). Indirect effects to animals dependent on invertebrate food resources are possible resulting from a reduction of those resources caused by monomolecular film. The magnitude of the impact would depend on the aerial extent of the treatment, the number of treatments, treatment frequency and the location of the treatment relative to the areas used by invertebrate feeding animals.

Table 1. Monomolecular film risk quotients.

Animal	Acute tox (ppm)	EEC (ppm)	RQ	LOC (ES)
bird	> 5000 (8 D LC 50)	850 (short grass)	0.2	0.1
fish	98 (96 hr LC 50)	2600 (6" water)	26.5	0.05
mammal	>20,000 (LD 50)	850 (short grass)	0.004	0.1

EEC calculated using a rate of 0.5 gal/ac (3.6 lbs ai/ac)
LD 50 for mammals converted to 1 Day LC50 using a conversion factor of 0.1 for RQ calculation

Methoprene

Methoprene has moderate acute fish toxicity, slight acute avian toxicity, and practically no acute mammalian toxicity (USEPA 2000, and USFWS 1984). In mallard ducks, dietary concentrations of 30 parts per million (ppm) caused some reproductive impairment (USEPA 1991). This figure exceeds the estimated environmental concentration by a factor 10 (Table 2). Methoprene residues have been observed to bioconcentrate in fish and crayfish by factors of 457 and 75, respectively (USEPA 1991). Up to 95 % of the residue in fish was excreted within 14 days (USEPA 1991). Risk quotients for birds, fish and mammals are below EPA levels of concern for endangered species indicating negligible risk to those taxa resulting from direct exposure using maximum labeled rates for mosquito control (Table 1) (Urban et al. 1986). In field studies no detectable adverse effects to breeding red-winged blackbirds using and nesting in areas treated with methoprene were observed (Niemi et al. 1999).

Methoprene affects terrestrial and aquatic invertebrates and is used to control fleas, sciarid flies in mushroom houses; cigarette beetles and tobacco moths in stored tobacco; Pharaoh's ants; leaf miners in glasshouses and midges (Tomlin 1994). Methoprene may also be fed to livestock in a premix food supplement for control of hornfly (WHO 2006). Methoprene is highly toxic to aquatic invertebrates with a 48 hour EC50 of 0.89 ppm for Daphnia magna (USEPA 1991). Laboratory studies show that methoprene is acutely toxic to chironomids,

Table 2. Risk assessment for Methoprene.

Animal	Acute Tox (ppm)	*EEC (ppm)	RQ	LOC (ES)
Bird	> 4640 (8 D LC 50)**	3.0 (short grass)	0.0006	0.1
Fish	0.4 (96 hr LC 50)	0.01 (6 inches)	0.025	0.05
Mammal	> 34,000 (LD 50)	3.0 (short grass)	0.00001	0.1

*EEC calculated using a rate of 0.013 lbs ai/ac (1.0 fluid oz/ac Altosid 20 % methoprene)
**LD 50 for mammals converted to 1 Day LC50 using a conversion factor of 0.1 for RQ calculation

cladocerans and some decapods, (Horst and Walker 1999, Celestial and McKenney 1994, McKenney and Celestial 1996, Chu et al. 1997). In field studies, significant declines of aquatic invertebrate, mollusk and crustacean populations have been directly correlated to methoprene treatments for mosquito control (Breaud et al. 1977, Miura and Takahashi 1973, Niemi et al. 1999, Hershey et al. 1998).

Methoprene has a ten day half life in soil, a photolysis half life of ten hours, and solubility in water is 2 ppm (Zoecon 2000). Degradation in aqueous systems is caused by microbial activity and photolysis (USEPA 1991). Degradation rates are roughly equal in freshwater and saltwater systems and are positively correlated to temperature (USEPA 1991).

Adulticides
There are only two general classes of adulticides, organophosphates and pyrethroids. The pyrethroids include both natural products called pyrethrins and synthetic molecules that mimic the natural pyrethrins, such as permethrin, resmethrin, and sumithrin. One organophosphate, Trumpet (Naled), is proposed for use at the Refuge but has not been applied to date. The two pyrethroid products proposed for use at the Refuge, Pyrocide 7336 and Sourge, are both synthetic pyrethrins.

In general, pyrethroids have lower toxicity to terrestrial vertebrates than organophosphates. Although not toxic to birds and mammals, pyrethroids are very toxic to fish and aquatic invertebrates (Anderson 1989, Siegfried 1993, Milam et al. 2000). The actual toxicity of pyrethroids in aquatic habitats, however, is less than may be anticipated because of the propensity of these pesticides to adsorb organic particles in water (Hill et al. 1994). Pyrethrins are toxic to all invertebrates, but the method of application via ultra-low volume atomizer limits toxicity and contact with non-targets. To minimize pesticide drift, applications would take place during the evening hours, when wind speeds are reduced and temperatures decreased. The evening is also the period when mosquito activity is the greatest.

Naled is a fast acting, nonsystemic contact and stomach organophosphate insecticide used to control aphids, mites, flies and mosquitos. Naled is highly to moderately toxic via the oral route. It is moderately toxic through skin exposure, may cause skin rashes and skin sensitization and may be corrosive to the skin and eyes. Naled is highly to moderately toxic to birds. The reported acute oral LD50 for naled is 52 mg/kg in mallard ducks, 65 mg/kg in sharp-tailed grouse, 36-50 mg/kg in Canadian geese, 120 mg/kg in ring-neck pheasants. Naled is highly to moderately toxic to fish and may be very highly toxic to aquatic invertebrate species (ETN 1996).

However, Trumpet (Naled) is practically nonpersistent in the environment, with reported field half-lives of less than 1 day. It is not strongly bound to soils and is rapidly broken down if wet. Soil microorganisms break down most of the naled in the soil. It therefore should not present a hazard to groundwater (ETN 1996).

Threatened and Endangered Species

The Refuge provides potential habitat for the following endangered species: giant garter snake, Sacramento splittail, Delta smelt, valley elderberry beetle, vernal pool tadpole shrimp and vernal pool fairy shrimp.

Vernal Pools

The growth regulator Methoprene (Altosid or A.L.L) can have deleterious effects on vernal pool shrimp by delaying the development of adult shrimp and thus the number of eggs laid before the pools dry up (Lawrenz 1984). Because of the effects of Methoprene on fairy shrimp and a lack of information on how long the agent remains in the soil, use of the larvicide methoprene within vernal pools or swales at any time, in either wet or dry conditions, is prohibited (USFWS 2001).

The majority of vernal pools and seasonal swales will be dry during the main pesticide application period (June-October). In general, vernal pool habitats are not significant mosquito-producing habitat and should not require chemical treatments for control of mosquito larvae because they are sufficient predators in naturally functioning vernal pools to keep larval numbers below the treatment threshold. In the event that the use of a larvicide does become necessary in the vicinity of vernal pools, Bti, which is relatively specific to mosquitos and flies, will be the agent of choice.

The majority of the vernal pools at the Refuge occur on the Wetland Preserve property which became part of the Refuge under a conservation easement in 2004. During the spring of 2004, before the conservation easement went into effect, numerous vernal pools were treated with Bti. Relatively warm spring temperatures in 2004 likely contributed to elevated larval populations, but other factors may also be involved. The mosquito abatement district had increased larval monitoring in the area because the Wetland Preserve property is adjacent to a housing development and WNV had recently arrived in Sacramento county. Many of the vernal pools in the Wetland Preserve property are man made mitigation pools that may not be functioning as a naturally occurring vernal pool would. The hydrologic regime and/or diversity and number of invertebrates in man made vernal pools may create more favorable conditions for mosquito larvae in that mitigation pools may hold water longer and may harbor fewer invertebrates that prey on mosquito larvae (Stan Wright, pers. comm.). The increase in grazing that has occurred since the Service assumed management may reduce mosquito larvae populations by increasing water movement in the vernal pools due to wind action. Future mosquito abatement activities in the Wetland Preserve property will be closely monitored by Refuge staff to avoid conflicts between wildlife habitat improvement goals and mosquito control goals.

Giant Garter Snake

Mosquito control activities in giant garter snake habitat may affect giant garter snakes by harassment or injury from vehicle use. The District will only operate vehicles in existing roads; therefore, harassment or injury from vehicle use would occur only if snakes are in the roadway. Regarding the effects of the proposed pesticides, a Fish and Wildlife Service sponsored study indicated that the short-term effects of adulticides approved for mosquito control on the Sacramento NWR Complex did not significantly reduce abundance or biomass of the snake's prey items, macro-invertebrates and fish, in treated wetlands (Lawler et al. 1997). However, no information is available on the toxicity of the proposed pesticides directly to the giant garter snake. Without further information, it must be assumed that exposure of giant garter snakes to these chemicals could result in direct impacts, such as loss or sublethal effects to individual animals. Adverse effects to the giant garter snake from mosquito control activities will therefore be minimized by avoiding any wetland habitat suitable for giant garter snakes while applying chemical treatments for control of mosquitos.

The application of adulticides by dispersal vehicles will be planned to fog downwind of and outside a buffer of 300 feet away from permanent emergent wetlands.

Valley Elderberry Longhorn Beetle
Adverse effects on the valley elderberry longhorn beetle are not likely since the main mosquito abatement period (June-September) does not coincide with the period of adult beetle emergence (late April through mid-May or early June). Also, the riparian corridors that house the valley elderberry longhorn beetle, generally do not require treatment with chemical control agents. If control measures are needed in these areas, some granular applications of Bti or Altocid (Methoprene) may be used during February or March when adult beetles are not present.

Delta Smelt and Sacramento Splittail
Both Delta smelt and Sacramento splittail are not likely to be adversely affected by mosquito abatement activities. Delta smelt and Sacramento splittail have never been recorded within Refuge waterways. In addition, the open water areas of the Refuge in which these species could occur are not considered mosquito production areas and would not be subject to any chemical treatment (USFWS 2001).

In general, species of concern will not be adversely affected by mosquito control activities provided the conservation measures detailed in the Intra-Agency Formal Section 7 Consultation on Pest Management Activities and the stipulations contained herein are followed (USFWS 2001).

Wetlands and Waterfowl
The Refuge was established to provide habitat for migratory birds, in particular waterfowl. The District will continue to minimize disturbance and non-target effects to wildlife by limiting mosquito abatement activities between October 15 and February 15 when the majority of migratory bird species would be arriving on the Refuge. However, since the District continues to treat until temperatures have dropped sufficiently to reduce the abundance of mosquitos, in warmer years there may well be a longer period of overlap between the arrival of migrants and continued mosquito abatement activities. In addition, if mosquito thresholds are exceeded, or the presence of WNV is detected in or around the Refuge, then the District may need to extend mosquito surveillance and control into late fall.

In some years, most notably 2004, the District has applied Bti or planted mosquito fish as early as March when some migratory waterfowl may still be lingering before departing on their spring migration. However, Bti and Bsp have not been found to be toxic to birds (USFWS 2001). In addition, it has been found that birds are not negatively affected by utilizing foods exposed to Bti or methoprene (Niemi et al. 1999). Although physico-chemico data and environmental fate data are limiting, *Bacillus* spp. are virtually non-toxic to mammals, birds and fish. Though methoprene has not been shown to pose a threat to birds from direct exposure, it may affect insectivorous species by decreasing the invertebrate food source. During the last 8 years methoprene has not been applied prior to June and was applied as late as October in only one instance. Thus, applications of methoprene have not directly or indirectly affected migratory birds utilizing the Refuge because migratory birds have not been present during mosquito abatement activities.

There is not likely to be much impact on geese and swans from pesticides because they are year round herbivores. Geese feed mainly on grasses and agricultural lands, while swans feed mainly on roots, tubers, stems, and leaves of submerged and emergent aquatic vegetation. In contrast, ducks are known to be opportunistic feeders on both plants and invertebrates, utilizing the most readily available food sources. Invertebrates, plants,

and seeds compose the majority of their diet, varying with the season and the geographic location. A study in California's Sacramento Valley has shown that plant foods are dominant in fall diets of northern pintails, while invertebrate use increases in February and March (Miller 1987). Seeds of swamp timothy comprise the most important duck food in the summer, dry habitats of the San Joaquin Valley (Miller 1987). Waterfowl in general tend to feed on seeds when they reach their wintering areas, perhaps to regain energy lost during long flights (Heitmeyer 1988, Miller 1987). Thus any food chain impacts resulting from larvicide and adulticide treatment will have limited impacts to the mainly seed diet of newly arriving ducks. Their diet shifts to invertebrates after mosquito treatments are expected to be reduced in frequency, thereby allowing the invertebrate populations to recover.

Resident Waterfowl
Birds utilizing the Refuge during the summer months and early fall, when most of the mosquito abatement occurs, could have a greater risk of being affected by pesticide applications. These species include herons, egrets, white pelicans, mallards and wood ducks. The pesticides being applied at the Refuge have not been shown to be toxic to birds, but could potentially affect resident waterfowl indirectly by reducing invertebrate food sources. Shorebirds could also be of concern, since they feed on a wide variety of invertebrates all year, feeding which intensifies at the onset of spring migration. However, documentation of indirect food-chain effects have not come to light. Hanowski et al. (1997) studied 19 different bird species after collecting data on wetlands two years before treatment and three years after treatment of both Bti and methoprene applications and found no negative effects. Jensen et al (1999) found that no decreases were detected in the biomass or abundance of aquatic invertebrates in seasonal wetlands from ultra-low volume applications of pyrethrin, permethrin or malathion.

Public Review and Comment:
If through monitoring it is determined that targeted mosquito species; 1) are known carriers of Encephalomyelitis viruses and 2) occur in densities that warrant control, the public will be notified. However, given the nature of potential serious health risks and the rapid development of mosquito larvae, applications may occur simultaneously with public notification or before.

Public review and comments will be solicited in conjunction with distribution of the Draft CCP for Stone Lakes NWR. The public will be provided 30 days to review and comment upon the CCP and this CD. Following the public review and comment period, comments and actions taken to address comments will be summarized here.

Determination (Check One Below)

_____ Use is not compatible

___X___ Use is compatible

Stipulations Necessary to Ensure Compatibility:

1. The District will notify the Refuge manager as soon as possible when mosquito larval thresholds are exceeded and ground treatment is warranted by calling refuge headquarters.

2. When adult thresholds are exceeded, and in the event of a planned adulticiding or aerial application of any kind, the District will contact and personally coordinate with the Refuge Manager or Assistant Refuge Manager prior to conducting the treatment.

3. The District will notify the Refuge Manager in the event of detection of virus activity within or near the Refuge and the method of disease surveillance yielding positive results.

4. The District will provide the Refuge Manager with an annual report summarizing mosquito control activities during the previous year.

5. The District has and will continue to consider environmental conditions, including water temperature, density of mosquito larvae and presence of mosquito predators, when deciding mosquitos on the Refuge pose a serious threat to human health and whether to treat.

6. Access will be prohibited in closed areas on Wednesdays and Sundays during the waterfowl hunt season.

7. Application of mosquito control measures is to be conducted in accordance with approved Pesticide Use Proposals.

8. Mosquito control will be authorized on an annual basis by a Special Use Permit (SUP). The SUP conditions will stipulate that all mosquito control work will be carried out under the guidance of pre-approved Pesticide Use Proposals.

Justification:

For many years the Refuge has worked cooperatively with the District and its associated mosquito control activities. After a review of these activities, the Refuge has determined that allowing these uses to continue would not interfere or derogate from the purpose for the Refuge, nor the mission of the National Wildlife Refuge System.

The Refuge is located within a 10 mile radius of various urban and rural communities. Species of mosquito like *Culex tarsalis, Anopheles freeborni, Ochlerotatus melanimon* and *O. nigromaculis*, are found on the Refuge and are capable of dispersing various miles to obtain a blood meal. With the exception of *Culex tarsalis*, the remaining fore mentioned species are capable of dispersing 5-10 miles; *Culex tarsali*s is known to disperse over 25 miles. All species are known to be vectors for Saint Louis encephalitis, California encephalitis and western equine encephalitis; additionally, *C. tarsalis* is particularly known to transmit West Nile virus. Mosquito control is conducted on Refuge lands to prevent populations of adult mosquitos from rising to levels that could pose a public health hazard or significant nuisance to neighboring communities, following the guidance of the stipulations within this document. Cooperative efforts between the Refuge and the District have successfully controlled larval mosquito populations on the Refuge to the extent that adulticide applications have only been necessary twice over the last 8 years. Since the approved adulticides are generally more toxic to wildlife and wildlife food sources than larvicides, it is in the best interest of wildlife to minimize adulticide applications.

Because mosquito treatment occurs during the early weeks of fall flood-up before most migratory birds have arrived, and since the frequency of treatments are low and spaced apart on a per unit basis, overall effects to non-target organisms are not expected to be significant. In addition, the number of treatment days per year is fairly low, and if the applicator follows the stipulations previously outlined and within the SUP, mosquito abatement practices should not materially interfere with or detract from the Refuge purpose or the mission of the National Wildlife Refuge System. If additional biological monitoring of this activity documents substantial negative impacts to migratory birds or other wildlife, this determination would be re-analyzed on the basis on new evidence.

Mandatory Re-Evaluation Date (provide month and year):

_____Mandatory 15-year Re-Evaluation Date (for priority public uses)

__2016__Mandatory 10-year Re-Evaluation Date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

___X___ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

Literature Cited:

Ali, A. 1981. *Bacillus thuringiensis* serovar *israelensis* against chironomids and some non-target aquatic invertebrates. Journal of Invertebrate Pathology 38: 264-272.

Anderson, R.L. 1989. Toxicity of synthetic pyrethroids to freshwater invertebrates. Environmental Toxicology and Chemistry 8: 403-410.

Boisvert, M., and J. Boisvert. 2000. Effects of *Bacillus thuringiensis* var. *israelensis* on target and nontarget organisms: a review of laboratory and field experiments. Biocontrol Science and Technology 10: 517-561.

Breaud, T.P., J.E. Farlow, C.D. Steelman, and P.E. Schilling. 1977. Effects of the insect growth regulator methoprene on natural populations of aquatic organisms in Louisiana intermediate marsh habitats. Mosquito News. 37(4); 704-712.

Brown, M.D., T.M. Watson, S. Green, J.G. Greenwood, D. Purdie, and B.H. Kay. 2000. Toxicity of insecticides for control of freshwater *Culex annulirostris* (Diptera: Culicidae) to the nontarget shrimp, *Caradina indistincta* (Decapoda: Atyidae). Journal of Economic Entomology. 93(3): 667-672.

Brown, M.D., J. Carter, D. Purdie, D. Thomas, D.M. Purdie, and B.H. Kay. 2002. Pulse-exposure effects of selected insecticides to juvenile Australian Crimson-Spotted Rainbowfish (*Melanotaenia duboulayi*). Journal of Economic Entomology 95(2):294-298.

California Department of Health Services (CDHS). 2003. California mosquito-borne virus surveillance and response plan.

Celestial, D.M and C.L. McKenney, Jr. 1994. The influence of an insect growth regulator on the larval development of the mud crab *Rhithropanopeus harrisii*. Environmental Pollution. 85: 169-173.

Chu, K.H., Wong, C.K., and Chiu, K.C. 1997. Effects of the insect growth regulator (S)-methoprene on survival and reproduction of the freshwater cladoceran *Moina macrocopa*. Environmental Pollution. 96: 173-178.

Dale, P.E.R. and K. Hulsman. 1990. A critical review of salt marsh management methods for mosquito control, Crit. Rev. in Aquatic Science 3:281–311.

Dritz, D.A., S.P. Lawler, J. Albertson, W. Hamersky, and J.R. Rusmisel. 2001. The impact of Bti on survival of the endangered tadpole shrimp *Lepidurus packardi*. In Proceeding and Papers of the Sixty-ninth Annual Conference of the Mosquito and Vector Control Association of California. Jan. 21-24. pp. 88-91.

Dupont, C. and J. Boisvert. 1986. Persistence of *Bacillus thuringiensis* serovar. *israelensis* toxic activity in the environment and interaction with natural substrates. Water, Air, and Soil Pollution 29:425-438.

Extension Toxicology Network (ETN). 1994. Pyrethrin Pesticide information profile. http://ace.ace.orst.edu/info/extoxnet/pips/ghindex.html

Extension Toxicology Network (ETN). 1996. Methoprene Pesticide information profile. http://ace.ace.orst.edu/info/extoxnet/pips/methopre.htm

Extension Toxicology Network (ETN). 1996. Naled Pesticide information profile. http://ace.ace.orst.edu/info/extoxnet/pips/naled.htm

Florida Coordinating Council on Mosquito Control (FCCMC). 1998. Florida mosquito control: The state of the mission as defined by mosquito controllers, regulators, and environmental managers. University of Florida.

Fortin, C, D. Lapointe, and G. Charpentier. 1986. Susceptibility of brook trout (*Salvelinus fontinalis*) fry to a liquid formulation of *Bacillus thuringiensis* serovar. *israelensis* (Teknar®) used for blackfly control. Canadian Journal of Fisheries and Aquatic Science 43:1667-1670.

Garcia, R., B. Des Rochers, amd W. Tozer. 1980. Studies on the toxicity of *Bacillus thuringiensis* var. *israelensis* against organisms found in association with mosquito larvae. California Mosquito and Vector Control Association Proceedings and Papers 48:33-36.

Hanowski, J. M., G. J. Niemi, A. R. Lima, and R. R. Regal. 1997. Do mosquito control treatments of wetlands affect red-winged blackbird (*Agelaius phoeniceus*) growth, reproduction, or behavior? Environmental Toxicology and Chemistry 16(5):1014-1019.

Hershey, A. E., A. R. Lima, G. J. Niemi, and R R. Regal. 1998. Effects of *Bacillus thuringiensis israelensis* (Bti) and methoprene on non-target macroinvertebrates in Minnesota wetlands. Ecological Applications 8:41-60.

Horst, M.N., and A.N. Walker. 1999. Effects of the pesticide methoprene on morphogenesis and shell formation in the blue crap *Callinectues sapidus*. Journal of Crustacean Biology 19: 699-707.

Jackson, J. K., R.J. Horowitz, and B.W. Sweeny. 2002. Effects of *Bacillus thuringiensis israelensis* on black flies and nontarget macroinvertebratess and fish in a large river. Transactions of the American Fisheries Society 131:910-930.

Jensen, T., S. P. Lawler, and D. A. Dritz. 1999. Effects of ultra-low volume pyrethrin, malathion, and permethrin on nontarget invertebrates, sentinel mosquitos, and mosquitofish in seasonally impounded wetlands. Journal of the American Mosquito Control Association 15: 330-338.

Lacey, L.A., and Mulla, M.S. 1990. Safety of *Bacillus thuringiensis* var. *israelensis* and *Bacillus sphaericus* to non-target organisms in the aquatic environment. In Laird, M., L.A. Lacey, E.W. Davidson, eds. Safety of microbial insecticides. CRC Press.

Lawler, S. P., T. Jensen, and D. A. Dritz. 1997. Mosquito management on National Wildlife Refuges: ecosystem effects study, phase II, part 1 - Effects of ultra low volume applications of pyrethrin, malathion, and permethrin on macro-invertebrates in the Sacramento National Wildlife Refuge, California. Final rep. to U.S. Fish Wildl. Serv., Coop. Agreem. No. 14-48-0001-94582. 102 pp.

Lawrenz, R. W. 1984. The response of invertebrates in temporary vernal wetlands to Altosid ® SR-10 as used in mosquito abatement programs. Aquatic Biologist, Minnesota Dept. of Natural Resources. St. Paul, Minnesota. 50(3):31-34.

Lee, B. M. And G. I. Scott. 1989. Acute toxicity of temephos, fenoxycarb, diflubenzuron, and methoprene and *Bacillus thuringiensis* var. *israelensis* to the mummichog (*Fundulus heteroclitus*). Bulletin of Environmental Contamination and Toxicology 43:827-832.

Heitmeyer, M. E. 1988. Body composition of female mallards in winter in relation to annual cycle events. Condor 90:669-680.

Hill, I. R., J. L. Shaw, and S. J. Maund.Hill, I. R., Heimbach, F., Leeuwangh, P., and Mattiessen, P. [eds.] 1994. Review of Aquatic Field Tests with Pyrethroid Insecticides. Lewis Publishers. Boca Raton, FL (USA).

McKenney, C.L., Jr., and D.M. Celestial. 1996. Modified survival, growth, and reproduction in an estuarine mysid (*Mysidoposis bahia*) exposed to a juvenile hormone analogue through a complete life cycle. Aquatic Toxicology 35:11-20.

Merritt, R. W., E. D. Walker, M. A. Wilzbach, K. W. Cummings, and W. T. Morgan. 1989. A broad evaluation of Bti for black fly (Diptera: Simuliidae) control in a Michigan River: Efficacy, carry, and non-target effects on invertebrates and fish. Journal of the American Mosquito Control Association 5:397-415.

Millam, D.C., J.L. Farris, and J.D. Wilhide. 2000. Evaluating mosquito control pesticides for effect on target and nontarget organisms. Mosquito News 40:619-622.

Miller, M. R. 1987. Fall and winter foods of northern pintails in the Sacramento Valley, California. Journal of Wildlife Management. 51:405-414.

Miura, T., and R.M. Takahashi. 1973. Insect development inhibitors. 3. Effects on nontarget aquatic organisms. Journal of Economic Entomology. 66(4):917-922.

Miura, T.; Takahashi, R. M.; and Mulligan, F.S. 1980. Effects of the bacterial mosquito larvicide *Bacillus thuringiensis* stereotype H-14 on selected aquatic organisms. Mosquito News. 40:619-622.

Mulla, M.S. 1992. Activity, Field Efficacy, and Use of *Bacillus thuringiensis israelensis* against Mosquitos. Pp. 134-160 in de Barjac, Hugette and Donald J. Sutherland, eds. Bacterial Control of Mosquitos and Blackflies: Biochemistry, Genetics, and Applications of *Bacillus thuringiensis israelensis* and *Bacillus sphaericus*. Kluwer Academic.

Niemi, G. J., A. E. Hershey, L. Shannon, J. M. Hanowski, A. Lima, R. P. Axler, and R. R. Regal. 1999. Ecological Effects of Mosquito Control on Zooplankton, Insects, and Birds. Environmental Toxicology and Chemistry, 18(3):549-559.

Sacramento County Division of Public Health (Sacramento County). 2006. 2005 Summary of West Nile Virus Activity in Sacramento County. http://www.sacdhhs.com/article.asp?ContentID=1402 Viewed on July 21, 2006.

Sacramemento/Yolo Mosquito Vector Control District. 2004. Vector Information. http://www.sac-yolomvcd.com/vectorinfo.htm

Siegfried, B. D. 1993. Comparative toxicity of pyrethroid insecticides to terrestrial and aquatic insects. Environmental Toxicology and Chemistry 12: 1683-1689.

Siegel, Joel, P. and J. A. Shadduck. 1992. Mammalian safety of *Bacillus thuringiensis israelensis* and *Bacillus sphaericus*. Pp. 202-217 in de Barjac, Huguette and Donald J. Sutherland, eds. Bacterial control of mosquitos and blackflies: biochemistry, genetics, and applications of *Bacillus thuringiensis israelensis* and *Bacillus sphaericus*. Kluwer Academic.

Su. T., and M.S. Mulla. 1999. Microbial agents *Bacillus thuringiensis* ssp. *israelensis* and *Bacillus sphaericus* suppress eutrophication, enhance water quality, and control mosquitos in microcosms. Environmental Entomology 28:761-767.

Tomlin, C. 1994. The Pesticide Manual. Farnham: British Crop Protection Council/ Cambridge: Royal Society of Chemistry.

Urban, J. D. and N.J. Cook. 1986. Standard evaluation procedure: Ecological risk assessment. U. S. EPA. Office of Pesticide Programs. Hazard evaluation division

U.S. Environmental Protection Agency (USEPA). 1991. Re-registration eligibility document. Isopropyl (2E, 4E)-11-methoxy-3,7,11-trimethyl-2,4-dodecadienoate (Referred to as methoprene). List A. Case 0030. Office of pesticide Programs. Special Review and Registration Division.

U.S. Environmental Protection Agency (USEPA). 1998. Re-registration eligibility document. *Bacillus thuringiensis.* Office of Prevention, Pesticides and Toxic Substances. EPA738-R-98-004.

U.S. Environmental Protection Agency (USEPA). 2000. Ecotoxicity onliner database. Division of Environmental Fate and Effects. Office of Pesticide Programs.

U.S. Fish and Wildlife Service (USFWS). 1984. Acute toxicity rating scales. Research Information Bulletin No. 84-78.

U.S. Fish and Wildlife Service (USFWS). 2001. Intra-Agency Formal Section 7 Consultation on Pest Management Activities at the Stone Lakes National Wildlife Refuge, Sacramento, California.

Walton, W.E., M.C. Wirth, and B.A. Federici. 1998. The effect of the CytA toxin ratio on the suppression of resistance and cross-resistance to mosquitocidal *Bacillus* toxins. Mosquito Control Research Annual Report. University of California. Division of Agriculture and Natural Resources.

WHO. Undated. Data sheet on pesticides no. 47. Methoprene. World Health Organization. Food and Agriculture Organization. http://www.inchem.org/documents/pds/pds/pest47_e.htm

Wipfli, M.S., R.W. Merritt. And W.W. Taylor. 1994. Low toxicity of the blackfly larvicide Bacillus thuringiensis var. israelensis to early stages of brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), and steelhead trout (*Oncorhynchus mykiss*) following direct and indirect exposure. Canadian Journal of Fisheries and Aquatic Science 41:1451-1458.

Zoecon. 2000. MSDS Altosid Liquid Larvicide Concentrate

Personal Communications:

Stan Wright, Sacramento-Yolo Mosquito Vector Control District (SYMVCD). 2005.

Refuge Determination

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: _____ _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____ _____
(Signature) (Date)

Assistant Manager,
Refuges,
California/Nevada
Operations: _____ _____
(Signature) (Date)

California/Nevada
Operations Manager: _____ _____
(Signature) (Date)

Compatibility Determination for Grazing Programs on the Stone Lakes National Wildlife Refuge

Use:
Grazing program to provide (1) suitable habitat for wintering sandhill cranes, arctic nesting geese such as Aleutian cackling geese, shorebirds and breeding habitat for nesting grassland birds such as Western meadowlark; (2) expand native grasses (3) reduce fire danger by reducing thatch layer (Alternative B, Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan Environmental Assessment).

Refuge Name:
Stone Lakes National Wildlife Refuge

Establishing and Acquisition Authority:
Stone Lakes National Wildlife Refuge (NWR) was established in 1994 under the following authorities: Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b)), Fish and Wildlife Act of 1956 (16 U.S.C. 742f(a)(4)), Migratory Bird Conservation Act (16 U.S.C. 715d), and Endangered Species Act of 1973 (16 U.S.C. 1534). Additional acquisition authorities can be found in the funding sources used to acquire land. These sources include: the California Environmental License Plate Fund, the Cigarette and Tobacco Product Surtax (California Proposition 99, 1988), the North American Wetland Conservation Act (16 U.S.C. 4401-4412), the Land and Water Conservation Fund (16 USC 460l - 460l-11), the Sacramento County Environmental Mitigation Grant/Packard Foundation, the Central Valley Improvement Act (16 U.S.C 695d-695j), the National Fish and Wildlife Fund (16 U.S.C. 3701-3709), the Trust for Public Land Grant/Packard Foundation, the City of Sacramento, and CalFed Bay Delta Program.

Refuge Purpose(s):
Stone Lakes NWR purposes include the following:

"... 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 ..." (Emergency Wetlands Resources Act of 1986)

"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." (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 ..." (Fish and Wildlife Act of 1956)

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.' (Migratory Bird Conservation Act of 1929)

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ...@ (Endangered Species Act of 1973)

National Wildlife Refuge System Mission:
"The mission of the National Wildlife Refuge System (System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use:

The Stone Lakes National Wildlife Refuge (Refuge) will administer a grazing program on the North Stone Lake (2,791 acres), Sun River (537 acres) and Gallagher Units (45 acres) of the Refuge. The North Stone Lake Unit is comprised of approximately 1,900 acres of mostly non-native grassland and 891 acres of open water, riparian and wetland habitat. The Gallagher Unit is comprised of approximately 43 acres of irrigated pasture. The Sun River Unit consists of 140 acres of irrigated pasture, and 397 acres of seasonal, permanent wetlands, open water and riparian habitats.

Grazing has been occurring on the properties for over 50 years. The Refuge will continue to administer this use as outlined in this Compatibility Determination. Although grazing is not identified as a wildlife dependent public use by the National Wildlife Refuge System Improvement Act of 1997, grazing will allow the Refuge to manage mostly non-native grassland habitats on the Refuge for the benefit of wildlife and native plants while reducing the fire danger to adjacent communities. This use will provide short grass foraging and loafing habitat to a variety of wintering migratory birds such as the greater sandhill crane (*Grus canadensis tabida*), arctic nesting geese including Aleutian cackling goose (*Branta hutchinsii leucopareia*) and white fronted goose (*Anser albifrons*), shorebirds including white faced ibis (*Plegadis chihi*), long billed curlew (*Numenius americanus*) and black bellied plover (*Pluvialis squatarola*). These grasslands also provide nesting and foraging habitat for western meadowlark (*Sturnella neglecta*), horned lark (*Eremophila alpestris*), northern harrier (*Circus cyaneus*), white tailed kite (*Elanus leucurus*) and Swainson's hawk (*Buteo swainsoni*), and have the potential to provide habitat for nesting and wintering burrowing owls (*Athene cunicularia*), Savannah sparrows (*Passerculus sandwichensis*) and grasshopper sparrows (*Ammodramus savannarum*). Habitat consists of introduced (> 70% annual rye [*Lolium multiflorum*]) and native grasses (including creeping wildrye [*Leymus triticoides*], saltgrass [*Distichlis* spp.] and meadow barley [*Hordeum branchyntherum*])as well as other forbs and associated native plant food resources.

Only the grazing of cattle is to be considered on the Refuge; grazing by sheep (*Ovis aries*), goats (*Capra hircus*), or other creatures such as bison (*Bison bison*) will not be considered. During drought years or years of low rainfall, cattle will not be allowed to graze on the Refuge.

The timing of the placing of cattle on the Refuge are termed "turn in dates" (November 1 or slightly later) and are adjusted year to year based upon the date of the first effective germinating rainfall, and the amount of dry forage available in the fall (Stechman 1995). The timing of removing cattle from the Refuge is termed "turn out dates" and is determined solely on the amount of residual dry matter (RDM) within the unit, but will be no later than July 15th. If and when 800 lbs per acre, of RDM, or less is achieved cattle will be removed from the unit.

The unit of measure used to summarize the quantity of cattle grazing on the Refuge is termed Animal Unit Month (AUM). AUM is defined as the amount of forage needed by an "animal unit" (AU) grazing for one month (USDA-NRCS 2004). An AU is defined as one mature 1,000 pound cow and her sucking calf. An assumption in this definition is that a cow nursing her calf will consume about 26 pounds of dry matter per day. Other types of livestock are assigned AUM equivalents based on body size and consumption of dry matter.

The optimal time for grazing in the Central Valley begins in November and may continue through mid July depending on winter and spring rainfall. Prior to the beginning of the grazing season, an assessment is made to determine the amount of residual dry matter (RDM) available to the cattle. The number of cattle allowed to graze on the Refuge, for a

specific amount of time, varies with the amount of local rainfall. Because grazing on the Refuge supports various wildlife populations, this RDM level is linked to the needs of wildlife and not the needs of the cattle. The RDM is determined by clipping, drying, and then weighing the amount of RDM in representative samples from the unit cattle are to graze and varies upon temperature, monthly rainfall and the density of new grass/forb growth.

The Refuge has developed a 5-year grazing management plan with the assistance of the Natural Resource Conservation Service that promotes variability in grass height and density among the five dry pasture units to provide habitat for a suite of grassland dependent species. This plan rotates grazing pressure (low, medium and high) in five pastures (see Figure 1) resulting in a range of grass heights and densities (see Table 1). The rotational grazing should result in higher quality habitat for species that inhabit short grasses such as burrowing owls, without impacting other grassland dependent species. A monitoring program will be implemented to determine if increasing grazing rates and rotating grazing pressure through the units will have the desired effects of providing a variety of nesting, foraging and breeding cover for a variety of birds and other wildlife. If the RDM level drops below 800 lbs/acre, prior to or anytime during the grazing season, the Refuge manager may request that the grazing permit holder reduce the number of cattle grazing in that unit or remove them all together in order to prevent degradation of the resources in the unit.

Table 1. Residual Dry Matter (RDM) targets over a five year period on the North Stone Lake Unit of the Stone Lakes National Wildlife Refuge in California.

	RDM Value at the End of the Grazing Season (Nov – June)*				
Pasture	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
A	Medium	Low	Medium	High	Low
B	High	Medium	Low	Medium	Medium
C	Low	Medium	High	Low	Medium
D	Medium	High	Low	Medium	High
E	Low	Low	Medium	Low	Low
F**	Medium	Medium	Medium	Medium	Medium

*RDM values – Low(1200-1750 lbs/acre), Medium (1750-2500 lbs/acre), High (+2500 lbs/acre).

** Southwestern portion of South Irrigated Pasture (Fig. 1). Cattle will be in unit for 30-60 days from March-May to control weeds.

Grazing in the irrigated/wet meadow units (371 acres) on the North Stone Lake, Gallagher and Sun River units begins in mid summer, corresponding to the removal of cattle from the dry pasture and continues until approximately November 1. Grazing rates typically range between 1.1 – 1.3 acres per AUM. These pastures, which are not grazed during the winter season, are heavily used by cranes, geese and shorebirds.

The grazing cooperator is chosen following guidance in U.S. Fish and Wildlife Service Refuge Manual under heading 5 RM 17. At the time of this writing, there are no anticipated changes to grazing on the Refuge.

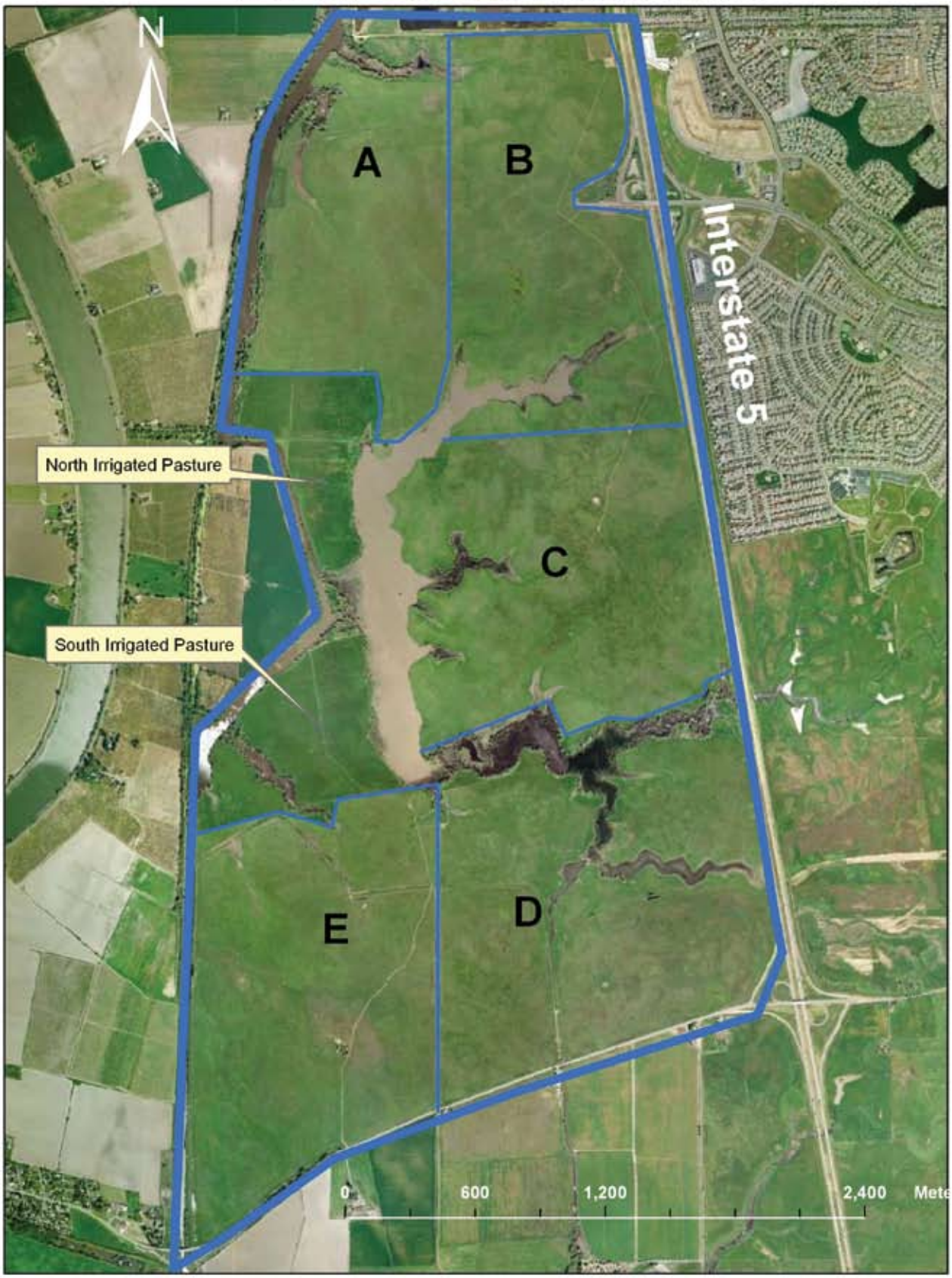


Figure 1. Map of the North Stone Lake Unit of the Stone Lakes National Wildlife Refuge showing the designation of pasture units and location of perimeter and cross fences in blue.

Availability of Resources:

The assistant refuge manager, under the direction of the project leader, will manage the grazing program. The permittee, working under a Cooperative Land Management Agreement, will accomplish certain facility management and improvement projects under the direction of the assistant manager. Accomplishments will be in direct support of the Refuge grazing program; these projects may include maintenance or improvements of existing facilities or installation of new facilities. Projects may include: deep well construction and maintenance; installing and/or maintaining water control structures, watering troughs; fence installation, repair, and/or removal; sign repair, removal, or installation; gate installation; noxious weed control; road building and maintenance; parking lot maintenance; and vegetation control around facilities. Facilities that are installed primarily for Refuge purposes are constructed or maintained at Refuge expense. All projects will be agreed upon before the beginning of the grazing season and will directly support the unit being grazed.

Rates charged per AUM are based on a survey of grazing rates in the area and were done on an upward sliding scale. Rates are now fixed until the end of the current grazing contract with the County of Sacramento which ends in 2008. Rates will then be renegotiated based on a survey of grazing rates in the area.

At the end of each grazing season, the permittee submits information that includes AUMs per month per grazing unit and the cost of various projects completed on the unit that year. The project list is then revised for the following year. Work contributions of this type will be associated with improvement projects for the particular grazed unit.

The Refuge receives adequate funding to cover the costs associated with management of the grazing program including the RDM assessment conducted at the end of every grazing season. Staff costs associated with this use emanates from the annual review of Special Use Permits, Cooperative Land Management Agreement and monitoring the impacts of this use as outlined in the grassland management plan. Annual costs to manage the grazing programs averages $25,000, which includes all costs associated with monitoring, weed control, law enforcement, improvements and planning activities.

Anticipated Impacts of the Use:

To provide this use, the Refuge has adequate staff which includes biological, administrative and managerial personnel. The grazing program results in both long and short term effects, both negative and positive. The following is a list of possible short and long-term negative impacts to wildlife resources from grazing: trampling of desirable vegetation, disturbances to ground nesting species, trampling of rodent burrows, soil compaction especially during wet periods and erosion of the bank along North Stone Lake. The following activities can minimize these negative impacts associated with grazing: fencing off sensitive habitats, development of alternative watering sources for cattle to drink from, allowing the use in years of adequate rainfall only and supporting grazing within the same unit areas and not moving animals to un-grazed or sensitive areas.

Conversely, short and long-term positive impacts of the grazing program include: an overall reduction of undesirable, non-native vegetation; re-establishment of native grass, forb, and shrub communities; reduced fire danger to surrounding communities; and increased habitat for grassland dependent species. Prior to reestablishment of a grazing program by the Refuge, the North Stone Lake Unit was left idle for approximately 12 years. Over that time, the grass became dense with vegetation reaching 6-8 feet tall. Bird surveys revealed no use by sandhill cranes, arctic nesting geese or shorebirds, although these birds used the area historically. Once the grazing plan was implemented, these birds returned within two years,

and the, California State Endangered Species Act, listed greater sandhill crane now number over 300 birds. Native grass stands have also benefited from the grazing program and are expanding (Huitt 2003). Adjacent landowners are also satisfied with the decrease in thatch and the fire break that further reduces the threat of fire spreading across the property and onto neighboring lands.

The impact of cattle to existing water supplies is negligible and being diminished as alternative watering sources are being developed. Alternative watering sources help keep cattle from watering in the lake where they can erode the bank in high use areas. A solar powered well now brings water to cattle in Pastures A and B, and a pipeline from the well at the HQ will bring water to cattle in Pasture E. A well already exists in Pasture D and plans are being finalized to construct an additional well in pasture C.

Much of the topography is flat with little sedimentation and erosion entering the two arms of North Stone Lake. The south arm of the lake which is surrounded by riparian vegetation has been fenced off to cattle, as have the other sensitive riparian zones on the property.

Bird surveys indicate the grazing program provides a significant benefit to various species of concern that winter in the Central Valley including the greater sandhill crane, white faced ibis, long billed curlew, Aleutian cackling goose and white fronted goose. Furthermore initial studies of nesting songbirds found that western meadowlarks nested in a wide range of grass heights below 3.5 feet, but were not found in areas where the grass exceeded this height.

Cowbirds (*Molothrus ater*) are found over the entire Refuge and parasitize nests of various species in riparian areas. Therefore 85% of existing riparian areas have been fenced off to decrease suitable habitat for cowbirds. Whether the grazing program will contribute to increases in the cowbird population by providing additional foraging areas is unknown. Large mixed flocks of blackbirds are seen in the spring and fall, but no cowbirds were recorded during point count surveys done the spring of 2006. Efforts to fence off riparian remaining riparian areas will continue.

Impacts to known cultural resources from this use are negligible. Tremaine and Associates (2006) completed a survey of the entire property in 2005, and all cultural resource sites that could be impacted by cattle were fenced off. Furthermore, the grazed units are closed to the public, further protecting these sites. Any ground-disturbing activities will be coordinated with the Service's Regional Archaeologist, in order to preserve the Refuge's archaeological and historic resources.

The Draft Comprehensive Conservation Plan (USFWS 2006) identifies the need to develop additional information relating to the effects of grazing on resident and migratory species. While the effects have been determined to be generally positive, additional research and evaluation will allow the Refuge to refine its management strategies and objectives for grassland management.

Public Review and Comment:

Public review and comments will be solicited in conjunction with distribution of the Draft CCP for Stone Lakes NWR. The public will be provided 30 days to review and comment upon the CCP and this CD.

Following the public review and comment period; comments, Service responses and actions taken to address comments will be summarized here.

Determination: (Check One Below)

_____ Use is not compatible

__X__ Use is compatible, with Stipulations

Stipulations Necessary to Ensure Compatibility:
The Cooperator is operating under the terms and conditions of a Cooperative Land Management Agreement (2001), special use permit and a Refuge Grazing Plan. These documents provide the necessary information and assistance from the Refuge to determine start and end dates for cattle placement and removal.

Additional Stipulations are as follows:
- It is the responsibility of the Refuge Manager to determine fair market value of grazing, to issue special use permits, monitor permittee compliance and maintain up-to-date files on all grazing activities.
- All cattle grazing on the Refuge would be removed no later than July 15th.

Monitoring:
A monitoring program will be established to provide data on residual dry matter, cover density, bird use, and noxious weeds. These data will establish guidelines for making management decisions concerning the grazing program. Maps of RDM will be compiled using the comparative yield method (Dudley, pers. comm.) in September or October of each year. The comparative yield method measures the residual dry matter by clipping the grass in a 1 meter square and then weighing the dried sample. This is repeated until the observer can determine the residual dry matter by observation rather than clipping grass samples. Samples are still collected to ensure accuracy of the observations. Maps are then compiled from the data and visual observations. Data on grass height and density is collected during the nesting season (March-April) using the Robel Pole Method (Harmoney et al. 1997). These data will be used to guide grazing rates the following year. Photo plots for each grazing unit will also be established and photos will be taken each year at the end of the grazing season (July – August). Wildlife surveys will include bimonthly waterfowl and shorebird surveys (November – March), greater sandhill crane surveys (September – March), and rookery surveys (March – June). Noxious weed surveys will include mapping noxious weed infestations using a hand-help GPS unit and developing and implementing integrated pest management techniques to control and/or eliminate target species.

Justification:
The primary management goals guiding the grazing of the Refuge are to 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, and to conserve, enhance, and restore high quality migrating, wintering, and breeding habitat for migratory birds within the Sacramento-San Joaquin Delta of the Central Valley. The mission of the National Wildlife Refuge System also includes the conservation, management and restoration of wildlife resources. When evaluating the appropriate management direction for refuges, Refuge Managers are required to use sound professional judgment to determine their refuge's contribution to biological integrity, diversity and environmental health at multiple landscape scales as called for in (601 FW 3[3.7B]). The grazing program is designed to enhance habitat for a variety of special status species including greater sandhill crane, Swainson's hawk and Aleutian cackling geese. The regulated use of grazing to benefit these and other species clearly supports both the System mission and the purpose for which the Refuge was established.

With the dramatic changes to the plant communities in California over the past 150 years, has come an increase in the density of ground cover due to the introduction of nonnative grasses and forbs (Kuchler 1988). A limited grazing season can benefit the recovery of native perennials by reducing annual plant biomass, increasing seed production and stimulating native perennial production (Huitt 2003).

Prior to the management of the property by the Refuge, the uplands were altered from their original native condition by the introduction of non-native grasses and intensive grazing practices. In order to maintain the biological integrity and diversity of the Refuge, species of special concern must be provided for. The use of moderate grazing to reduce the build-up of annual introduced grassland biomass is viewed as beneficial to species such as greater sandhill crane, Aleutian cackling geese and others. By restricting the intensity and duration of grazing, and by adhering to the stipulations for this use, the environmental health of the Refuge will be maintained.

Mandatory Re-evaluation Date (provide month and year):

_____Mandatory 15 year Re-evaluation Date (for priority uses)

2016 Mandatory 10 year Re-evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

__X__Environmental Assessment and Finding of No Significant Impact

_____Environmental Impact Statement and Record of Decision

Literature Cited

Dudley, Dennis. 2004. Personal Communication. Natural Resource Conservation Service, Madera, California.

Harmoney, K.R., K.J. Moore, J.R. George, E.C. Brummer, and J.R. Russell. 1997. Determination of Pasture Biomass Using Four Indirect Methods. Agronomy Journal. 89: 665-672.

Huitt, C.C. 2003. Effects Of Grazing And Burning On Three Perennial Grassland Species In The Central Valley Of California: *Hordeum Brachyantherum Californicum*, *Leymus Triticoides*, And *Carex Praegracilis*. Masters Thesis, Univ. California, Davis. 65 pp.

Kuchler, A.W. 1988. The Map of the Natural Vegetation of California. 909-938 pp. *In:* M.G. Barbour and J. Major (editors); Terrestrial Vegetation of California. Calif. Native Plant Society Special publication No. 9.

Tremaine and Associates. 2006. Draft Pedestrian and Geophysical Archaeological Surveys of North Stone Lakes: Stone Lakes National Wildlife Refuge. Tremaine and Associates. 30 pp.

Stechman, J. 1995. Grazing assessment and management recommendations, Fort Hunter Liggett, California. Consult. Rpt. for U.S. Army and the Nature Conservancy, Seattle, WA. 178p. Dec.

U.S. Department of Agriculture, Natural Resource Conservation Service (USDA-NRCS). 2004. Technical Note No. 31. Montana Grazing Animal Unit Month (AUM) Estimator. Bozeman, MT. http://www.mt.nrcs.usda.gov/technical/ecs/range/technotes/rangetechnoteMT32.html Viewed on July 5, 2006.

USFWS. 2004. Stone Lakes National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment. CA/NV Refuge Planning Office, Sacramento, California.

Refuge Determination

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: _____ _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____ _____
(Signature) (Date)

Assistant Manager,
Refuges,
California/Nevada
Operations: _____ _____
(Signature) (Date)

California/Nevada
Operations Manager: _____ _____
(Signature) (Date)

Appendix B. Environmental Assessment

Stone Lakes
National Wildlife Refuge
Draft Comprehensive Conservation Plan Environmental Assessment

U. S. Fish and Wildlife Service
California/Nevada Refuge Planning Office
2800 Cottage Way, Room W-1832
Sacramento, CA 95825

September 2006

Contents

Chapter 1. Purpose of and Need for Action

Introduction

This draft environmental assessment (EA) evaluates the environmental effects of three alternatives for managing the Stone Lakes National Wildlife Refuge (Refuge). The U.S. Fish and Wildlife Service (Service) will use this EA to solicit public involvement in the Refuge planning process and to determine whether implementation of the Comprehensive Conservation Plan (CCP) will have a significant effect on the quality of the human environment. This EA is part of the Service's decision-making process in accordance with the National Environmental Policy Act (NEPA).

Proposed Action

The Service proposes to implement Alternative B, as described in this EA. More information is provided about Alternative B in the CCP.

Purpose of and Need for the Proposed Action

The Refuge needs this CCP to guide Refuge management. In addition, the National Wildlife Refuge System Improvement Act of 1997 requires that within 15 years of its enactment, a CCP must be in place for all refuges established prior to 1997.

Project Area

The Refuge was established in 1994, becoming the 505th refuge in the National Wildlife Refuge System. The Refuge boundary encompasses about 17,640 acres, including a core Refuge of about 9,000 acres, and a 9,000-acre "Cooperative Wildlife Management Area" (USFWS 1992). The Service actively manages about 6,000 acres. The Refuge is located in the Sacramento/San Joaquin River Delta (Figure 1). It is in the Beach-Stone Lakes Basin, found within the Sacramento Valley in the southwestern part of Sacramento County. It lies about ten miles south of the city of Sacramento, straddling Interstate Five from the town of Freeport south to Lost Slough (Figure 2). The Refuge provides wintering habitat for migratory waterfowl and other waterbirds in the Pacific Flyway (Figure 1). It is surrounded by privately owned nonnative grassland used for pasture, agricultural croplands and dense urban development.

Decisions to be Made

Based on the analysis documented in this draft EA, the California/Nevada Operations Manager must determine the type and extent of management and visitor access that will occur on the Refuge and whether the selected management alternative would have a significant effect on the quality of the environment.

Issue Identification

The Service identified issues, concerns and opportunities through early planning discussions and the public scoping process. This process began with the mailing of the first planning update in July 2002. The public also provided comments in writing and through personal communications. For a discussion of the planning process and issues raised, please see Chapter 2 of the CCP.

The planning team helped to further define the issues. The planning team includes Service employees from the Stone Lakes National Wildlife Refuge Complex office and the California/Nevada Refuge Planning Office.


Oregon
Pacific Flyway
Area Enlarged
MODOC NWR
Redding
101
SACRAMENTO RIVER NWR
DELEVAN NWR
SACRAMENTO NWR
COLUSA NWR
99
80
5
SUTTER NWR
SAN PABLO BAY NWR
Sacramento
Stone Lakes National Wildlife Refuge
MARIN ISLANDS NWR
San Francisco
580
SAN JOAQUIN RIVER NWR
Modesto
DON EDWARDS SAN FRANCISCO BAY NWR
ANTIOCH DUNES NWR
SAN LUIS NWR
MERCED NWR
Fresno
BLUE RIDGE NWR
KERN NWR
PIXLEY NWR
Bakersfield
BITTER CREEK NWR
Los Angeles
Pacific Ocean
Nevada
California
Morrison Creek
Sacramento/ San Joaquin Delta
Cosumnes River
Local Watersheds
Figure 1. Watershed and Ecosystem Setting
Stone Lakes
National Wildlife Refuge
Sacramento River Watershed
Central Valley-San Francisco Bay Ecoregion
0
Miles
100
0
Kilometers
100

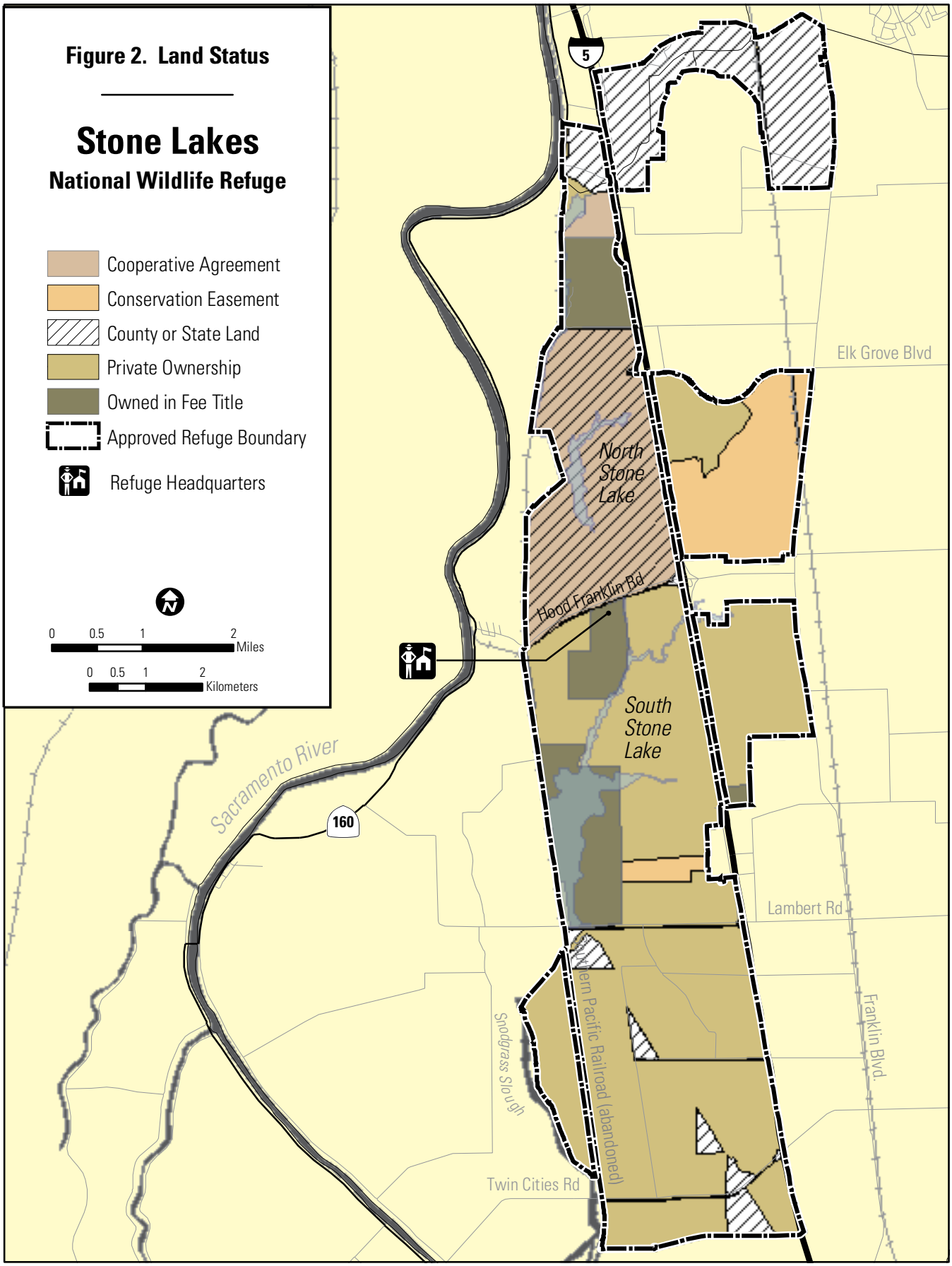


Figure 2. Land Status
Stone Lakes
National Wildlife Refuge
Cooperative Agreement
Conservation Easement
County or State Land
Private Ownership
Owned in Fee Title
Approved Refuge Boundary
Refuge Headquarters
0 0.5 1 2 Miles
0 0.5 1 2 Kilometers
5
Elk Grove Blvd
North Stone Lake
Hood Franklin Rd
South Stone Lake
Sacramento River
160
Lambert Rd
Snodgrass Slough
Franklin Blvd.
Twin Cities Rd

Public Involvement

The planning team distributed three planning updates to a mailing list of about 210 individuals, groups and agencies in July 2002, September 2002 and December 2002. The team held four public workshops during August and September 2002, one each in; Elk Grove, Sacramento, Walnut Grove and Davis, California.

The planning staff has incorporated public input received in response to these updates and workshops into the CCP and EA; a summary of these comments is included in Chapter 2 of the CCP. The original comments are available for review in planning administrative files at the California/Nevada Refuge Planning Office in Sacramento, California.

U.S. Fish and Wildlife Service and the National Wildlife Refuge System

The mission of the Service is to conserve, protect, and enhance the nation's fish and wildlife and their habitats for the continuing benefit of the American people. The Service is the primary Federal agency responsible for migratory birds, endangered plants and animals, certain marine mammals and interjurisdictional fish. The responsibility to conserve our nation's fish and wildlife resources is shared with other Federal agencies, State and Tribal governments.

As part of this responsibility, the Service manages the National Wildlife Refuge System (Refuge System). The Refuge System is the only nationwide system of Federal lands managed and protected specifically for wildlife and their habitats. 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.

The Refuge is managed as part of the Refuge System in accordance with the National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997, and other relevant legislation, Executive Orders, regulations, and policies. Chapter 1 of the CCP summarizes these major laws, regulations, and policies and describes the goals of the Refuge System.

Refuge Purposes

The Emergency Wetlands Resources Act of 1986, the Fish and Wildlife Act of 1956 and the Migratory Bird Conservation Act are the establishing authorities for the Refuge.

The primary Refuge purposes 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)

"... 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)

Further refinements in the Refuge purposes can be found in the funding sources used to acquire land. Grants have been provided by: City of Sacramento, County of Sacramento, California Wildlife Conservation Board, California Environmental Enhancement Mitigation Fund, California Environmental License Plate Fund, Cigarette and Tobacco Product Surtax, Department of Transportation-TEA 21 Fund, CALFED Bay Delta Program, North American Wetlands Conservation Act, Land and Water Conservation Fund, Central Valley Project Improvement Act, National Fish and Wildlife Foundation, David and Lucille Packard Foundation, The Trust for Public Land and other private donations.

Refuge Goals

Goal 1. 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.

Goal 2. Conserve, enhance and restore high quality migrating, wintering and breeding habitat for migratory birds within the Sacramento San Joaquin Delta of the Central Valley.

Goal 3. Provide visitors with wildlife-dependent recreation, interpretation and education opportunities that foster an understanding of the Refuge's unique wildlife and plant communities in an urban setting.

Goal 4. In cooperation with tribal representatives, identify and protect cultural resources on the Refuge and educate the public regarding Native American people and the history of the region.

Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes three alternatives for managing the Refuge: Alternative A (No Action), Alternative B and Alternative C. These alternatives are described below. Figures 3 and 4 show a graphical representation of Refuge areas described in the alternatives. The Service's proposed action is Alternative B. Two of the three alternatives presented in this chapter are "action alternatives" that would involve a change in the current management of the Refuge. Under Alternative A, the No Action alternative, the Service would continue managing the Refuge as it currently does.

Current Management

The primary management focus of the Refuge is providing habitat for migrating, wintering and nesting migratory and resident birds with an emphasis on waterbirds, and a variety of special status species by restoring and maintaining wetland, riparian woodland, grassland habitats and valuable agricultural lands.

Restoration and management of seasonal and permanent wetland habitats has been a major emphasis since the inception of the Refuge due to loss or conversion of this habitat in the Central Valley. The Refuge promotes water management regimes on managed wetland impoundments involving specific water draw down dates, spring irrigations and fall flood-up periods to produce quality habitat, primarily for wintering waterbirds. Seasonal wetlands are irrigated in summer to stimulate the growth of high quality waterfowl foods. Wetland vegetation is also manipulated periodically to maintain desired habitat conditions for feeding, loafing and breeding waterfowl, waterbirds and other birds. These manipulations can include mowing, prescribed burning, discing and noxious weed control. The Refuge works cooperatively with local and State agencies and private landowners throughout open water aquatic habitat in the Stone Lakes Basin to control mosquitos and water hyacinth (*Eichhornia crassipes*), a non-native invasive aquatic plant.

Riparian restoration has included planting riparian trees, such as Fremont cottonwood (*Populus fremontii*), willow species (*Salix* sp.), box elder maple (*Acer negundo* var. *californicum*), valley oak (*Quercus lobata*) and associated understory shrubs and grasses and irrigating restoration areas on the Beach, North Stone, and South Stone Lake, and Headquarters units for three to five years to establish the plants.

Large scale grassland management such as on the North Stone Lake Unit, includes promoting remnant native grasslands through use of cattle grazing, small scale prescribed burns, and invasive weed control. Increased use by sandhill cranes (*Grus canadensis*), long billed curlews (*Numenius americanus*), white fronted geese (*Anser albifrons*), burrowing owls (*Athene cunicularia*), and other raptors has been recorded on the unit since the grazing program was implemented in 1999.

The Refuge cooperative farming program on the Headquarters Unit benefits a variety of migratory birds, including waterfowl, shorebirds, and sandhill cranes, that depend on small grains, alfalfa, tomatoes and invertebrates for a significant portion of their diet. The farming program maintains approximately 80 acres in corn, wheat, or grass to provide wildlife habitat and reduce weeds until the Service can implement expanded restoration plans.

Service staff, cooperators, and volunteers periodically conduct biological surveys and monitoring within a variety of Refuge habitat, including surveys of: (1) colonial nesting waterbirds; (2) mistnetting of landbirds (in cooperation with the Sacramento-Yolo Mosquito and Vector Control District); (3) nesting success and survival of song sparrows; (4) wintering

(October-May) waterfowl populations; (5) invasive weed mapping; and (6) range monitoring through surveys of residual dry matter.

For a complete description of the current management practices, please see "Current Management" in Chapter 3 of the CCP. Table 1 summarizes the alternatives analyzed in this Environmental Assessment.

Features Common to All Alternatives

All of the alternatives contain some common features. These common features are presented in the following pages to reduce the length and redundancy of the individual alternative descriptions.

Mosquito Control

In 1993, the Service and Sacramento-Yolo Mosquito and Vector Control District (SYMVCD) signed a Memorandum of Understanding (MOU). According to the MOU, both parties agreed to cooperate to limit production and harboring of mosquitos on Refuge habitats. The Service, in cooperation with SYMVCD, manages wetlands and other habitats on the Refuge to discourage mosquitos by: adopting wetland design features, managing water regimes, planting mosquitofish (*Gambusia affinis*), and applying larvicides or adulticides, as needed. In addition, the Service and SYMVCD collaborate on other mutually beneficial projects, such as landbird monitoring and water hyacinth control. The Service will continue to participate in ongoing studies of Refuge landbirds, related to mosquito borne viruses, in cooperation with SYMVCD. When considering the burgeoning population immediately down wind of the Refuge and the recent establishment of West Nile Virus in the Central Valley, it is essential that the Refuge and SYMVCD continue to build on their successful partnership

Weed Control

Since 1995, the Refuge has adopted an active aquatic and terrestrial weed management program in the Beach-Stone Lakes Basin, particularly as a founding member of the Stone Lakes Water Hyacinth Control Group and the Sacramento Weed Management Area. The Refuge and the Sacramento Regional County Sanitation District conduct treatments for control of water hyacinth (*Eichhornia crassipes*) under a Statewide National Pollution Discharge Elimination System (NPDES) General Permit (No. CAG990005) for discharge of aquatic pesticides. The Refuge and SRCSD utilize Reward (Diquat) and Aquamaster (glyphosphate) to control water hyacinth in the basin. Another aquatic species, Brazilian elodea (*Egeria densa*), is also abundant in waterways and may emerge as a management concern as opportunities for recreational boating are developed on the Refuge.

The Integrated Pest Management methods that the Refuge uses to control weeds include burning, mowing, discing and herbicide application. The Refuge uses Transline® (clopyralid), Telar® (chlorsulfuron), Roundup (glyphosphate), and 2, 4-D, to control the upland weeds such as yellow starthistle (*Centaurea solstitialis*) and perennial pepperweed (*Lepidium latifolium*). To date, the Refuge has found chemical control to be the most effective method of managing water hyacinth and perennial pepperweed. Stone Lakes NWR is a member of the Sacramento County Weed Abatement Team.

Riparian Habitat Maintenance/Restoration on North Stone Lake Unit

Ongoing and planned improvements to the grazing program on the North Stone Lake Unit will continue under all alternatives and include developing alternative watering sources for the cattle in each pasture, bank stabilization along the SP Cut in the north irrigated pasture, invasive weed control, and continued monitoring of migratory bird responses.

Table 1. Summary of Alternatives

	Alternative A	Alternative B	Alternative C
	No Action/Current Management	**Wetland, Riparian and Grassland Restoration with Facilitated Public Use**	**Restore to Natural Conditions with Self-Directed Public Use**
HABITAT MANAGEMENT			
Riparian restoration and management	• 0 acres or riparian habitat restored	• Same as Alternative A but:	• Same as Alternative A but:
	• Maintain 360 acres of riparian and oak woodland habitat	• Maintain 425 acres of riparian and oak woodland habitat	• Maintain 385 acres of riparian and oak woodland habitat
	• 25 acres of riparian and oak woodland habitat actively restored	• 65 acres of riparian and oak woodland habitat actively restored	• 65 acres allowed to restore through natural process restoration
	N/A	• 40 acres of riparian understory restored	• 25 acres of riparian understory restored
	N/A	• Establish a native plant nursery at HQ office	• No native plant nursery
	N/A	• Intensify control efforts for perennial pepperweed in riparian areas using a variety of methods	• Same as Alternative B
	• Maintain existing fencing along SP Cut on the North Stone Lake Unit to exclude cattle from riparian areas	• Maintain and expand fencing along SP Cut on the North Stone Lake Unit to exclude cattle from riparian areas	• Same as Alternative A
Wetlands restoration and management	• 200 acres of wetland restored at Headquarters Unit	• Same as Alternative A	• Same as Alternative A
	• 452 acres of seasonal wetlands maintained	• 452 acres of seasonal wetlands manipulated to improve vegetation conditions	• 133 acres of seasonal wetlands manipulated to improve vegetation conditions
	• 136 acres of vernal pool seasonal wetlands manipulated to improve vegetation conditions	• Same as Alternative A	• Same as Alternative A
	• 715 acres of permanent wetlands managed to provide habitat for a variety of wetland dependent species	• Same as Alternative A	• Same as Alternative A
	N/A	• 50 acres wetlands enhanced on Lewis Unit	• Same as Alternative B
Grassland restoration and management	• 1,900 acres of non-irrigated grassland maintained and enhanced	• Same as Alternative A	• Same as Alternative A
	• 0 percent high residual dry matter	• 20 percent high residual dry matter	• Same as Alternative B

Table 1. (continued)

	Alternative A	Alternative B	Alternative C
	• Implement a long term grazing management plan developed in collaboration with range management experts	• Same as Alternative A	• Same as Alternative A
	• 0 acres planted to restore the native grassland community	• 30 acres planted to restore the native grassland community	• Same as Alternative B
	N/A	• Enhance and create habitat for burrowing owls by reintroducing ground squirrels to the North Stone Lake Unit and constructing and maintaining artificial burrows	N/A
Wet meadow/pasture management	• 460 acres of irrigated pasture/wet meadow maintained	• Same as Alternative A.	• Same as Alternative A.
	N/A	• If feasible, sheet flood irrigated pastures to a depth of less than six inches every two weeks from November through March on the North Stone Lake Unit	• Same as Alternative B
	N/A	• Maintain grasslands by periodic disturbance (eg., mowing, grazing, burning, or discing)	• Same as Alternative B
Moist soil habitat management	• 529 acres of seasonal wetlands managed as moist soil habitat	• Same as Alternative A and:	• Same as Alternative A but:
	• Flood moist soil units early Sept – May	• Same as Alternative A.	• Begin floodup concurrent with first rainfall after Sept. 1
	• Stagger timing of drawdown starting in March	• Same as Alternative A.	• Drawdown beginning in mid-March to mimic natural rainfall conditions
	• Irrigate 1-2 times from May – Aug to promote desired vegetation	• Same as Alternative A	• No irrigation from May - Aug
	• Disc and/or mow 25-50% of units to stimulate plant growth and maintain equal ratio of open water to emergent vegetation	• Same as Alternative A	• Same as Alternative A
	N/A	• Drawdown one permanant wetland in August to provide shorebird habitat and flood again in September with other wetlands	• Begin flooding seasonal wetlands concurrent with the first rainfall

Table 1. (continued)

	Alternative A	Alternative B	Alternative C
	N/A	• Explore reverse cycle wetlands management on an experimental basis to benefit shorebirds	• Same as Alternative B
Sandhill crane habitat management	• 2,500 acres of Refuge lands managed to support a population of 400 to 700 sandhill cranes	• 2,950 acres of Refuge lands managed to support a population of 400 to 700 sandhill cranes	• 2,700 acres of Refuge lands managed to support a population of 400 to 700 sandhill cranes
	N/A	• Periodically sheet-flood irrigated pastures on North Stone Lake Unit in winter	• Same as Alternative B
	N/A	• Maintain 40 to 60 acres of agriculture fields (eg., corn, winter wheat and other small grains) on the Headquarters Unit of the Refuge for foraging cranes	• Same as Alternative
Pest control	• Use integrated pest management techniques to control weeds	• Same as Alternative	• Same as Alternative A
	• Continue cooperative water hyacinth control efforts	• Survey for and control Brazilian elodea	• Same as Alternative B
	• Continue using prescribed fire, where appropriate	• Depending on restrictions, employ prescribed burns to reduce nonnative annual grasses and replicate the historical fire regime	• Same as Alternative B
	• Drawdown managed permanent wetlands every two to four years to control carp populations and improve germination of desirable wetland plants	• Same as Alternative A	• Same as Alternative A
	N/A	• Cooperate with other entities to conduct weed control	• Same as Alternative B
HYDROLOGY MANAGEMENT			
Water Quality	• Develop a long-term water quality monitoring plan	• Same as Alternative A and:	• Same as Alternative B
	N/A	• Within 10 years of CCP approval, work toward achieving the water quality supply standard set forth by the USEPA, CDFG and the RWQCB	• Same as Alternative B

Table 1. (continued)

	Alternative A	Alternative B	Alternative C
	N/A	• Develop a water quality monitoring program to track contaminant concentrations, and water quality parameters resulting from current and future land use patterns around the Refuge within five years	• Same as Alternative B
	N/A	• Develop strategies to educate local landowners, businesses, and neighborhood organizations within the watershed about nonpoint sources of pollution	• Same as Alternative B
	N/A	• Expand outreach and education effort to inform upstream urban residents and businesses about the sensitivity of downstream water uses	• Same as Alternative B
Floodplain management	• Manage Refuge floodplain in a manner consistent with regional water quality objectives, as described in the EIS establishing the Refuge	• Same as Alternative A	• Same as Alternative A
	N/A	• Develop Refuge levee and flood control channel maintenance program	• Same as Alternative B
VISITOR USE			
Visitors	• 3,000 wildlife observation visits per year	• 10,500 wildlife observation visits per year	• 15,000 wildlife observation visits per year
Trails	• One trail	• 4.0 miles of foot trails open to the public 7 days a week with seasonal restrictions	• 6.0 miles of foot trails open to the public 7 days a week with seasonal restrictions
	N/A	• 2.0 miles of universally accessible trail to be constructed on the Headquarters Unit and named the Blue Heron Trails System	• 2.5 miles of universally accessible trail to be constructed on the Headquarters Unit and named the Blue Heron Trails System
	N/A	200 feet of boardwalk on Headquarters unit as part of the Blue Heron Trails System	• 140 feet of boardwalk on Headquarters unit as part of the Blue Heron Trails System
	N/A	• 40 vehicle parking capacity on Headquarters unit	• 40 vehicle parking capacity on Headquarters unit

Table 1. (continued)

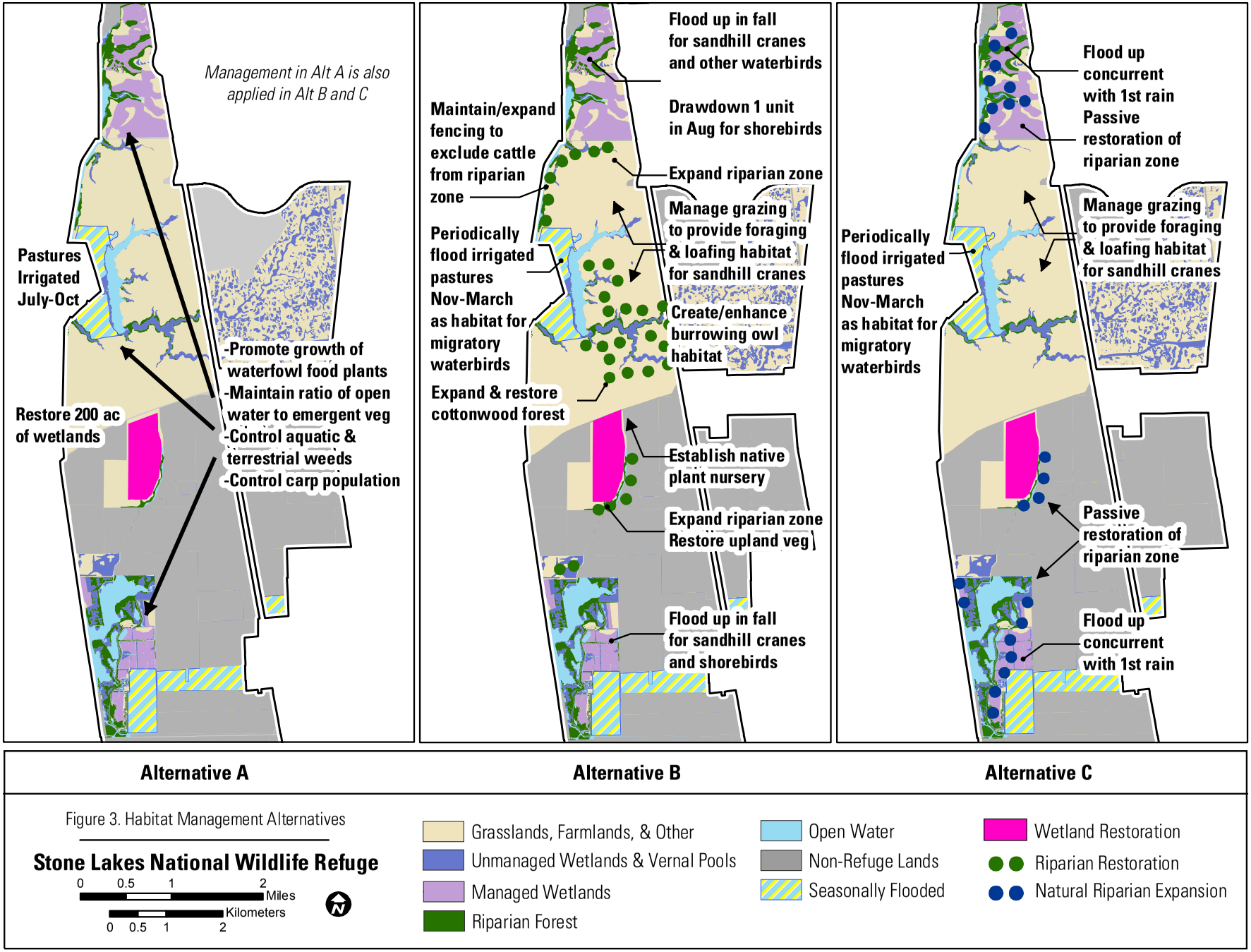
	Alternative A	Alternative B	Alternative C
	N/A	• 1.5 miles of foot trails to be constructed on the South Stone Lake unit open to the public seven days a week with seasonal restrictions	• Same as Alternative B
	N/A	• 200 feet of boardwalk to be constructed on the South Stone Lake Unit open to the public seven days a week with seasonal restrictions	• Same as Alternative B
	N/A	• Develop a boat-accessible haul-out site, walking trail, and viewing blind on the South Stone Lake Unit	• Same as Alternative B
	N/A	• Provide parking and boat launch capacity for a maximum of 10 cartop boats on the Beach Lake unit	• Same as Alternative B
	N/A	• Restrict land-based visitor use near habitat suitable for heron/egret rookeries, nesting Swainson's hawks, and other areas used by nesting migratory birds during sensitive periods	• Same as Alternative B
	N/A	• Minimize disturbance to sandhill crane habitats by restricting public access during October through March	• Same as Alternative B
	N/A	• Reduce potential spread of invasive species by visitors by restricting access to paved or graveled trails	• Same as Alternative B
	N/A	N/A	• Develop two mile trail system on Lewis and North Stone Lake tracts to be open to the public seven days a week, with seasonal closures, and improve associated parking
	N/A	N/A	• Resolve access issues and develop a parking area for five to ten cars and walking trails on Lodi Gun Club
Hunting	• The 912-acre South Stone Lake Unit open to waterfowl hunting for up to 22 hunters, 2-3 days per week	• Same as Alternative A	• Same as Alternative A

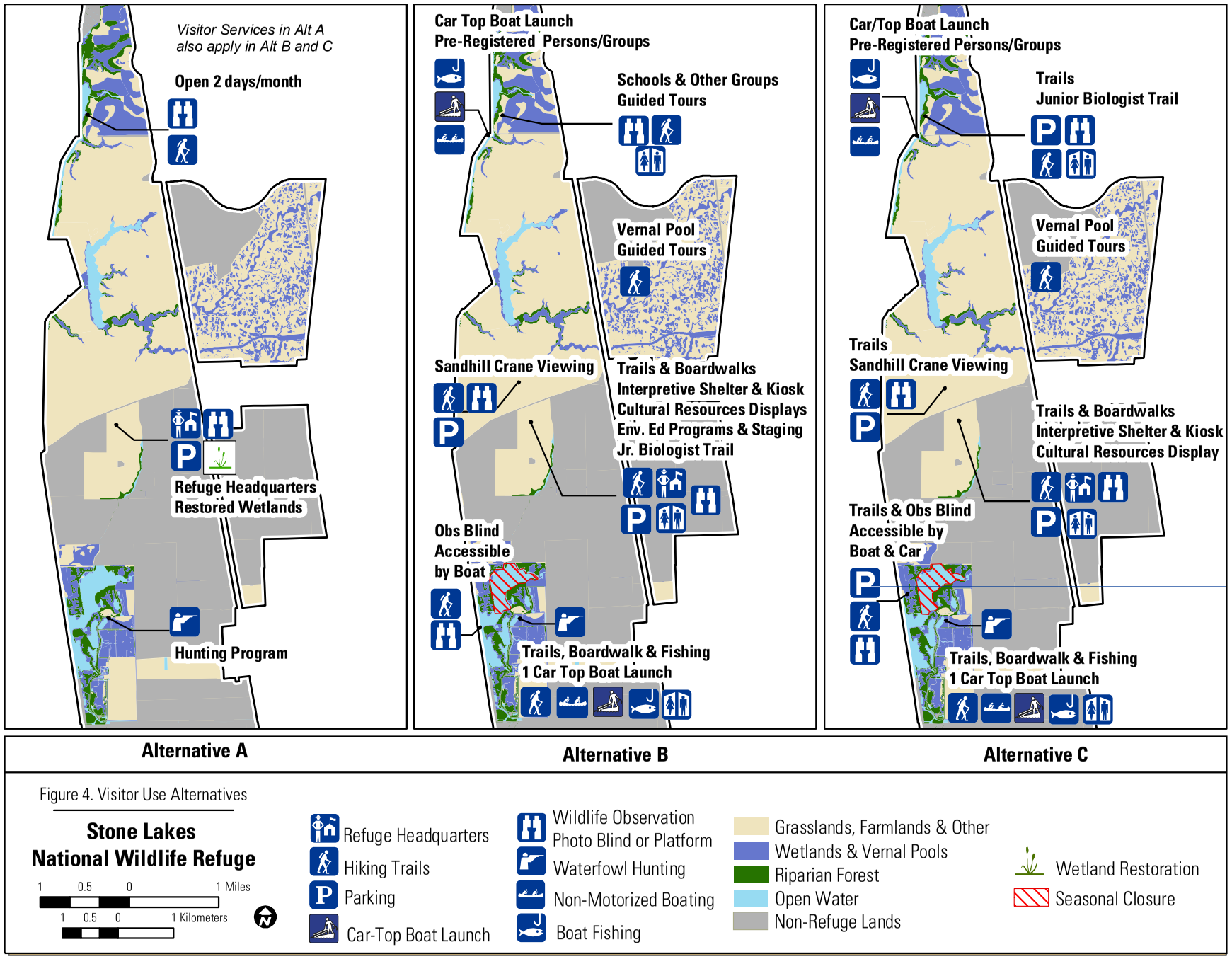
Table 1. (continued)

	Alternative A	Alternative B	Alternative C
Fishing	• No legal fishing	• Within five years provide safe, boat-only fishing with day use parking facilities to accommodate a maximum of twenty boats on South Stone Lake and a minimum of ten boats on SP Cut from June through September	• Same as Alternative B
	N/A	• Fishing will be in accordance with all State regulations, will not include take of frogs or crayfish and will only be done with rod and reel	• Same as Alternative B
Wildlife Viewing and Photography	N/A	• Minimum of two photography blinds to be constructed	• Same as Alternative B
	N/A	• Construct a viewing platform on the Headquarters Unit	• Same as Alternative B
	N/A	• Construct a vehicular access point, parking area for 15 cars, a trail and a wildlife observation platform on southern North Stone Lake Unit	• Same as Alternative B
	N/A	• Provide parking for up to 20 cars at the boat launch on the South Stone Lake Unit	• ame as Alternative B
Environmental Education and Interpretation	N/A	• Develop a self-guided trail as part of the Blue Heron Trails System with hands-on learning stations within two years	• Same as Alternative B
	N/A	• Develop a class/group staging area and 5 open air interpretive shelters with one kiosk and exhibits as part of the Blue Heron Trails System to accommodate approximately 40 children	• Same as Alternative B
	N/A	• Develop interpretive displays on the Headquarters Unit to illustrate traditional dwellings, various subsistence strategies, and the overall lifestyle of local American Indians	• Same as Alternative B
	N/A	• Develop self-guided trail and interpretive displays for the Wetland Preserve Unit	N/A

Table 1. (continued)

	Alternative A	Alternative B	Alternative C
	N/A	N/A	• Develop interpretive panels and exhibits on South Stone Lake Unit
Boating	• High speed boating (waterskiing) occurs as a non-sanctioned use, but has been allowed to continue pending compatibility determination. High speed boats (waterskiers) launch from off the refuge and ski through the Refuge.	• No-wake speed limit	• Same as Alternative B
	N/A	• Develop and maintain a safe public parking lot and boat launch facilities to accommodate a maximum of 20 cartop boats on the South Stone Lake Unit	• Same as Alternative B
	N/A	• Provide a launch for pre-registered canoe/kayak groups in SP Cut on the Beach Lake Unit from June through September	• Same as Alternative B
	N/A	• Restrict water-based visitor use near habitat suitable for heron/egret rookeries and Swainson's hawks during sensitive periods	• Same as Alternative B
	N/A	• Develop facilities for mobility impaired persons to enter and exit canoes and kayaks safely	• Same as Alternative B
Cultural resources management	• Develop additional measures to protect, stabilize and/or remediate past damages if necessary	• Same as Alternative A and:	• Same as Alternative B
	• Meet annually with the Ione Band of Miwok Indians and other concerned tribal groups to discuss land management and restoration activities planned for the upcoming field season	• Within 15 years evaluate conditions of known cultural resource sites on Refuge managed lands and conduct seasonal monitoring of known sites	• Same as Alternative B
	N/A	• Develop a minimum of two interpretive panels and exhibits to be located on various units to share with the public the importance of cultural resources on the Refuge and American Indian cultural practices	• Same as Alternative B


Management in Alt A is also applied in Alt B and C
Pastures Irrigated July-Oct
Restore 200 ac of wetlands
-Promote growth of waterfowl food plants
-Maintain ratio of open water to emergent veg
-Control aquatic & terrestrial weeds
-Control carp population
Flood up in fall for sandhill cranes and other waterbirds
Maintain/expand fencing to exclude cattle from riparian zone
Drawdown 1 unit in Aug for shorebirds
Expand riparian zone
Periodically flood irrigated pastures Nov-March as habitat for migratory waterbirds
Manage grazing to provide foraging & loafing habitat for sandhill cranes
Create/enhance burrowing owl habitat
Expand & restore cottonwood forest
Establish native plant nursery
Expand riparian zone
Restore upland veg
Flood up in fall for sandhill cranes and shorebirds
Flood up concurrent with 1st rain
Passive restoration of riparian zone
Periodically flood irrigated pastures Nov-March as habitat for migratory waterbirds
Manage grazing to provide foraging & loafing habitat for sandhill cranes
Passive restoration of riparian zone
Flood up concurrent with 1st rain
Alternative A
Alternative B
Alternative C
Figure 3. Habitat Management Alternatives
Stone Lakes National Wildlife Refuge
0 0.5 1 2 Miles
0 0.5 1 2 Kilometers
N
Grasslands, Farmlands, & Other
Unmanaged Wetlands & Vernal Pools
Managed Wetlands
Riparian Forest
Open Water
Non-Refuge Lands
Seasonally Flooded
Wetland Restoration
Riparian Restoration
Natural Riparian Expansion


Visitor Services in Alt A
also apply in Alt B and C
Open 2 days/month
Refuge Headquarters
Restored Wetlands
Hunting Program
Car Top Boat Launch
Pre-Registered Persons/Groups
Schools & Other Groups
Guided Tours
Vernal Pool
Guided Tours
Sandhill Crane Viewing
Trails & Boardwalks
Interpretive Shelter & Kiosk
Cultural Resources Displays
Env. Ed Programs & Staging
Jr. Biologist Trail
Obs Blind
Accessible
by Boat
Trails, Boardwalk & Fishing
1 Car Top Boat Launch
Car/Top Boat Launch
Pre-Registered Persons/Groups
Trails
Junior Biologist Trail
Vernal Pool
Guided Tours
Trails
Sandhill Crane Viewing
Trails & Boardwalks
Interpretive Shelter & Kiosk
Cultural Resources Display
Trails & Obs Blind
Accessible by
Boat & Car
Trails, Boardwalk & Fishing
1 Car Top Boat Launch
Alternative A
Alternative B
Alternative C
Figure 4. Visitor Use Alternatives
Stone Lakes
National Wildlife Refuge
1 0.5 0 1 Miles
1 0.5 0 1 Kilometers
Refuge Headquarters
Hiking Trails
Parking
Car-Top Boat Launch
Wildlife Observation
Photo Blind or Platform
Waterfowl Hunting
Non-Motorized Boating
Boat Fishing
Grasslands, Farmlands & Other
Wetlands & Vernal Pools
Riparian Forest
Open Water
Non-Refuge Lands
Wetland Restoration
Seasonal Closure

Vernal Pool Management
Vernal pools are present on the North Stone Lake and Wetland Preserve units. The Wetland Preserve Unit contains the highest concentration of vernal pools (98 percent of all Refuge vernal pools) that harbor the Federally-listed vernal pool fairy shrimp (*Branchinecta lynchi*) and vernal pool tadpole shrimp (*Lepidurus packardi*) and many vernal pool plant and animal species of concern (USFWS 2005). Only 12 percent of the vernal pools located on the Refuge are naturally occurring. The majority have been created over the last 15 years as mitigation for vernal pool loses elsewhere.

Hunting
Through a separate planning process from the Refuge CCP, the Service has implemented a waterfowl hunting program on the Refuge that will remain in effect under all Alternatives. Currently, the program is offered two days per week on the South Stone Lake Unit and consists of seven spaced blinds, with an emphasis on youth and handicap hunters. Over the next five years, the program will expand to provide hunting opportunities for up to 22 hunters. Hunting occurs currently only on the Sun River property of the South Stone Lake Unit but as more resources become available for the Refuge, the program will expand to include more of South Stone Lake. The Service currently emphasizes youth hunting by reserving at least two blinds for youth hunters and by providing two youth hunts before and after the waterfowl season in accordance with State regulations. Currently, the entire program is operated by the Refuge but the California Department of Fish and Game may assume a more active role, in cooperation with the Service, as hunting expands.

Boating
A number of private landowners with property adjacent to the Refuge have allowed access to waterways in the Stone Lakes Basin for a variety of different boating activities (e.g., waterskiing, fishing, waterfowl hunting). The Service has allowed boating to continue on Refuge waters within the Beach Lake and North Stone Lake units pending finalization of compatibility determinations for visitor uses. Under all alternatives, the Service will continue to allow some boating on the Refuge.

Cultural Resources
To preserve and minimize disturbance to Refuge archaeological and historic resources, all undertakings, including but not limited to ground disturbance and prescribed burns, will be coordinated with the Service's Regional Archaeologist. In consultation with the State Historic Preservation Office and local tribal representatives, the Service will ensure that Refuge activities comply with all relevant cultural resource protection laws, including Section 10 of the National Historic Preservation Act and the Native American Graves Protection and Repatriation Act. Any cultural resources overviews or site surveys for properties or monitoring of ground disturbing activities will be conducted by qualified professional archaeologists. The Refuge will continue to consult regularly with the Ione Band of Miwok Indians and other concerned tribal organizations on management and restoration projects, as well as plant-gathering activities and interpretive projects.

Alternatives Removed From Further Consideration

Auto Tour Route on North Stone Lake Unit and Associated Trails
The Service considered creating an automobile tour route and associated walking trails on the North Stone Lake Unit. Developing an auto tour route was rejected because since the entire unit lies within the 100-year floodplain, accommodating vehicle traffic would necessitate construction of new roads involving major grading and gravel placement on a unit where preservation of natural topography and hydrology and native grass communities are management priorities. Furthermore, greater sandhill cranes (*Grus canadensis tabida*) and white-fronted geese use the area for foraging during winter and are highly sensitive

to automobile and pedestrian traffic. An auto tour route would also further fragment the, already limited crane habitat on the Refuge. Walking trails and a viewing platform on the North Stone Lake Unit are still components of the alternatives considered in this CCP.

Equestrian Use
After receiving inquiries from selected members of the public, the Service evaluated accommodation of equestrian use on the Refuge. However, this is considered a non-wildlife-dependent use and there are no trails suitable for riding that would not conflict with other priority visitor uses. Moreover, there are no adequate parking facilities for horse trailers and the Service determined that the limited parking areas available should be primarily for priority visitor uses such as wildlife observation and fishing that do not require trailers. Horses traveling through the Refuge may be a source for the introduction and spread of exotic and invasive plants . Many trails are primarily on levees and use by horses, particularly after precipitation, could accelerate the erosion of these levees. Other nearby areas have more extensive horse trails and are better able to accommodate horse use. These areas include the American River Parkway and Auburn State Recreation Area.

Upland Game and Deer Hunting
Refuge Staff considered the inclusion of upland game and deer hunting in formulating the alternatives. However, since such a program would be limited to land that the Service owns in fee (1,740 acres in four isolated areas; only two of which support upland habitat), not enough acreage is in Refuge ownership to provide quality, safe upland game or deer hunting with a reasonable chance of hunter success. If additional lands are added to the Refuge, upland game and deer hunting could be reconsidered.

Fishing Derbies
Some of the public suggested the Service consider fishing derbies on the South Stone Lake Unit. Fishing derbies typically involve fast moving, gas powered boats that conflict with other non-motorized boats, such as canoes or kayaks, used for wildlife observation. Furthermore, South Stone Lake is a small body of water with underwater hazards and dense, submerged vegetation and is too small for a quality fish derby. Other nearby locations, such as reservoirs, are better suited for this activity.

Alternative A: No Action

Under this alternative, the Service would continue to manage Stone Lakes Refuge as it has in the recent past. Management would be consistent with the "Current Management" section in Chapter 3 of the CCP. Current staffing and funding needs would remain the same.

Habitat Restoration
Under this alternative, the 330-acre Headquarters Unit would be restored primarily to wetland habitat (200 acres), with 50 acres of native grassland habitat and 80 acres of farmed land.

Migratory Birds
Flood up, drawdown and summer irrigations will continue to be scheduled to provide habitat for migrating, wintering and breeding birds. These actions will occur on 840 acres of wetlands, 360 acres of riparian habitat, 3,320 acres of grassland habitat, 400 acres of open water/aquatic bed habitat, 460 acres of irrigated pasture and 305 acres of cropland. Seasonal wetlands will be managed to provide feeding and loafing habitat for wintering migratory waterbirds. Water would continue to be carefully managed to produce food and to create habitat for nesting waterbirds. The Service would continue to maintain water through most of the summer in permanent wetlands to provide rearing habitat for waterbirds and year-round habitat for other species, such as bitterns, herons and marsh wrens (*Cistothorus*

palustris). Drawdowns will continue to vary to stimulate production of a variety of plants and to provide habitat for nesting shorebirds. Wildlife friendly farming practices would be continued to supply grain and other forage for birds on about 320 acres.

Monitoring
The Service would continue its ongoing monitoring programs, including colonial waterbird nesting, landbird, song sparrow, weekly waterfowl, plant, noxious weed and residual dry matter (dry grass remaining after the growing season) surveys.

Special Status Species
Sandhill crane. Under this alternative, the Service would continue to manage the Refuge to benefit sandhill cranes by managing 460 acres of irrigated pasture, 540 acres of seasonally flooded wetlands, 305 acres of cropland, and 3,320 acres of grassland habitat.

Swainson's hawk. The Refuge would continue to provide breeding and foraging habitat for Swainson's hawks (*Buteo swainsoni*). However, there would be no increase in these habitats since no additional acres of riparian, grassland, or wetland habitat would be restored.

Valley elderberry longhorn beetle (VELB). Although there are no documented occurrences of the Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*, VELB) on the Refuge, suitable VELB habitat is present on the Refuge. All existing elderberry shrubs (*Sambucus* sp.), the host plant for the VELB, are mapped. Shrubs that may be affected by the water hyacinth control program are monitored during the water hyacinth control season to minimize disturbance during water hyacinth control operations.

Giant garter snake. The most recent documented occurrence of the giant garter snake (*Thamnophis gigas*) on the Refuge was in 1992 at Beach Lake. Recent surveys have not located any, although the snake is presumed to be present on the Refuge. Aside from avoidance, no specific measures have been taken to manage for the snake.

Wetland, Grassland, Riparian Habitats
Wetlands would continue to be managed for the benefit of migratory birds. Wetlands (moist soil units) would be flooded from September to May for the benefit of migratory waterbirds. Grassland habitat would continue to be mowed and grazed. Grazing would occur on about 1,900 acres of the Refuge on the North Stone Lake Unit. No attempts to restore native grassland would be pursued. The Service would continue to allow researchers to conduct research on the Refuge but would not actively encourage or support research.

The Service would continue to manage the existing riparian habitat and would continue, sporadically, to plant riparian vegetation up to one mile from the edge of the SP Cut and adjacent to lakes on the Refuge where soils are appropriate and as time and funding allow. Little or no active riparian restoration would occur.

New Lands
Additional lands within the approved Refuge boundary that come under Refuge management would be evaluated and either maintained in agriculture beneficial to wildlife or developed into natural habitats, such as wetlands, grasslands and riparian areas, depending on site-specific conditions.

Visitor Services
Under alternative A, the Refuge visitor services program would continue as described under "Visitor Services" in Chapter 3 of the CCP. The Refuge would continue its current

wildlife observation and photography program, limited to two Refuge tour days per month. Environmental education would not change on the Refuge. Twenty-five groups would continue to visit the Refuge at their current level, with a limited number of presentations by Refuge staff at schools, public service and conservation group meetings. The Refuge would continue to host Walk on the Wildside, an annual special event held on the Refuge. The Refuge would continue to offer a waterfowl hunting program on the South Stone Lake Unit. Sixteen hunters would be accommodated two days a week. Under this alternative, an emphasis would be placed on youth and disabled hunters. In addition to blinds reserved for youth and disabled hunters, the Refuge would hold two youth hunts before the hunting season and two after the season.

Alternative B

Alternative B is the preferred alternative because it meets the criteria described in the Proposed Action Criteria section at the end of this chapter. Under Alternative B, the Refuge would continue its current focus of providing wintering habitat for migratory birds and management for the benefit of special status species. Management programs for migratory birds and other Central Valley wildlife would be expanded and improved, as described below. Visitor use opportunities would also be expanded as described below.

Habitat Restoration

Alternative B would include the same elements as Alternative A. The Service would also restore Refuge lands based on the habitat requirements of migratory birds and special status species, which includes 65 acres of riparian habitat, 40 acres of wetland habitat and 30 acres of native grassland habitat.

Migratory Birds

Alternative B would include the same elements as Alternative A. Additional riparian and seasonal and permanent wetlands would be restored. Measures would be implemented to increase the food supply and provide additional migratory bird habitat, such as sheet flooding irrigated pastures, habitat manipulations, grazing to promote native grasses and forbs and exploring reverse-cycle wetland regimes. Reverse-cycle wetlands are flooded during the spring/summer and are dry during the fall/winter. Additional coordination is planned with other agencies and nongovernmental organizations under Alternative B. Visitor use would be restricted during heron and Swainson's hawk nesting and sandhill crane roosting. A portion of South Stone Lake would also be closed to boating seasonally to protect nesting waterbirds and giant garter snake habitat.

Monitoring

Under this alternative, monitoring would be the same as for alternative A. In addition, the Service would monitor wetland, riparian and oak woodland habitats each spring for invasive species, such as cocklebur, yellow starthistle and perennial pepperweed. The Service would develop a Refuge water-quality monitoring program, expand migratory bird monitoring and develop surveys on the South Stone Lake, Headquarters, Wetlands Preserve units and other lands as they come under Refuge management.

The Service would continue to collaborate with Sacramento-Yolo Mosquito Vector Control District (SYMVCD) on the ongoing landbird monitoring program and pursue funding for a seasonal employee or graduate students to assist with the banding program and data analysis to assess population trends and assist with developing associated habitat restoration and management plans. This expansion is not included in Alternative C.

Special Status Species
Sandhill crane. Under this alternative, the Service would continue to manage for cranes as in Alternative A. In addition, there would be an increase of 80 acres of foraging and resting habitat with 50 acres of wetland and 30 acres of native grasslands habitat restored. In addition, when possible, Refuge staff would begin flooding moist soil units in early September to provide shallow water for cranes earlier in the season.

Swainson's hawk. Under this alternative, there would be an increase in 65 acres of breeding habitat since 65 additional acres of riparian habitat would be restored. In addition, 30 acres of native grassland would be restored, adding to existing foraging habitat.

Valley elderberry longhorn beetle (VELB). The Refuge would continue to map and monitor elderberry shrubs as in Alternative A. In addition, the Service would restore 40 acres of riparian understory, to include elderberry shrubs, which would benefit the VELB.

Giant garter snake. Same as Alternative A.

Wetland, Grassland, and Riparian Habitats
Wetland habitat would be expanded on 50 acres of the South Stone Lake Unit. The Service would use the same tools and techniques to manage wetland units under Alternative B as it does under Alternative A. However, some fields would be flooded in early September to provide habitat for cranes earlier in the year. Under Alternative B, seasonal marsh management activities would be the same as described under Alternative A. In addition, one permanent wetland unit would be drawn down in August to provide habitat for migrating shorebirds. Vernal pools on the Wetland Preserve Unit would be grazed.

Portions of the Beach Lake, North Stone Lake, and South Stone Lake units would be closed as a sanctuary. The Lewis property of the Beach lake Unit and the Wetland Preserve and portions of the Headquarters units would be subject to seasonal closure to provide wildlife sanctuaries.

Grassland habitat would be restored on 30 acres. For this alternative only, burrowing owl habitat would be improved by reintroducing ground squirrels (*Spermophilus beecheyi*) and constructing artificial burrows. Irrigated pasture would be grazed from July through October to promote native grasses and forbs and shortgrass conditions.

Riparian habitat would be expanded along lower Morrison Creek on the Beach Lake Unit, the south arm of North Stone Lake and the Sacramento drainage canal and South Stone Lake on the Headquarters and South Stone Lake units. In addition, riparian habitat would be managed for a variety of different successional stages for the benefit of neotropical migrants, colonial nesting birds and raptors.

New Lands.
Same as alternative A.

Visitor Services
Visitor Services would be improved and expanded under alternative B. For example, the number of units open to visitors would increase from one to five. In addition, environmental education, interpretation, wildlife observation, wildlife photography, hunting and fishing programs would be expanded, as described below. Visitor Services would be offered on the South Stone Lake, Headquarters, Beach Lake, Wetland Preserve and North Stone Lake units. The South Stone Lake, Headquarters, and a portion of North Stone Lake units would be open to visitors seven days a week from sunrise until sundown.

Visitor services would be concentrated south of Hood-Franklin Road at the Headquarters and South Stone Lake Units. A trail system with boardwalks, interpretive displays, parking for 40 cars and an environmental education center would be constructed on the Headquarters Unit. A trail system and observation platform overlooking South Stone Lake would be constructed. The environmental education and interpretive programs would be facilitated by Refuge staff or volunteers.

A boat launching area would be provided on the Sun River property of the South Stone Lake Unit for fishing, wildlife observation and photography from boats. Only non-motorized, hand-launched boats (e.g., canoes, kayaks) or non-trailered boats with electric motors would be allowed. A no-wake zone with boat speeds of less than five mph will be enforced for all Refuge waters. All fishing would be from boats only. A boat haul-out site would be constructed on the Lodi Unit upstream from Sun River. Non-motorized boating by pre-registered groups, including commercial outfitters who engage in fishing, and wildlife observation, would also be allowed on SP Cut on the Beach Lake and North Stone Lake units at the west end of Elliott Ranch Road.

Safe access to the North Stone Lake Unit would be constructed to a parking area for 25 cars on the north side of Hood-Franklin Road. A short trail would lead to an observation platform overlooking North Stone Lake to provide visitors an opportunity to view sandhill cranes and other wildlife. Schools and other groups would use the Beach Lake Unit for guided tours only.

The Wetland Preserve Unit would be open to the visitors for guided tours and via a self-guided trail.

The volunteer and outreach programs would expand and become more defined.

The hunt program would be the same as alternative A.

Other major new visitor services projects under this alternative include: developing new interpretive signs, displays and interpretive brochures for the Wetland Preserve and Headquarters units; and constructing and making accessible on a daily basis, a kiosk, boardwalk, and four miles of walking trails on the Headquarters Unit; and constructing two photo blinds and additional hunting blinds on the South Stone Lake Unit.

Alternative C

Under this alternative, the Service would continue to focus on providing wintering habitat for migratory birds and managing for endangered species while placing a greater emphasis on historic conditions in management and habitat restoration activities as described below. Opportunities for the six priority public uses would be expanded from both alternatives A and B.

Habitat Restoration

Management of newly acquired Refuge lands would focus on the restoration of historic native plant communities rather than maintaining lands in agriculture or constructing wetlands. Under this alternative, 40 acres of riparian, 25 acres of understory shrub, 50 acres of wetland and 30 acres of native grassland habitat would be restored.

Migratory Birds

Alternative C would be similar to alternative B, however, more emphasis would be placed on restoration of natural conditions. Riparian restoration would be accomplished by natural process restoration. Flood up would not occur in early September as in alternatives A and B, but would begin with the first rainfall.

Monitoring
Same as Alternative B, except that there would be no expansion of the SYMVCD monitoring.

Special Status Species
Sandhill crane. Same as alternative B.

Swainson's hawk. Same as alternative B, except that restored breeding habitat would be increased by 40, rather than 65, acres. Restored foraging habitat would remain the same as in Alternative B.

Valley elderberry longhorn beetle (VELB). Same as alternative B, except with fewer acres of riparian understory shrubs planted. In alternative B, 40 acres of shrubs would be restored; under alternative C shrub habitat would increase naturally by approximately 25 acres.

Giant garter snake. Same as Alternative A.

Wetland, Grassland, Riparian Habitats
Grassland and wetland habitat will be restored as in alternative B. Although seasonal wetlands would still be managed to provide feeding and loafing habitat for waterbirds, they would not be managed as intensely as the moist soil units in alternatives A and B. would In addition, flood-up for seasonal wetlands would begin with the first rainfall in fall rather than beginning in early September.

Riparian habitat restoration would be through natural process-based restoration only. Vegetation would not be planted, but would be allowed to expand naturally. In addition, the Service would allow riparian habitat to expand naturally into managed seasonal and permanent wetland units.

New Lands
Under this alternative, new lands brought under the protection of the Refuge System would be restored to historic conditions, where feasible. Restoring new lands to natural historic conditions would probably result in restoration of grassland habitat and to a lesser extent, wetland and riparian habitats. By contrast, alternatives A and B would likely result in more wetland habitat than grassland habitat.

Visitor Services
Under this alternative, visitor service facilities would be expanded as in alternative B. In addition, the Beach Lake Unit would be open to visitors seven days a week from sunrise to sunset, subject to seasonal closure.

Visitor Services provided at the Headquarters Unit would be similar. However, the environmental education and interpretive programs would de-emphasize programs facilitated by Refuge staff or volunteers and tours would be self-guided.

Visitor services for the South Stone Lake Unit would be similar to those offered in Alternative B. In addition to the facilities for South Stone Lake described in Alternative B, the Service would create vehicle access to a parking area for up to ten cars. The parking area would be connected to the trail system.

Visitor services for the north side of Hood-Franklin Road would be the same as Alternative B.

In addition to the guided tours and canoe and kayak groups described in Alternative B, visitor services concentrated in the Beach Lake Unit would include environmental education, interpretation, wildlife observation and photography. The parking area near the corral on the North Stone Lake Unit would be improved and include restrooms, trails, interpretive displays, and an environmental education kiosk.

Visitor services for the Wetland Preserve Unit would be the same as alternative B.

The hunt program would be the same as alternative A.

The volunteer and outreach programs would be the same as alternative B.

Proposed Action Criteria

The planning policy that implements the Improvement Act of 1997 requires the Service to select a preferred alternative that becomes its proposed action, as required by the NEPA. The written description of this proposed action is effectively the draft CCP. Alternative B is the proposed action for the Refuge because it best meets the following criteria:

- achieves the mission of the National Wildlife Refuge System;
- achieves the purposes of the Refuge;
- provides guidance for achieving the Refuge's 15 year vision and goals;
- maintains and restores the ecological integrity of the habitats and populations on the Refuge;
- addresses the important issues identified during the scoping process;
- addresses the legal mandates of the Service and the Refuge; and
- is consistent with the scientific principles of sound fish and wildlife management and endangered species recovery.

The proposed action described in this EA is preliminary. The action ultimately selected and described in the final CCP will be determined, in part, by the comments received on this version of the EA. The proposed action presented in the final CCP may or may not be the preferred alternative presented in this version. The final CCP may propose a modification of one of the alternatives presented here or a combination of elements from more then one alternative. Alternative B is the preferred alternative.

Chapter 3. Affected Environment

Chapter 3 of the CCP provides a detailed description of the affected environment for Stone Lakes.

Chapter 4. Environmental Consequences

Overview of the NEPA Analysis Parameters

This chapter describes the direct, indirect and cumulative impacts of the three alternatives. The purpose of this analysis is to provide the context and intensity of the impacts of each action, such that a determination of significance can be made by the deciding official.

In 1978, the Council on Environmental Quality promulgated regulations for implementing the NEPA. These regulations include a definition of significantly as used in the NEPA (40 CFR 1508.27). The elements of this definition are critical to reducing paperwork through use of a Finding of No Significant Impact (FONSI) when an action will not have a significant effect on the human environment and is therefore exempt from requirements to prepare an environmental impact statement (EIS). Human environment is a comprehensive phrase that includes the physical and natural environments and the relationship of people with those environments. Many of the analyses focus on the different resource areas such as soils, air quality, water quality, plant communities, wildlife, visitor services and others. It is important to note that for each of these criteria all of these resources, or human environments, have been considered.

The significance of an action must be analyzed in several contexts, such as the whole of society; affected region; affected interests and locality. Significance varies with the setting. In the case of a site-specific action, significance would usually depend on the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

The regional context of the action alternatives is the Beach–Stone Lakes Basin. Even in a local context, the action alternatives would not pose significant short- or long-term effects. The action alternatives are designed to minimize and avoid adverse impacts to the extent that such impacts are less than significant, even a the local level.

Alternative A, the No Action Alternative, is a continuation of current management practices; it serves as the baseline against which Alternatives B and C are compared. Discussion of the action alternatives, Alternatives B and C, follow each discussion of No Action.

Soils

Common to all Alternatives. Under all alternatives the Refuge would continue to use, Service-approved aquatic herbicides, such as Aquamaster and Remedy and terrestrial herbicides such as Roundup and 2, 4-D, for weed control. Glyphosate, the active ingredient in Aquamaster and Roundup, is considered nonmobile in soils and sediments because it rapidly and strongly adheres to soil particles and degrades in the soil. Glyphosate is moderately persistent in the soil, with an estimated half-life of 47 days. Glyphosate has no known effect on soil microorganisms. The World Health Organization (1984) concluded that 2, 4-D does not accumulate or persist in the environment. The primary degradation mechanism is microbial metabolism, but mineralization and possibly photolysis may also play a role. The average half-life of 2, 4-D is ten days (Tu, M. et al 2001).

Alternative A. Under Alternative A, the Service would complete construction of wetlands and grasslands on the Headquarters Unit and would redesign the Headquarters entrance; as described in a previous draft Environmental Assessment (EA), issued March 4, 2005. Construction activities could result in large areas of bare soil that could be subject to erosion. Erosion is expected to be minor and localized because construction will occur only during the dry season, the terrain is flat and the Refuge will employ dust control measures.

Alternative B. In addition to the potential soil impacts related to construction on the Headquarters Unit, Alternative B could also result in similar impacts due to restoration activities, including restoration or enhancement of 105 acres of riparian and oak woodland habitat, 30 acres of grasslands and 50 acres of wetlands. Developing visitor facilities on the South Stone Lake, Headquarters, North Stone Lake, Beach Lake and Wetland Preserve Units could result in impacts, as well. These impacts are expected to be minor and localized for the same reasons described above. Additional short-term disturbance would result from mechanical removal of nonnative weeds from the seasonal marsh, riparian and upland habitats.

Alternative C. In addition to the soil impacts described under Alternative B, Alternative C also includes other Refuge improvements that could result in the same type of impacts. These improvements include natural process-based restoration of 65 acres of riparian habitat in addition to the same construction, weed removal and wetland and grassland restoration as in Alternative B.

Water Quantity and Quality

Common to all Alternatives. Under all alternatives, the conversion of 200 acres of former agricultural lands on the Headquarters Unit to wetlands would add to the region's floodwater storage capacity and help maintain water quality by trapping sediments and removing some excess nutrients.

Alternative A. No impacts on water quality or quantity are anticipated under Alternative A. Under all alternatives, glyphosate will be used in the form of Roundup and Aquamaster to control aquatic and terrestrial weeds. In most cases, glyphosate will dissipate rapidly from natural water bodies through adsorption to organic substances and inorganic clays, degradation and dilution (Folmar et al. 1979, Feng et al. 1990).

Alternatives B and C. Under Alternatives B and C, periodic flooding of irrigated pastures would begin earlier each fall, adding to groundwater recharge. The restoration and natural expansion of riparian vegetation would help to stabilize shorelines; this would reduce erosion and the resulting sediment loads in Refuge waters, improving water quality. The prohibition of gas-powered boats within the Refuge under Alternatives B and C would contribute to better water quality by removing a source of turbidity, potential petroleum leaks and inadvertently transported aquatic nuisance species. As new lands come under Refuge management and are either converted from agricultural uses or removed from urban development pressures, further benefits to water quality would accrue through reductions in: erosion, sedimentation and nonpoint source pollution.

Air Quality

Alternative A. Under all alternatives, soil disturbance and/or use of heavy equipment would cause short-term increases in dust (particulate matter less than 10 microns [PM10]) and tailpipe emissions of PM10, nitrogen oxide (NO_X) and reactive organic gasses (ROG), including those activities associated with the restoration of wetland habitat on the Headquarters Unit. However, implementation of Alternative A (No Action Alternative) would not substantially increase pollutant emissions related to Refuge management in the long term. Since no increase in the level of visitor services is proposed, visitor use levels and vehicle trips to and from the Refuge are expected to increase only moderately as the population of the surrounding region grows.

Alternatives B and C. In addition to the short-term impacts to air quality from wetland restoration on the Headquarters Unit, under Alternatives B and C, there would be both short and long-term increases in pollutant emissions. Short-term increases in PM10 and

tailpipe PM10, NO_X and ROG would result from restoring riparian habitat on the North Stone Lake, Headquarters, and South Stone Lake units and constructing trails, parking areas and observation platforms. Tailpipe emissions (ROG, NOX, and PM10) would result from the use of combustion engines in construction equipment and employee vehicles during trips to and from the job sites. Dust emissions and generation (PM10) would result from the excavation, transport and grading of large amounts of soil.

Long-term increases in emissions would result from the growing number of vehicular trips to, from and on the Refuge as visitation increases. This increase is expected to be similar under both action alternatives, at about 10,500 to 15,000 more visitors per year by 2012. However, there would be a slight decrease in emissions from gasoline powered boats since only non-motorized and electric motor boats would be allowed.

Plant Communities

Common to all Alternatives. Discing, mowing, chemical treatments, and occasionally grazing would be periodically used to maintain cover of emergent vegetation in seasonal wetland impoundments at 45-55 percent of total wetland surface area. The Service would continue to physical and chemical means to control undesirable plants such as cocklebur and joint grass. These same techniques would be used to manage vegetation in about 25 percent of the moist soil impoundments each year to reduce the cover of emergent vegetation and encourage the growth of annuals that provide food for waterfowl, maintaining an equal ratio of open water to emergent vegetation. The Service would continue to mow and graze grassland habitat to reduce the cover of non-native annual grasses and promote native species.

All applications of aquatic herbicides (e.g., glyphosphate, diquate dibromide) will be from properly calibrated and maintained ground or boat-mounted spray apparatus. In keeping with product labels, no applications will occur when wind speeds exceed 10 miles per hour. All applications will occur in compliance with best management practices identified in the Aquatic Pesticide Application Plan for the Statewide National Pollution Discharge Elimination System (NPDES) General Permit (No. CAG990005) for discharge of aquatic pesticides administered by the Central Valley Regional Water Quality Control Board.

Alternative A. Under Alternative A (no action), current vegetation management would continue unchanged. Wetlands would be flooded from early September through May for the benefit of migratory waterbirds and would continue to be mowed, grazed, disced and sprayed with pesticides. In addition, under all alternatives, the Service would maintain 360 acres of riparian and oak woodland habitat, 529 acres of moist soil seasonal wetlands, 136 acres of vernal pool seasonal wetlands, 715 acres of permanent wetlands, 460 acres of irrigated pasture/wet meadow and restore 25 acres of riparian habitat on the Headquarters Unit.

Alternative B. Alternative B would include the same vegetation management measures as described under Alternative A. In addition, the Service would increase the cover of native seasonal marsh plants on the Refuge by controlling nonnative weeds. In addition, the Service would restore 65 acres of riparian and oak woodland habitat, along the North Stone Lake, Headquarters and South Stone Lake units, as well as enhancing 40 acres of understory shrub and herbaceous vegetation in existing riparian areas. Planting riparian vegetation and restoring seasonal wetland and grassland habitat would have a beneficial effect on local and regional biodiversity because the vast majority of the historic riparian vegetation in the Central Valley has been lost or degraded. Under both Alternatives B and C, 30 acres would be planted to restore native grasslands throughout the Refuge. This would have a beneficial effect on the Refuge's vegetation because it would restore a larger diversity of the Refuge's native plant cover.

Enhancement and restoration of native grasslands, wetlands, and riparian habitats on the Refuge would not exacerbate threats of weed infestations to adjacent properties because Refuge staff and cooperators would continue to promote desirable vegetation and control invasive weeds as part of ongoing management programs. Some weed species of concern that will require ongoing control include: perennial pepperweed or whitetop, yellow star thistle, Johnson grass, and fennel or anise. Control of invasive weeds would be part of an integrated pest management program that would include physical (e.g., mowing, discing, grazing, and burning) and chemical (herbicide) treatments.

Alternative C. Impacts under Alternative C would be similar to those described under Alternative B, with a few differences. Riparian habitat expansion would be allowed to proceed through natural succession and volunteering by riparian woody species. There would be no active planting of riparian vegetation. However, riparian vegetation would be allowed to expand into wetland habitat on the Beach Lake and South Stone Lake units. Under Alternative C, the Service would restore 65 acres of riparian vegetation as under Alternative B. This would have a beneficial effect on the Refuge's vegetation because it would restore a larger diversity of the Refuge's native plant cover.

Wildlife

Common to all Alternatives. Under all alternatives, the Service would continue to allow the Sacramento Yolo Mosquito Vector Control District (SYMVCD) to monitor and control mosquitos on the Refuge. The typical monitoring and control period is March through October. The mosquito species identified by SYMVCD for monitoring and control at the Refuge are *Culex tarsalis, Anopheles freeborni, Ochlerotatus vexans, Ochlerotatus melanimon, Ochlerotatus nigromaculis,* and *Aedes increpitus*. The SYMVCD would use the biological larvicides *Bacillus thuringiensis isrealensis* (Bti) and *Bacillus sphaericus* (Bsp) and the insect growth inhibitor methoprene. The bacterium Bti is a microbial insecticide that, when ingested, is toxic to mosquitos, black flies and several other members of the Nematocera suborder within the order Diptera. Methoprene is an insect growth regulator that interferes with the normal maturation process of mosquitos. In the event, adulticide applications become necessay, SYMVCD will utilize synthetic pyrethrins or the organophosphate Naled, applied from an ultra-low volume ground rig.

See Appendix P: Integrated Pest Management Plan for Mosquito-Associated Threats and Appendix A: Compatibility Determination, Use: Monitor and Control Mosquitos, for detailed descriptions of mosquito control on the Refuge and the potential impacts to target and non-target organisms.

Under all alternatives, control of invasive weeds, particularly aquatic weeds such as water hyacinth, currently require the application of herbicides (i.e., Diquat dibromide and Glyphosate). Glyphosate has low acute toxicity, is not a carcinogen, does not adversely affect reproduction and development, and does not bioaccumulate (build up) in mammals (Monsanto 2001). When applied properly, Glyphosate is of relatively low toxicity to birds, mammals and fish (Evans and Batty 1986). However, amphibians may potentilly be negatively affected by Glyphosate that enters aquatic systems (Smith 2001).

All alternatives identify herbicide use to control invasive terrestrial or aquatic weeds. Glyphosate and diquat dibromide herbicides could have short-term negative effects on aquatic wildlife and waterbirds, but removal of invasive weeds favors native plants and ultimately improves the quality of wildlife habitat. Refuge staff will continue to comply with National Pollution Discharge Elimination System general permit protocols and best management practices for aquatic herbicide applications and water quality monitoring that were developed by the Central Valley Regional Water Quality Control Board to

avoid adverse effects on water quality and and aquatic wildlife. Glyphosate, found in both Roundup® and Rodeo®, does not bioaccumulate in fish. The Rodeo® formulation is practically non-toxic to freshwater fish and aquatic invertebrates, while the Roundup® formulation is moderately to slightly toxic to freshwater fish and aquatic invertebrate animals. However, in laboratory studies, Roundup® has been shown to cause high rates of mortality to juvenile North American tadpoles (Relyea 2005). Clopyralid is of low toxicity to fish, aquatic invertebrate animals, birds, and mammals, is not toxic to bees and has very low acute mammalian toxicity. It does not bioaccumulate in fish. Triclopyr is low in toxicity to fish, does not bioaccumulate in fish, and is slightly toxic or nontoxic to invertebrates; however, it has not been tested for chronic effects in aquatic animals. Triclopyr is slightly toxic to mammals, however, in mammals, most triclopyr is excreted unchanged in urine. Triclopyr and its formulations have very low toxicity to birds and is nontoxic to bees. Sethoxydim is practically nontoxic to birds, has low toxicity to wildlife, and is nontoxic to bees. It is moderately to slightly toxic to aquatic species. Only herbicides that are approved for use near water, such as Rodeo®, Reward ®, or Garlon 3a®, would be used on Refuge lands that are within 100 feet of surface waters. In addition, to prevent further water contamination and effects to aquatic species, the Refuge would not spray when wind velocities exceed five miles per hour, when vegetation is wet, or when precipitation is occurring or forecasted in the following 24 to 36 hours. Herbicide applications are not expected to significantly affect wildlife.

Some negative effects to reproductive success of late-nesting ground nesting birds, such as mallards (*Anas platyrhynchos*), and meadowlarks may occur during prescribed fires and mowing operations

Alternative A. Under Alternative A, current management of the Refuge would continue unchanged. The Refuge would continue to manage water for migratory waterfowl, shorebirds, water birds and other migratory birds. Grasslands and agricultural lands would continue to be managed to provide foraging and loafing habitat. Under this alternative, no new riparian or wetland habitat would be restored or created beyond the restoration of 25 acres of riparian habitat on the headquarters unit, but existing habitat would be maintained and fostered. Maintaining and fostering habitat would benefit the variety of wildlife that uses the Refuge, including birds of prey, songbirds, waterfowl and colonial nesting birds, such as egrets and herons as well as many species of mammals and reptiles..

Because visitor use is currently limited to bimonthly tour days and hunting for 16 hunters two days per week during waterfowl season, human disturbance to wildlife would be minimal under Alternative A. By contrast, Alternatives B and C both would increase visitor use and implement a recreational fishing program. Potential impacts of visitor use include: flushing of birds, disruption of feeding and roosting activity, reducing use of preferred habitat, and increasing bioenergetic demands (DeLong 2002).

Alternative B. Alternative B would result in mostly beneficial and some adverse impacts on wildlife. Recreational use of the Refuge is expected to increase dramatically under Alternative B. Most of these new users are expected to participate in wildlife observation. This growth in recreational use could adversely affect birds using the Refuge wetlands, resulting in flushing, disruption of feeding and roosting, increased demands on the birds' available energy and reduced use of preferred habitat (DeLong 2002).

Under Alternative B, visitor use facilities such as parking areas, kiosks, trails and new buildings would be developed. This could result in the temporary disturbance and/or displacement of wildlife due to construction activities. The riparian portion of the unit would not be directly affected by construction but wildlife would, nonetheless, experience

disruption because of the nearby construction activity. Once construction is completed, substantial numbers of waterfowl, shorebirds and other waterbirds would be expected to utilize the restored and enhanced wetlands of the Headquarters Unit.

Sixty-five acres of riparian vegetation would be restored throughout the Refuge, an additional 40 acres of riparian understory vegetation would be enhanced, 50 acres of wetlands near South Stone Lake would be enhanced and planting native grasses over 30 acres in various portions of the Refuge would begin. Once established, this new habitat would provide a long-term benefit to a variety of wildlife, including migratory songbirds and birds of prey. In addition, existing grassland habitat would be maintained through grazing, mowing and/or burning for the benefit of grassland dependent species. Riparian habitat would be further protected by further exclusion of cattle from riparian areas. Shorebirds would benefit from exploring reverse-cycle wetlands and by drawing down one permanent wetland until August to provide food. The Refuge would also enhance and create habitat for burrowing owls by reintroducing ground squirrels to the North Stone Lake and Wetland Preserve units and constructing artificial burrows, as needed.

Under Alternative B, the Refuge would be opened to fishing from non-motorized, hand-launched boats (e.g., canoes, kayaks) or non-trailered boats with electric motors only. A boat launching area would be provided on the Sun River property of the South Stone Lake Unit Non-motorized boating by pre-registered groups, including commercial outfitters who engage in fishing, and wildlife observation, would also be allowed on SP Cut on the Beach Lake and North Stone Lake units at the west end of Elliott Ranch Road.

No native game fishes remain in Refuge waters but introduced game fish species are abundant, so the direct impact of recreational fishing on fish populations is not expected to be detrimental. Fishing may even benefit native fish species by reducing habitat competition from introduced species. Indirect effects of fishing and boating, such as disturbance to waterfowl, reptiles and amphibians, would be controlled by restricting shoreline fishing, by allowing access only during the summer before winter migrants have arrived and by providing sanctuary to species that are present during the summer.

Alternative C. Alternative C would result in primarily beneficial impacts on wildlife and few adverse impacts. The effects on wildlife under this alternative would be similar to those described under Alternative B, with the following exceptions.

Implementation of Alternative C would have similar effects on the Headquarters Unit as would Alternative B. Under this alternative, riparian vegetation would be allowed to expand naturally into managed wetland units. Though some riparian restoration along North Stone Lake would occur, no new riparian restoration would take place in the Sun River, Headquarters or Lewis units. The more limited and gradual increase in riparian habitat would still benefit wildlife over a longer period than under Alternative B. The reduction in wetland restoration and construction under Alternative C would result in reduced disturbance for wildlife. The effects on wildlife from the hunting and fishing programs are similar to Alternative B.

Special Status Species

Suitable habitat exists on the Refuge for federally-listed the giant garter snake, valley elderberry longhorn beetle VELB), vernal pool tadpole shrimp and fairy shrimp . Vernal pool tadpole and fairy shrimp are the only federally-listed species whose presence has been verified on the Refuge within the last 13 years. California Endangered Species Act-listed species that inhabit the Refuge include greater sandhill crane and Swainson's hawk.

Alternative A. Under Alternative A, continuation of current management activities will have beneficial effects on special status species. The Service will continue to manage the Refuge to support sandhill cranes by providing irrigated pasture, seasonally flooded wetlands, grain crops and grasslands. Breeding and foraging habitat would also be provided for Swainson's hawks in the Refuge's riparian forests and grasslands. Though there are no documented occurrences of VELB on the Refuge, all existing elderberry shrubs are mapped and protected from herbicides intended to control invasive weeds.

Alternative B. No significant adverse effects on special status species are anticipated. Beneficial effects to special status species would result from expansion and enhancement of riparian, wetland and grassland habitats. However, increases in human disturbance due to the increased number of visitors may also occur. Human disturbance would most likely affect sandhill cranes and Swainson's hawks.

Swainson's hawks would benefit from increased riparian habitat under Alternative B, including the expansion of riparian vegetation along the North Stone Lake, Headquarters, South Stone Lake, and Beach Lake units and the Sacramento Drainage Canal. Access for recreational fishing allowed between June and September could affect nesting Swainson's hawks, because their nesting season typically lasts from mid-February through July. As a result, the Service will prohibit visitor access within a 0.25-mile radius of any occupied hawk nest until the young have fledged.

Under Alternative B, the Refuge would enhance habitat management for sandhill cranes by flooding earlier in the fall (mid-September) than under Alternative A, by periodically flooding irrigated pastures and by developing a grazing program near North Stone Lake to provide foraging and loafing habitat adjacent to roosting sites. The Refuge also plans to construct a new observation platform for viewing sandhill cranes north of Hood Franklin Road on the North Stone Lake Unit. Alternative B's net effect is expected to be beneficial for sandhill cranes because while visitor disturbance will increase, habitat will also increase and greater foraging opportunities will be available.

No impact to vernal pool species is anticipated under Alternative B. The majority of the vernal pools at the Refuge occur in the Wetland Preserve Unit. This area will be opened for guided tours and via a self-guided trail that will be routed to avoid impacts to wetlands. Therefore, visitor use is not expected to affect the vernal pool tadpole shrimp or fairy shrimp.

The VELB would benefit under Alternative B by planting early successional upland vegetation, including elderberry bushes, on the South Stone Lake Unit. Riparian and grassland restoration will also benefit the Swainson's hawk.

Alternative C. The effects of Alternative C on special status species are largely the same as in Alternative B except that less riparian habitat would be restored. The Refuge would continue its sandhill crane habitat management as in Alternative B. The natural expansion of riparian vegetation allowed under Alternative C would ultimately benefit Swainson's hawks.

Diseases and Toxins

Common to all Alternatives. Under each alternative, the Service would continue current botulism control practices, including keeping all units dry between June 1 and August 1; patrolling historically problematic wetlands on the Refuges and in the surrounding areas in cooperation with the California Department of Fish and Game; and removing sick birds and carcasses from wetlands. As a result of these coordinated activities, the potential for an outbreak of botulism would be minimized.

Increased wetland habitat under Alternative B, increases the potential for breeding mosquitos and hence, could lead to an incremental increase in the potential spread of mosquito-borne diseases. In accordance with their 1993 Memorandum of Understanding, Refuge staff will continue efforts to minimize mosquitos in cooperation with SYMVCD through wetland design, efficient water management, vegetation manipulations through mowing, discing, and burning, biological control such as planting of mosquitofish, and applying larvicides and adulticides, as needed. See Appendix P, Integrated Pest Management Plan for Mosquito-Associated Threats for a detailed description of mosquito control on the Refuge.

Under all alternatives, the Service would continue to prohibit lead shot for waterfowl hunting as it has been Refuge system policy for over 15 years.

Cultural Resources

Common to all Alternatives. Under all alternatives, including the No Action alternative, Refuge management activities have the potential to disturb cultural resources. To preserve Refuge archaeological and historic resources, all undertakings, including but not limited to ground disturbance and prescribed burns, will be coordinated with the Service's Regional Archaeologist. Under each alternative: a cultural resources overview would be prepared; baseline data on all cultural resource sites collected; an attempt made to locate and delineate all unrecorded cultural resource sites; appropriate buffers zones established to ensure their protection; and updated or new site records forwarded to the California North Central Information Center. Also, an attempt would be made to locate any human remains, covered under the Native American Grave Protection and Repatriation Act (NAGPRA) (25 USC 3001 et seq. or 43 CFR 10), removed in the past from within the Refuge boundary

When it is determined after consultation with the Service's Regional Archaeologist and local professional archaeologists, that a consultation with the State Historic Preservation Office (SHPO) under Section 10 of the National Historic Preservation Act is warranted for a planned undertaking, the Refuge will ensure that appropriate procedures to protect cultural resources and provide necessary mitigation are identified and implemented, in accordance with the Service Programmatic Agreement for cultural resources with the SHPO. All monitoring of ground-disturbance will be performed by a professional archaeologist who may request assistance from tribal representatives. The Refuge will provide copies of SHPO correspondence and monitoring reports to the Regional Archaeologist and any concerned tribal organizations.

A cultural resources survey may not be required if burning is proposed entirely within a flood zone, in a previously disced or plowed area, or if burning has been an ongoing practice on the site. However, cultural resources surveys will likely be necessary for all burns on upland sites, and for burns that require excavation (scraping, plowing, or discing) to establish a fire line. In some cases, it may be appropriate to conduct cultural resources survey work after a prescribed burn is completed, because the visibility of artifacts or other resources may be increased after burning and artifacts may be more vulnerable to vandalism or theft when exposed by burning.

As required by the NAGPRA, any construction or ground-disturbing activity with the potential to disturb human remains, burial objects, sacred objects, or objects of cultural patrimony will be planned and implemented in consultation with affected Tribes. If potentially significant artifacts are found during any activity, work will cease within 100 feet of the find and access will be restricted until a qualified archaeologist and members of local Tribes can assess the significance of the find and propose appropriate methods of treatment, as required by NAGPRA. If human remains are found during any activity, work will cease

within 100 feet of the find, access will be restricted and the Sacramento County Coroner will be informed of the discovery, as required under Public Resources Code Section 5050.5. If no investigation of the cause of death is required, remains will be treated in accordance with the requirements of NAGPRA.

With assistance from the Service's Regional Archaeologist and local professional archaeologists, the Refuge has identified the Ione Band of Miwok Indians as the nearest tribal organization with whom the Refuge should consult on management and restoration projects. As a result, the Refuge intends to meet with the tribal liaison at least annually to discuss any planned project that may result in ground disturbance of prehistoric or historic sites.

Visitor Services

According to California State Department of Finance projections, the population of the Delta Region (Sacramento, Solano, Yolo, San Joaquin and Contra Costa Counties) is expected to grow by about 19 percent between 2005 and 2020. The State as a whole is expected to grow by 24 percent over the same period. In the western states, participation in hunting is predicted to decline by 21 percent in the period between 1995 and 2020. For example, statewide hunter use days declined in four out of five years, through 2004 (USFWS 2004). The trend for non-consumptive recreation shows an opposite trend. Participation in non-consumptive recreation is expected to increase by 37 percent over the same period (Cordell et al. 1999).

Common to All Alternatives. Under each alternative, hunting on the South Stone Lake Unit is expected to continue at 16 hunters per day, for two days per week throughout the hunt season, with two youth only hunts held both before and after the regular hunt season. Non-consumptive recreation will increase at a rate proportional to the predicted population growth for the five county Delta/Sacramento metropolitan region. Currently, Stone Lakes receives about 3,500 visits per year consisting of 3,000 wildlife observation visitors and 25 environmental education groups of 20 each.

Alternative A. Under the No Action alternative, the Refuge is expected to receive 4,200 visits annually by 2020. This projected increase in visitor use under the no action alternative serves as a baseline against which to compare the action alternatives. Figure 5 shows the current visitor use levels and predicted use levels under each alternative. Under the No Action alternative, the Service would maintain current Refuge visitor services and facilities. However, overall Refuge use is expected to increase as the population of the Sacramento metropolitan area and the rest of the State continues to grow over the next 15 years.

Alternative B. Visitor services would be improved and expanded under Alternative B. Volunteer opportunities would be expanded, including at least one comprehensive volunteer training per year. Opportunities for wildlife observations would expand to a capacity of 10,500 visits per year. Four miles of foot trails would be open to visitors seven days a week, with seasonal restrictions. Two miles of universally accessible trails would be constructed on the Headquarters Unit and named the Blue Heron Trails System. Two new photography blinds would be constructed, on the North Stone Lake and Headquarters Units. Two hundred feet of boardwalk, on the Headquarters Unit, would be constructed as part of the Blue Heron Trails System. One and one-half miles on foot trails would be constructed on the South Stone Lake Unit and would be open to visitors seven days a week, with seasonal restrictions. Two hundred feet of boardwalk would be constructed on the South Stone Lake Unit and would be open to visitors seven days a week, with seasonal restrictions. Parking facilities and a car top boat launch, for a maximum of ten cars, would be provided on the Lewis Unit. The number of supported environmental education groups would expand to 80

per year. Two new interpretative programs would be developed within five years, including displays illustrating traditional dwelling and subsistence strategies on the Headquarter Unit.

Within five years the Refuge would provide safe, boat only fishing with day use parking facilities that could accommodate up to 20 boats per day. Refuge staff would expand community outreach and would expand the number of presentations given to schools, conservation groups and public service organizations.

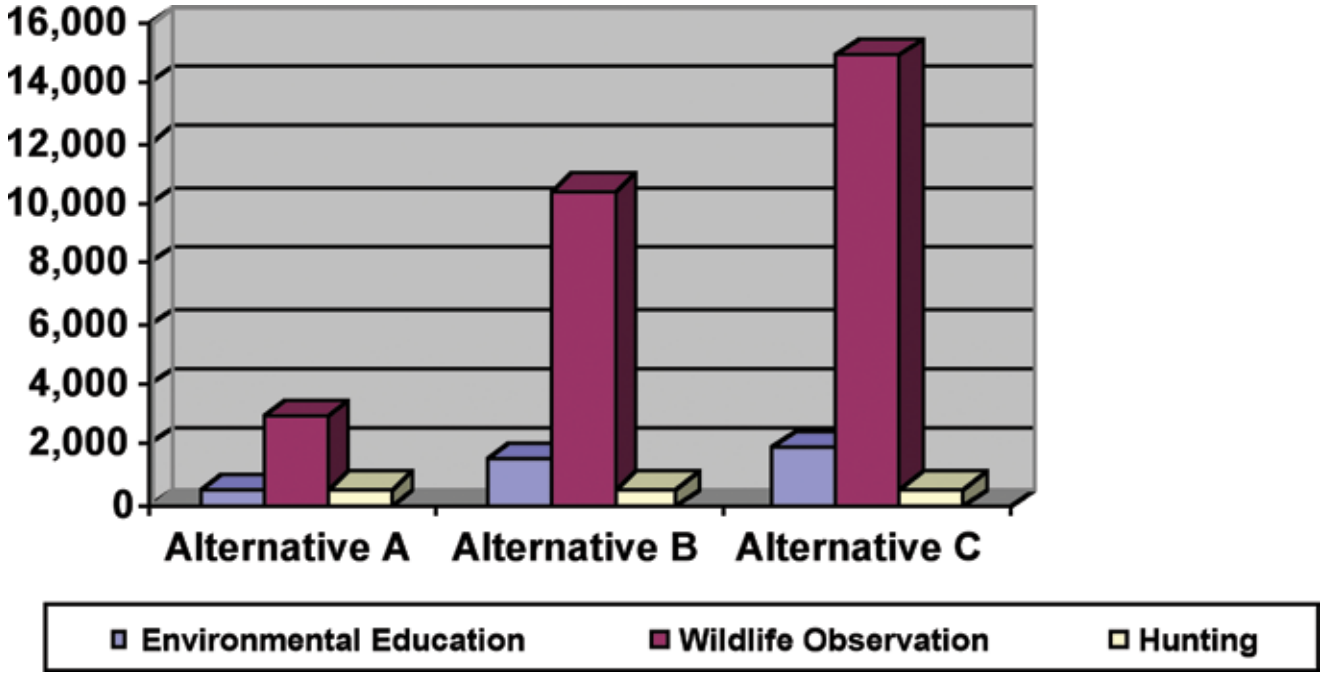


Figure 5. Current and Projected Visitation (15 years).

Alternative C. Under this alternative, visitor service facilities would be similarly expanded as in Alternative B. Opportunities for wildlife observations would expand to a capacity of 15,000 visitors per year. Six miles of foot trails would be open to visitors seven days a week, with seasonal restrictions. Less boardwalk would be constructed at the Headquarters Unit (140 feet). An additional two miles of trails would be developed on the Lewis and North Stone Lakes Units and would be open to visitors seven days a week, with seasonal closures. Four new interpretative programs would be developed within the next five years.

Socioeconomics

Alternative A. Under the No Action alternative, current management practices would continue to be followed and no change in Refuge staffing would be required. The No Action alternative would thus have no impact on local employment conditions or the local economy.

Alternatives B and C. Under Alternatives B and C, fish and wildlife management and visitor services programs would be substantially expanded. This may lead to increases in Refuge budget and staffing. Additional funding and staff proposals related to implementation of the CCP will be entered into the Service's agency budget systems, including Refuge Operating Needs System and Maintenance Management System. Additional Refuge staff required under these alternatives may be hired from local communities and would likely live in and contribute to the local communities.

Refuge visitation under Alternatives B and C is expected to substantially increase over the life of the CCP. This increase could benefit the local economy and employment conditions if Refuge visitors supported local businesses, such as gas stations, restaurants, hotels, and sporting good stores. No projects proposed under any of the Alternatives would have a disproportionate negative impact on low-income or minority populations.

The elimination of high-speed boating in Refuge waterways is expected to have limited socioeconomic impact on small businesses in the local community when compared with the growing volume of boating occurring on the adjacent Sacramento River. Use of the Refuge by high-speed boats is limited to one to three boats per weekend, primarily during May-July and is comprised of the approximately 25 members of the Beach Lake Ski Club. Re-location of this activity outside of the Refuge will result in a reduction of revenue to landowners who provide the waterskiers and gas-powered fishermen with a launch site to access the Beach and North Stone lake units.

The expanded wildlife-dependent visitor uses opportunities proposed under Alternatives B and C could potentially result in increased instances of trespass, vandalism, and littering and some minor disruption of farming practices of adjacent to nearby landowners.

Appendix 1: References

Boisvert, M., and J. Boisvert. 2000. Effects of *Bacillus thuringiensis* var. *israelensis* on target and nontarget organisms: a review of laboratory and field experiments. Biocontrol Science and Technology 10: 517-561.

Breaud, T.P., J.E. Farlow, C.D. Steelman, and P.E. Schilling. 1977. Effects of the insect growth regulator methoprene on natural populations of aquatic organisms in Louisiana intermediate marsh habitats. Mosquito News. 37(4): 704-712.

California Department of Fish and Game (DFG). 2000. The status of rare, threatened, and endangered animals and plants of California, Annual Report for 2000. California Department of Fish and Game. Sacramento, CA. 226 pp.

California Department of Fish and Game (DFG). 2006. California Wildlife: Conservation Challenges (California's Wildlife Action Plan). Prepared by Bunn, David, Andrea Mummert, Roxie Anderson, Kirsten Gilardi, Marc Hoshovsky, Sandra Shanks and Kiffanie Stahle. Wildlife Health Center, University of California, Davis.

Charbonneau, C.S., R.D. Drobney, and C.F. Rabeni. 1994. Effects of *Bacillus thuringiensis* var. *israelensis* on nontarget benthic organisms in a lentic habitat and factors affecting the efficacy of the larvicide. Environmental Toxicology and Chemistry 13 Vol. 2:267-279.

Cordell, H.K., C, Betz, J.M. Bowker, and others. 1999. Outdoor recreation in American life: a national assessment of demand and supply trends. Sagamore Publishing, Champaign, IL. 219-321.

Dale, P.E.R. and K. Hulsman. 1990. A critical review of salt marsh management methods for mosquito control. Crit. Rev. in Aquatic Science 3:281–311.

DeLong, A.K. 2002. Managing visitor use and disturbance of water birds–a literature review of impacts and mitigation measures–prepared for Stillwater National Wildlife Refuge. Stillwater National Wildlife Refuge Complex final environmental impact statement for the comprehensive conservation plan and boundary revision (Vol. II), Appendix L. Department of the Interior, U.S. Fish and Wildlife Service, Portland, OR. 114 pp.

Extension Toxicology Network (ETN). 1996. Naled Pesticide information profile. http://ace.ace.orst.edu/info/extoxnet/pips/naled.htm

Euliss, N.H., and S.W. Harris. 1987. Feeding ecology of northern pintails and green-winged teal wintering in California. Journal of Wildlife Managment 51: 724-732.

Evans, D.D., and M.J. Batty. 1986. Effects of high dietary concentrations of glyphosate on a species of bird, marsupial and rodent indigenous to Australia. Environmental toxicology and chemistry 5: 399-401.

Feng, J.C., D.G. Thompson, and P.E. Reynolds. 1990. Fate of glyphosate in a Canadian forest watershed: 1. Aquatic residues and off-target deposit assessment. Journal of Agricultural Food Chemistry 38: 1110-1118.

Folmar, L.C., H.O. Sanders, and A.M. Julin. 1979. Toxicity of the herbicide glyphosate and several of its formulations to fish and aquatic invertebrates. Archives of Environmental Contamination and Toxicology 8: 269-278.

Hansen, G.W., F.E. Oliver, and N.E. Otto. 1984. Herbicide manual. A Water Resources Technical Publication. U.S. Department of the Interior, Bureau of Reclamentation, Denver, CO. 346 pp.

Heady, H. F. 1977. Valley grassland. P ages 491-514 In M. G. Barbour and J. Major, eds. Terrestrial vegetation of California. John Wiley and Sons, New York.

Lacey, L.A., and M.S. Mulla. 1990. Safety of *Bacillus thuringiensis* var. *israelensis* and *Bacillus sphaericus* to non-target organisms in the aquatic environment. In Laird, M., L.A. Lacey, E.W. Davidson, editors. Safety of microbial insecticides. CRC Press.

Merritt, R.W., E.D. Walker, M.A. Wilzbach, K.W. Cummins, and W.T. Morgan. 1989. A broad evaluation of Bti for black fly (Diptera: Simuliidae) control in a Michigan River: efficacy, carry and nontarget effects on invertebrates and fish. Journal of the American Mosquito Control Association 5: 397-415.

Miura, T., and R.M. Takahashi. 1974. Insect developmental inhibitors. Effects of candidate mosquito control agents on nontarget aquatic organisms. Environmental Entomology 3: 631-636.

Miura, T., and R.M. Takahashi. 1973. Insect developmental inhibitors. Effects on nontarget organisms. Journal of Economic Entomology 66: 917-922.

Monsanto. 2001. Aquamaster Technical Fact Sheet.

Niemi, G.J., A.E. Hershey, L. Shannon, J.M. Hanowski, A. Lima, R.P. Axler, and R.R. Regal. 1999. Ecological Effects of Mosquito Control on Zooplankton, Insects, and Birds. Environmental Toxicology and Chemistry 18(3): 549-559.

Norland, R.L., and M.S. Mulla. 1975. Impact of Altosid on selected members of an aquatic ecosystem. Environmental Entomology 4: 145-152.

Stebbins, G. Ledyard. 1965. Colonizing species of the native California flora. In The Genetics of Colonizing Species. Academic Press, NY, pp. 173-191.

U.S. Fish and Wildlife Service (USFWS). 1992. Environmental impact statement with appendices for Stone Lakes National Wildlife Refuge Project, Sacramento County, California; Final. With technical assistance provided by Jones & Stokes Associates, Inc. (JSA 91-047). Sacramento, CA.

U.S. Fish and Wildlife Service (USFWS). 2004. Kern and Pixley National Wildlife Refuges Comprehensive Conservation Plan. Sacramento, CA.

U.S. Fish and Wildlife Service (USFWS). 2005. Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. Portland, OR. http://www.fws.gov/sacramento/es/recovery_plans/vp_recovery_plan_links.htm

Relyea, Rick A. 2005. The Lethal Impact of Roundup on Aquatic and Terrestrial Amphibians. Ecological Applications: 15 (4): 1118–1124.

Riparian Habitat Joint Venture (RHJV). 2004. Version 2.0. The Riparian Bird Conservation Plan: a Strategy for Reversing the Decline of Riparian Associated Birds in California. California Partners in Flight. http://www.prbo.org/calpif/pdfs/riparian.v-2.pdf.

Smith, G.R. 2001. Effects of Acute Exposure to a Commercial Formulation of Glyphosate on the Tadpoles of Two Species of Anurans. Bulletin of Environmental Contaminant Toxicology: 67(4): 483-488.

State of California, Department of Finance. 2001. Interim County population projections. Sacramento, California, June 2001.

Thomas, C.M., and T.C. Maurer. 2003. Toxicity of Stormwater Runoff at Stone Lakes National Wildlife Refuge, 1999-2000, Final Report, Investigation No.: 199910003, U.S. Department of the Interior, Fish and Wildlife Service, Portland, Oregon.

Tomlin, C. 1994. The Pesticide Manual. Farnham: British Crop Protection Council/ Cambridge: Royal Society of Chemistry.

Tu, M., C. Hurd, and J.M. Randall. 2001. Weed Control Methods Handbook, The Nature Conservancy, http://tncweeds.ucdavis.edu version: April 2001.

World Health Organization. 1984. 2,4-Dichlorophenoxyacetic acid (2,4-D), Environmental Health Criteria 29. United Nations Environment Programme, Geneva. 151 pp.

Personal Communications

Ivey, G. 2002. Wildlife and Habitat Review.

Marty, J. 2004. The Nature Conservancy (TNC). September, 2004.

Van Loben Sels, R. 2005. Subject. RD 744.

G. Geupel, Point Reyes Bird Observatory (PRBO). 2004.

Appendix C. Fire Management Plan

Wildland Fire Management Plan
Stone Lakes National Wildlife Refuge
September 2001

Prepared: _____ _____

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_____ _____

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Concurred: _____ _____

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Steve Thompson — Date
or Acting Manager
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Introduction

The Stone Lakes National Wildlife Refuge (NWR) was established to preserve and enhance native Central Valley plant communities and their associated fish, wildlife and plant species. It currently consists of 4,000 acres within an approved project boundary of 18,129 acres (Figure 1). Approximately 5,000 acres within the boundary are owned by a number of state and county agencies. Through a cooperative agreement, the U.S. Fish and Wildlife Service (Service) manages over 2,700 acres of these lands as part of the National Wildlife Refuge System. The Refuge land base protects important habitats that have largely been eliminated in the Central Valley of California. The Refuge supports essential habitats for numerous federal and state listed-threatened and endangered species, such as giant garter snake, Swainson's hawk, and California hibiscus. One of the goals of the Refuge is to reduce non-native grasses and forbs and restore native habitats. A fire management program will assist the Refuge in reaching that goal. Cultivation, livestock overgrazing, disturbances, and years of neglect have converted Refuge grasslands to a condition where primarily annual non native grasses and forbs predominate. There is also a significant fire hazard due to heavy accumulations of flashy fuels immediately adjacent to an urban setting.

When approved, this document will become the Stone Lakes National Wildlife Refuge (NWR) Fire Management Plan. Major components include:

- Refuge policy documents referenced (grazing management plan, CCP when completed.).
- Format changes under the direction of Fire Management Handbook.
- Continue a program of prescribed burning and full suppression of all wildland fires.

This plan is written to provide guidelines for appropriate suppression and prescribed fire programs at Stone Lakes NWR. Prescribed fires may be used to reduce hazard fuels, restore the natural processes and vitality of ecosystems, improve wildlife habitat, remove or reduce non-native species, and/or conduct research.

This Fire Management Plan (FMP) will help achieve resource management objectives by enabling the Refuge to utilize prescribed fire, as one of several tools, to control non-native vegetation and reduce fire hazards in grassland and riparian habitats. It will be used in conjunction with other management tools that are currently applied on Refuge properties (i.e., grazing, mowing, and herbicide applications) to meet resource objectives.

This plan will meet the requirements of the National Environmental Policy Act (NEPA) and the National Historic Preservation Act (NHPA). An Environmental Action Statement for a Categorical Exclusion was completed and signed by the Project Leader (Appendix C). This FMP meets the guidelines established by the Intra-service Section 7 Handbook for Endangered Species Consultation; the Project Leader determined that wildland and prescribed fire activities will have "no effect" on Threatened and Endangered species on the Refuge.

There are significant archaeological resources on the Refuge, including burial sites. Theses resources will be protected during all fire activities except in the case of threats to life.

There is currently no dedicated fire staff located at Stone Lakes NWR. An agreement (Appendix D) is in place with Elk Grove Community Service District (CSD) to provide suppression services to the Refuge. Fire staff located at Sacramento National Wildlife Refuge Complex (NWRC) will respond when requested to any wildland fire and will be responsible for implementing the prescribed fire program. Collateral firefighters located at the Refuge will assist, as needed and qualified, on all fires.


Oregon
Pacific Flyway
Area Enlarged
MODOC NWR
Redding
SACRAMENTO RIVER NWR
SACRAMENTO NWR
DELEVAN NWR
COLUSA NWR
SUTTER NWR
SAN PABLO BAY NWR
MARIN ISLANDS NWR
Sacramento
Stone Lakes National Wildlife Refuge
Morrison Creek
Sacramento/ San Joaquin Delta
Cosumnes River
Local Watersheds
San Francisco
SAN JOAQUIN RIVER NWR
Modesto
DON EDWARDS SAN FRANCISCO BAY NWR
ANTIOCH DUNES NWR
SAN LUIS NWR
MERCED NWR
Fresno
BLUE RIDGE NWR
KERN NWR
PIXLEY NWR
Bakersfield
BITTER CREEK NWR
Los Angeles
Nevada
California
Pacific Ocean
101
5
99
80
580
Figure 1. Watershed and Ecosystem Setting
Stone Lakes
National Wildlife Refuge
Sacramento River Watershed
Central Valley-San Francisco Bay Ecoregion
0 Miles 100
0 Kilometers 100

Compliance With USFWS Policy

Stone Lakes NWR was established in 1994 to preserve, restore, and manage disappearing Central Valley habitats. Specific habitats to be managed under this program include permanent and seasonal wetlands, grasslands, and riparian corridors for the benefit of waterfowl and other wildlife. The primary objective of the fire management program is to protect and enhance the necessary habitats native species while controlling non-native vegetation.

No Refuge master plan or Comprehensive Conservation Plan (CCP) has been prepared for Stone Lakes NWR. However, the Refuge will begin the planning process for preparation of a CCP during the second half of FY 2001. Through cooperative agreement with Sacramento County the Refuge manages the 2,700-acre North Stone Lake property according to the Draft North Stone Lake Restoration and Management Master Plan until a CCP for the entire Refuge is completed. The Cooperative Agreement for Grassland Management on North Stone Lake Wildlife Refuge authorizes the Service to manage Sacramento County's North Stone Lake property as part of the National Wildlife Refuge System, as directed in Title 50, United States Code, as well as other laws, regulations and policies for the administration of the National Wildlife Refuge System (Appendix D). The Service has full management responsibilities for the North Stone Lake property, including fire management.

Service policy mirrors Departmental policy (620 DM 1.4) relating to wildland fire and prescribed fire, and Departmental policy states:

- Firefighter and public safety is always the first priority. All Fire Management Plans and activities must reflect this commitment.

- Every area with burnable vegetation must have an approved Fire Management Plan. Fire management plans must be consistent with firefighter and public safety, values to be protected, and land, natural, and cultural resource management plans and must address public health issues. Fire management plans must also address all potential wildland fire occurrences and include the full range of wildland fire management actions. Bureau fire management plans must be coordinated, reviewed, and approved by responsible agency administrators, to insure consistency with approved land management plans.

- Fire, as a critical natural process, will be integrated into land, natural, and cultural management plans and activities on a landscape scale, across bureau boundaries, and will be based upon best available science. All use of fire for natural and cultural resource management requires an approved plan which contains a formal prescription.

- Wildland fire will be used to protect, maintain, and enhance natural and cultural resources and, as nearly as possible, be allowed to function in its natural ecological role.

- Bureaus will ensure their capability to provide safe, cost-effective fire management programs in support of land, natural, and cultural resource management plans through appropriate planning, staffing, training, and equipment.

- Management actions taken on wildland fires must be cost effective, consider firefighter and public safety, benefits, and values to be protected, and be consistent with natural and cultural resource objectives.

- Bureaus will work together and with other affected groups and individuals to prevent unauthorized ignition of wildland fires.

- Protection priorities are (1) human life and (2) property and natural/cultural resources. If it becomes necessary to prioritize between property and natural/cultural resources, this is done based on relative values to be protected, commensurate with fire management costs. Once people have been committed to an incident, these human resources become the highest value to be protected.

- Fire management planning, preparedness, wildland fire and prescribed fire operations, monitoring, and research will be conducted on an interagency basis with the involvement of all partners.

- Bureaus will use compatible planning processes, funding mechanisms, training and qualification requirements, operational procedures, values-to-be-protected methodologies, and public education programs for all fire management activities.

- Fire management programs and activities will be based on economic analyses that incorporate commodity, non-commodity, and social values.

- The operational role of the bureaus as a partner in the wildland/urban interface is wildland firefighting, hazard fuels reduction, cooperative prevention and education, and technical assistance. Structural fire protection is the responsibility of Tribal, State, and local governments. Federal agencies may assist with exterior structural protection activities under formal Fire Protection Agreements that specify the mutual responsibilities of the partners, including funding. (Some Federal agencies have full structural protection authority for their facilities on lands they administer and may also enter into formal agreements to assist Tribes, State and local governments with full structural protection.)

- Employees who are trained and certified will participate in the wildland fire program as the situation demands; non-certified employees with operational, administrative, or other skills will support the wildland fire program as needed. Agency Administrators will be responsible, and will be held accountable, to make employees available to participate in the wildland fire program.

The authority for funding (normal fire year programming) and all emergency fire accounts is found in the following authorities:

Section 102 of the General Provisions of the Department of Interior's annual Appropriations Bill provides the authority under which appropriated monies can be expended or transferred to fund expenditures arising from the emergency prevention and suppression of wildland fire.

P.L. 101-121, Department of the Interior and Related Agencies Appropriation Act of 1990, established the funding mechanism for normal year expenditures of funds for fire management purposes.

31 US Code 665(E)(1)(B) provides the authority to exceed appropriations due to wildland fire management activities involving the safety of human life and protection of property.

Authorities for procurement and administrative activities necessary to support wildland fire suppression missions are contained in the Interagency Fire Business Management Handbook.

The Reciprocal Fire Protection Act of May 27, 1955 (42 USC 815a; 69Stat 66) provides Authorities to enter into agreements with other Federal bureaus and agencies; with state, county, and municipal governments; and with private companies, groups, corporations, and individuals regarding fire activities.

Authority for interagency agreements is found in A Inter-agency Agreement between the Bureau of Land Management, Bureau of Indian Affairs, National Park Service, U.S. Fish and Wildlife Service of the United States Department of the Interior and the Forest Service of the United States Department of Agriculture@ (1996).

Fire Management Objectives

Refuge fire management objectives include:
- Protect life, property, and natural and cultural resources.
- Safely suppress wildland fires using strategies and tactics appropriate for the situation.
- Use of heavy equipment will be prohibited except in cases of threats to life and/or property or by specific approval of the Refuge Manager.
- Off-road travel will be limited to areas outside fenced-off archaeological sites.
- Use prescribed fire as a tool to control non-native vegetation and reduce fuel loads.
- Integrate prescribed fire into the mix of habitat restoration, in conjunction with other management tools already utilized such as grazing, mowing, and spraying of herbicides.
- Protect wildlife, with special emphasis on endangered, threatened and species of special concern.

Description of Refuge

The Stone Lakes NWR is located approximately 1.5 miles east of the Sacramento River and two miles south of the town of Freeport in Sacramento County, California (Figure 1). The Refuge is located along the I-5 Corridor, and is largely surrounded by state and county highways and waterways (to the west). The Refuge consists of a combination of fee title, easement, and county and state-owned properties. The Refuge ranges from 2.8-12.9 feet in elevation. The Refuge is surrounded by agricultural and urban lands. Urban development and vineyards are encroaching on the eastern and southern borders.

Climate

The climate is classified as Mediterranean with cool, wet winters and hot, dry summers. Rainfall is fairly well distributed throughout the winter, occurring in steady but gentle 2-3 day storms. The annual average precipitation is 16-18 inches. Heavy fogs are common during the winter months, while thunderstorms, hail and snow are a rare occurrence. The mean annual temperature is 62EF with extremes of 118EF and 15EF. Southerly winds are associated with storms in the winter and cooling trends in the summer. North winds are usually dry following winter storms and hot and dry in the summer when the most hazardous wildland fire conditions occur. Winds during summer are generally west or southwesterly coming from the Sacramento-San Joaquin River Delta. High winds and gusts are frequent during summer.

Cultural Resources

Numerous archaeological and historic properties are located throughout the Refuge, since many higher elevation areas are former Plains Miwok Indian village and burial sites. Due to historic farming practices, many of these sites have human remains and artifacts at or near the surface. Therefore, ongoing coordination and consultation to ensure protection of these resources will continue, as needed, between Refuge staff and the State Historic Preservation

Office, California Native American Heritage Commission, local tribal representatives, and Service archaeologists with the assistance of private archaeological consultants. As properties are acquired for the Refuge, they are surveyed by archaeologists and historic sites are identified and delineated. Refuge staff consult annually with archaeological experts and local tribal representatives to ensure that all legal responsibilities under the National Historic Preservation Act and the Native American Graves Protection and Repatriation Act are observed and historic properties are protected during any habitat management activities. Any ground disturbance associated with firelines that may be necessary will only be constructed when considered absolutely necessary.

Visitor Use

Along the eastern Refuge boundary, Refuge lands are immediately adjacent with urban residential and commercial development. As a result, there is substantial community interest in visitor use opportunities on the Refuge. At present a Refuge hiking trail and wildlife observation platform are only open every other Saturday and other visitation is limited.

Fish and Wildlife

The Refuge provides habitats for migratory and resident bird species. The Refuge also contains aquatic habitats for species such as the western pond turtle. The Refuge has a large rookery (great blue heron, great egret and double crested cormorant). A species list for the Refuge is attached (Appendix E).

Threatened and Endangered Species

Stone Lakes NWR currently supports habitat for six threatened and endangered species. The fire management program will be implemented in accordance with the Endangered Species Act of 1973 and will take appropriate action to identify and minimize adverse effects on any threatened or endangered species.

Threatened and endangered species include:
- Vernal pool fairy shrimp (*Branchinecta lynchi*)(Threatened)
- Vernal pool tadpole shrimp (*Lepidurus packardi*)(Endangered)
- Giant garter snake (*Thamnophis gigas*)(Threatened)
- Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)(Threatened)
- Delta smelt (*Hypomesus transpacificus*)(Threatened)
- Sacramento splittail (*Pogonichthys macrolepidotus*)(Threatened)

All of these species, except the valley elderberry longhorn beetle, occur in aquatic habitats. The beetle occurs only on elderberry.

Service Endangered Species Division staff from the Sacramento Fish and Wildlife Office were informally consulted on the Refuge grassland habitat management program including the use of prescribed burning as a management tool. As result of this verbal consultation and the small scope of the Refuge burn program , the Project Leader determined that this management program will have “no affect” on listed, proposed, and/or candidate species or designated critical habitat.

Habitats

The major natural habitats of the Refuge are: (1) grasslands, (2) riparian woodlands, and (3) seasonal and permanent wetlands. Portions of the Refuge remain as agricultural lands (vineyards and crops), although restoration of these areas is planned.

Grasslands

The grasslands on the Refuge occur on clay-rich soils that are moist in winter and very

dry in summer. These areas are open habitats supporting grasses and forbs and little in the way of woody vegetation. Grasslands are composed of a mix of native and non-native grasses and forbs. They are currently dominated by exotic annual grasses such as wild oat (*Avena fatua*), soft chess (*Bromus mollis*), annual rye (*Lolium perenne*), and ripgut brome (*Bromus diandrus*). However, one native, creeping wild rye (*Leymus triticoides*) still occurs abundantly. Some perennials such as meadow barley (*Hordeum brachyantherum*) and other native wild flowers cannot compete as well with the non-natives. Vernal pools occur within the grassland habitat, and may contain water from December through April. These pools may contain the Vernal pool fairy shrimp, the Vernal pool tadpole shrimp, as well as a unique assemblage of plants.

Riparian Woodlands
The riparian woodlands are very diverse, multilayered communities which experience occasional flooding. The canopy is very diverse consisting of mostly willow species, cottonwood, and valley oak. This habitat supports a rich array of native wildlife as well as an extensive colonial bird rookery. The rookery is one of the largest in the Central Valley and supports nesting by the great blue heron, great egret, snowy egret, black-crowned night-heron and double crested cormorant.

Seasonal and Permanent Wetlands
Refuge wetlands contain a wide variety of plants (Appendix E) some of which have special state status. These include: dwarf downingia (*Downingia humilis*), Legenere (*Legenere limosa*), California hibiscus (*Hibiscus lasiocarpus*), and Sandford's arrowleaf (*Sagittaria sanfordii*). The seasonal and permanent wetlands on the Refuge occur in low lying areas that are inundated with water for long periods during the year and may contain water for at least part of the summer. The seasonal wetlands mostly consist of rushes, sedges and smartweeds. The permanent wetlands consist of cattail, tule and water primrose.

Physical Resources

The Refuge has a gentle slope from east to west, with the east being the higher elevation. There are twelve soil types in the North Stone Lakes area. These types can be classified into three general categories: 1) alluvial flood basins bordering natural levees of the Sacramento River, 2) low terraces of the valley plain composed of old alluvium, and 3) transitional areas.

There are two lakes on the Refuge, North and South Stone Lake (Figure 2). The Lewis property is bordered by a slough to the north. The Southern Pacific (SP) cut is a major waterway used to divert water from the Sacramento River to private and public lands for irrigation purposes. It forms the western edge of the Refuge and flows year-round. Irrigation on the Refuge is managed by Refuge staff. All other water levels are managed by non-Refuge entities or through natural water fluctuations (e.g., tidal influences).

The Refuge is located in the Sacramento Metropolitan Air Quality Management District (SMAQMD), which is identified by Environmental Protection Agency (EPA) as a non-attainment area.

Structures and Facilities

The Refuge has two management sites, each with two buildings. Other structures on the Refuge are in the process of being removed. The main office at 1624 Hood-Franklin Road in Elk Grove. The maintenance shop is located on Fogg Road in Point Pleasant.

A viewing platform exists on the Lewis property and is located at the end of the hiking trail. A kiosk, which is not currently used, is located at the start of the trail.

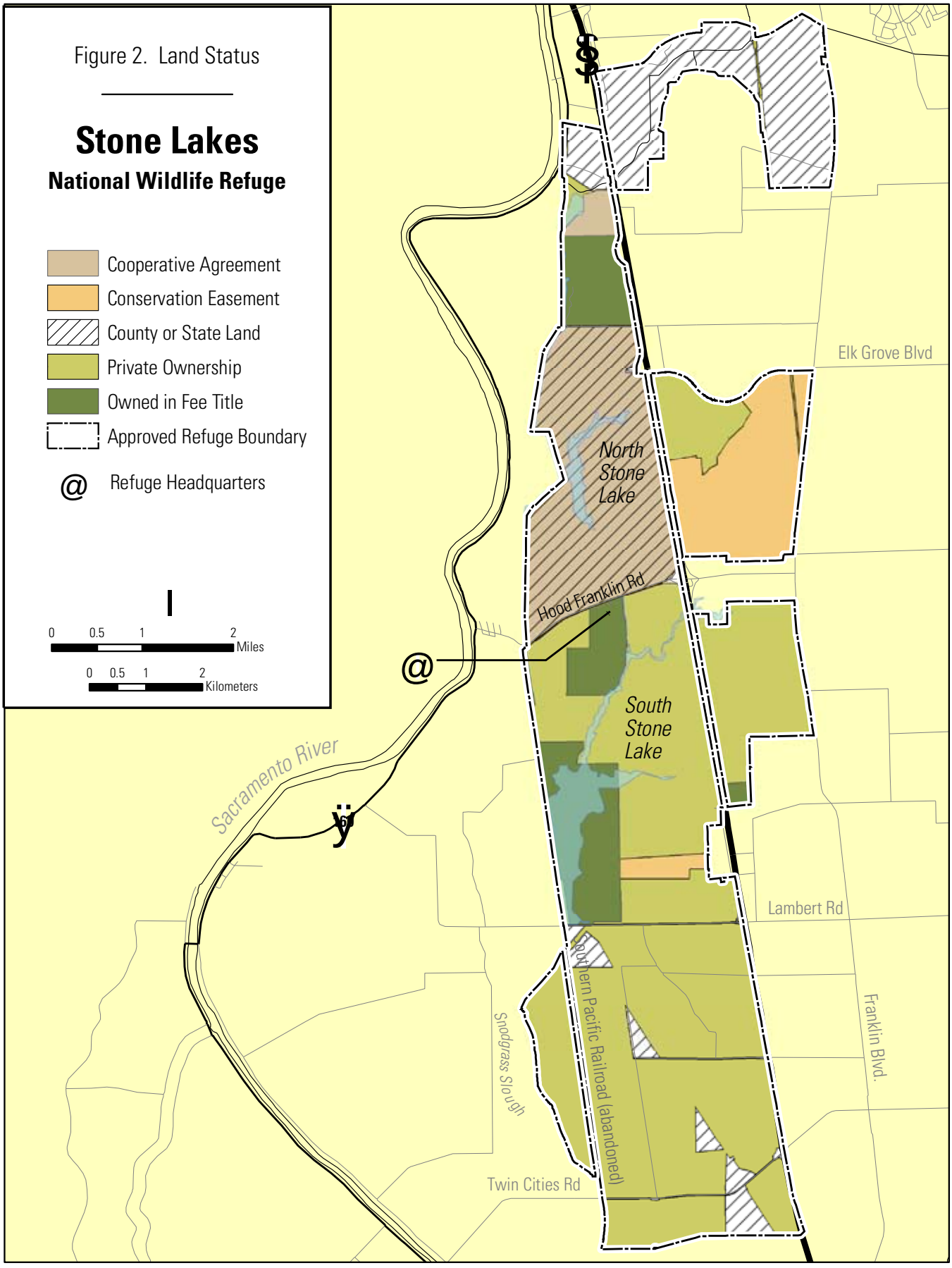
Figure 2. Land Status
Stone Lakes
National Wildlife Refuge
Cooperative Agreement
Conservation Easement
County or State Land
Private Ownership
Owned in Fee Title
Approved Refuge Boundary
@ Refuge Headquarters
0 0.5 1 2 Miles
0 0.5 1 2 Kilometers
Elk Grove Blvd
North Stone Lake
Hood Franklin Rd
South Stone Lake
Sacramento River
Lambert Rd
Southern Pacific Railroad (abandoned)
Franklin Blvd.
Snodgrass Slough
Twin Cities Rd

Wildland Fire Management Situation

Historic Role of Fire

The typical period of high fire danger is from May through early November based on information from the California Department of Forestry (CDF). Most fires on the Refuge have lasted no more than one burning period.

Pre-settlement fires

Most of the Stone Lakes NWR was and is grassland. Lightning-caused fire in the Sacramento Valley is uncommon, although fires which began in the foothills may have historically spread to the Valley floor. Native American practices likely included burning of the area, although frequency is unclear. Native grasslands were probably well-adapted to fire, but information on these native plant communities is extremely limited due to the intense agriculture that has existed in the area since the 1800s.

Post-settlement Fire History

Since the establishment of the Refuge in 1994, there have been 2 wildland fires on the Refuge that were contained at less than 1 acre each. Other fires have occurred within the planned Refuge boundary, but documentation of these fires is poor. Most wildland fires that have occurred within the entire Refuge have been fire trespass incidents along the Refuge boundaries (i.e., adjacent to public use areas, roadways, and a railroad line). Damage from these fires may have negative effects on resident or nesting wildlife, threatened and endangered species, or habitat.

Prescribed fire history

Prescribed fire has been utilized since 1998 as part of Refuge habitat management. Fire is used to produce the desired habitat conditions that meet specific needs of wildlife or to reduce non-native plant species. Stone Lakes NWR had a total of three prescribed fires between 1998-2000. These fires averaged 10 acres.

Responsibilities

Stone Lakes NWR does not have an onsite fire management staff and only limited suppression equipment. The Refuge landbase consists of several isolated units spread over the Refuge project area. This necessitates reliance on the Elk Grove CSD. The closest Service fire crew is stationed at Sacramento NWRC, about 75 miles to the north. Responsibilities for fire management at Stone Lakes NWR are shared by the Refuge Manager, Refuge Biologist, Central Valley Zone Assistant Fire Management Officer stationed at Sacramento NWRC, and the Zone Fire Management Officer stationed at San Luis NWRC.

The Stone Lakes NWR Project Leader is the primary line officer responsible for all aspects of the Refuge fire management program and for ensuring that all fire management program elements are carried out in accordance with Service policies, regulations, and guidelines. The Central Valley Zone Assistant Fire Management Officer assists with preparing and submitting the fire management plan updates, prescribed burn plans, and the annual fire budget. The prescribed burn plans are approved by the Refuge Manager.

Red-carded staff will assist with the overall implementation of the fire management program. Assistance from local fire department and neighboring Refuges will be needed.

Project Leader (PL)

- Is responsible for implementation of all Fire Management activities within the Refuge and will ensure compliance with Department, Service and refuge policies.

- Selects the appropriate management responses to wildland fire in the WFSA process.
- Coordinates Refuge programs to ensure personnel and equipment are made available and utilized for fire management activities including fire suppression, prescribed burning and fire effects monitoring.
- Ensures that the fire management program has access to Refuge resources when needed.
- Ensures that Refuge Staff considers the fire management program during Refuge related planning and implementation.

Biologist
- Identifies prescribed burn units and biological objectives to the Central Valley Zone (AFMO) notifies FMO of prescribed fire project constraints, and ensures that Refuge resources are available to accomplish prescribed fire and fire suppression objectives.
- Acts as the primary Refuge Resource Management Specialist during fire management planning and operations.
- Ensures fire effects monitoring is being implemented, drafts wildfire Rehabilitation Plans for Project Leader, and is responsible for posting and enforcing fire restriction regulations.
- Coordinates through Project Leader to provide biological input for the fire program with the Zone AFMO.
- Assists in design and implementation of fire effects monitoring, with Zone AFMO.
- Participates, as requested, in prescribed burning and fire suppression.

Zone Fire Management Officer (FMO)
- Responsible for all fire related planning and implementation for the Complex, which includes Stone Lakes NWR, San Luis NWRC, Kern NWRC, Sacramento NWRC, and San Francisco Bay NWRC.

Zone Assistant Fire Management Officer (AFMO)
- Integrates biological Refuge objectives into all fire management planning and implementation.
- Solicits program input from the PL and Biologist.
- Supervises prescribed fire planning.
- Coordinates fire related training.
- Coordinates with cooperators to ensure adequate resources are available for fire operational needs.
- Is responsible for preparation of fire reports following the suppression of wildland fires and for operations undertaken while conducting prescribed fires.
- Prepares an annual report detailing fire occurrences and prescribed fire activities undertaken in each calendar year. This report will serve as a post-year's fire management activities review, as well as provide documentation for development of a comprehensive fire history record for the complex.
- Submits budget requests and monitors FIREBASE funds.
- Maintains records for all personnel involved in suppression and prescribed fire activities, detailing the individual's qualifications and certifications for such activities.

Fire Management/Suppression Personnel
- Consist of all Refuge personnel, whether permanent or seasonal, who meet the minimum standard set by the National Wildfire Coordinating Group (NWCG) for firefighters.
- Are fully equipped with proper personal protective equipment, have taken and passed the minimum classroom training, and meet physical fitness standards required.
- Undertake fire management duties as assigned by the qualified IC on each suppression action or by the Prescribed Fire Burn Boss on each prescribed fire project.
- Are responsible for their personal protective equipment and physical conditioning, qualifying annually with the work capacity test.

Incident Commander
Incident Commanders (of any level) use strategies and tactics as directed by the Project Leader and WFSA where applicable to implement selected objectives on a particular incident. A specific Limited Delegation of Authority (Appendix F) will be provided to each Incident Commander prior to assuming responsibility for an incident. Major duties of the Incident Commander are given in the National Wildfire Coordinating Group (NWCG) Fireline Handbook, including:

- Brief subordinates, direct their actions, and provide work tools.
- Ensure that safety standards identified in the Fire Orders, the Watch Out Situations, and agency policies are followed at all times.
- Personally scout and communicate with others to be knowledgeable of fire conditions, fire weather, tactical progress, safety concerns and hazards, condition of personnel, and needs for additional resources.
- Order resources to implement the management objectives for the fire.
- Inform appropriate dispatch of current situation and expected needs.
- Coordinate mobilization and demobilization with dispatch and the AFMO.
- Perform administrative duties, i.e., approving work hours, completing fire reports for command period, maintaining property accountability, providing or obtaining medical treatment, and evaluating performance of subordinates.
- Assure aviation safety is maintained to the highest standards.

Initial attack modules
Initial attack modules will consist of red-carded firefighters with appropriate red-carded supervision. A Type 5 (ICT5) or Engine Boss (ENGB) is the basic requirement of leadership when responding to a fire with an organized suppression module, i.e., engine. Modules will be prepared and equipped with hand and power tools as needed and will be dispatched with a day's supply of food and water, so they can continue work for 24 hours without additional support.

Employees participating in any wildland fire activities on Fish and Wildlife Service or cooperators' lands will meet fitness requirements established in PMS 310-1, except where Service-specific fitness requirements apply.

- Continue to develop a cadre of "red-carded" firefighters for wildland fire; trained and equipped to accomplish the fire management program.
- Maintain the Refuge fire cache and fire equipment in ready state.

Interagency Operations

There is currently a cooperative agreement between the Refuge and the Elk Grove Community Services District to provide initial attack for wildland fires within the Refuge (Appendix D). Other interagency contacts will be established at the federal, state, and local levels to provide the most efficient level of fire management operations. Other agreements and memoranda of understanding (MOU) will be established, as needed, to establish guidelines for assistance from local cooperators. The MOU allows the responding agency to assume command of the incident until a representative of the Refuge arrives to establish a unified command or assume responsibility for the incident, if qualified. The Refuge Dispatch Plan (Appendix G) contains guidelines for a reported fire and the proper dispatching to affect a quick and orderly initial attack by the closest local resource.

Protection of Sensitive Resources

To protect Refuge resources, mechanical line construction (dozers, discing) must be authorized by the Refuge Manager or their designate, unless human life and/or property are threatened. Sensitive areas will be mapped and distributed to suppression resources.

The Regional Archaeologist and/or his/her staff will work with fire staff, project leaders, and incident commanders to ensure that cultural resources are protected from fire and fire management activities. The "Request For Cultural Resource Compliance" form (RCRC, Appendix L) will be used to inform the Regional Archaeologist of impending activities, thereby meeting the regulations and directions governing the protection of cultural resources as outlined in Departmental Manual Part 519, National Historic Preservation Act (NHPA) of 1966, Code of Federal Regulations (36CFR800), the Archaeological Resources Protection Act of 1979, as amended, and the Archaeological and Historic Preservation Act of 1974. The NHPA Section 106 clearance will be followed for any fire management activity that may affect historic properties (cultural resources eligible to the National Register of Historic Places).

Impacts to archaeological resources by fire resources vary. The four basic sources of damage are (1) fire intensity, (2) duration of heat, (3) heat penetration into soil, and (4) suppression actions. Of the four, the most significant threat is from equipment during line construction for prescribed fires or wildfire holding actions (Anderson 1983).

The following actions will be taken to protect archaeological and cultural resources:

Wildland Fires
- Minimum impact fire suppression tactics will be used to the fullest extent possible.
- Resource Advisors will inform Fire Suppression personnel of any areas with cultural resources. The Resource advisor should contact the Regional Archaeologist and/or his/her staff for more detailed information.
- Foam will be limited in areas known to harbor surface artifacts.
- Mechanized equipment should not be used in areas of known cultural significance.
- The location of any sites discovered as the result of fire management activities will be reported to the Regional Archaeologist.
- Rehabilitation plans will address cultural resources impacts and will be submitted to the Regional Archaeologist using the RCRC.

Prescribed Fires
- The Refuge Fire staff will submit a completed RCRC to the Regional Archaeologist and/or his/her staff as soon as the burn area is identified (i.e., as soon as feasible).
- Upon receipt of the RCRC, the Regional Archaeologist and/or his/her staff will be responsible for consulting with the FMO and evaluating the potential for adverse impacts to cultural resources.
- When necessary, the Regional Archaeologist and/or his/her staff will coordinate with the State Historic Preservation Officer (SHPO). The SHPO has 30 days to respond. The Refuge will consider all SHPO recommendations.
- Mechanized equipment should not be used in areas of know cultural significance.
- The location of any sites discovered as the result of fire management activities will be reported to the Regional Archaeologist.

Wildland Fire Activities

Fire program management describes the operational procedures necessary to implement fire management at Stone Lakes NWR. Program management includes: fire prevention, preparedness, emergency preparedness, step-up staffing plan, fire detection, fire suppression, minimum impact suppression, minimum impact rehabilitation, and documentation.

All fires not classified as prescribed fires are wildland fires and will be appropriately suppressed. Records show that fire season is typically from May through early November, based on information provided by CDF.

Fire Management Strategies

All unplanned wildland fires will be suppressed in a prompt, safe, and cost-effective manner to produce fast, efficient action with minimum damage to resources while using appropriate management strategies.

- Suppress all wildland fires in a safe and cost effective manner;
- Conduct all fire management programs in a manner consistent with applicable laws, policies and regulations;
- Develop and maintain cooperative agreements with local fire agencies, since the Refuge will rely largely on local fire departments for suppression as well as prescribed fire back up;
- Develop monitoring to see if objectives are being met and that wildlife and special status species are not negatively affected.
- Develop and implement fire prevention/education programs.
- Utilize mechanical treatments to reduce hazardous fuels or disrupt fuel continuity.

Although the resource impacts of suppression alternatives must always be considered in selecting a fire management strategy, resource benefits will not be the primary consideration. Appropriate suppression action will be taken to ensure firefighter safety, public safety, and protection of resources.

Preparedness

Preparedness is the work accomplished prior to fire occurrence to ensure that the appropriate response, as directed by the Fire Management Plan, can be carried out. Preparedness activities include: budget planning, equipment acquisition, equipment maintenance, dispatch (i.e., initial attack, extended, and expanded), equipment inventory, personnel qualifications, training, and fire prevention.

Fire readiness planning is to be done on an annual basis. This will ensure that all personnel, engines, fire cache, Personal Protective Equipment (PPE), and training are identified and prepared for the fire season. Lists of engines, equipment, and inventory are located in Appendix H.

Historical Weather

The fire season generally begins with the curing of annual grasses in late May and extends to the first rains in mid October to early November. Easterly and northerly winds in September and October increase the potential for large fires in the local area. However, there is some potential for prescribed and wildland fires year-round. Neither Elk Grove CSD nor the Sacramento County Fire Protection District have any weather station data that could be used to characterize historical weather trends.

Fire Prevention
Stone Lakes NWR fire prevention program is designed to protect human life and property, and prevent damage to cultural resources or physical facilities. A program of internal and external education regarding potential fire danger will be implemented. Visitor contacts, bulletin board materials, handouts and interpretive programs may be utilized to increase visitor and neighbor awareness of fire hazards. Qualified Refuge staff will interpret for the public the beneficial effects of prescribed fires as opposed to unwanted human-caused fires. Emphasis will be placed on information, essential to understanding the potential severity of human-caused wildland fires, and how to prevent them. Zone fire staff will keep Refuge staff informed about changes in existing conditions throughout the fire season.

During periods of extreme or prolonged fire danger, emergency restrictions regarding Refuge operations or area closures may become necessary. Such restrictions, when imposed by the Project Leader, will usually be consistent with those implemented by Refuge cooperators. It will remain the duty of the Central Valley Zone AFMO to inform the Project Leader of extreme fire danger.

Staffing Levels
There are no fire-funded staff stationed at Stone Lakes NWR, therefore there will be no formalized step-up plan. Elk Grove CSD will be responsible for suppression operations and will determine their staffing levels based on their own indicators. Indicators which include weather, fire location and proximity to the highway. There are no automatic triggers for shutting down equipment or instituting closures, however, the PL may restrict equipment and visitation as deemed necessary and as authorized by the Fire Management Handbook.

Training
Departmental policy requires that all personnel engaged in suppression and prescribed fire duties meet the standards set by the National Wildfire Coordinating Group (NWCG). Stone Lakes NWR will conform strictly to the requirements of the wildland and prescribed fire management qualification and certification system (PMS 310-1) and Service guidelines.

Service policy sets training, qualification, and fitness standards for all fire positions. All fire personnel (full time fire or collateral duty) will be provided with the training (classroom and on-the-job) required to meet Service fire position qualification standards for the positions they are expected to perform. All firefighters will be required to participate in an annual refresher to remain qualified. Refreshers will focus on local needs; fire shelter deployment; Look outs, Communications, Escape Routes, Safety Zones (LCES); fire orders; and watch out situations. On-the job training is encouraged and will be conducted at the field level. Whenever appropriate, the use of fire qualification task books will be used to document the fire experience of trainees. The AFMO will coordinate fire training needs with those of other nearby Refuges, cooperating agencies, and the Regional Office (RO).

All fire-qualified employees are required to pass the mandatory fitness and training requirements prior to May 30 or within 2 weeks of entering duty. Employees not meeting fitness and training requirements may assist in support capacities, but will not be permitted on the fireline. Personnel will not perform fire jobs they are not qualified for.

Refuge engines may be used for prescribed burning and may assist Elk Grove CSD in suppression operations. All Refuge engines will be equipped with tools, firing devices, and water handling accessories. To ensure engine readiness, all annual maintenance should be completed by Sacramento NWRC fire staff in the off season (by May 30), and Refuge staff will maintain the equipment during fire season.
The Refuge supports the development of individual Incident Command System (ICS)

overhead personnel from among qualified and experienced Refuge staff for assignment to overhead teams at the local, regional, and national level.

Supplies and Equipment
A small fire cache for three people will be located at Refuge headquarters, and the engines are typically located at the maintenance shop. All firefighters will be issued the required personal protective equipment to include: Nomex pants and shirts, gloves, helmet and goggles, field pack with shelter, overnight pack, sleeping bag, headlamp, and personal first aid kit.

Detection
Fires are typically reported by members of the general public to the 9-1-1 system, and Sacramento County dispatchers initiate suppression response. If Refuge staff observe a wildland fire, they are to call 9-1-1. Sacramento County dispatch notifies Elk Grove CSD, who initiates suppression response. Elk Grove CSD will notify Refuge staff as specified in the MOU (Appendix D).

Communications
Elk Grove CSD uses 800 megahertz radios for primary communication. The Refuge will acquire one or more radios to be able to communicate directly with Elk Grove CSD personnel. The Refuge is currently working on frequency authorization. Telephones may be used as a secondary communication tool. A complete contact list with phone numbers for Refuge staff and cooperators is located in the dispatch plan (Appendix G).

Some of the local agencies have capability to communicate using the NIFC and CDF tactical Channels. The most frequently used for all operations on Refuges is NIFC tactical channel 2 (168.200). For those local agencies that do not have that capability, a Service radio will be provided and cell phone information exchanged to ensure communication during the incident. Cell phones will not be used as the primary communication tool on fires, unless no other options exist.

Pre-attack Plan
Pre-attack planning data will be updated annually by Refuge staff. Pre-attack plans will be placed in each engine, the Fire Management Office, and with the Dispatch Plan at the Refuge. Pre-attack plans should include:
- Response map: roads, gates, water sources, mutual aid zones / fire cooperator districts.
- Hazard/Risk map: power lines, main ditches and canals.
- Natural and cultural resources map: sensitive zones, non-sensitive zones, restricted vehicle access areas.
- Structure list and maps.
- Ownership maps.

Fire Management Units
Stone Lakes NWR will be managed as a single Fire Management Unit (FMU). Suppression strategies, management restrictions, fuels, fire environment, and values at risk are similar throughout the Refuge.

Due to staff limitations, relatively small land management parcels, valuable resources, and values at risk on neighboring lands, this plan does not recommend wildland fire managed for resource benefit as an option for Stone Lakes NWR. Wildland fires will be suppressed using the appropriate suppression response. Prescribed fires will be used to reduce hazardous fuels and to meet resource management objectives.

Fuel Types and Fire Behavior
The following behaviors are based on the average conditions found on the Refuge in a normal fire season or mid-July averages for the 14:00 weather. These averages include: maximum temp of 98 degrees F, 25% relative humidity, mid-flame wind speed of 8 mph, and 4% average 1hr (< 1/4 A diameter) dead fuel moisture. The slope is 0 to 2% and the rate of spread is for a head fire. The outputs are from the BEHAVE - Fire Behavior Prediction Models based on the conditions above and for the major fuel models found within the Refuge:

Fuel Model 1 - Upland Grass and Vernal Pools: Fire spread is governed by the fine and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass and associated material. The fire behavior is directly related to the fuel moisture and windspeed. Fuel loading is 0.74 tons/acre and consists of 1/4" or smaller (1 hr) dead fuel component. Spot fires are generally not produced because fuels are consumed too quickly and thoroughly. Resistance to control is low to moderate, depending on windspeed. The behavior output includes:
- Rate of Spread - 275 chains/hr (3.5 mph)
- Flame Length - 7.7 feet

Fuel Model 3 - Seasonal Marsh: Fires in this model display high rates of spread under the influence of wind. Wind may drive fire into the uppers heights of the bulrush and across standing water. Stands are tall, averaging about 3-6 feet but considerable variation may occur. Approximately 1/3 or more of the stand is considered dead or cured and maintains the fire. Fuel loading is 3.0 tons/acre and consists of up to 1/4" 1 and 10 hr) dead fuel component. Fire behavior is directly related to the fuel moisture and windspeed. Short-range (up to 100') spotting usually occurs and causes high to extreme control problems. The behavior output includes:
- Rate of Spread - 259 chains/hr (3.0 mph
- Flame Length - 20.4 feet

Fuel Model 9 - Riparian Woodland: Fires are carried by dead, loosely compacted leaves and understory grasses. Wind tumbled leaves and torching trees may cause short-range spotting that may increase the rate of spread above the predicted value. Fuel loading is 3.5 tons/acre and consists of <3" of dead and live fuel. Fire behavior is directly related to the fuel moisture and fuel loading with windspeed in exposed areas. Resistance to control is moderate except during drought conditions when extreme fire conditions are present. The behavior output includes:
- Rate of Spread - 22 chains/hr (0.2 mph)
- Flame Length - 4.8 feet

Suppression Tactics

Wildland fires will be suppressed in a prompt, safe, and cost-effective manner to produce fast, efficient action with minimum damage to resources. Suppression involves a range of possible actions. All wildland fires will be suppressed.

Personnel and equipment must be efficiently organized to suppress fire effectively and safely. To this end, the Elk Grove Fire Protection District assumes the command function on major or multiple fire situations, setting priorities for the use of available resources and establishing a suppression organization. There will be only one Incident (IC) Commander responsible to the Refuge Manager. The Incident Commander will designate all overhead positions on fires requiring extended attack.

Suppression Conditions
The Cooperative agreement with Elk Grove ensures that a qualified IC is assigned for each fire occurring on the Refuge. The IC will be responsible for all aspects of the fire's management, within the predetermined guidelines of this Plan. The IC will select the appropriate suppression strategies and tactics. Minimum impact tactics will be used whenever possible. Dozers, plows, discs, or graders will be used inside Refuge boundaries only in cases where necessary to protect life and/or property, or where specifically authorized by the Refuge Manager or their designate.

Mutual aid resources responding from local fire departments to Refuge fires must meet federal fire qualifications as outlined in PMS 310-1 or National Fire Protection Association (NFPA) standards. The California State Fire Marshall's Office has issued standards for the State that meet or exceed PMS 310-1 standards.

The IC will notify the Refuge Manager whenever it appears that a fire will exceed initial attack efforts, may threaten private lands, or when fire complexity will exceed the capabilities of command or operations. The Refuge Manager will be responsible for coordinating with the IC all extended attack actions including:
- Completion and daily review of a WFSA (Wildland Fire Situation Analysis; Appendix I);
- Assignment or ordering of appropriate resources;
- Completion of Delegation of Authority if needed; and
- Development of standards and guidelines for use of heavy equipment, foam, retardant, aircraft, etc. using an interdisciplinary process.

Wildland Fire Situation Analysis
For fires that cannot be contained in one burning period, a WFSA must be prepared (Appendix I). In the case of a wildland fire, the IC, in conjunction with the Zone AFMO, will prepare the WFSA. Approval of the WFSA resides with the Refuge Project Leader.

The purpose of the WFSA is to allow consideration of alternatives by which a fire may be controlled. Damages from the fire, suppression costs, safety, and the probable character of suppression actions are all important considerations.

Public safety will require coordination between all Refuge staff and the IC. Notices may be posted to warn visitors of possible trail closures and traffic control may be necessary where smoke crosses roads. Where wildland fires do cross roads, the adjacent burned areas should be mopped up and dangerous snags felled. Every attempt will be made to utilize natural and constructed barriers, including changing fuel complexes, in the control of wildland fire. Rehabilitation efforts will concentrate on the damages done by suppression activities rather than on the burned area itself.

Aircraft Operations
Aircraft may be used in all phases of fire management operations. All aircraft must be Office of Aircraft Services (OAS) or U.S. Forest Service approved. An OAS Aviation Policy Department Manual will be provided by OAS.

Helicopters may be used for reconnaissance, bucket drops and transportation of personnel and equipment. Natural helispots and parking lots are readily available in most cases. Clearing for new helispots should be avoided where possible. Improved helispots will be rehabilitated following the fire.

As in all fire management activities, safety is a primary consideration. Qualified aviation personnel will be assigned to all flight operations.

Rehabilitation and Restoration

When suppression action is taken, rehabilitation is appropriate. The most effective rehabilitation measure is prevention of impacts through careful planning and the use of minimum impact suppression techniques. All wildland fire sites will be evaluated for rehabilitation needs as soon as possible. Re-seeding needs will be determined according to Service policy and regulations. Per Service policy, only damage to improvements caused by suppression efforts can be repaired with fire funds. Rehabilitation will be directed toward minimizing or eliminating the effects of the suppression effort and reducing the potential hazards caused by the fire. These actions may include:

1. Backfill control lines, scarify, and seed.
2. Install water bars and construct drain dips on control lines to prevent erosion.
3. Install check dams to reduce erosion potential in drainages.
4. Restore natural ground contours.
5. Remove all flagging, equipment and litter.
6. Completely restore camping areas and improved helispots.
7. Consider and plan more extensive rehabilitation or re-vegetation to restore sensitive impacted areas.

If re-vegetation or seeding is necessary, only native plant species will be used.

If emergency rehabilitation measures are needed or if rehabilitation is needed to reduce the effects of a wildland fire then the Refuge can request appropriate funding through the Burned Area Emergency Stabilization and Rehabilitation (ESR) fund.

Required Reporting

The fire staff will complete all situation reports as soon as practical. The IC will complete the DI-1202 Fire Report and Crew Time Reports for all personnel assigned to the fire, and return these documents to the Fire Program Manager for entry into the DOI Computer (SACS). The Fire Program Manager will ensure that all expenses and/or items lost on the fire are reported, that the timekeeper is advised of all fire time and premium pay to be charged to the fire and that expended supplies are replaced.

Fire Investigation

Fire management personnel will attempt to locate and protect the probable point of origin and record pertinent information required to determine fire cause. They will be alert for possible evidence, protect the scene and report findings to the fireline supervisor.

The Project Leader, Zone FMO/AFMO, or Incident Commander may order a fire investigator through normal dispatch channels.

Prescribed Fire Activities

Prescribed Burn Program Objectives

Stone Lakes National Wildlife Refuge has pursued a prescribed burning program as part of the overall management of the Refuge. Prescribed fire has been an integral part of the resource management on the Refuge since 1998. Planning and coordination for any prescribed fire activity is conducted on an annual basis. The use of prescribed fire to remove excess vegetation in wetlands and uplands reduces the accumulation of dead fuels. It also creates an improved mosaic of open water and emergent vegetation that provides for less intense fires in the future and better quality habitat for many waterbirds and other species. The prescribed fire program goals are hazard fuel reduction and resource/habitat management.

Hazard fuel reduction (i.e., mechanical removal or prescribed fire) will be pursued within or near Refuge development zones, sensitive natural resources areas, and Refuge boundary areas to reduce the risks of wildland fire. To the greatest extent possible, hazard fuel burns should compliment resource management objectives. Resource management prescribed fire is used to restore/create/maintain a diversity of plant communities in order to restore and perpetuate native wildlife species. The frequency of achieving many of the goals requires repeated prescribed burns every 5-10 years in marsh units and every 1-5 years in upland units. Goals of prescribed burning include:

- maintain fuel loadings within the natural ranges (determined by fuel type).
- protect resources / habitat from wildland fire trespass.
- establish defensible space around improvements and structures.
- aid in control of noxious weeds.
- control dense hardstem bulrush and cattail growth in wetlands.
- enhance native upland species production.
- maintain/rejuvenate quality “green browse” for ducks, geese, and cranes in upland areas.
- maintain/rejuvenate quality nesting cover for waterfowl.

Complexity is dependent upon fuels/vegetation, objectives, burn boundaries, and size. Burns on the Refuge vary from low-medium in fuel models 1 and 3, which represents approximately 80-90% of the total acres treated, to low- high in the model 9 fuels. Complexities are determined by using the FIREBASE analysis described in the Service Fire Management Handbook.

The Refuge reserves the option to utilize an interagency team approach for complex burns carried out on the boundaries and close to developed areas or burns of large acreage. The most highly qualified and experienced personnel in the regional interagency community would be requested to serve on this team.

Fire Management Strategies

The following strategies will be employed to meet the fire management objectives:

- Conduct all fire management programs in a manner consistent with applicable laws, policies and regulations.
- Maintain Memoranda of Understanding with local fire agencies and protection districts to support prescribed fire activities.
- Utilize prescribed fire as a management treatment for achieving hazard fuel reduction and resource management objectives.
- Initiate cost effective fire monitoring to assist managers ascertain if objectives are being met. Monitoring information will also be used to refine burn prescriptions to better achieve objectives.
- Integrate fire ecology, management, and prevention themes into existing interpretive and education programs.

Prescribed Fire Planning

The climate of the Sacramento-San Joaquin River Delta and the Sacramento Valley and their diverse plant communities combined with habitat management objectives, allow prescribed burns to be conducted at any time of the year. However, most burning will occur from June through November.

Annual Activities

The AFMO will be responsible for completing an annual fire summary report. The report will contain the number of fires by type, acres burned by fuel type, cost summary, personnel utilized, and fire effects.

The Refuge Biologist and Project Leader, in conjunction with fire staff, are responsible for identifying annual prescribed fire needs and developing resource goals and treatment objectives for Refuge units/areas. The AFMO determines if prescribed fire can be utilized to meet the treatment objectives and identifies a burn boss to complete the Prescribed Fire Plan. Burn plans will meet all training, personnel, equipment, and other requirements as specified in the Service Fire Management Handbook. Prescribed fires will be planned to minimize the risk of escape and/or to mitigate necessary risks and provide an adequate contingency plan for suppressing the fire should an escape occur. The plan will then go through the review process with input from the Refuge Biologist and FMO/AFMO before final approval from the Project Leader.

Agricultural Burn Permits will be obtained from the Sacramento Metropolitan Air Quality Management District (issued by the Sacramento County Agricultural Commissioner). Permit parameters and fees may vary and be subject to change. An estimate of total acres to be treated should be provided early in the planning process to allow the air district to complete and coordinate for the proposed emissions.

Prescribed Fire Burn Plan

Individual prescribed fire burn plans will be the primary document used to record prescribed fire information. Burn plans document air quality requirements, personnel, costs, fire behavior, weather, fire summary, and burn critique information (Appendix J). Prescribed burns will also be documented on
DI-1202 forms and entered into the Department of the Interior Shared Applications Computer System (SACS).

The Prescribed Fire Burn Boss will conduct a field reconnaissance of the proposed burn location with the FMO, AFMO, Prescribed Fire Specialist (PFS), Refuge Biologist, and/or Refuge Manager to discuss objectives, special concerns, and gather all necessary information to prepare the burn plan. After completing the reconnaissance, a qualified Prescribed Fire Burn Boss will prepare the prescribed fire burn plan.

All prescribed fires will have prescribed fire burn plans. The prescribed burn plan is a site specific action plan describing the purpose, objectives, prescription, and operational procedures needed to prepare and safely conduct the burn. The treatment area, objectives, constraints, and alternatives will be clearly outlined. No burn will be ignited unless all prescriptions of the plan are met. Fires not within those parameters will be suppressed.

Strategies and Personnel

The Sacramento NWRC fire staff will oversee and assist the Refuge field staff with the unit preparations including equipment maintenance, fuel break mowing, and blacklining. Refuge staff will be responsible for assisting with public relations and education regarding the use of fire as a management practice.

The PFS will assign a burn boss of the appropriate level to implement the burn. The burn boss will follow all guidelines and procedures that are contained in the Prescribed Fire Burn Plan.

The Refuge will meet or exceed standard and qualification requirements as outlined in the Service Fire Management Handbook and Interagency prescribed fire qualification (NWCG publication 310-1). The Refuge Manager shall delegate to the AFMO the responsibility for ensuring that Refuge personnel maintain the qualifications necessary to implement the growing fire program.

Weather and fuel moisture conditions must be monitored closely in planned burn units to determine when the prescription criteria are met. A belt weather kit may also be utilized to augment monitoring.

When all prescription criteria are within the acceptable range, the Burn Boss will select an ignition time based on current and predicted weather forecasts. A thorough briefing will be given by the Burn Boss and specific assignments and placement of personnel will be discussed. An updated spot weather forecast will be obtained on the day of ignition and all prescription elements will be rechecked to determine if all elements are still within the approved ranges. If all prescription and plan elements are met using the Go-No-Go check list and concurrence with the Project Leader or their designate, a test fire will be ignited to determine on-site fire behavior conditions as affected by current weather. If conditions are not satisfactory, the test fire will be suppressed and the burn will be rescheduled. If conditions are satisfactory the burn will continue as planned.

Prior to ignition the burn boss will verify that contingency resources are available. Minimum contingency resources for the Refuge are: a qualified Incident Commander Type III (within 30 minutes), and suppression resources to be determined based on each burn plan. If the prescribed burn escapes the predetermined burn area, all further ignition will be halted except as needed for suppression efforts. Suppression efforts will be initiated, as discussed in the pre-burn briefing. The Zone AFMO or FMO will be notified immediately of any control actions on a prescribed burn. If the escaped prescribed fire escapes initial suppression efforts, the burn will be declared a wildland fire and suppressed using guidelines established in this plan. If the escaped fire continues into the next burning period, a WFSA will be completed and additional personnel and resources ordered as determined by the Incident Commander. If the fire continues to burn out of control, additional resources will be called from the local cooperating agencies via the servicing dispatch. A management overhead team may be requested to assume command of the fire.

Monitoring and Evaluation
Monitoring of prescribed fires is intended to provide information for quantifying and predicting fire behavior and its ecological effects on Refuge resources while generating an historical record. Monitoring will measure the parameters common to all fires: fuels, topography, weather and fire behavior. In addition, ecological changes such as plant and wildlife species composition and structural changes will be monitored. This information will then be utilized to fine-tune the prescribed burn program.

During prescribed burns, monitoring can serve as a precursor to invoking suppression action to help determine if the fire is in prescription, assess its overall potential, and determine the effects of the prescribed burn.

Monitoring and evaluation are part of the prescribed fire process. Monitoring is completed in three steps: pre-burn, burn day, and post-burn. Burn day evaluations document

temperature, relative humidity, wind speed, rate of spread, flame length, smoke dispersal, and objectives.

Required Reports
All prescribed burn forms will be completed as outlined by the Prescribed Burn Boss. A monitor will be assigned to collect all pre-identified information and complete all necessary forms prior to, during, and after the burn. All records will be archived in the Refuge's fire records for future use and reference.

The Prescribed Burn Boss will prepare a final report on the prescribed burn for the Project Leader. Information will include a narrative of the burn operation, a determination of whether objectives were met, weather and fire behavior data, map of the burn area, photographs of the burn, number of work hours, and final cost of the burn.

Prescribed Burn Critique
Prescribed fires will be critiqued by the burn boss and documented in the burn plan. The Zone AFMO and Project Leader will conduct a formal critique if:
- significant injury/accident.
- an escape prescribed fire occurs.
- significant safety concerns are raised.
- smoke management problems occur.

Air Quality / Smoke Management Guidelines

Visibility and clean air are primary natural resource values. The protection of these resources must be given full consideration in fire management planning and operations. In addition, smoke management can have serious health and safety effects which must be considered during the planning and approval process.

Smoke management is a concern in the southern Sacramento River Valley. The Refuge is situated in a non-attainment area. When air quality is poor, a "no-burn" day is declared by the Sacramento Metropolitan Air Quality Management District (SMAQMD) in Sacramento. All Refuge prescribed burns should be conducted between 10:00 a.m. and 5:00 p.m. to help reduce air pollution. Early morning and late afternoon fires tend to produce more smoke that persists longer (due to more stable atmospheric condition). If smoke on public roads is anticipated, the California Highway Patrol should be notified. Prior to any burns, a public notice should be placed in local newspapers to avoid unnecessary public concern.

All prescribed burns must comply with the State of California Air Quality Regulations for Burning (CCR Title 17, Subchapter 2 "Smoke Management Guidelines for Agricultural and Prescribed Burning"), and local implementation plans. All burns are required to have a permit ("credits") from SMAQMD.

The management of smoke will be incorporated into the planning of prescribed fires and to the extent possible, in the suppression of wildland fires. A sample Burn permit is located in Appendix K. Sensitive areas will be identified and precautions will be taken to safeguard visitors and Refuge neighbors. When burning occurs adjacent to roads and highways, close monitoring will be conducted of wind conditions to prevent traffic hazards. There will be no hesitation to postpone a burn if wind conditions become questionable.

Fire Research

Assessing the effects of fire upon Refuge plant and animal communities will involve ongoing monitoring and research. Through applied research and careful application of fire, data collection will provide a better understanding of the natural ecological effects of fire and the information needed to refine prescriptions to meet resource objectives. Normal fire-year funding cannot be used to fund research projects.

Any research will comply with accepted scientific guidelines. This data, along with information gathered through research studies, will be used to improve the effectiveness of the fire management program.

Conducting the following fire research would be beneficial at Stone Lakes NWR:

- comprehensive inventory and assessment of Refuge hazard fuels and the identification and prioritization of hazard fuel units;
- assessment of hazard fuel management options, and their effects upon Refuge resource objectives;
- assessment of long and short term fire effects on upland and wetland habitats of the Refuge with recommendations for using prescribed fire in conjunction with other management tools to meet resource objectives; and
- assessment of fire effect monitoring needs and preparation of fire effect monitoring plan..

Public Safety

Firefighter and public safety will always take precedence over property and resource protection during any fire management activity. The greatest threat to public safety from Refuge wildland fires or escaped prescribed fires is entrapment by extremely fast moving fire fronts or fingers. Of particular concern are hunters or visitors who may be present in the area of the fire and neighbors who initiate their own suppression actions without proper training, equipment, or communication. Refuge staff will attempt to ensure that the fire scene is clear of people except for Service firefighters and any resources requested from cooperators.

Another concern is smoke from a Refuge wildland or prescribed fire, particularly smoke that drifts into a roadway causing dangerously reduced visibility. The fire dispatcher may notify the local law enforcement agency (i.e., Sacramento County Sheriff's Department) whenever the IC believes that drifting smoke may compromise public safety. The California Highway Patrol may also be consulted to assess the situation and take action as needed.

A final concern is fires which may escape the Refuge and expand onto inhabited nearby private property. The IC is responsible for contacting the appropriate official (Sacramento County Sheriff's Department) to warn and evacuate the public from potentially dangerous wildland fires.

Public Information and Education

Providing effective public outreach is an important part of fire suppression, fire prevention, prescribed fire, and the Service mission. During fire operations, the IC and/or burn boss is responsible for providing fire information to the press and the public. The IC may delegate this task as needed.

Informing the public is a vital element of the prescribed fire program. Areas that have been burned may present an opportunity for the public to actually see the effects of fire and offer an excellent opportunity for Refuge staff to interpret the goals of the fire program to the public. These programs should demonstrate the Refuge's capability to safely conduct prescribed fire operations and increase the public's tolerance of the short-term aesthetic impacts.

Approximately 90-95 percent of the Refuge's wildland fires have been human caused (i.e., traffic along county and state roads, equipment, power poles) and could have been prevented. Human-caused fires have the potential to cause significant damage since they can occur at a time of year when few initial attack resources are available and fuels are well cured.

In general, the local public and many visitors to the Refuge are well aware of fire prevention. However, the Refuge should employ the following, as needed:

- signing,
- closures when necessary,
- public contacts through press releases and verbal contacts,
- enforcement of regulations and prosecution of violators,
- employee training and awareness,
- implementation of state regulations and restrictions,
- contacts with Refuge cooperators and neighbors, and
- maintenance of a fuel break and/or blackline around headquarters each spring.

Fire Critiques and Annual Plan Review

Fire Critiques

Wildland fires with be critiqued by the IC. The FMO will conduct formal fire critiques in the event of:

- significant injury/accident.
- significant property or resource damage.
- significant safety concerns are raised.
- an extended attack is necessary.

Annual Fire Summary Report

The Zone AFMO will be responsible for completing an annual fire summary report that will contain the number of fires by type, acres burned by fuel type, cost summary (prescribed burns and wildland fires), personnel utilized, and fire effects.

Annual Fire Management Plan Review

The Fire Management Plan will be reviewed annually. Necessary updates or changes will be accomplished prior to the upcoming fire season. Any additions, deletions, or changes will be reviewed by the Refuge Manager to determine if such alterations warrant a re-approval of the plan.

Consultation and Coordination

Numerous agencies, organizations and/or individuals were consulted in the course of developing the fire management program for Stone Lakes NWR. All fire management program activities will continue to be implemented in cooperation and coordination with federal, state, county, and local agencies. Other agencies and organizations will be consulted as needed. General program consultation and coordination will be sought from the Regional Fire Management Coordinator, Regional Prescribed Fire Specialist, and the National Interagency Fire Center (NIFC).

During the planning process for establishment of the Refuge in the early 1990s, the Service received over 6,000 public comments in the form of letters, petitions and received input from the public in the course of 24 public meetings. In the course of this public involvement, there were numerous opportunities to comment on the full range of potential Refuge habitat management approaches, including use of fire.

In the course of finalizing the Cooperative Agreement with the Elk Grove Community Services District, Refuge staff attended two public district meetings and solicited input on the Refuge fire management program. As part of the pre-planning process for prescribed burns conducted in 1999 and 2000, the Refuge provided public notices to several local newspapers. No comments on these notices were received and no opposition to prescribed burning was conveyed to the Refuge. Rather, support for the use of prescribed fire has been communicated to Refuge staff by adjacent private landowners on several occasions.

Service and Refuge fire planning staff have also hosted a number of meetings with staff of the Sacramento Metropolitan Air Quality Management District, the California Air Resources Board, and the Sacramento County Agricultural Commission. At these meeting, these entities expressed their support for the goals of the Refuge fire program and agreed to cooperate during its implementation. Coordination meetings with these agencies will be held by Refuge staff on an annual basis.

Since some fire management activities occur on lands owned by Sacramento County Department of Regional Parks, Recreation and Open Space and California Department of Parks and Recreation which are managed as part of Stone Lakes NWR through cooperative agreement, the Service will continue ongoing coordination and consultation with those agencies, as needed.

Roddy Baumann, Prescribed Fire Specialist, Pacific Region, USFWS, Portland, OR.

Michael Brady, Wildlife Biologist, Stone Lakes NWR, Elk Grove, CA

Michael Durfee, Prescribed Fire Specialist, Walkill NWR, Sussex, NJ

Kenneth Fuller, Fish and Wildlife Biologist, Sacramento Fish and Wildlife Office, Sacramento, CA

Richard Hadley, Assistant Refuge Supervisor, California/Nevada Operations, Sacramento, CA

Amanda McAdams, Fire Planner, Pacific Region, USFWS, Portland, OR.

Vince Nyvall, Sacramento County Agricultural Commissioner, Sacramento, CA

David Paullin, Refuge Supervisor, California-Nevada Operations Office, Sacramento, CA

Roger Wong, Zone Fire Management Officer, San Luis NWRC, Los Banos, CA

Appendices

Appendix C.1: References Cited

Sacramento County and U.S. Fish and Wildlife Service. February 1999. Cooperative Agreement for Grassland Management on the North Stone Lake Wildlife Refuge and Notice of Exemption. 8 pp.

Elk Grove Fire Protection District. 1998. Cooperative Agreement with U.S. Fish and Wildlife Service. 3 pp.

EA Engineering, Science, and Technology. 1990. Draft Land Use and Management Plan for the Proposed North Stone Lake Wildlife Refuge. Prepared for: Sacramento County Department of Parks and Recreation. 27 pp.

Hart, J. A. and U.S. Fish and Wildlife Service. In Draft. North Stone Lake Restoration and Management Master Plan. HART Inc. Prepared for Sacramento County, Department of Regional Parks, Recreation and Open Space.

Tremaine, K. 1994. Preliminary observations on lacustrine adaptation in the Central Valley, California. Paper presented at the 28th Annual Meeting, Society for California Archeology, Ventura, California.

U.S. Fish and Wildlife Service. 1992. Final Environmental Impact Statement with appendices for Stone Lakes National Wildlife Refuge Project, Sacramento County, California. With Technical assistance provided by Jones and Stokes, Associates, Inc. (JSA 91-047), Sacramento, California.

Tremaine and Associate. In Preparation. Archaeological Survey Report for the North Stone Lake Unit of Stone Lakes National Wildlife Refuge, Sacramento County, California.

Appendix C.2: Definitions

Agency Administrator. The appropriate level manager having organizational responsibility for management of an administrative unit. May include Director, State Director, District Manager or Field Manager (BLM); Director, Regional Director, Complex Manager or Project Leader (FWS); Director, Regional Director, Park Superintendent, or Unit Manager (NPS), or Director, Office of Trust Responsibility, Area Director, or Superintendent (BIA).

Appropriate Management Action. Specific actions taken to implement a management strategy.

Appropriate Management Response. Specific actions taken in response to a wildland fire to implement protection and fire use objectives.

Appropriate Management Strategy. A plan or direction selected by an agency administrator which guide wildland fire management actions intended to meet protection and fire use objectives.

Appropriate Suppression. Selecting and implementing a prudent suppression option to avoid unacceptable impacts and provide for cost-effective action.

Bureau. Bureaus, offices or services of the Department.

Class of Fire (as to size of wildland fires):
Class A—3 acre or less.
Class B—more than 3 but less than 10 acres.
Class C—10 acres to 100 acres.
Class D—100 to 300 acres.
Class E—300 to 1,000 acres.
Class F—1,000 to 5,000 acres.
Class G—5,000 acres or more.

Emergency Fire Rehabilitation/Burned Area Emergency Rehabilitation (EFR/BAER). Emergency actions taken during or after wildland fire to stabilize and prevent unacceptable resource degradation or to minimize threats to life or property resulting from the fire. The scope of EFR/BAER projects are unplanned and unpredictable requiring funding on short notice.

Energy Release Component (ERC). A number related to the available energy (BTU) per unit area (square foot) within the flaming front at the head of a fire. It is generated by the National Fire Danger Rating System, a computer model of fire weather and its effect on fuels. The ERC incorporates thousand hour dead fuel moistures and live fuel moistures; day to day variations are caused by changes in the moisture content of the various fuel classes. The ERC is derived from predictions of (1) the rate of heat release per unit area during flaming combustion and (2) the duration of flaming.

Extended attack. A fire on which initial attack forces are reinforced by additional forces.

Fire Suppression Activity Damage. The damage to lands, resources and facilities directly attributable to the fire suppression effort or activities, including: dozer lines, camps and staging areas, facilities (fences, buildings, bridges, etc.), handlines, and roads.

Fire effects. Any consequences to the vegetation or the environment resulting from fire, whether neutral, detrimental, or beneficial.

Fire intensity. The amount of heat produced by a fire. Usually compared by reference to the length of the flames.

Fire management. All activities related to the prudent management of people and equipment to prevent or suppress wildland fire and to use fire under prescribed conditions to achieve land and resource management objectives.

Fire Management Plan. A strategic plan that defines a program to manage wildland and prescribed fires and documents the Fire Management Program in the approved land use plan. The plan is supplemented by operational procedures such as preparedness plans, preplanned dispatch plans, prescribed fire plans and prevention plans.

Fire prescription. A written direction for the use of fire to treat a specific piece of land, including limits and conditions of temperature, humidity, wind direction and speed, fuel moisture, soil moisture, etc., under which a fire will be allowed to burn, generally expressed as acceptable range of the various fire-related indices, and the limit of the area to be burned.

Fuels. Materials that are burned in a fire; primarily grass, surface litter, duff, logs, stumps, brush, foliage, and live trees.

Fuel loadings. Amount of burnable fuel on a site, usually given as tons/acre.

Hazard fuels. Those vegetative fuels which, when ignited, threaten public safety, structures and facilities, cultural resources, natural resources, natural processes, or to permit the spread of wildland fires across administrative boundaries except as authorized by agreement.

Initial Attack. An aggressive suppression action consistent with firefighter and public safety and values to be protected.

Maintenance burn. A fire set by agency personnel to remove debris; i.e., leaves from drainage ditches or cuttings from tree pruning. Such a fire does not have a resource management objective.

Natural fire. A fire of natural origin, caused by lightning or volcanic activity.

NFDRS Fuel Model. One of 20 mathematical models used by the National Fire Danger Rating System to predict fire danger. The models were developed by the US Forest Service and are general in nature rather than site specific.
NFFL Fuel Model. One of 13 mathematical models used to predict fire behavior within the conditions of their validity. The models were developed by US Forest Service personnel at the Northern Forest Fire Laboratory, Missoula, Montana.

Prescription. Measurable criteria which guide selection of appropriate management response and actions. Prescription criteria may include safety, public health, environmental, geographic, administrative, social, or legal considerations.

Prescribed Fire. A fire ignited by agency personnel in accord with an approved plan and under prescribed conditions, designed to achieve measurable resource management objectives. Such a fire is designed to produce the intensities and rates of spread needed to achieve one or more planned benefits to natural resources as defined in objectives. Its purpose is to employ fire scientifically to realize maximize net benefits at minimum impact and acceptable cost. A written, approved prescribed fire plan must exist and NEPA requirements must be met prior to ignition. NEPA requirements can be met at the land use or fire management planning level.

Preparedness. Actions taken seasonally in preparation to suppress wildland fires, consisting of hiring and training personnel, making ready vehicles, equipment, and facilities, acquiring supplies, and updating agreements and contracts.

Prevention. Activities directed at reducing the number or the intensity of fires that occur, primarily by reducing the risk of human-caused fires.

Rehabilitation. (1) Actions to limit the adverse effects of suppression on soils, watershed, or other values, or (2) actions to mitigate adverse effects of a wildland fire on the vegetation-soil complex, watershed, and other damages.

Suppression. A management action intended to protect identified values from a fire, extinguish a fire, or alter a fire's direction of spread.

Unplanned ignition. A natural fire that is permitted to burn under specific conditions, in certain locations, to achieve defined resource objectives.

Wildfire. An unwanted wildland fire.

Wildland Fire. Any non-structure fire, other than prescribed fire, that occurs in the wildland.

Wildland Fire Situation Analysis (WFSA). A decision-making process that evaluates alternative management strategies against selected safety, environmental, social, economical, political, and resource management objectives as selection criteria.

Wildland/urban interface fire. A wildland fire that threatens or involves structures.

Appendix C.3: Compliance Documents

United States Fish and Wildlife Service
Environmental Action Statement for Categorical Exclusion

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA), and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and determined that the following proposed action is categorically excluded from NEPA documentation requirements consistent with 40 CFR 1508.4 and 516 DM 2.3A.

Proposed Action and Alternatives

The U.S. Fish and Wildlife Service (Service) proposes to adopt a Fire Management Plan for Stone Lakes National Wildlife Refuge (NWR) that will utilize fire as a habitat management tool for the maintenance and enhancement of grasslands and wetlands and reduction of hazardous fuels on the refuge. The Service currently manages 4,000 acres within the approved refuge boundary, consisting of both Service-owned properties and lands belonging to other agencies including, California Department of Transportation, Sacramento County Department of Regional Parks, Recreation and Open Space, and California Department of Parks and Recreation. The refuge supports a variety of habitats including grasslands, seasonal and permanent wetlands, and riparian woodlands. Alternate vegetation management approaches which the refuge is pursuing include livestock grazing, mowing, discing, and planting of native grasses and woody vegetation. All methods may be incorporated, to varying degrees, into the grassland and wetland management programs of the refuge, when appropriate and feasible to implement. For example, a successful domestic livestock grazing program has been in place on the 2,600-acre North Stone Lake unit and Gallagher property within the refuge for three years and will continue to be utilized. However, the refuge has determined that fire should continue to be utilized for restoration of native grass communities and hazardous fuel reduction due to it's cost effectiveness and since not all refuge properties are suitable for the alternative vegetation techniques.

Categorical Exclusion(s)

The specific categorical exclusions from NEPA allowing for this action pursuant to 516 DM 2.3A (2) are:

B.(4) The use of prescribed burning for habitat improvement purposes, when conducted in accordance with local and State ordinances and laws.

B.(5) Fire management activities, including prevention and restoration measures, when conducted in accordance with departmental and Service procedures.

Permits/Approvals

In accordance with Service policy, a Prescribed Burn Plan will be prepared and approved by the Project Leader prior to conducting a prescribed burn.

An Agricultural Burn Permit will be obtained from the Sacramento County Agricultural Commission on behalf of the Sacramento Metropolitan Air Quality Management District. Stone Lakes NWR has also entered into a cooperative agreement with the Elk Grove Fire Protection District (District). In accordance with this agreement, the refuge is required to provide copies of Prescribed Burn Plans to the District in advance of any prescribed burning. The Service must also acquire a District radio prior to prescribed burn.

Service Endangered Species Division staff from the Sacramento Fish and Wildlife Office were informally consulted on the refuge grassland habitat management program including the use of fire as a management tool. As result of this consultation, the refuge Project Leader determined this management program will have "no affect" on listed, proposed, and/or candidate species or designated critical habitat.

Due to the presence of a number of cultural resource sites within the refuge boundary, ongoing coordination and consultation to ensure protection of these sites will continue, as needed, between refuge staff and the State Historic Preservation Office, California Native American Heritage Commission, local tribal representatives, and private archaeological consultants. All refuge lands have been surveyed and known historic properties delineated. Archaeological specialists and local Native American representatives are annually consulted in the planning of refuge habitat management activities to ensure that all responsibilities under Section 106 of the National Historic Preservation Act are satisfied.

Public Involvement/Interagency Coordination

During the planning process for establishment of Stone Lakes NWR (U.S. Fish and Wildlife Service 1992), the Service received over 6000 public comments in the form of letters, petitions and received input from the public in the course of 24 public meetings. In the course of this public involvement, there were numerous opportunities to comment on the full range of potential refuge habitat management approaches, including use of fire.

In the course of finalizing a cooperative agreement with the Elk Grove Fire Protection District, refuge staff attended two public district meetings and solicited input on the refuge fire management program. As part of the pre-planning process for prescribed burns conducted in 1999 and 2000, the refuge provided public notices to several local newspapers. No comments on these notices were received and no opposition to prescribed burning was conveyed to the refuge. Rather, support for the use of prescribed fire has been communicated to refuge staff by adjacent private landowners on several occasions.

Service and refuge fire planning staff have also hosted a number of meetings with staff of the Sacramento Metropolitan Air Quality Management District, the California Air Resources Board, and the Sacramento County Agricultural Commission. At these meeting, these entities expressed their support for the goals of the refuge fire program and agreed to cooperate during its implementation. Coordination meetings with these agencies will be held by refuge staff on an annual basis.

Since some fire management activities occur on lands owned by Sacramento County Department of Regional Parks, Recreation and Open Space and California Department of Parks and Recreation which are managed as part of Stone Lakes NWR through cooperative management agreement, the Service will continue ongoing coordination and consultation with those agencies, as needed.

Supporting Documents

Sacramento County and U.S. Fish and Wildlife Service. February 1999. Cooperative Agreement for Grassland Management on the North Stone Lake Wildlife Refuge and Notice of Exemption. 8 pp.

Elk Grove Fire Protection District. 1998. Cooperative Agreement with U.S. Fish and Wildlife Service. 3 pp.

EA Engineering, Science, and Technology. 1990. Draft Land Use and Management Plan for the Proposed North Stone Lake Wildlife Refuge. Prepared for: Sacramento County Department of Parks and Recreation. 27 pp.

Hart, J. A. and U.S. Fish and Wildlife Service. In Draft. North Stone Lake Restoration and Management Master Plan. HART Inc. Prepared for Sacramento County, Department of Regional Parks, Recreation and Open Space.

Tremaine, K. 1994. Preliminary Observations on lacustrine adaption in the Central Valley, California. Paper presented at the 28th Annual Meeting, Society for California Archeology, Ventura, California.

U.S. Fish and Wildlife Service. 1992. Final Environmental Impact Statement with appendices for Stone Lakes National Wildlife Refuge Project, Sacramento County, California. With Technical assistance provided by Jones and Stokes, Associates, Inc. (JSA 91-047), Sacramento, California.

Tremaine and Associate. In Preparation. Archaeological Survey Report for the North Stone Lake Unit of Stone Lakes National Wildlife Refuge, Sacramento County, California.

_____ _____

Project Leader
Stone Lakes National Wildlife Refuge

Date

Appendix C.4: Cooperative Agreements

Cooperative Agreement for Grassland Management on North Stone Lake Wildlife Refuge

THIS AGREEMENT is made and entered into by and between the United States Fish and Wildlife Service, an executive agency of the United States Department of The Interior (hereinafter referred to as "Service"), and the County of Sacramento (hereinafter referred to as "County").

R E C I T A L S:

WHEREAS, the Service and the County share a common interest in protecting, enhancing, and managing habitat for the benefit of migratory birds and other wildlife and native plan communities; and

WHEREAS, this agreement allows for the limited interchange of services, personnel, equipment, facilities, and funds; and provides for the long term management and administration of the lands which as of the date of this agreement constitute the North Stone Lake Wildlife Refuge in South Sacramento County; and

WHEREAS, this Cooperative Agreement is made and entered into under the following authorities of the Parties, among others:

A. Service:
Section 1 of the Fish and Wildlife Coordination Act (48 Stat/401 as amended; (6 U.S.C. 661 et seq.), Section 7 of the Fish and Wildlife Act of 1956, 16 U.S.C. 742f (a)(4), and the Migratory Bird Conservation Act (45 Stat. 1222).

B. County:
Government Code, Section 23004. Board of Supervisors Resolution No. _____ dated _____; and

WHEREAS, the County, as landowner of 1,567 acres of the North Stone Lake Wildlife Refuge, desires to enable the long term protection, care, regulation, administration, enhancement, and management of these lands by making available the herein described land base; and

WHEREAS, the Service as designated land manager, desires to secure through established wildlife refuge management practices the long term protection, care, regulation, administration, enhancement, and management of these lands; and

WHEREAS, the purpose and objective of this Cooperative Agreement is to establish a framework for the management and administration of the property subject to this Agreement consistent with the goals and objectives of the "Grasslands" chapter of the Draft North Stone Lake Restoration and Management Master Plan (hereinafter referred to as "Management Plan") and as a component of and consistent with the native plant restoration goals of Stone Lakes National Wildlife Refuge.

NOW, THEREFORE, in consideration of the mutual promises and covenants hereinafter set forth the parties agree as follows:

Section 1. APPLICATION. This Cooperative Agreement applies to the administration and management of the following lands, which are collectively referred to herein as "property subject to this Agreement" (See Map, Figure A);

All portions of the County's existing holdings in the vicinity of North Stone Lake, known as the North Stone Lake Wildlife Refuge (Assessors Parcel Numbers: 119-230-20,48,49; 132-010-54-58,64,65,68,69; 132-120-24-26; 132-131-27,28), hereinafter referred to as "the Refuge", in Sacramento County as of the date of this Agreement.

Section 2. PURPOSE. Service agrees that it will manage the grasslands on the Refuge in a manner consistent with the goals and objectives of the "Grasslands" chapter of the Management Plan and the native plant restoration goals described in the Final Environmental Impact Statement for Stone Lakes National Wildlife Refuge (May 1992).

Section 3. LIMITATIONS. In the event that the Management Plan is ultimately approved by the County, the Service agrees to abide by the "Grasslands" chapter of such plan.

Section 4. COOPERATIVE AGREEMENT ADMINISTRATORS. The parties agree to appoint the following project officers, or their designees, to coordinate the implementation of this Cooperative Agreement:

The County of Sacramento:
Director
Department of Regional Parks, Recreation and Open Space
3711 Branch Center Road
Sacramento, California 95827
Phone: (916) 366-2932; 366-2950 (fax)

The U.S. Fish and Wildlife Service:
Project Leader
Stone Lakes National Wildlife Refuge
2233 Watt Avenue, Suite 230
Sacramento, California 95825
Phone: (916) 979-2085; 979-2058 (fax)

Section 5. SERVICE OBLIGATIONS. The Service, as designated on-site land manager, shall:

A. develop a grassland management strategy for the Refuge, select a qualified grazing permittee, and in consultation with the County, oversee implementation of a cooperative land management agreement with the grazing permittee. The cooperative land management agreement will identify: the season of use, stocking rate, estimated animal unit months (AUM), the rate charged per AUM, and a program for the control of noxious weeds as defined by the County Agricultural Commissioner;

B. provide necessary staff, commensurate with available funding, to pursue the goals of Stone Lakes National Wildlife Refuge; related to grassland management and habitat protection and enhancement;

C. provide expertise in planning and consulting on habitat enhancement activities including securing of funds to implement improved management of the Refuge;

D. coordinate any law enforcement activities on the Refuge with County law enforcement authorities;

E. prepare and present for review by the Sacramento County Recreation and Park and Fish and Game Commission, an annual report for the previous year and an annual work plan for the current year summarizing Service management of the Refuge;

F. not permit hunting nor the possession or discharge of firearms on the Refuge pursuant to County Ordinances;

G. protect any cultural resources on the Refuge from routine maintenance and other activities pursuant to Section 106 of the National Historic Preservation Act and the California Public Resources Code Section 5097.5 and 5097.9 et seq; and

H. manage the Refuge as part of the National Wildlife Refuge System, as directed in Title 50, United States Code, as well as other laws, regulations and policies for the administration of the National Wildlife Refuge System.

Section 6. COUNTY OBLIGATIONS. The County, as landowner, shall:

A. provide the necessary land base as described by the aforementioned Refuge for the purposes of accomplishing the goals described in this Cooperative Agreement and in the "Grasslands" chapter of the Management Plan; and

B. allow the Service with the agreement of the County, to exercise flexibility in requiring the permittee to perform a variety of maintenance and management tasks on the property subject to this Agreement in lieu of providing grazing fees to the County.

Section 7. SPECIAL PROVISIONS. The Service and the County further agree:

A. to provide neighboring landowners and reclamation districts with advance notification of any proposed physical modification of the property subject to this Agreement; notification will be the responsibility of the party proposing the modification and any modification must comply with the Sacramento County Water Resources Division Flood Management Plan and not result in any net loss in flood plain storage;

B. that in the event the County proposes to establish a habitat mitigation bank or mitigation site on the Refuge, consistent with the Management Plan, the Service agrees, consistent with Service mitigation policy, to cooperate in the creation of said mitigation site in conformance with a Habitat Restoration Program as adopted by the Sacramento County Department of Regional Parks, Recreation and Open Space. Any funds generated from the sale of mitigation credits will go to the Sacramento County Department of Regional Parks, Recreation and Open Space Trust Fund and not back to management of the Refuge;

C. to meet at least semi-annually. The Stone Lakes National Wildlife Refuge Project Leader shall be responsible for scheduling meetings in this regard;

D. that nothing herein shall be considered as obliging the Service or the County to expend funds or otherwise obligate the Service or County for the future payment of money in excess of appropriations authorized by law and administratively allocated for the provisions of this Agreement;

E. to recognize each other's interests as parties to this Agreement and the development of the Refuge in public media releases, public signs, and promotional materials where such acknowledgment is appropriate; and

F. to administer the grassland and refuge management programs on the property so that traditional and historic agricultural practices on adjacent properties can continue. In the event of a conflict between this program and adjacent agriculture, an adequate buffer zone will be established on the Refuge in consultation with the County Agricultural Commissioner.

G. to continue to recognize and allow historic drainage flows into the Stone Lakes Slough from neighboring reclamation districts.

Section 8. FUNDING. Revenues resulting from use of the property subject to this Agreement, such as those generated by grazing, will go back for use on the Refuge for maintenance, security, capital improvements for the grassland management program, management, enhancement, and other operations. Any revenues that may result that are not applied back to the Refuge will be deposited in the Sacramento County Department of Regional Parks, Recreation and Open Space Trust Fund.

Section 9. TERMINATION. Either party may terminate this Agreement by providing to the other written notice of such termination one year prior to the date such termination is to take effect. The County may immediately suspend this agreement in the event of a health or safety emergency or other related cause as determined by the Director of the Sacramento County Department of Regional Parks, Recreation and Open Space.

Section 10. MODIFICATIONS. Modifications to the Agreement may be proposed by either party but no modification or amendment to this Agreement shall be effective unless in writing and executed by both parties.

Section 11. NOTICES. Any notice required or authorized to be given pursuant to this Agreement shall be deemed delivered twenty-four (24) hours after being deposited, postage prepaid, in the United States Post and addressed in the manner set forth in Section 4 hereof.

Section 12. EXECUTION. This Cooperative Agreement is executed in three (3) copies, each of which is to be considered an original.

Section 13. ELECTED OFFICIALS NOT TO BENEFIT. No member of or delegate to the Congress or resident commissioner shall be entitled to any share or part of this Management Agreement or to any benefit that may arise from it.

Section 14. EFFECTIVE DATE. This Agreement shall become effective upon being executed by the Parties and remain in effect for a period of five (5) years from the date of initiation of a cooperative land management agreement with the grazing permittee, but not to exceed six (6) years, unless terminated prior to that time by either of the parties, or until such time as the County ultimately approves the Management Plan and the terms of this Agreement are revisited.

EXECUTED THIS _____ DAY OF _____, 1998, in Sacramento, County, California.

"Service"
U.S. FISH AND WILDLIFE SERVICE

_____ _____
Name Title

_____
Signature

Contract Sufficiency Review (U.S. Fish and Wildlife Service):

_____ Date: _____
Signature

_____
Title

"County"
COUNTY OF SACRAMENTO - BOARD OF SUPERVISORS

_____ _____
Name Title

_____
Signature

ATTEST:

_____
Clerk of the Board of Supervisors

DEPARTMENT OF REGIONAL PARKS, RECREATION AND OPEN SPACE

_____ _____
Name Title

_____
Signature

Cooperative Agreement Between the U.S. Fish and Wildlife Service and the Elk Grove Fire Protection District

I. INTRODUCTION

The U.S. Fish and Wildlife Service (hereinafter referred to as the Service), an agency of the Federal Government, is primarily responsible for the welfare and protection of lands, structures and wildlife within the boundaries of National Wildlife Refuge (hereinafter referred to as the Refuge). Because wildfires sometime threaten to damage those resources, and local fire districts have historically provided fire protection assistance to the Refuges, the Service desires to enter an agreement with the Elk Grove Fire Protection District (hereinafter referred to as the District) which will formalize responsibilities of both parties and provide for remuneration to the District for fire suppression services rendered.

II. AUTHORITY

The Service enters into agreement under the authority of the "Protection Act of September 20, 1922", (42 Stat.857; 16 USC 594), the "Reciprocal Fire Protection Act of May 27, 1955"60 Stat.66, 67; 42 USC 1856, 1856a and b" and 31 USC 6305 (Cooperative Agreements).

III. PURPOSE

The purpose of this agreement is to provide fire protection services to those portions of National Wildlife Refuge within the boundaries of the Fire Protection District and to remunerate the District for costs incurred in providing fire suppression services to those lands.

IV. TERMS OF AGREEMENT

This agreement shall become effective upon being executed by both parties and shall remain in effect through December 31, 2005. This agreement terminates and supersedes any previous agreements between the District and the Service.

V. SPECIFIC OBLIGATIONS OF THE PARTIES

A. The Service shall:

1. Delegate authority to the District as necessary to put the Fire Chief or his delegate in Unified command of the fire fighting effort.
2. Provide manpower and/or equipment, as available, to assist the District in fighting fires on or adjacent to Service lands when so requested by the District.
3. Provide funds (as indicated in Section VII, herein) for fire suppression services.
4. Make arrangements with the Elk Grove Fire Department to borrow a portable 800 MHz radio, until such time that the Service changes over to these frequencies.
5. All prescribe burns will require there own burn plan and be conducted in accordance to NWCG rules and guidelines and will be sent to Elk Grove Fire Chief no later than 14 days before the actual burn date.

B. The District shall:

1. Provide, as available, manpower and equipment necessary to suppress wildland and structural fires on Service lands within the District's jurisdiction.
2. Respond as quickly as possible when asked to suppress any such fire on Service lands.

VI. PROJECT OFFICERS

A. The Service's project officer shall be:

Refuge Manager - Stone Lakes National Wildlife Refuge
2233 Watt Ave. Suite 230
Sacramento, CA 95825
916-979-2086

VII. FUNDING

A. The Service agrees to pay the District for actual fire suppression costs incurred by the District while suppressing fires on Refuge lands. Reimbursement to be claimed by the District (as determined by the District and approved by the Service) shall include:
   1. Salaries and wages for District personnel used to suppress a fire. Reimbursement for the salary or wage of any employee shall be computed on the direct daily or hourly wage of that employee, including both actual overtime payments and related employee benefit cost
   2. The actual cost to the District for use of personnel from other agencies, and for paid "pickup" labor used to suppress a fire.
   3. The actual cost to the District for food services, transportation, and sleeping accommodations for personnel engaged in suppressing a fire.
   4. The actual equipment operation costs expended by the District to suppress a fire. These costs shall be calculated using an hourly or mileage based rate for each class of equipment or vehicle.
   5. The total cost to the District for equipment rented to suppress a fire.
   6. Replacement or repair costs to the District for equipment and tools damaged, destroyed or lost as a result of a fire. However, any such claim shall be reduced by any salvage value and be based on the depreciated value of such equipment and tools prior to the fire, as determined by the District. Furthermore, the District shall eliminate from said claims any costs directly attributable to the negligence of District personnel operating the equipment or tool.
   7. Costs will include direct expenditures, as well as indirect or administrative costs.
   8. Fire Cost Reimbursement Tables for manpower and equipment are attached as Appendix A, and the District will update these costs annually.

B. Reimbursement to the District for fires which burn onto the Refuge from adjacent property shall be based on the percentage of the total acres burned that were actually within the Refuge.

C. Reimbursement to the District for fire suppression on lands in accordance with this agreement may not exceed $50,000 per response or $150,000 per fiscal year without further approval of the Refuge Manager .

D. Reimbursement will be made to the District within 60 days of receiving the District's invoice for suppression costs. Each payment will be made to the District at the address listed above.

E. All invoices prepared by the District should be submitted to the Refuge Manager at the address listed above.

VIII. SPECIAL PROVISIONS

A. This agreement shall not affect the rights of any party to recover suppression costs and/or damages sustained as a result of the negligent or willful act of any person causing a fire.

B. No party shall be liable to any other for loss, damage, personal injury or death occurring in consequence of the performance of this agreement, except as provided herein.

C. Both parties may work jointly on fire trespass investigations. Fire law enforcement reports may be prepared independently.

D. Copies of fire reports shall be mutually provided to the other agency as soon as possible.

IX. GENERAL PROVISIONS

The U.S. Office of Management and Budget Circular numbers: 87, 102 and 128; shall be applicable to this agreement and are incorporated herein as Attachments 1,2 and 3.

X. AMENDMENTS

Amendment to this agreement may be proposed by either party and shall become effective upon being reduced to a written document executed by both parties.

XI. TERMINATION

This agreement may be terminated in whole or in part when all parties agree that the continuation of the agreement would not produce satisfactory results. The parties shall agree upon the termination conditions including the effective date and, in the case of partial terminations, the portion to be terminated. The parties shall not incur new obligations after the effective date of termination, and shall cancel as many outstanding obligations as possible. The Service shall allow full credit to the other parties for the Federal share of non-cancelable obligations properly incurred by the other parties prior to termination.

U.S. Fish and Wildlife Service - Stone Lakes National Wildlife Refuge

_____ _____

Signature Date

_____

Title

Elk Grove Fire Protection District

_____ _____

Signature Date

_____

Title

Sufficiency Review:

U.S. Fish and Wildlife Service

_____ _____

Signature Date

_____

Title

Appendix C.5: Species List

Stone Lakes NWR Reptiles

Common Name	Scientific Name	Habitat	Sp	S	F	W
Class AMPHIBIA (amphibians) Order ANURA						
Family BUFONIDAE (true toads)						
western toad	*Bufo boreas*	msrg	r	r	r	r
Family HYLIDAE (tree frogs and relatives)						
pacific treefrog	*Pseudacris regilla*	rm	c	c	c	r
Family RANIDAE (true frogs)						
bullfrog	*Rana catesbeiana*	omr	c	c	c	r
Class REPTILIA (reptiles) Order SQUAMATA (lizards and snakes)						
Family ANGUIDAE (alligator lizards and relatives)						
southern alligator lizard	*Elgaria multicarinata*	rg	r	r	r	r
Family COLUBRIDAE (Colubrids)						
western yellowbelly racer	*Coluber constrictor mormon*	rg	u	c	u	r
common kingsnake	*Lampropeltis getula*	sg	u	c	u	r
gopher snake	*Pituophis catenifer*	sg	u	c	u	r
elegant garter snake	*Thamnophis elegans*	sm	u	c	u	r
giant garter snake	*Thamnophis gigas*	msrg	r	r	r	r
common garter snake	*Thamnophis sirtalis*	sm	u	c	u	r
Family PHRYNOSOMATIDAE (North American spiny lizards)						
western fence lizard	*Sceloporus occidentalis*	sg	c	c	c	c
Order TESTUDINES (turtles)						
Family EMYDIDAE (box and water turtles)						
western pond turtle	*Clemmys marmorata* (syn. *Emys marmorata*)	om	u	u	u	r
red-eared slider	*Trachemys scripta*	om	u	u	u	u

Stone Lakes NWR Mammals

Common Name	Scientific Name	Habitat	Sp	S	F	W
Order ARTIODACTYLA (even-toed hoofed animals)						
Family CERVIDAE (deer, moose, reindeer, elk)						
black-tailed deer	*Odocoileus hemionus*	rsg	r	r	r	r
Order CARNIVORA (meat-eaters)						
Family CANIDAE (coyotes, dogs, foxes, jackals and wolves)						
coyote	*Canis latrans*	wide	c	c	c	c
gray fox	*Urocyon cinereoargenteus*	gr	o	o	o	o
Family FELIDAE (cats)						
feral house cat	*Felis catus*	rgu	c	c	c	c
Family MEPHITIDAE (skunks and stink badgers)						
striped skunk	*Mephitis mephitis*	wide	u	u	u	u
Family MUSTELIDAE (badgers, otters, weasels and relatives)						
river otter	*Lontra canadensis*	or	c	c	c	c
mink	*Mustela vison*	om	o	o	o	o
Family PROCYONIDAE (coatis, raccoons, lesser pandas)						
raccoon	*Procyon lotor*	mr	c	c	c	c
Order CHIROPTERA (bats)						
Family MOLOSSIDAE (free-tailed bats)						
guano bat	*Tadarida brasiliensis*	r	r	r	r	r
Order DIDELPHIMORPHIA (American marsupials)						
Family DIDELPHIDAE (opossums)						
virginia opossum	*Didelphis virgiana*	r	c	c	c	c
Order INSECTIVORA (insect-eaters)						
Family Soricidae (shrews)						
ornate shrew	*Sorex ornatus*	msg	r	r	r	r
Order LAGOMORPHA (pikas, hares and rabbits)						
Family LEPORIDAE (hares and rabbits)						
black-tailed jackrabbit	*Lepus californicus*	sg	c	c	c	c
desert cottontail	*Sylvilagus audubonii*	g	c	c	c	c
Order RODENTIA (gnawing mammals)						
Family CASTORIDAE (beavers)						
beaver	*Castor canadensis*	mr	a	a	a	a
Family CRICETIDAE (New World rats and mice, voles, hamsters and relatives)						
California vole	*Microtus californicus*	gr	c	c	c	c
muskrat	*Ondatra zibethicus*	om	c	c	c	c
deer mouse	*Peromyscus maniculatus*	rg	u	u	u	u
western harvest mouse	*Reithrodontomys megalotis*	msg	u	u	u	u

Common Name	Scientific Name	Habitat	Sp	S	F	W
Family GEOMYIDAE (gophers)						
Botta's Pocket Gopher	*Thomomys bottae*	g	u	u	u	u
Family MURIDAE (Old World mice, rats)						
house mouse	*Mus musculus*	sgru	u	u	u	u
Norway rat	*Rattus norvegicus*	sgru	u	u	u	u
black rat	*Rattus rattus*	sgru	u	u	u	u
Family SCIURIDAE (chipmunks, squirrels, marmots)						
western gray squirrel	*Sciurus griseus*	sg	u	u	u	u
Fox Squirrel	*Sciurus niger*	rg	u	u	u	u
California ground squirrel	*Spermophilus beecheyi*	rg	u	u	u	u

Stone Lakes NWR Birds

Common Name	Scientific Name	Habitat	Sp	S	F	W
Order ANSERIFORMES (waterfowl)						
Family ANATIDAE (ducks, geese and swans)						
wood duck*	*Aix sponsa*	osr	c	c	c	c
greater white-fronted goose	*Anser albifrons*	oga	o	-	u	c
northern pintail	*Anas acuta*	s	u	r	c	c
american wigeon	*Anas americana*	s	c	-	c	a
northern shoveler	*Anas clypeata*	s	a	r	u	a
green-winged teal	*Anas crecca*	s	c	-	c	c
cinnamon teal*	*Anas cyanoptera*	msg	c	o	o	c
blue-winged teal	*Anas discors*	s	r	-	r	r
eurasian wigeon	*Anas penelope*	s	-	-	-	r
mallard*	*Anas platyrhynchos*	msg	a	a	a	a
gadwall*	*Anas strepera*	msg	c	r	r	c
lesser scaup	*Aythya affinis*	os	u	-	-	u
redhead	*Aythya americana*	os	r	-	-	r
ring-necked duck	*Aythya collaris*	os	o	-	-	c
greater scaup	*Aythya marila*	os	-	-	-	#
canvasback	*Aythya valisineria*	os	r	-	-	c
bufflehead	*Bucephala albeola*	os	o	-	-	c
common goldeneye	*Bucephala clangula*	os	-	-	-	u
barrow's goldeneye	*Bucephala islandica*	os	-	-	-	#
canada goose*	*Branta canadensis*	osg	o	o	o	o
snow goose	*Chen caerulescens*	osga	-	-	-	r
ross' goose	*Chen rossii*	osga	-	-	-	r
tundra swan	*Cygnus buccinator*	osa	-	-	-	o
hooded merganser	*Lophodytes cucullatus*	os	r	-	-	o
common merganser	*Mergus merganser*	os	r	-	-	r
ruddy duck*	*Oxyura jamaicensis*	os	o	r	r	o
Order APODIFORMES (swifts and hummingbirds)						
Family APODIDAE (swifts)						
white-throated swift	*Aeronautes saxatalis*	a	r	r	r	r
Vaux's swift	*Chaetura vauxi*	a	r	-	r	-
Family TROCHILIDAE (hummingbirds)						
black-chinned hummingbird*	*Archilochus alexandri*	r	r	r	u	-
Anna's hummingbird*	*Calypte anna*	r	c	c	c	u
Rufous/Allen's hummingbird	*Selasphorus rufus*	r	-	-	r	-
Order CHARADRIIFORMES (shorebirds)						
Family CHARADRIIDAE (plovers and lapwings)						
semipalmated plover	*Charadrius semipalmatus*	s	r	-	r	-
killdeer*	*Charadrius vociferus*	wide	a	a	a	a

Common Name	Scientific Name	Habitat	Sp	S	F	W
black-bellied plover	*Pluvialis squatarola*	s	o	-	u	c
Family LARIDAE (gulls and terns)						
black tern	*Chlidonias niger*	osa	#	-	-	-
herring gull	*Larus argentatus*	osa	o	-	-	c
California gull	*Larus californicus*	osa	o	r	c	c
Mew Gull	*Larus canus*	osa	#	-	r	r
ring-billed gull	*Larus delawarensis*	osa	o	-	c	c
Thayer's gull	*Larus glaucoides*	osa	-	-	#	-
Bonaparte's gull	*Larus philadelphia*	osa	-	r	r	#
Caspian tern*	*Sterna caspia*	osa	o	r	o	-
Forster's tern	*Sterna forsteri*	osa	c	r	r	o
Family RECURVIROSTRIDAE (avocets and stilts)						
black-necked stilt*	*Himantopus mexicanus*	s	c	o	c	c
american avocet*	*Recurvirostra americana*	s	o	u	o	o
Family SCOLOPACIDAE (sandpipers and phalaropes)						
spotted sandpiper	*Actitis macularius*	s	o	r	o	o
ruddy turnstone	*Arenaria interpres*	s	#	-	-	-
sanderling	*Calidris alba*	s	#	-	-	-
dunlin	*Calidris alpina*	s	c	-	a	a
baird's sandpiper	*Calidris bairdii*	s	-	-	#	-
western sandpiper	*Calidris mauri*	s	c	-	c	o
pectoral sandpiper	*Calidris melanotos*	s	-	-	#	-
least sandpiper	*Calidris minutilla*	s	c	o	c	a
semipalmated sandpiper	*Calidris pusilla*	s	-	-	r	-
willet	*Catoptrophorus semipalmatus*	s	#	-	-	-
common snipe	*Gallinago delicata*	s	u	r	o	c
short-billed dowitcher	*Limnodromus griseus*	s	-	#	-	-
long-billed dowitcher	*Limnodromus scolopaceus*	s	c	-	c	c
whimbrel	*Numenius phaeopus*	sga	o	-	r	-
long-billed curlew	*Numenius americanus*	sga	o	r	o	o
red-necked phalarope	*Phalaropus lobatus*	s	r	-	r	-
wilson's phalarope*	*Phalaropus tricolor*	s	o	r	r	-
ruff	*Philomachus pugnax*	s	#	-	-	-
lesser yellowlegs	*Tringa flavipes*	s	o	-	o	o
greater yellowlegs	*Tringa melanoleuca*	s	c	r	c	c
solitary sandpiper	*Tringa solitaria*	s	#	-	#	-
Order CICONIIFORMES (storks, herons and relatives)						
Family ARDEIDAE (bitterns, herons and egrets)						
great blue heron*	*Ardea herodias*	wide	a	a	a	a
great egret*	*Ardea alba*	wide	a	a	a	a

Common Name	Scientific Name	Habitat	Sp	S	F	W
American bittern*	*Botaurus lentiginosus*	m	o	o	o	u
cattle egret	*Bubulcus ibis*	g	-	-	r	r
green heron*	*Butorides virescens*	mr	o	o	o	o
snowy egret*	*Egretta thula*	ms	c	u	c	c
least bittern	*Ixobrychus exilis*	m	r	r	r	-
black-crowned night-heron*	*Nycticorax nycticorax*	mr	o	o	o	o
Family CATHARTIDAE (vultures)						
turkey vulture*	*Cathartes aura*	a	a	a	a	a
Family THRESKIORNITHIDAE (ibises)						
white-faced ibis	*Eudocimus albus*	sg	o	o	o	-
Order COLUMBIFORMES (pigeons)						
Family COLUMBIDAE (doves and pigeons)						
rock dove*	*Columba livia*	u	c	c	c	c
mourning dove*	*Zenaida macroura*	wide	c	c	c	c
Order CORACIIFORMES (kingfishers and relatives)						
Family ALCEDINIDAE (kingfishers)						
belted kingfisher*	*Ceryle alcyon*	ra	c	c	c	c
Order FALCONIFORMES (diurnal birds of prey)						
Family ACCIPITRIDAE (osprey, kites, eagles and hawks)						
osprey	*Pandion haliaetus*	ra	r	r	r	-
cooper's hawk*	*Accipiter cooperii*	ra	u	u	c	c
sharp-shinned hawk	*Accipiter striatus*	ra	o	o	o	o
golden eagle	*Aquila chrysaetos*	sga	o	o	o	o
red-tailed hawk*	*Buteo jamaicensis*	wide	a	a	a	a
red-shouldered hawk*	*Buteo lineatus*	ra	a	a	a	a
rough-legged hawk	*Buteo lagopus*	mga	-	-	-	r
ferruginous hawk	*Buteo regalis*	sa	-	-	-	r
swainson's hawk*	*Buteo swainsoni*	rsga	o	c	u	-
northern harrier*	*Circus cyaneus*	msga	a	c	a	a
white-tailed kite*	*Elanus leucurus*	wide	c	c	c	c
bald eagle	*Haliaeetus leucocephalus*	a	-	-	-	#
Family FALCONIDAE (falcons)						
merlin	*Falco columbarius*	rga	r	-	-	o
prairie falcon	*Falco mexicanus*	msga	r	-	-	r
peregrine falcon!	*Falco peregrinus*	msga	r	-	r	r
american kestrel*	*Falco sparverius*	wide	a	a	a	a
Order GALLIFORMES (megapodes, curassows, pheasants, quails and relatives)						
Family PHASIANIDAE						
ring-necked pheasant*	*Phasianus colchicus*	rg	a	a	a	a
Family ODONTOPHORIDAE						
california quail*	*Callipepla californica*	rg	c	c	c	c

Common Name	Scientific Name	Habitat	Sp	S	F	W
Order GRUIFORMES (coots, cranes and rails)						
Family GRUIDAE (cranes)						
sandhill crane	*Grus canadensis*	sg	r	-	c	c
Family RALLIDAE						
American coot*	*Fulica americana*	ms	c	o	o	a
common moorhen*	*Gallinula chloropus*	m	o	o	o	o
sora*	*Porzana carolina*	m	o	o	o	o
Virginia rail*	*Rallus limicola*	m	o	o	o	o
Order PASSERIFORMES (perching birds)						
Family AEGITHALIDAE (bushtits)						
bushtit*	*Psaltriparus minimus*	r	a	a	a	a
Family ALAUDIDAE (larks)						
horned lark	*Eremophila alpestris*	g	o	-	c	c
Family BOMBYCILLIDAE (waxwings)						
cedar waxwing	*Bombycilla cedrorum*	r	u	-	u	u
Family CARDINALIDAE (grosbeaks and buntings)						
lazuli bunting*	*Passerina amoena*	r	u	u	-	-
blue grosbeak*	*Passerina caerulea*	r	u	u	-	-
black-headed grosbeak*	*Pheucticus melanocephalus*	r	c	c	-	-
Family CERTHIIDAE (creepers)						
brown creeper	*Certhia americana*	r	-	-	#	#
Family CORVIDAE (jays, magpies and crows)						
western scrub-jay*	*Aphelocoma californica*	rs	a	a	a	a
American crow*	*Corvus brachyrhynchos*	rsg	c	c	c	c
yellow-billed magpie*	*Pica nuttalli*	rsg	o	o	o	o
Family EMBERIZIDAE (towhees and sparrows)						
spotted towhee*	*Pipilo maculatus*	r	a	a	a	a
dark-eyed junco	*Junco hyemalis*	r	u	-	u	c
swamp sparrow	*Melospiza georgiana*	g	-	-	#	-
Lincoln's sparrow	*Melospiza lincolnii*	gs	u	-	-	o
song sparrow*	*Melospiza melodia*	mr	c	c	c	c
savannah sparrow	*Passerculus sandwichensis*	gs	a	-	a	a
fox sparrow	*Passerella iliaca*	r	o	-	r	o
California towhee*	*Pipilo crissalis*	r	u	u	u	u
vesper sparrow	*Pooecetes gramineus*	g	#	-	-	-
chipping sparrow	*Spizella passerina*	g	#	#	-	-
white-throated sparrow	*Zonotrichia albicollis*	gs	r	-	-	r
golden-crowned sparrow	*Zonotrichia atricapilla*	gs	r	-	c	a
white-crowned sparrow	*Zonotrichia leucophrys*	gs	r	-	c	a

Common Name	Scientific Name	Habitat	Sp	S	F	W
Family FRINGILLIDAE (finches)						
lesser goldfinch*	*Carduelis psaltria*	g	-	-	r	r
American goldfinch*	*Carduelis tristis*	g	c	c	c	c
house finch*	*Carpodacus mexicanus*	wide	a	a	a	a
pine siskin	*Carduelis pinus*	r	-	-	r	-
purple finch	*Carpodacus purpureus*	r	-	-	-	#
Family HIRUNDINIDAE (swallows)						
barn swallow*	*Hirundo rustica*	msra	c	c	c	-
cliff swallow*	*Petrochelidon pyrrhonota*	msra	a	a	o	-
northern rough-winged swallow*	*Stelgidopteryx serripennis*	msra	u	o	r	-
tree swallow*	*Tachycineta bicolor*	msra	a	a	o	r
violet-green swallow	*Tachycineta thalassina*	msra	-	-	r	-
Family ICTERIDAE (icterids)						
red-winged blackbird*	*Agelaius phoeniceus*	mg	a	a	a	a
tricolored blackbird	*Agelaius tricolor*	mg	o	o	r	r
Brewer's blackbird*	*Euphagus cyanocephalus*	us	a	a	a	a
bullock's oriole*	*Icterus bullockii*	r	u	u	-	-
hooded oriole	*Icterus cucullatus*	r	r	-	-	-
brown-headed cowbird*	*Molothrus ater*	wide	c	c	c	o
great-tailed grackle*	*Quiscalus mexicanus*	sg	r	r	r	r
western meadowlark*	*Sturnella neglecta*	g	a	a	a	a
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	m	r	r	-	-
Family LANIIDAE (shrikes)						
northern shrike	*Lanius excubitor*	gr	-	-	-	#
loggerhead shrike*	*Lanius ludovicianus*	gr	u	u	u	u
Family MIMIDAE (mockingbirds and thrashers)						
northern mockingbird*	*Mimus polyglottos*	rg	o	o	o	o
Family MOTACILLIDAE (wagtails and pipits)						
American pipit	*Anthus rubescens*	sg	c	-	u	c
Family PARIDAE (titmice)						
oak titmouse*	*Baeolophus inornatus*	r	u	u	u	u
Family PARULIDAE (warblers)						
yellow-rumped warbler	*Dendroica coronata*	r	c	-	c	a
black-throated gray warbler	*Dendroica nigrescens*	r	o	-	u	r
yellow warbler	*Dendroica petechia*	r	c	r	c	-
townsend's warbler	*Dendroica townsendi*	r	o	-	o	-
common yellowthroat*	*Geothlypis trichas*	mr	c	c	c	u
yellow-breated chat	*Icteria virens*	r	#	-	-	-
Macgillivray's warbler	*Oporornis tolmiei*	r	o	-	u	-

Common Name	Scientific Name	Habitat	Sp	S	F	W
northern waterthrush	*Seiurus noveboracensis*	m	#	-	-	-
orange-crowned warbler	*Vermivora celata*	r	c	r	c	r
Nashville warbler	*Vermivora ruficapilla*	r	r	-	r	-
Canada warbler	*Wilsonia canadensis*	r	-	#	-	-
Wilson's warbler	*Wilsonia pusilla*	r	c	-	c	-
Family PASSERIDAE (Old World sparrows)						
house sparrow*	*Passer domesticus*	u	c	c	c	c
Family REGULIDAE (kinglets)						
ruby-crowned kinglet	*Regulus calendula*	r	c	-	c	a
golden-crowned kinglet	*Regulus satrapa*	r	r	-	u	u
Family SITTIDAE (nuthatches)						
white-breasted nuthatch*	*Sitta carolinensis*	r	u	u	u	u
Family STURNIDAE (starlings)						
european starling*	*Sturnus vulgaris*	rs	a	a	a	a
Family SYLVIIDAE (gnatchatchers)						
blue-gray gnatcatcher	*Polioptila caerulea*	r	#	-	r	-
Family THRAUPIDAE (tanagers)						
western tanager	*Piranga ludoviciana*	r	u	r	u	-
Family TIMALIIDAE (babbler)						
wrentit*	*Chamaea fasciata*	r	c	c	c	c
Family TROGLODYTIDAE (wrens)						
marsh wren*	*Cistothorus palustris*	m	a	a	a	a
rock wren	*Salpinctes obsoletus*	g	#	#	#	#
house wren*	*Troglodytes aedon*	r	c	c	c	u
bewick's wren*	*Thryomanes bewickii*	mr	u	u	u	u
winter wren	*Troglodytes troglodytes*	r	-	-	-	r
Family TURDIDAE (thrushes)						
hermit thrush	*Catharus guttatus*	r	o	-	o	o
Swainson's thrush	*Catharus ustulatus*	r	o	-	o	-
varied thrush	*Ixoreus naevius*	r	-	-	r	r
mountain bluebird	*Sialia currucoides*	r	-	-	-	#
western bluebird	*Sialia mexicana*	rg	#	-	-	#
American robin*	*Turdus migratorius*	rg	c	u	c	c
Family TYRANNIDAE (flycatchers)						
olive-sided flycatcher	*Contopus cooperi*	r	r	-	o	-
western wood-pewee*	*Contopus sordidulus*	r	r	-	o	-
pacific-slope flycatcher	*Empidonax difficilis*	r	r	r	r	-
hammond's flycatcher	*Empidonax hammondii*	r	#	-	r	-
dusky flycatcher	*Empidonax oberholseri*	r	#	#	-	-
willow flycatcher	*Empidonax traillii*	r	r	-	o	-
ash-throated flycatcher*	*Myiarchus cinerascens*	rg	u	c	r	-

Common Name	Scientific Name	Habitat	Sp	S	F	W
black phoebe*	*Sayornis nigricans*	mr	a	a	a	a
say's phoebe	*Sayornis saya*	sg	-	-	u	u
tropical kingbird	*Tyrannus melancholicus*	rg	-	-	-	#
western kingbird*	*Tyrannus verticalis*	rg	u	c	-	-
Family VIREONIDAE (vireos)						
Cassin's vireo	*Vireo cassinii*	r	r	-	r	-
warbling vireo	*Vireo gilvus*	r	u	-	u	-
Hutton's vireo	*Vireo huttoni*	r	r	r	r	r
Order PELECANIFORMES (pelicans, tropicbirds, cormorants and relatives)						
Family PELECANIDAE (pelicans)						
American white pelican	*Pelecanus erythrorhynchos*	os	c	u	o	o
Family PHALACROCORACIDAE (cormorants)						
double-crested cormorant	*Phalacrocorax auritus*	o	c	c	o	c
Order PICIFORMES (woodpeckers and relatives)						
Family PICIDAE (woodpeckers)						
northern flicker*	*Colaptes auratus*	r	c	o	c	c
acorn woodpecker	*Melanerpes formicivorus*	r	-	-	-	#
Nuttall's woodpecker*	*Picoides nuttallii*	r	c	c	c	c
downy woodpecker*	*Picoides pubescens*	r	c	c	c	c
red-breasted sapsucker	*Sphyrapicus nuchalis*	r	-	-	r	r
Order PODICIPEDIFORMES (grebes)						
Family PODICIPEDIDAE (grebes)						
clark's grebe	*Aechmophorus clarkii*	o	r	r	o	o
western grebe	*Aechmophorus occidentalis*	o	r	r	o	o
horned grebe	*Podiceps auritus*	os	r	-	r	r
eared grebe	*Podiceps nigricollis*	oms	r	r	r	r
pied-billed grebe*	*Podilymbus podiceps*	oms	c	u	a	a
Order STRIGIFORMES (owls)						
Family TYTONIDAE (typical owls)						
long-eared owl	*Asio otus*	srg	-	-	-	#
short-eared owl	*Asio flammeus*	msg	-	-	-	r
burrowing owl*	*Athene cunicularia*	f	r	r	r	r
great horned owl*	*Bubo virginianus*	r	c	c	c	c
western screech-owl	*Megascops kennicottii*	r	r	r	r	r
barn owl*	*Tyto alba*	wide	c	c	c	c

Habitats: o - Open water, lakes, creeks, ponds; m - Marshes, tule and cattail stands; s - seasonal wetlands, mudflats, flooded fields; r - Riparian forests; g - Grasslands; a - Aerial, usually observed in flight; wide - Widespread, found in a variety of habitats; u - urban

Seasons: Sp - Spring, March through May; S - Summer, June through August; F - Fall, September through November; W - Winter, December through February

Abundance: a - Abundant, expected to be observed 80 to 100 percent of the time in appropriate habitat; c - Common: 60 to 80 percent; u - Uncommon: 30 to 60 percent; o - Occasionally: 10 to 30 percent; r - Rare: 0 to 10 percent; * - Birds known to nest locally; ! -Threatened/Endangered Species; # - Observed less than 10 times in the past 10 years

Stone Lakes NWR Plants

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
ACERACEAE (maple family)					
Acer negundo var. *californicum*	box elder	native	perennial	tree	dicot
ALISMATACEAE (water plantain family)					
Alisma lanceolatum	water plantain	introduced	perennial	forb/herb	monocot
Echinodorus berteroi	burhead	native	perennial	forb/herb	monocot
Sagittaria latifolia	arrowhead	native	perennial	forb/herb	monocot
ANACARDIACEAE (sumac family)					
Toxicodendron diversilobum	poison oak	native	perennial	shrub/vine	monocot
APIACEAE (carrot family)					
Daucus carota	wild carrot	introduced	biennial	forb/herb	dicot
Foeniculum vulgare	fennel	introduced	biennial, perennial	forb/herb	dicot
Scandix pecten-veneris	Venus' needle	introduced	annual	forb/herb	dicot
APOCYNACEAE (dogbane family)					
Apocynum cannabinum	indian hemp	native	perennial	forb/herb	dicot
ASCLEPIADACEAE (milkweed family)					
Asclepias fascicularis	narrow leaf milkweed	native	perennial	forb/herb	dicot
Asclepias incarnata	milkweed	native	perennial	forb/herb	dicot
ASTERACEAE (aster family)					
Achyrachaena mollis	blow-wives	native	perennial	forb/herb	dicot
Acroptilon repens	russian knapweed	introduced	perennial	forb/herb	dicot
Ambrosia psilostachya	western ragweed	native	perennial	forb/herb	dicot
Anthemis cotula	chamomile	introduced	annual	forb/herb	dicot
Artemisia douglasiana	mugwort	native	perennial	forb/herb	dicot
Aster subulatus var. *ligulatus*	southern annual saltmarsh aster	native	annual, biennial	forb/herb	dicot
Baccharis pilularis	coyote bush	native	perennial	subshrub, shrub	dicot
Bidens frondosa	nodding beggarticks	native	annual	forb/herb	dicot
Carduus pycnocephalus	italian thistle	introduced	annual	forb/herb	dicot
Centaurea solstitialis	yellow star thistle	introduced	annual	forb/herb	dicot
Matricaria discoidea (syn. *Chamomilla suaveolens*)	pineapple weed	introduced	annual	forb/herb	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
Cichorium intybus	chicory	introduced	biennial, perennial	forb/herb	dicot
Cirsium vulgare	bull thistle	introduced	biennial	forb/herb	dicot
Conyza canadensis	horseweed	native	annual, biennial	forb/herb	dicot
Coreopsis wrightii	tickseed	native	annual	forb/herb	dicot
Euthamia occidentalis	grass-leaved goldenrod	native	perennial	forb/herb	dicot
Gnaphalium luteo-album	cudweed, weedy	introduced	annual	forb/herb	dicot
Gnaphalium palustre	cudweed, everlasting	native	annual	forb/herb	dicot
Gnaphalium stramineum	cudweed, everlasting	native	annual, biennial	forb/herb	dicot
Grindelia camporum	gum plant	native	perennial	subshrub, forb/herb	dicot
Helianthus annuus	sunflower	native	annual	forb/herb	dicot
Hemizonia fitchii	fitch's tarweed	native	annual	forb/herb	dicot
Centromadia pungens (syn. *Hemizonia pungens*)	spikeweed	native	annual	forb/herb	dicot
Hesperevax caulescens	dwarf dwarf-cudweed	native	annual	forb/herb	dicot
Heterotheca grandiflora	telegraph plant	native	annual, biennial, perennial	forb/herb	dicot
Holocarpha virgata	holocarpha	native	annual	forb/herb	dicot
Hypochaeris glabra	smooth cats ear	introduced	annual	forb/herb	dicot
Hypochaeris radicata	rough cat's-ear	introduced	perennial	forb/herb	dicot
Lactuca serriola	prickly lettuce	introduced	annual, biennial	forb/herb	dicot
Lasthenia californica	California goldfields	native	annual, perennial	forb/herb	dicot
Lasthenia fremontii	Fremont's goldfields	native	annual	forb/herb	dicot
Lasthenia glaberrima	smooth goldfields	native	annual	forb/herb	dicot
Layia chrysanthemoides	tidy tips	native	annual	forb/herb	dicot
Madia elegans ssp. *vernalis*	common madia	native	annual	forb/herb	dicot
Picris echioides	bristly ox-tongue	introduced	annual	forb/herb	dicot
Psilocarphus brevissimus	wooly heads	native	annual	forb/herb	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
Psilocarphus oregonus	Oregon wooly-heads	native	annual	forb/herb	dicot
Senecio vulgaris	common groundsel	introduced	annual, biennial	forb/herb	dicot
Silybum marianum	milk thistle	introduced	annual, biennial	forb/herb	dicot
Sonchus asper ssp. *asper*	prickly sow thistle	introduced	annual	forb/herb	dicot
Sonchus oleraceus	annual sowthistle	introduced	annual	forb/herb	dicot
Xanthium spinosum	spiny cocklebur	introduced	annual	forb/herb	dicot
Xanthium strumarium	cocklebur	native	annual	forb/herb	dicot
BORAGINACEAE (borage family)					
Amsinckia menziesii var. *intermedia*	fiddleneck	native	annual	forb/herb	dicot
Heliotropium curassavicum	heliotrope	native	annual, perennial	subshrub, forb/herb	dicot
Plagiobothrys greenei	popcorn flower	native	annual	forb/herb	dicot
Plagiobothrys leptocladus	alkali popcorn flower	native	annual	forb/herb	dicot
Plagiobothrys stipitatus var. *micranthus*	stalked popcornflower	native	annual	forb/herb	dicot
Plagiobothrys stipitatus var. *stipitatus*	stalked popcornflower	native	annual	forb/herb	dicot
Plagiobothrys trachycarpus	roughfruit popcornflower	native	annual	forb/herb	dicot
BRASSICACEAE (mustard family)					
Brassica nigra	black mustard	introduced	annual	forb/herb	dicot
Brassica rapa	field mustard	introduced	annual, biennial	forb/herb	dicot
Capsella bursa-pastoris	shepherd's purse	introduced	annual	forb/herb	dicot
Cardamine oligosperma	little western bittercress	native	annual, biennnial, perennial	forb/herb	dicot
Cardaria chalepensis	lens-podded hoary-cress	introduced	perennial	shrub	dicot
Lepidium latifolium	perennial peppergrass	introduced	perennial	forb/herb	dicot
Lepidium latipes var. *heckardii*	Heckard's peppergrass	native	annual	forb/herb	dicot
Lepidium nitidum var. *nitidum*	shining pepperweed	native	annual	forb/herb	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
Raphanus raphanistrum	jointed charlock	introduced	annual, biennial	forb/herb	dicot
Raphanus sativus	wild radish	introduced	annual, biennial	forb/herb	dicot
Rorippa curvisiliqua	yellow cress	native	annual, biennial	forb/herb	dicot
CALLITRICHACEAE (water-starwort family)					
Callitriche trochlearis	water starwort	native	annual	forb/herb	dicot
CAMPANULACEAE (bellflower family)					
Downingia bicornuta var. *bicornuta*	downingia	native	annual	forb/herb	dicot
Downingia ornatissima var. ornatissima	folded calicoflower	native	annual	forb/herb	dicot
Legenere limosa	legenere	native	annual	forb/herb	dicot
CAPRIFOLIACEAE (honeysuckle family)					
Sambucus nigra (syn. *Sambucus mexicana*)	elderberry	native	perennial	shrub, tree	dicot
Symphoricarpos albus var. *laevigatus*	snowberry	native	perennial	subshrub, shrub	dicot
CARYOPHYLLACEAE (pink family)					
Cerastium glomeratum	sticky chickweed	introduced	annual	forb/herb	dicot
Silene gallica	catchfly	introduced	annual, biennial	forb/herb	dicot
Spergula arvensis ssp. *arvensis*	starwort	introduced	annual	forb/herb	dicot
Spergularia bocconii	sand-spurry	introduced	annual	forb/herb	dicot
Stellaria media	common chickweed	introduced	annual	forb/herb	dicot
CHENOPODIACEAE (goosefoot family)					
Chenopodium album	lamb's quarters	native, introduced	annual	forb/herb	dicot
Chenopodium ambrosioides	Mexican tea	introduced	annual, perennial	forb/herb, subshrub	dicot
Chenopodium multifidum	chenopodium	introduced	annual	forb/herb	dicot
Salsola tragus	russian tumbleweed	introduced	annual	forb/herb	dicot
CONVOVULACEAE (morning-glory family)					
Convolvulus arvensis	bindweed	introduced	perennial	vine, forb/herb	dicot
CRASSULACEAE (stonecrop family)					
Crassula aquatica	water pygmyweed	native	annual	forb/herb	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
CUCURBITACEAE (cucumber family)					
Marah fabaceus	manroot	native	perennial	vine, forb/herb	dicot
CUSCUTACEAE (dodder family)					
Cuscuta pentagona	dodder	native	annual, perennial	vine, forb/herb	dicot
CYPERACEAE (sedge family)					
Carex praegracilis	carex	native	perennial	graminoid	monocot
Cyperus eragrostis	sedge	native	perennial	graminoid	monocot
Cyperus erythrorhizos	redroot flatsedge	native	annual, perennial	graminoid	monocot
Cyperus esculentus	yellow nut sedge	native, introduced	perennial	graminoid	monocot
Eleocharis macrostachya	spike rush	native	perennial	graminoid	monocot
Schoenoplectus acutus (syn. *Scirpus acutus var. occidentalis*)	hardstem bulrush	native	perennial	graminoid	monocot
Schoenoplectus mucronatus (syn. *Scirpus mucronatus*)	bog bulrush	introduced	perennial	graminoid	monocot
Scirpus robustus	alkali bull rush	native	perennial	graminoid	monocot
Schoenoplectus glaucus (syn. *Scirpus tuberosus*)	scirpus	introduced	perennial	graminoid	monocot
EUPHORBIACEAE (spurge family)					
Chamaesyce maculata	spotted sandmat	native	annual	forb/herb	dicot
Eremocarpus setigerus	turkey mullin, doveweed	native	annual	forb/herb	dicot
FABACEAE (pea family)					
Glycyrrhiza lepidota	wild licorice	native	perennial	forb/herb	dicot
Lotus corniculatus	trefoil	introduced	perennial	forb/herb	dicot
Lotus unifoliolatus var. unifoliolatus (syn. *Lotus purshianus* var. *purshianus*)	lotus	native	annual	forb/herb	dicot
Lupinus albifrons var. *albifrons*	lupine	native	perennial	subshrub, shrub	dicot
Lupinus bicolor	annual lupine	native	annual	forb/herb	dicot
Medicago polymorpha	California burclover	introduced	annual, perennial	forb/herb	dicot
Medicago sativa	alfalfa	introduced	annual, perennial	forb/herb	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
Melilotus alba	white sweetclover	introduced	annual, biennnial, perennial	forb/herb	dicot
Melilotus indica	yellow sweetclover	introduced	annual	forb/herb	dicot
Trifolium depauperatum var. *depauperatum*	balloon clover	native	annual	forb/herb	dicot
Trifolium dubium	hopclover, shamrock	introduced	annual	forb/herb	dicot
Trifolium fucatum	bull clover	native	annual	forb/herb	dicot
Trifolium hirtum	rose clover	introduced	annual	forb/herb	dicot
Trifolium microdon	thimble clover	native	annual	forb/herb	dicot
Trifolium variegatum	whitetip clover	native	annual	forb/herb	dicot
Trifolium willdenovii	tomcat clover	native	annual	forb/herb	dicot
Vicia sativa ssp. *nigra*	common vetch	introduced	annual	vine, forb/herb	dicot
Vicia villosa	hairy vetch	introduced	annual, biennnial, perennial	vine, forb/herb	dicot
FAGACEAE (beech family)					
Quercus douglasii	blue oak	native	perennial	tree	dicot
Quercus lobata	valley oak	native	perennial	tree	dicot
Quercus wislizenii	live oak	native	perennial	tree	dicot
Centaurium muehlenbergii	centaury	native	annual, biennial	forb/herb	dicot
Erodium botrys	broad leaf cranes bill	introduced	annual, biennial	forb/herb	dicot
Erodium cicutarium	red stemmed filaree	introduced	annual, biennial	forb/herb	dicot
Erodium moschatum	white-stemmed filaree	introduced	annual, biennial	forb/herb	dicot
GERANIACEAE (geranium family)					
Geranium carolinianum	Carolina geranium	native	annual, biennial	forb/herb	dicot
Geranium dissectum	geranium	introduced	annual, biennial	forb/herb	dicot
HYDROPHYLLACEAE (waterleaf family)					
Nemophila menziesii	baby blue-eyes	native	annual	forb/herb	dicot
Nemophila pedunculata	nemophila	native	annual	forb/herb	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
IRIDACEAE (iris family)					
Sisyrinchium bellum	blue-eyed grass	native	perennial	forb/herb	monocot
JUGLANDACEAE (walnut family)					
Juglans californica var. *hindsii*	black walnut	native	perennial	tree	dicot
JUNCACEAE (rush family)					
Juncus arcticus ssp. *littoralis* (syn. *Juncus balticus*)	baltic rush	native	perennial	graminoid	monocot
Juncus bufonius	toad rush	native	annual	graminoid	monocot
Juncus patens	rush	native	perennial	forb/herb	monocot
Juncus phaeocephalus	rush	native	perennial	graminoid	monocot
Juncus xiphioides	irisleaf rush	native	perennial	graminoid	monocot
LAMIACEAE (mint family)					
Lamium amplexicaule	henbit	introduced	annual, biennial	forb/herb	dicot
Lycopus americanus	bugleweed	native	perennial	forb/herb	dicot
Marrubium vulgare	white horehound	introduced	perennial	subshrub, forb/herb	dicot
Mentha pulegium	pennyroyal	introduced	perennial	forb/herb	dicot
Pogogyne douglasii	Douglas' mesamint	native	annual	forb/herb	dicot
Pogogyne ziziphoroides	Sacramento mesamint	native	annual	forb/herb	dicot
Stachys ajugoides	hedge nettle	native	perennial	forb/herb	dicot
Trichostema lanceolatum	vinegar weed	native	annual	forb/herb	dicot
LAURACEAE (laurel family)					
Umbellularia californica	California bay tree	native	perennial	tree, shrub	dicot
LILIACEAE (lily family)					
Asparagus officinalis ssp. *officinalis*	asparagus	introduced	perennial	forb/herb	monocot
Brodiaea elegans ssp. elegans	harvest brodiaea	native	perennial	forb/herb	monocot
Chlorogalum pomeridianum	soap root	native	perennial	forb/herb	monocot
Dichelostemma capitatum ssp. *capitatum*	blue dicks	native	perennial	forb/herb	monocot
Triteleia hyacinthina	white brodiaea	native	perennial	forb/herb	monocot
Triteleia laxa	Ithuriel's spear	native	perennial	forb/herb	monocot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
LYTHRACEAE (loosestrife family)					
Ammannia coccinea	ammannia	native	annual	forb/herb, subshrub	dicot
Lythrum hyssopifolia	hyssop loosestrife	introduced	annual, biennial	forb/herb	dicot
Lythrum tribracteatum	threebract loosestrife	introduced	perennial	forb/herb	dicot
MALVACEAE (mallow family)					
Abutilon theophrasti	velvetleaf	introduced	annual	forb/herb	dicot
Malva neglecta	cheeses	introduced	annual, biennnial, perennial	forb/herb	dicot
Malvella leprosa	alkali mallow	native	perennial	forb/herb	dicot
OLEACEAE (olive family)					
Fraxinus latifolia	Oregon ash	native	perennial	tree	dicot
ONAGRACEAE (evening primrose family)					
Epilobium brachycarpum	willowweed	native	annual	forb/herb	dicot
Epilobium canum	zauschneria	native	perennial	subshrub, forb/herb	dicot
Epilobium ciliatum	willow weed	native	perennial	forb/herb	dicot
Epilobium pygmaeum	epilobium	native	annual	forb/herb	dicot
Ludwigia peploides ssp. *peploides*	water primrose	native	perennial	forb/herb	dicot
PAPAVERACEAE (poppy family)					
Eschscholzia californica	California poppy	native	annual, perennial	forb/herb	dicot
PLANTAGINACEAE (plantain family)					
Plantago coronopus	buckhorn plantain	introduced	annual, biennial	forb/herb	dicot
Plantago elongata	little plantain	native	annual	forb/herb	dicot
Plantago lanceolata	English plantain	introduced	annual, biennnial, perennial	forb/herb	dicot
PLATANACEAE (plane-tree family)					
Platanus racemosa	California sycamore	native	perennial	tree	dicot
POACEAE (grass family)					
Alopecurus saccatus	foxtail	native	annual	graminoid	monocot
Avena fatua	wild oats	introduced	annual	graminoid	monocot
Briza minor	quaking grass	introduced	annual	graminoid	monocot
Bromus carinatus	California brome	native	annual, perennial	graminoid	monocot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
Bromus diandrus	ripgut brome	introduced	annual, perennial	graminoid	monocot
Bromus hordeaceus	soft chess	introduced	annual	graminoid	monocot
Bromus madritensis ssp. *rubens*	foxtail chess	introduced	annual	graminoid	monocot
Crypsis schoenoides	swamp grass	introduced	annual	graminoid	monocot
Crypsis vaginiflora	swamp timothy	introduced	annual	graminoid	monocot
Cynodon dactylon	bermuda grass	introduced	perennial	graminoid	monocot
Deschampsia cespitosa	tufted hairgrass	native	perennial	graminoid	monocot
Distichlis spicata	salt grass	native	perennial	graminoid	monocot
Echinochloa crus-galli	water grass	introduced	annual	graminoid	monocot
Elymus glaucus	blue wild rye	native	perennial	graminoid	monocot
Elymus trachycaulus	wheat grass	native	perennial	graminoid	monocot
Eragrostis mexicana	Mexican lovegrass	native	annual	graminoid	monocot
Schedonorus phoenix (syn. *Festuca arundinacea*)	tall fescue	introduced	perennial	graminoid	monocot
Festuca brevipila (syn. *Festuca trachyphylla*)	hard fescue	introduced	perennial	graminoid	monocot
Hordeum brachyantherum	meadow barley	native	perennial	graminoid	monocot
Hordeum jubatum	foxtail barley	native	perennial	graminoid	monocot
Hordeum marinum ssp. *gussonianum*	mediterranean barley	introduced	annual	graminoid	monocot
Hordeum murinum ssp. *leporinum*	foxtail barley	introduced	annual	graminoid	monocot
Koeleria macrantha	junegrass	native	perennial	graminoid	monocot
Leymus triticoides	creeping wild rye	native	perennial	graminoid	monocot
Leptochloa uninervia	Mexican sprangletop	native	annual, perennial	graminoid	monocot
Lolium perenne ssp. *multiflorum* (syn. *Lolium multiflorum*)	annual rye grass	introduced	annual, perennial	graminoid	monocot
Melica californica	California melic	native	perennial	graminoid	monocot
Muhlenbergia rigens	deer grass	native	perennial	graminoid	monocot
Nassella cernua	nodding needlegrass	native	perennial	graminoid	monocot
Nassella pulchra	purple needle grass	native	perennial	graminoid	monocot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
Paspalum dilatatum	dallis grass	introduced	perennial	graminoid	monocot
Phalaris californica	California canarygrass	native	perennial	graminoid	monocot
Phalaris minor	canary grass	introduced	annual	graminoid	monocot
Phalaris paradoxa	hood canarygrass	introduced	annual	graminoid	monocot
Phleum pratense	cultivated timothy	introduced	perennial	graminoid	monocot
Poa annua	annual bluegrass	introduced	annual	graminoid	monocot
Poa bulbosa	bulbous bluegrass	introduced	perennial	graminoid	monocot
Polypogon monspeliensis	rabbit foot grass	introduced	annual	graminoid	monocot
Setaria pumila	bristly foxtail	introduced	annual	graminoid	monocot
Sorghum halepense	johnsongrass	introduced	perennial	graminoid	monocot
Taeniatherum caput-medusae	medusahead	introduced	annual	graminoid	monocot
Vulpia myuros	rat tail fescue	introduced	annual	graminoid	monocot
POLYGONACEAE (buckwheat family)					
Polygonum amphibium var. *emersum*	water smartweed	native	perennial	forb/herb	dicot
Polygonum arenastrum	common knotweed	introduced	annual, perennial	forb/herb	dicot
Polygonum lapathifolium	willow smartweed	native	annual	forb/herb	dicot
Polygonum persicaria	thumbprint smartweed	probably introduced	annual, perennial	forb/herb	dicot
Polygonum punctatum	annual smartweed	native	annual, perennial	forb/herb	dicot
Rumex conglomeratus	clustered dock	introduced	perennial	forb/herb	dicot
Rumex crispus	curly dock	introduced	perennial	forb/herb	dicot
Rumex maritimus	golden dock	native	annual, biennial	forb/herb	dicot
Rumex pulcher	fiddle dock	introduced	perennial	forb/herb	dicot
POLEMONIACEAE (phlox family)					
Linanthus montanus	mustang clover	native	annual	forb/herb	dicot
Navarretia leucocephala	whitehead navarretia	native	annual	forb/herb	dicot
PONTEDERIACEAE (water-hyacinth family)					
Eichhornia crassipes	water hyacinth	introduced	perennial	forb/herb	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
PORTULACEAE (purslane family)					
Calandrinia ciliata	red maids	native	annual	forb/herb	dicot
Claytonia parviflora	miners lettuce	native	annual	forb/herb	dicot
Claytonia perfoliata ssp. *mexicana*	miners' lettuce	native	annual	forb/herb	dicot
Montia fontana	water chickweed	native	annual	forb/herb	dicot
PRIMULACEAE (primrose family)					
Anagallis arvensis	scarlet pimpernel	introduced	annual, biennial	forb/herb	dicot
RANUNCULACEAE (buttercup family)					
Clematis ligusticifolia	virgin's bower	native	perennial	vine	dicot
Ranunculus bonariensis var. *trisepalus*	buttercup	native	annual	forb/herb	dicot
Ranunculus muricatus	spiny-fruited buttercup	introduced	annual, biennnial, perennial	forb/herb	dicot
Rosa californica	california rose	native	perennial	subshrub	dicot
Rubus armeniacus (syn. *Rubus discolor)*	himalayan blackberry	introduced	perennial	subshrub	dicot
Rubus ursinus	California blackberry	native	perennial	subshrub	dicot
RUBIACEAE (madder family)					
Cephalanthus occidentalis var. *californicus*	California button willow	native	perennial	tree, shrub	dicot
Galium tricornutum	rough corn bedstraw	introduced	annual	forb/herb	dicot
SALICACEAE (willow family)					
Populus fremontii	Fremont's cottonwood	native	perennial	tree	dicot
Salix exigua	sandbar willow	native	perennial	tree, shrub	dicot
Salix gooddingii	Goodding's willow	native	perennial	tree	dicot
Salix laevigata	red willow	native	perennial	shrub	dicot
Salix lasiolepis	arroyo willow	native	perennial	tree, shrub	dicot
Salix lucida ssp. *lasiandra*	yellow willow	native	perennial	tree, shrub	dicot
SCROPHULARIACEAE (figwort family)					
Castilleja attenuata	valley tassels	native	annual	forb/herb	dicot
Castilleja campestris ssp. *campestris*	owl's clover	native	annual	forb/herb	dicot
Castilleja campestris ssp. *succulenta*	succulent owl's clover	native	annual	forb/herb	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
Castilleja exserta	purple owl's clover	native	annual	forb/herb	dicot
Kickxia spuria	sharppoint fluellin	introduced	annual	forb/herb	dicot
Diplacus aurantiacus ssp. aurantiacus (syn. *Mimulus aurantiacus*)	orange bush monkeyflower	native	perennial	subshrub, shrub	dicot
Mimulus glaucescens (syn. *Mimulus guttatus*)	shieldbract monkeyflower	native	annual	forb/herb	dicot
Mimulus latidens	broadtooth monkeyflower	native	annual	forb/herb	dicot
Mimulus tricolor	tricolor monkeyflower	native	annual	forb/herb	dicot
Triphysaria eriantha ssp. *eriantha*	Johnny jump-up	native	annual	forb/herb	dicot
Triphysaria pusilla	dwarf owl's-clover	native	annual	forb/herb	dicot
Veronica peregrina ssp. *xalapensis*	purslane speedwell	native	annual	forb/herb	dicot
Veronica persica	persian speedwell	introduced	annual	forb/herb	dicot
SOLANACEAE (potato family)					
Nicotiana quadrivalvis	coyote tobacco	native	annual	forb/herb	dicot
Physalis lanceolata	ground cherry	native	perennial	forb/herb	dicot
TYPHACEAE (cat-tail family)					
Typha angustifolia	cattail	introduced	perennial	forb/herb	monocot
Typha latifolia	narrow leaf cattail	native	perennial	forb/herb	monocot
URTICACEAE (nettle family)					
Urtica dioica	stinging nettles	native and introduced	perennial	forb/herb	dicot
Urtica urens	dwarf nettle	introduced	annual	forb/herb	dicot
Phyla nodiflora	phyla	native	perennial	forb/herb	dicot
VERBENACEAE (Verbena family)					
Verbena bonariensis	verbena	introduced	annual, biennnial, perennial	subshrub, forb/herb	dicot
VISCACEAE (Christmas mistletoe family)					
Phoradendron macrophyllum ssp. *macrophyllum* (syn. *Phoradendron tomentosum* ssp. *macrophyllum*)	mistletoe	native	perennial	subshrub, shrub	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
VITACEAE (grape family)					
Vitis californica	wild grape	native	perennial	vine	dicot
ZYGOPHYLLACEAE (Creosote-bush family)					
Tribulus terrestris	puncturevine	introduced	annual	forb/herb	dicot

All plant scientific names confirmed by: USDA, NRCS. 2006. The PLANTS Database (http://plants.usda.gov, August 2006). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Appendix C.6: Delegation of Authority

REFUGE NAME

Delegation of Authority
for

_____ Incident

_____ is assigned as Incident Commander. You have full authority and responsibility for managing the fire suppression activities within the framework of laws, Agency policy, and direction provided in the Wildland Fire Situation Analysis and the Agency Administrator Briefing.

Your primary responsibility is to organize and direct your assigned resources for efficient and effective suppression of the fire. You are accountable to the Agency Administrator the representatives designated below.

Specific direction for this incident covering management and environmental concerns are:

1. Protection of life and private property is your highest priority task.
2. Give special consideration to firefighter safety, especially with respect to aviation operations, working around dozers, snags, and entrapments. Avoid sensitive environmental areas such as the Little White Salmon River and hatchery fish production ponds and intakes. When in doubt, sacrifice acres not people in your strategic and tactical decisions.
3. You are authorized to utilize helicopters, chainsaws, portable pumps, fireline explosives, and retardant at REFUGE NAME. You are not authorized to use equipment within the ANY AREAS. Do not use hatchery raceways as a helicopter bucket dip site. Do not use retardant adjacent to fish production ponds.
4. Manage human resources assigned to the fire in a manner that promotes mutual respect and is consistent with the enclosed U.S. Fish & Wildlife Service "Harassment-Free Workplace" policy.
5. Be cost effective; Final costs should be no more than 120% of the preferred WFSA alternative.
6. Manage equipment and supplies to ensure losses are within Acceptable Fire Loss/Use Rates.

You should takeover management of the incident on or before _____, _____.

_____ _____
NAME, Project Leader, REFUGE NAME Date

Delegation of Authority— Guidelines for Mitigating the Effects of Fire Suppression

LINE BUILDING

1. Do not fall snags on the outside of the line unless they are an obvious safety hazard.
2. On the inside of the line, fall only those snags that would reach the fire line should they burn and fall over, or if they are an obvious safety hazard.
3. Don't cut live trees over 12" d.b.h. unless deemed absolutely necessary by the Complex Manager. Limbing of these trees, as necessary, should be the first choice.
4. Cut brush or small trees flush with the ground if the area is visible from roads.
5. Lop and scatter cut limbs so the depth will not exceed 15 inches.
6. There will be no dozer line construction unless qualified person is present to protect archaeological sites.

MOP-UP

1. Extinguish fire in living trees or snags within 200 feet of the fires perimeter with water or dirt. Fell those trees as a last resort.
2. If felling occurs in the vicinity of service roads/trails, cut the stumps flush with the ground.
3. Buck fallen trees across service roads/trails only to the extent necessary to facilitate road/trail passage.

AIR OPERATIONS

1. Consider fixed wing delivery of water vs. standard colored retardant.
2. When possible, use long line slings instead of cutting helispots.
3. Do not dip helicopter buckets into hatchery raceways.

Appendix C.7: Dispatch Plan

Stone Lakes National Wildlife Refuge

1. When a report of smoke or fire is received the following information should be taken from the caller:
Location of smoke or fire:
Location of person reporting:
Name and telephone number of person reporting:
Size of fire:
Character of fire (running, creeping, direction, etc.):
Type of fuel:
Color of smoke:
Anyone fighting fire?:
Did they see anyone in vicinity or vehicles leaving area?:
Time since caller first noticed fire to time call placed:

2. Notify Refuge:
Stone Lakes National Wildlife Refuge
Office (916) 775-4421(8:00 am to 4:30pm)

IF NO ANSWER ABOVE OR NOTIFY:
- Elk Grove Fire Protection District: 911 or (916) 685-1426
- Deputy Refuge Manager: Beatrix Treiterer:
  Wk: (916) 775-4421, Hm: (916) 966-7676
- Refuge Manager: Thomas Harvey
  Wk: (916) 775-4421, Hm: (916) 988-9707

3. Dispatch Refuge Staff Fire Personnel and Refuge Engine (if Fire Crew not available):
Fire is on refuge property
Fire is threatening refuge property
If requested by Local Fire District for assistance.

4. Other contacts:
Zone Fire Manager - Roger Wong
Wk: (209) 826-3508, Hm: (209)827-4390, Cell: (209) 777-4504
Zone AFMO - Perry Grissom
Wk: (530) 510-6326 Hm: (530) 934-5869
Refuge Supervisor - Dave Paullin: (916) 414-6464
Regional Fire Management Coordinator: (503) 231-6174 or (503) 231-6175 (Pam Ensley or Andy Anderson)

Appendix C.8: Equipment Inventory

- Chevy Brush Truck with 150 gallon slip on unit
- Caterpillar D7 Dozer
- 98 International Dump Truck with towing package
- Jacob's flatbed equipment trailer
- John Deere 7410 Tractor with disk and mower

Appendix C.9: Wildland Fire Situation Analysis (WFSA)

(Available from Sacramento Valley Fire Management Officer upon request)

Appendix C.10: Sample Burn Plan

Prescribed Fire Plan
Stone Lakes National Wildlife Refuge
Tract _____

Approved By: _____ Date: _____
Project Leader

Prepared By: _____ Date _____
Prescribed Fire Burn Boss

Reviewed By: _____ Date: _____
Refuge Fire Management Officer

Reviewed By: _____ Date: _____
Assistant Refuge Manager

Reviewed By: _____ Date _____
Refuge Biologist

The approved Prescribed Fire Plan constitutes the authority to burn, pending approval of Section 7 Consultations, Environmental Assessments, or other required documents. No one has the authority to burn without an approved plan or in a manner not in compliance with the approved plan. Prescribed burning conditions established in the plan are firm limits. Actions taken in compliance with the approved Prescribed Fire Plan will be fully supported, but personnel will be held accountable for actions taken which are not in compliance with the approved plan.

Refuge: Stone Lakes NWR

Name of Area:

Acres To Be Burned:

Legal Description:
State: California **County:** Sacramento
Latitude: Longitude:
Township: Range: Sections:
Quad Map: USGS - **Series:** 7.5" Scale: 1:24000

Is a Section 7 Consultation being forwarded to Fish and Wildlife Enhancement for review? **YES/NO**

Prescribed Fire Burn Boss/Specialist participated in the development of this plan? **YES/NO**

I. General Description of Burn Unit

Physical Features and Vegetation Cover Types: (Species, height, density, etc.):

Elevation: ‘ Slope: % **Aspect:**

Unit Description:

Vegetation:

Primary Resource Goals of Unit:.

Objectives of Fire and Acceptable Range of Results:
General Objectives:
1) Provide for Firefighter and Public Safety.
2) E.g., Reduce non-native plant cover
3) Minimize smoke impacts

Resource Objectives and Ranges:
1) e.g., Reduce or consume 1 hr fuels(jointgrass); 60 - 100%

II. Pre-Burn Monitoring

Vegetation Type	Acres	%	FBPS Fuel Model	
				Model
				Model
Total			100	

Habitat Conditions:

Type of Transects:

III. Planning and Actions

Complexity Analysis Results: Medium (see attached complexity sheet)

Prescribed Fire Organization:

Site preparation:
Who:
Time:
What is to be done:

Weather information required:
Instrument Location and Elevation(s): On site (wx kit)

Data Collected and Sampling Period: Temp, RH, Wind Speed and direction(mid flame). On site will be 1 day prior to burn.

Forecasts: Weather forecasts(general) will be monitored 2 - 3 days prior to burning. A spot weather forecast will be requested for the day of the burn via internet e-mail request. Forecast will be obtained from the local Fire Weather Unit: Sacramento Fire Weather Office, National Weather Service.

Safety considerations:

General:

Special Constraints and Considerations (Should be discussed with Burn Boss):

Special Safety Precautions Needing Attention: (Aerial ignition, aircraft, ignition from boat, etc.):

Public safety:

Safety Zones and Escape Routes: All areas will be identified in the pre-fire briefing....

Medical Facility: Minor injuries will be handled at the scene. Major injuries -

Adjacent Lands:

Adjacent Fuels:
To the north. To the east. To the south. To the west.

Facilities:

Protection of sensitive features:

Endangered, Threatened, or Listed Species:
PROTECTION ACTIONS:

Sensitive or Species of Concern:
PROTECTION ACTIONS:

Archeological, Historical, or Cultural Areas:
PROTECTION ACTIONS:

COMMUNICATION:

Communication and Coordination on the Burn (Who will have radios, frequencies to be used, who will coordinate various activities.):

Media Contacts (Radio stations, newspaper, etc., list with telephone numbers):

IV. Ignition, Burning and Control

Ignition Technique:

Prescription monitoring: Fire behavior, weather, smoke, and effects will be monitored during the burn. Duration will be a minimum of every 1 hour or sooner if needed or conditions start to change.

Stone Lakes NWR - Tract_____
Scheduling: Approx. Date(s):
Duration:
Acceptable Range:

FBPS Fuel Model
Temperature (degrees F)

Relative Humidity (%)

MF Wind Speed (sustained)

Wind Direction

Cloud Cover (%)
Anticipated

ENVIRONMENTAL CONDITIONS
1 hr. Fuel Moisture
10 hr. FM
Live Fuel Moisture

FIRE BEHAVIOR
Rate of Spread (mph):

Head fire
Backing fire

Flame Length (feet)

Head fire
Backing fire

Cumulative effects of weather and drought on fire behavior:
Summer drought is normal for this region, and vegetation dries through the summer, peaking in August. Drought conditions are ... than normal so far this year. For stations in the general area, the Palmer drought index is currently ... and the Keetch-Byram drought index is ...

V. Smoke Management

Permits:

Burn will be conducted on a declared Aburn day@ or as planned under a favorable 48 and 24 hour smoke forecast from the California Air Resources Board(ARB). A call will be placed at 8:30 a.m. the day of the burn to the Air Quality District for Burn Day status and to register the acres for the day.

Total Particulate Emissions Estimate(Tons):

FOFEM Generated -
PM 10:
PM 2.5:

Distance and Direction from Smoke Sensitive Area(s):
Interstate 5 -

Visibility Hazard(s) (Roads, airports, etc.):

Actions to Reduce Visibility Hazard(s):

Residual Smoke Problems:

VI. Funding and Personnel

Activity Code: 11710-9263-

VII. Burn-Day Activities

Contacts on Burn Day:

Crew & Equipment Assignments:

Crew Briefing Points: Area / unit overview, burn objectives, safety including escape and safety zones, weather, fire behavior, crew assignments, firing pattern and timing, holding concerns, communication, and contingency actions and responsibilities.

Firing Procedures:

Personnel Escape Plan:

Go-No-Go Checklist: (see Attached)

Holding Actions:

Critical Control Problems:

Water Refill Points:

Contingency Plan:

General plan for escapes into these areas:
To north:
Spot fire--. Escape--.

To east:

To south:

To west:

In the event of an escape or conditions become unfavorable(smoke, weather, fire behavior, and/or objectives not being achieved)the Burn Boss will declare the fire out of prescription or escaped (which ever is the situation) and will assume IC of the fire(until relieved by a higher rated IC). All new burning will stop unless needed to contain the RX or escaped fire. The holding crew will begin attacking the escape and the ignition crew will hold and work the RX fire until the RX fire is contained or is deemed as no threat.

If the fire exceeds the capability of the crews on hand a call will be placed for assistance from local resources through ... (phone). The contingency plan will be outlined in the briefing with procedures for activation of the contingency plan. Dispatch will be the ordering point for the incident. If the escape fire exceeds more than 12 hours, a Wildland Fire Situation Analysis(WFSA) will be completed for the incident.

Minimum required on-site contingency resources and response times:

Minimum required off-site contingency resources and response times:

Mop Up and Patrol:

Rehabilitation Needs:

VIII. Critique of Burn

Were burn objectives within acceptable range of results? (Refer to Section I):

What would be done differently to obtain results or get better results?

Was there any deviation from plan? If so, why?

Problems and general comments:

IX. Post-Burn Monitoring

Date: Refuge Burn Number:

Length of Time after Burn:

Vegetative Transects:

Comments on Habitat Conditions, etc.:

Photo Documentation:

Other:

X. Follow-Up Evaluation

Date: Refuge Burn Number:
Length of Time after Burn:

Vegetative Transects:

Comments on Habitat Conditions, etc.:

Photo Documentation:

Example Complexity Analysis
from FIREBASE

Score Score Criteria

Potential for Escape

5 Potential for multiple spot fires outside the burn unit totaling more than 1 acre, requiring greater than average holding capability along certain sections of burn perimeter. Additional holding resources may be needed to control if escape occurs. Fuel outside burn unit is continuous, with limited fuel breaks. Engines and heavy equipment are primary suppression tools.

Values to be Protected

3 Burn is in area occasionally visited by people, and may be adjacent to a primary field unit road. The burn unit contains structures, cultural resources, sensitive biological communities, or T&E habitat that must be protected from fire.

Fuels/Fire Behavior

3 Fuels within the primary model vary somewhat in loadings and arrangement, but are still well represented by one of the standard fire behavior fuel models. There may be small areas of secondary fuel types present, mostly away from the burn unit perimeter. The terrain contains low relief, and slope and aspect cause minor variations in fire behavior. The fire behavior variations present no difficulties in carrying out the burn, and the predominant fire behavior still can be predicted easily under most prescription conditions.

Fire Duration

1 Entire burn unit will be burned in one burning period. Some minor residual burning may continue inside the unit, but reuqires no continued resource commitment. Primarily 1-hour fuels.

Air Quality

3 If prescription parameters are not met one or more minor developments or visitor use areas may experience noticeably impaired visibility and increased particulate concentrations, but not in excess of secondary Federal standards. The impairment is expected to last no more than 3 days. No critical targets are present. There are no impacts to non-attainment areas.

Ignition Methods

3 Burn is ignited using simple ground methods or Terra Torch device (or equivalent). Ignition requires three to four personnel who may work in small teams igniting separate areas simultaneously. Ignition patterns may be complex enough to require detailed planning, but there is only minor chance of confusion. Ignition team is not expected to become involved in hazardous situations.

Management Team Size

7 Burn team consists of 10-12 personnel, including Burn Boss, Ignition and Holding Specialist, Aircraft Manager (aerial ignitions), and a Fire Weather Observer.

Treatment Objectives

1 Objectives are limited to fuel reduction or maintenance burning and are easily achieved (e.g., removing cured grasses from grasslands or field maintenance). Prescriptions are broad and encompass safe burning conditions.

Element

Potential for escape

Values at risk

Fuels/fire behavior

Fire duration

Smoke/air quality

Ignition methods

Management team size

Treatment objectives

TOTAL

Total weighted score: 158, Medium Complexity, RXB2

APPENDIX C.11: Air Quality Burn Permit

Appendix C.12: Request For Cultural Resource Compliance

Request For Cultural Resource Compliance
U.S. Fish and Wildlife Service, Region 1

Project Name:					Program: (Partners, Refuges, JITW, WSECP, etc.)	
State: CA, ID, HI, NV, OR, WA		EcoRegion: CBE, IPE,KCE, NCE			FWS Unit: Org Code:	
Project Location:	County	Township	Range	Section	FWS Contact: Name, Tel#, Address	
USGS Quad:					Date of Request:	
Total project acres/ linear ft/m:		APE Acres / linear ft/m (if different)			Proposed Project Start Date:	
MAPS Attached		Check below				
Copy of portion of USGS Quad with project area marked clearly (required)				Project (sketch) map showing Area of Potential Effect with locations of specific ground altering activities (required)		
Photocopy of aerial photo showing location (if available)				Any other project plans, photographs, or drawings that may help CRT in making determination (if available)		
Directions to Project: (if not obvious)						

Description of Undertaking:	Describe proposed project and means to facilitate (e.g., provide funds to revegetate 1 mile of riparian habitat, restore 250 acres of seasonal wetlands, and construct a 5-acre permanent pond). How is the project designed (e.g., install 2 miles of fence and create approximately 25' of 3' high check dam)?
Area of Potential Effects (APE):	Describe where disturbance of the ground will occur. What are the dimensions of the area to be disturbed? How deep will you excavate? How far apart are fenceposts? What method are you using to plant vegetation? Where will fill be obtained? Where will soil be dumped? What tools or equipment will be used? Are you replacing or repairing a structure? Will you be moving dirt in a relatively undisturbed area? Will the project reach below or beyond the limits of prior land disturbance? Differentiate between areas slated for earth movement vs. areas to be inundated only. Is the area to be inundated different from the area inundated today, in the recent past, or under natural conditions? Provide acres and/or linear ft/m for all elements of the project.
Environmental and Cultural Setting:	Briefly describe the environmental setting of the APE. A) What was the natural habitat prior to modifications, reclamation, agriculture, settlement? B) What is land-use history? When was it first settled, modified? How deep has it been cultivated, grazed, etc.? C) What is land use and habitat today? What natural agents (e.g., sedimentation, vegetation, inundation) or cultural agents (e.g., cultivation) might affect the ability to discover cultural resources? D) Do you (or does anybody else) know of cultural resources in or near the project area?

Appendix D. Wildlife Species Found on Stone Lakes National Wildlife Refuge

Stone Lakes NWR Reptiles

Common Name	Scientific Name	Habitat	Sp	S	F	W
Class AMPHIBIA (amphibians) Order ANURA						
Family BUFONIDAE (true toads)						
western toad	*Bufo boreas*	msrg	r	r	r	r
Family HYLIDAE (tree frogs and relatives)						
pacific treefrog	*Pseudacris regilla*	rm	c	c	c	r
Family RANIDAE (true frogs)						
bullfrog	*Rana catesbeiana*	omr	c	c	c	r
Class REPTILIA (reptiles) Order SQUAMATA (lizards and snakes)						
Family ANGUIDAE (alligator lizards and relatives)						
southern alligator lizard	*Elgaria multicarinata*	rg	r	r	r	r
Family COLUBRIDAE (Colubrids)						
western yellowbelly racer	*Coluber constrictor mormon*	rg	u	c	u	r
common kingsnake	*Lampropeltis getula*	sg	u	c	u	r
gopher snake	*Pituophis catenifer*	sg	u	c	u	r
elegant garter snake	*Thamnophis elegans*	sm	u	c	u	r
giant garter snake	*Thamnophis gigas*	msrg	r	r	r	r
common garter snake	*Thamnophis sirtalis*	sm	u	c	u	r
Family PHRYNOSOMATIDAE (North American spiny lizards)						
western fence lizard	*Sceloporus occidentalis*	sg	c	c	c	c
Order TESTUDINES (turtles)						
Family EMYDIDAE (box and water turtles)						
western pond turtle	*Clemmys marmorata* (syn. *Emys marmorata*)	om	u	u	u	r
red-eared slider	*Trachemys scripta*	om	u	u	u	u

Stone Lakes NWR Mammals

Common Name	Scientific Name	Habitat	Sp	S	F	W
Order ARTIODACTYLA (even-toed hoofed animals)						
Family CERVIDAE (deer, moose, reindeer, elk)						
black-tailed deer	*Odocoileus hemionus*	rsg	r	r	r	r
Order CARNIVORA (meat-eaters)						
Family CANIDAE (coyotes, dogs, foxes, jackals and wolves)						
coyote	*Canis latrans*	wide	c	c	c	c
gray fox	*Urocyon cinereoargenteus*	gr	o	o	o	o
Family FELIDAE (cats)						
feral house cat	*Felis catus*	rgu	c	c	c	c
Family MEPHITIDAE (skunks and stink badgers)						
striped skunk	*Mephitis mephitis*	wide	u	u	u	u
Family MUSTELIDAE (badgers, otters, weasels and relatives)						
river otter	*Lontra canadensis*	or	c	c	c	c
mink	*Mustela vison*	om	o	o	o	o
Family PROCYONIDAE (coatis, raccoons, lesser pandas)						
raccoon	*Procyon lotor*	mr	c	c	c	c
Order CHIROPTERA (bats)						
Family MOLOSSIDAE (free-tailed bats)						
guano bat	*Tadarida brasiliensis*	r	r	r	r	r
Order DIDELPHIMORPHIA (American marsupials)						
Family DIDELPHIDAE (opossums)						
virginia opossum	*Didelphis virgiana*	r	c	c	c	c
Order INSECTIVORA (insect-eaters)						
Family Soricidae (shrews)						
ornate shrew	*Sorex ornatus*	msg	r	r	r	r
Order LAGOMORPHA (pikas, hares and rabbits)						
Family LEPORIDAE (hares and rabbits)						
black-tailed jackrabbit	*Lepus californicus*	sg	c	c	c	c
desert cottontail	*Sylvilagus audubonii*	g	c	c	c	c
Order RODENTIA (gnawing mammals)						
Family CASTORIDAE (beavers)						
beaver	*Castor canadensis*	mr	a	a	a	a
Family CRICETIDAE (New World rats and mice, voles, hamsters and relatives)						
California vole	*Microtus californicus*	gr	c	c	c	c
muskrat	*Ondatra zibethicus*	om	c	c	c	c
deer mouse	*Peromyscus maniculatus*	rg	u	u	u	u
western harvest mouse	*Reithrodontomys megalotis*	msg	u	u	u	u

Common Name	Scientific Name	Habitat	Sp	S	F	W
Family GEOMYIDAE (gophers)						
Botta's Pocket Gopher	*Thomomys bottae*	g	u	u	u	u
Family MURIDAE (Old World mice, rats)						
house mouse	*Mus musculus*	sgru	u	u	u	u
Norway rat	*Rattus norvegicus*	sgru	u	u	u	u
black rat	*Rattus rattus*	sgru	u	u	u	u
Family SCIURIDAE (chipmunks, squirrels, marmots)						
western gray squirrel	*Sciurus griseus*	sg	u	u	u	u
Fox Squirrel	*Sciurus niger*	rg	u	u	u	u
California ground squirrel	*Spermophilus beecheyi*	rg	u	u	u	u

Stone Lakes NWR Birds

Common Name	Scientific Name	Habitat	Sp	S	F	W
Order ANSERIFORMES (waterfowl)						
Family ANATIDAE (ducks, geese and swans)						
wood duck*	*Aix sponsa*	osr	c	c	c	c
greater white-fronted goose	*Anser albifrons*	oga	o	-	u	c
northern pintail	*Anas acuta*	s	u	r	c	c
american wigeon	*Anas americana*	s	c	-	c	a
northern shoveler	*Anas clypeata*	s	a	r	u	a
green-winged teal	*Anas crecca*	s	c	-	c	c
cinnamon teal*	*Anas cyanoptera*	msg	c	o	o	c
blue-winged teal	*Anas discors*	s	r	-	r	r
eurasian wigeon	*Anas penelope*	s	-	-	-	r
mallard*	*Anas platyrhynchos*	msg	a	a	a	a
gadwall*	*Anas strepera*	msg	c	r	r	c
lesser scaup	*Aythya affinis*	os	u	-	-	u
redhead	*Aythya americana*	os	r	-	-	r
ring-necked duck	*Aythya collaris*	os	o	-	-	c
greater scaup	*Aythya marila*	os	-	-	-	#
canvasback	*Aythya valisineria*	os	r	-	-	c
bufflehead	*Bucephala albeola*	os	o	-	-	c
common goldeneye	*Bucephala clangula*	os	-	-	-	u
barrow's goldeneye	*Bucephala islandica*	os	-	-	-	#
canada goose*	*Branta canadensis*	osg	o	o	o	o
snow goose	*Chen caerulescens*	osga	-	-	-	r
ross' goose	*Chen rossii*	osga	-	-	-	r
tundra swan	*Cygnus buccinator*	osa	-	-	-	o
hooded merganser	*Lophodytes cucullatus*	os	r	-	-	o
common merganser	*Mergus merganser*	os	r	-	-	r
ruddy duck*	*Oxyura jamaicensis*	os	o	r	r	o
Order APODIFORMES (swifts and hummingbirds)						
Family APODIDAE (swifts)						
white-throated swift	*Aeronautes saxatalis*	a	r	r	r	r
Vaux's swift	*Chaetura vauxi*	a	r	-	r	-
Family TROCHILIDAE (hummingbirds)						
black-chinned hummingbird*	*Archilochus alexandri*	r	r	r	u	-
Anna's hummingbird*	*Calypte anna*	r	c	c	c	u
Rufous/Allen's hummingbird	*Selasphorus rufus*	r	-	-	r	-
Order CHARADRIIFORMES (shorebirds)						
Family CHARADRIIDAE (plovers and lapwings)						
semipalmated plover	*Charadrius semipalmatus*	s	r	-	r	-
killdeer*	*Charadrius vociferus*	wide	a	a	a	a

Common Name	Scientific Name	Habitat	Sp	S	F	W
black-bellied plover	*Pluvialis squatarola*	s	o	-	u	c
Family LARIDAE (gulls and terms)						
black tern	*Chlidonias niger*	osa	#	-	-	-
herring gull	*Larus argentatus*	osa	o	-	-	c
California gull	*Larus californicus*	osa	o	r	c	c
Mew Gull	*Larus canus*	osa	#	-	r	r
ring-billed gull	*Larus delawarensis*	osa	o	-	c	c
Thayer's gull	*Larus glaucoides*	osa	-	-	#	-
Bonaparte's gull	*Larus philadelphia*	osa	-	r	r	#
Caspian tern*	*Sterna caspia*	osa	o	r	o	-
Forster's tern	*Sterna forsteri*	osa	c	r	r	o
Family RECURVIROSTRIDAE (avocets and stilts)						
black-necked stilt*	*Himantopus mexicanus*	s	c	o	c	c
american avocet*	*Recurvirostra americana*	s	o	u	o	o
Family SCOLOPACIDAE (sandpipers and phalaropes)						
spotted sandpiper	*Actitis macularius*	s	o	r	o	o
ruddy turnstone	*Arenaria interpres*	s	#	-	-	-
sanderling	*Calidris alba*	s	#	-	-	-
dunlin	*Calidris alpina*	s	c	-	a	a
baird's sandpiper	*Calidris bairdii*	s	-	-	#	-
western sandpiper	*Calidris mauri*	s	c	-	c	o
pectoral sandpiper	*Calidris melanotos*	s	-	-	#	-
least sandpiper	*Calidris minutilla*	s	c	o	c	a
semipalmated sandpiper	*Calidris pusilla*	s	-	-	r	-
willet	*Catoptrophorus semipalmatus*	s	#	-	-	-
common snipe	*Gallinago delicata*	s	u	r	o	c
short-billed dowitcher	*Limnodromus griseus*	s	-	#	-	-
long-billed dowitcher	*Limnodromus scolopaceus*	s	c	-	c	c
whimbrel	*Numenius phaeopus*	sga	o	-	r	-
long-billed curlew	*Numenius americanus*	sga	o	r	o	o
red-necked phalarope	*Phalaropus lobatus*	s	r	-	r	-
wilson's phalarope*	*Phalaropus tricolor*	s	o	r	r	-
ruff	*Philomachus pugnax*	s	#	-	-	-
lesser yellowlegs	*Tringa flavipes*	s	o	-	o	o
greater yellowlegs	*Tringa melanoleuca*	s	c	r	c	c
solitary sandpiper	*Tringa solitaria*	s	#	-	#	-
Order CICONIIFORMES (storks, herons and relatives)						
Family ARDEIDAE (bitterns, herons and egrets)						
great blue heron*	*Ardea herodias*	wide	a	a	a	a
great egret*	*Ardea alba*	wide	a	a	a	a

Common Name	Scientific Name	Habitat	Sp	S	F	W
American bittern*	*Botaurus lentiginosus*	m	o	o	o	u
cattle egret	*Bubulcus ibis*	g	-	-	r	r
green heron*	*Butorides virescens*	mr	o	o	o	o
snowy egret*	*Egretta thula*	ms	c	u	c	c
least bittern	*Ixobrychus exilis*	m	r	r	r	-
black-crowned night-heron*	*Nycticorax nycticorax*	mr	o	o	o	o
Family CATHARTIDAE (vultures)						
turkey vulture*	*Cathartes aura*	a	a	a	a	a
Family THRESKIORNITHIDAE (ibises)						
white-faced ibis	*Eudocimus albus*	sg	o	o	o	-
Order COLUMBIFORMES (pigeons)						
Family COLUMBIDAE (doves and pigeons)						
rock dove*	*Columba livia*	u	c	c	c	c
mourning dove*	*Zenaida macroura*	wide	c	c	c	c
Order CORACIIFORMES (kingfishers and relatives)						
Family ALCEDINIDAE (kingfishers)						
belted kingfisher*	*Ceryle alcyon*	ra	c	c	c	c
Order FALCONIFORMES (diurnal birds of prey)						
Family ACCIPITRIDAE (osprey, kites, eagles and hawks)						
osprey	*Pandion haliaetus*	ra	r	r	r	-
cooper's hawk*	*Accipiter cooperii*	ra	u	u	c	c
sharp-shinned hawk	*Accipiter striatus*	ra	o	o	o	o
golden eagle	*Aquila chrysaetos*	sga	o	o	o	o
red-tailed hawk*	*Buteo jamaicensis*	wide	a	a	a	a
red-shouldered hawk*	*Buteo lineatus*	ra	a	a	a	a
rough-legged hawk	*Buteo lagopus*	mga	-	-	-	r
ferruginous hawk	*Buteo regalis*	sa	-	-	-	r
swainson's hawk*	*Buteo swainsoni*	rsga	o	c	u	-
northern harrier*	*Circus cyaneus*	msga	a	c	a	a
white-tailed kite*	*Elanus leucurus*	wide	c	c	c	c
bald eagle	*Haliaeetus leucocephalus*	a	-	-	-	#
Family FALCONIDAE (falcons)						
merlin	*Falco columbarius*	rga	r	-	-	o
prairie falcon	*Falco mexicanus*	msga	r	-	-	r
peregrine falcon!	*Falco peregrinus*	msga	r	-	r	r
american kestrel*	*Falco sparverius*	wide	a	a	a	a
Order GALLIFORMES (megapodes, curassows, pheasants, quails and relatives)						
Family PHASIANIDAE						
ring-necked pheasant*	*Phasianus colchicus*	rg	a	a	a	a
Family ODONTOPHORIDAE						

Common Name	Scientific Name	Habitat	Sp	S	F	W
california quail*	*Callipepla californica*	rg	c	c	c	c
Order GRUIFORMES (coots, cranes and rails)						
Family GRUIDAE (cranes)						
sandhill crane	*Grus canadensis*	sg	r	-	c	c
Family RALLIDAE						
American coot*	*Fulica americana*	ms	c	o	o	a
common moorhen*	*Gallinula chloropus*	m	o	o	o	o
sora*	*Porzana carolina*	m	o	o	o	o
Virginia rail*	*Rallus limicola*	m	o	o	o	o
Order PASSERIFORMES (perching birds)						
Family AEGITHALIDAE (bushtits)						
bushtit*	*Psaltriparus minimus*	r	a	a	a	a
Family ALAUDIDAE (larks)						
horned lark	*Eremophila alpestris*	g	o	-	c	c
Family BOMBYCILLIDAE (waxwings)						
cedar waxwing	*Bombycilla cedrorum*	r	u	-	u	u
Family CARDINALIDAE (grosbeaks and buntings)						
lazuli bunting*	*Passerina amoena*	r	u	u	-	-
blue grosbeak*	*Passerina caerulea*	r	u	u	-	-
black-headed grosbeak*	*Pheucticus melanocephalus*	r	c	c	-	-
Family CERTHIIDAE (creepers)						
brown creeper	*Certhia americana*	r	-	-	#	#
Family CORVIDAE (jays, magpies and crows)						
western scrub-jay*	*Aphelocoma californica*	rs	a	a	a	a
American crow*	*Corvus brachyrhynchos*	rsg	c	c	c	c
yellow-billed magpie*	*Pica nuttalli*	rsg	o	o	o	o
Family EMBERIZIDAE (towhees and sparrows)						
spotted towhee*	*Pipilo maculatus*	r	a	a	a	a
dark-eyed junco	*Junco hyemalis*	r	u	-	u	c
swamp sparrow	*Melospiza georgiana*	g	-	-	#	-
Lincoln's sparrow	*Melospiza lincolnii*	gs	u	-	-	o
song sparrow*	*Melospiza melodia*	mr	c	c	c	c
savannah sparrow	*Passerculus sandwichensis*	gs	a	-	a	a
fox sparrow	*Passerella iliaca*	r	o	-	r	o
California towhee*	*Pipilo crissalis*	r	u	u	u	u
vesper sparrow	*Pooecetes gramineus*	g	#	-	-	-
chipping sparrow	*Spizella passerina*	g	#	#	-	-
white-throated sparrow	*Zonotrichia albicollis*	gs	r	-	-	r
golden-crowned sparrow	*Zonotrichia atricapilla*	gs	r	-	c	a
white-crowned sparrow	*Zonotrichia leucophrys*	gs	r	-	c	a

Common Name	Scientific Name	Habitat	Sp	S	F	W
Family FRINGILLIDAE (finches)						
lesser goldfinch*	*Carduelis psaltria*	g	-	-	r	r
American goldfinch*	*Carduelis tristis*	g	c	c	c	c
house finch*	*Carpodacus mexicanus*	wide	a	a	a	a
pine siskin	*Carduelis pinus*	r	-	-	r	-
purple finch	*Carpodacus purpureus*	r	-	-	-	#
Family HIRUNDINIDAE (swallows)						
barn swallow*	*Hirundo rustica*	msra	c	c	c	-
cliff swallow*	*Petrochelidon pyrrhonota*	msra	a	a	o	-
northern rough-winged swallow*	*Stelgidopteryx serripennis*	msra	u	o	r	-
tree swallow*	*Tachycineta bicolor*	msra	a	a	o	r
violet-green swallow	*Tachycineta thalassina*	msra	-	-	r	-
Family ICTERIDAE (icterids)						
red-winged blackbird*	*Agelaius phoeniceus*	mg	a	a	a	a
tricolored blackbird	*Agelaius tricolor*	mg	o	o	r	r
Brewer's blackbird*	*Euphagus cyanocephalus*	us	a	a	a	a
bullock's oriole*	*Icterus bullockii*	r	u	u	-	-
hooded oriole	*Icterus cucullatus*	r	r	-	-	-
brown-headed cowbird*	*Molothrus ater*	wide	c	c	c	o
great-tailed grackle*	*Quiscalus mexicanus*	sg	r	r	r	r
western meadowlark*	*Sturnella neglecta*	g	a	a	a	a
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	m	r	r	-	-
Family LANIIDAE (shrikes)						
northern shrike	*Lanius excubitor*	gr	-	-	-	#
loggerhead shrike*	*Lanius ludovicianus*	gr	u	u	u	u
Family MIMIDAE (mockingbirds and thrashers)						
northern mockingbird*	*Mimus polyglottos*	rg	o	o	o	o
Family MOTACILLIDAE (wagtails and pipits)						
American pipit	*Anthus rubescens*	sg	c	-	u	c
Family PARIDAE (titmice)						
oak titmouse*	*Baeolophus inornatus*	r	u	u	u	u
Family PARULIDAE (warblers)						
yellow-rumped warbler	*Dendroica coronata*	r	c	-	c	a
black-throated gray warbler	*Dendroica nigrescens*	r	o	-	u	r
yellow warbler	*Dendroica petechia*	r	c	r	c	-
townsend's warbler	*Dendroica townsendi*	r	o	-	o	-
common yellowthroat*	*Geothlypis trichas*	mr	c	c	c	u
yellow-breated chat	*Icteria virens*	r	#	-	-	-
Macgillivray's warbler	*Oporornis tolmiei*	r	o	-	u	-

Common Name	Scientific Name	Habitat	Sp	S	F	W
northern waterthrush	*Seiurus noveboracensis*	m	#	-	-	-
orange-crowned warbler	*Vermivora celata*	r	c	r	c	r
Nashville warbler	*Vermivora ruficapilla*	r	r	-	r	-
Canada warbler	*Wilsonia canadensis*	r	-	#	-	-
Wilson's warbler	*Wilsonia pusilla*	r	c	-	c	-
Family PASSERIDAE (Old World sparrows)						
house sparrow*	*Passer domesticus*	u	c	c	c	c
Family REGULIDAE (kinglets)						
ruby-crowned kinglet	*Regulus calendula*	r	c	-	c	a
golden-crowned kinglet	*Regulus satrapa*	r	r	-	u	u
Family SITTIDAE (nuthatches)						
white-breasted nuthatch*	*Sitta carolinensis*	r	u	u	u	u
Family STURNIDAE (starlings)						
european starling*	*Sturnus vulgaris*	rs	a	a	a	a
Family SYLVIIDAE (gnatchatchers)						
blue-gray gnatcatcher	*Polioptila caerulea*	r	#	-	r	-
Family THRAUPIDAE (tanagers)						
western tanager	*Piranga ludoviciana*	r	u	r	u	-
Family TIMALIIDAE (babbler)						
wrentit*	*Chamaea fasciata*	r	c	c	c	c
Family TROGLODYTIDAE (wrens)						
marsh wren*	*Cistothorus palustris*	m	a	a	a	a
rock wren	*Salpinctes obsoletus*	g	#	#	#	#
house wren*	*Troglodytes aedon*	r	c	c	c	u
bewick's wren*	*Thryomanes bewickii*	mr	u	u	u	u
winter wren	*Troglodytes troglodytes*	r	-	-	-	r
Family TURDIDAE (thrushes)						
hermit thrush	*Catharus guttatus*	r	o	-	o	o
Swainson's thrush	*Catharus ustulatus*	r	o	-	o	-
varied thrush	*Ixoreus naevius*	r	-	-	r	r
mountain bluebird	*Sialia currucoides*	r	-	-	-	#
western bluebird	*Sialia mexicana*	rg	#	-	-	#
American robin*	*Turdus migratorius*	rg	c	u	c	c
Family TYRANNIDAE (flycatchers)						
olive-sided flycatcher	*Contopus cooperi*	r	r	-	o	-
western wood-pewee*	*Contopus sordidulus*	r	r	-	o	-
pacific-slope flycatcher	*Empidonax difficilis*	r	r	r	r	-
hammond's flycatcher	*Empidonax hammondii*	r	#	-	r	-
dusky flycatcher	*Empidonax oberholseri*	r	#	#	-	-
willow flycatcher	*Empidonax traillii*	r	r	-	o	-
ash-throated flycatcher*	*Myiarchus cinerascens*	rg	u	c	r	-

Common Name	Scientific Name	Habitat	Sp	S	F	W
black phoebe*	*Sayornis nigricans*	mr	a	a	a	a
say's phoebe	*Sayornis saya*	sg	-	-	u	u
tropical kingbird	*Tyrannus melancholicus*	rg	-	-	-	#
western kingbird*	*Tyrannus verticalis*	rg	u	c	-	-
Family VIREONIDAE (vireos)						
Cassin's vireo	*Vireo cassinii*	r	r	-	r	-
warbling vireo	*Vireo gilvus*	r	u	-	u	-
Hutton's vireo	*Vireo huttoni*	r	r	r	r	r
Order PELECANIFORMES (pelicans, tropicbirds, cormorants and relatives)						
Family PELECANIDAE (pelicans)						
American white pelican	*Pelecanus erythrorhynchos*	os	c	u	o	o
Family PHALACROCORACIDAE (cormorants)						
double-crested cormorant	*Phalacrocorax auritus*	o	c	c	o	c
Order PICIFORMES (woodpeckers and relatives)						
Family PICIDAE (woodpeckers)						
northern flicker*	*Colaptes auratus*	r	c	o	c	c
acorn woodpecker	*Melanerpes formicivorus*	r	-	-	-	#
Nuttall's woodpecker*	*Picoides nuttallii*	r	c	c	c	c
downy woodpecker*	*Picoides pubescens*	r	c	c	c	c
red-breasted sapsucker	*Sphyrapicus nuchalis*	r	-	-	r	r
Order PODICIPEDIFORMES (grebes)						
Family PODICIPEDIDAE (grebes)						
clark's grebe	*Aechmophorus clarkii*	o	r	r	o	o
western grebe	*Aechmophorus occidentalis*	o	r	r	o	o
horned grebe	*Podiceps auritus*	os	r	-	r	r
eared grebe	*Podiceps nigricollis*	oms	r	r	r	r
pied-billed grebe*	*Podilymbus podiceps*	oms	c	u	a	a
Order STRIGIFORMES (owls)						
Family TYTONIDAE (typical owls)						
long-eared owl	*Asio otus*	srg	-	-	-	#
short-eared owl	*Asio flammeus*	msg	-	-	-	r
burrowing owl*	*Athene cunicularia*	f	r	r	r	r
great horned owl*	*Bubo virginianus*	r	c	c	c	c
western screech-owl	*Megascops kennicottii*	r	r	r	r	r
barn owl*	*Tyto alba*	wide	c	c	c	c

Habitats: o - Open water, lakes, creeks, ponds; m - Marshes, tule and cattail stands; s - seasonal wetlands, mudflats, flooded fields; r - Riparian forests; g - Grasslands; a - Aerial, usually observed in flight; wide - Widespread, found in a variety of habitats; u - urban

Seasons: Sp - Spring, March through May; S - Summer, June through August; F - Fall, September through November; W - Winter, December through February

Abundance: a - Abundant, expected to be observed 80 to 100 percent of the time in appropriate habitat; c - Common: 60 to 80 percent; u - Uncommon: 30 to 60 percent; o - Occasionally: 10 to 30 percent; r - Rare: 0 to 10 percent; * - Birds known to nest locally; ! -Threatened/Endangered Species; # - Observed less than 10 times in the past 10 years

Appendix E. Fish Species Found on Stone Lakes NWR

Common name (scientific name)	North Stone Lake	South Stone Lake	SP Cut	Meadowlark Lake	Black-Crown Lake	Nicolaus Pond	Laguna Creek	Morrison Creek	Fishhead Lake	Lost Lake
Order ATHERINIFORMES (rainbow fishes and silversides)										
Family ATHERINIDAE (silversides)										
Inland Silverside (Menidia beryllina)	x			x	x	x	x	x	x	
Order CLUPEIFORMES (anchovies and herrings)										
Family CLUPEIDAE (herrings, menhadens, pilchards, sardines, shads and sprats)										
American shad (Alosa sapidissima)	x									
Threadfin shad (Dorosoma petenense)	x	x	x	x	x		x		x	x
Order CYPRINIFORMES (suckers and minnows)										
Family CYPRINIDAE (carps and minnows)										
California roach (Hesperoleucus symmetricus)					x			x		
Carp (Cyprinus carpio)	x	x	x	x	x	x	x	x	x	
Goldfish (Carassius auratus)	x	x			x	x			x	
Golden shiner (Notemigonus crysoleucas)	x	x	x							
Hardhead minnow (Mylopharodon conocephalus)				x	x		x	x		x
Sacramento blackfish (Orthodon microlepidotus)	x			x	x		x	x	x	
Sacramento pikeminnow (Ptychocheilus grandis)	x	x								
*Sacramento splittail (Pogonichthys macrolepidotus)										
Order CYPRINODONTIFORMES (killifishes)										
Family POECILIIDAE (livebearers and topminnows)										
Mosquitofish (*Gambusia* spp.)	x			x	x	x	x	x	x	
Order PERCIFORMES (perch-likes)										
Family MORONIDAE (temperate basses)										
Striped Bass (Morone saxatilis)			x							

Family CENTRARCHIDAE (sunfish and sunfishes)										
Black Crappie (Pomoxis nigromaculatus)	x	x	x	x	x		x	x	x	x
Bluegill (Lepomis macrochirus)	x	x	x	x	x		x		x	x
Crappie (Pomoxis spp.)				x	x		x		x	
Green sunfish (Lepomis cyanellus)	x									
Hybrid sunfish (Lepomis spp.)	x									
Largemouth bass (Micropterus salmoides)	x	x		x	x				x	
Redear sunfish (Lepomis microlophus)	x	x	x							
Warmouth (Lepomis gulosus)	x			x	x		x		x	
White Crappie (Pomoxis annularis)	x	x		x	x		x	x	x	x
Family PECIDAE (perches and true perches)										
Bigscale logperch (Percina macrolepida)	x			x	x		x	x	x	
Order SCORPAENIFORMES (scorpion fishes and sculpins)										
Family COTTIDAE (scaleless sculpins and sculpins)										
Prickly sculpin (Cottus asper)	x									
Sculpin (Cottus spp.)					x				x	
Order SILURIFORMES (catfishes)										
Family ICTALURIDAE (bullhead catfishes and North American freshwater catfishes)										
Black bullhead (Ictalurus melas)	x	x	x	x	x			x	x	
Brown bullhead (Ictalurus nebulosus)	x	x		x			x		x	
Bullhead (Ictalurus ssp.)				x	x	x	x		x	
Channel catfish (Ictalurus punctatus)	x	x		x	x					
Yellow bullhead (Ameiurus natalis)				x	x				x	
White catfish (Ictalurus catus)	x	x	x	x	x					

* presumed to be intermitently present after flooding events allow entry to the Refuge.

Appendix F. Wilderness Review

A wilderness review is the process used by the Service to determine whether or not to recommend lands or waters in the National Wildlife Refuge System to Congress for designation as wilderness. The Service is required to conduct a wilderness review for each refuge as part of the CCP process. Lands or waters that meet the minimum criteria for wilderness are identified in a CCP and further evaluated to determine whether they merit recommendation for inclusion in the Wilderness System.
According to the Wilderness Act of 1964 (16 USC 1131-1136; 78 Stat. 890), "An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value."

Stone Lakes National Wildlife Refuge contains a total 2,000 discontinuous acres. It is adjacent to a residential subdivision and a major interstate highway. The largest contiguous portion of land in fee ownership is about 840 acres, which is smaller than the area required for designation as wilderness. Moreover, the Refuge contains much evidence of past and current human use, including roads, actively managed wetlands, and remnants of past and current ranching and farming activities. For these reasons, Stone Lakes National Wildlife Refuge does not meet the criteria for wilderness designation.

Appendix G. Budget Requests: RONS & MMS

This page is intentionally left blank, for the 2006 Draft Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan (CCP). This appendix will be provided in the Final CCP.

Appendix H. Endangered Species Act, Section 7 Consultation

This page is intentionally left blank, for the 2006 Draft Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan (CCP). This appendix will be provided in the Final CCP.

Appendix I. Response to Public Comments

This page is intentionally left blank, for the 2006 Draft Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan (CCP). This appendix will be provided in the Final CCP.

Appendix J. Plants Species Found on Stone Lakes National Wildlife Refuge

Stone Lakes NWR Plants

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
ACERACEAE (maple family)					
Acer negundo var. *californicum*	box elder	native	perennial	tree	dicot
ALISMATACEAE (water plantain family)					
Alisma lanceolatum	water plantain	introduced	perennial	forb/herb	monocot
Echinodorus berteroi	burhead	native	perennial	forb/herb	monocot
Sagittaria latifolia	arrowhead	native	perennial	forb/herb	monocot
ANACARDIACEAE (sumac family)					
Toxicodendron diversilobum	poison oak	native	perennial	shrub/vine	monocot
APIACEAE (carrot family)					
Daucus carota	wild carrot	introduced	biennial	forb/herb	dicot
Foeniculum vulgare	fennel	introduced	biennial, perennial	forb/herb	dicot
Scandix pecten-veneris	Venus' needle	introduced	annual	forb/herb	dicot
APOCYNACEAE (dogbane family)					
Apocynum cannabinum	indian hemp	native	perennial	forb/herb	dicot
ASCLEPIADACEAE (milkweed family)					
Asclepias fascicularis	narrow leaf milkweed	native	perennial	forb/herb	dicot
Asclepias incarnata	milkweed	native	perennial	forb/herb	dicot
ASTERACEAE (aster family)					
Achyrachaena mollis	blow-wives	native	perennial	forb/herb	dicot
Acroptilon repens	russian knapweed	introduced	perennial	forb/herb	dicot
Ambrosia psilostachya	western ragweed	native	perennial	forb/herb	dicot
Anthemis cotula	chamomile	introduced	annual	forb/herb	dicot
Artemisia douglasiana	mugwort	native	perennial	forb/herb	dicot
Aster subulatus var. *ligulatus*	southern annual saltmarsh aster	native	annual, biennial	forb/herb	dicot
Baccharis pilularis	coyote bush	native	perennial	subshrub, shrub	dicot
Bidens frondosa	nodding beggarticks	native	annual	forb/herb	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
Carduus pycnocephalus	italian thistle	introduced	annual	forb/herb	dicot
Centaurea solstitialis	yellow star thistle	introduced	annual	forb/herb	dicot
Matricaria discoidea (syn. *Chamomilla suaveolens*)	pineapple weed	introduced	annual	forb/herb	dicot
Cichorium intybus	chicory	introduced	biennial, perennial	forb/herb	dicot
Cirsium vulgare	bull thistle	introduced	biennial	forb/herb	dicot
Conyza canadensis	horseweed	native	annual, biennial	forb/herb	dicot
Coreopsis wrightii	tickseed	native	annual	forb/herb	dicot
Euthamia occidentalis	grass-leaved goldenrod	native	perennial	forb/herb	dicot
Gnaphalium luteo-album	cudweed, weedy	introduced	annual	forb/herb	dicot
Gnaphalium palustre	cudweed, everlasting	native	annual	forb/herb	dicot
Gnaphalium stramineum	cudweed, everlasting	native	annual, biennial	forb/herb	dicot
Grindelia camporum	gum plant	native	perennial	subshrub, forb/herb	dicot
Helianthus annuus	sunflower	native	annual	forb/herb	dicot
Hemizonia fitchii	fitch's tarweed	native	annual	forb/herb	dicot
Centromadia pungens (syn. *Hemizonia pungens*)	spikeweed	native	annual	forb/herb	dicot
Hesperevax caulescens	dwarf dwarf-cudweed	native	annual	forb/herb	dicot
Heterotheca grandiflora	telegraph plant	native	annual, biennial, perennial	forb/herb	dicot
Holocarpha virgata	holocarpha	native	annual	forb/herb	dicot
Hypochaeris glabra	smooth cats ear	introduced	annual	forb/herb	dicot
Hypochaeris radicata	rough cat's-ear	introduced	perennial	forb/herb	dicot
Lactuca serriola	prickly lettuce	introduced	annual, biennial	forb/herb	dicot
Lasthenia californica	California goldfields	native	annual, perennial	forb/herb	dicot
Lasthenia fremontii	Fremont's goldfields	native	annual	forb/herb	dicot
Lasthenia glaberrima	smooth goldfields	native	annual	forb/herb	dicot
Layia chrysanthemoides	tidy tips	native	annual	forb/herb	dicot
Madia elegans ssp. *vernalis*	common madia	native	annual	forb/herb	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
Picris echioides	bristly ox-tongue	introduced	annual	forb/herb	dicot
Psilocarphus brevissimus	wooly heads	native	annual	forb/herb	dicot
Psilocarphus oregonus	Oregon wooly-heads	native	annual	forb/herb	dicot
Senecio vulgaris	common groundsel	introduced	annual, biennial	forb/herb	dicot
Silybum marianum	milk thistle	introduced	annual, biennial	forb/herb	dicot
Sonchus asper ssp. *asper*	prickly sow thistle	introduced	annual	forb/herb	dicot
Sonchus oleraceus	annual sowthistle	introduced	annual	forb/herb	dicot
Xanthium spinosum	spiny cocklebur	introduced	annual	forb/herb	dicot
Xanthium strumarium	cocklebur	native	annual	forb/herb	dicot
BORAGINACEAE (borage family)					
Amsinckia menziesii var. *intermedia*	fiddleneck	native	annual	forb/herb	dicot
Heliotropium curassavicum	heliotrope	native	annual, perennial	subshrub, forb/herb	dicot
Plagiobothrys greenei	popcorn flower	native	annual	forb/herb	dicot
Plagiobothrys leptocladus	alkali popcorn flower	native	annual	forb/herb	dicot
Plagiobothrys stipitatus var. *micranthus*	stalked popcornflower	native	annual	forb/herb	dicot
Plagiobothrys stipitatus var. *stipitatus*	stalked popcornflower	native	annual	forb/herb	dicot
Plagiobothrys trachycarpus	roughfruit popcornflower	native	annual	forb/herb	dicot
BRASSICACEAE (mustard family)					
Brassica nigra	black mustard	introduced	annual	forb/herb	dicot
Brassica rapa	field mustard	introduced	annual, biennial	forb/herb	dicot
Capsella bursa-pastoris	shepherd's purse	introduced	annual	forb/herb	dicot
Cardamine oligosperma	little western bittercress	native	annual, biennnial, perennial	forb/herb	dicot
Cardaria chalepensis	lens-podded hoary-cress	introduced	perennial	shrub	dicot
Lepidium latifolium	perennial peppergrass	introduced	perennial	forb/herb	dicot
Lepidium latipes var. *heckardii*	Heckard's peppergrass	native	annual	forb/herb	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
Lepidium nitidum var. *nitidum*	shining pepperweed	native	annual	forb/herb	dicot
Raphanus raphanistrum	jointed charlock	introduced	annual, biennial	forb/herb	dicot
Raphanus sativus	wild radish	introduced	annual, biennial	forb/herb	dicot
Rorippa curvisiliqua	yellow cress	native	annual, biennial	forb/herb	dicot
CALLITRICHACEAE (water-starwort family)					
Callitriche trochlearis	water starwort	native	annual	forb/herb	dicot
CAMPANULACEAE (bellflower family)					
Downingia bicornuta var. *bicornuta*	downingia	native	annual	forb/herb	dicot
Downingia ornatissima var. ornatissima	folded calicoflower	native	annual	forb/herb	dicot
Legenere limosa	legenere	native	annual	forb/herb	dicot
CAPRIFOLIACEAE (honeysuckle family)					
Sambucus nigra (syn. *Sambucus mexicana*)	elderberry	native	perennial	shrub, tree	dicot
Symphoricarpos albus var. *laevigatus*	snowberry	native	perennial	subshrub, shrub	dicot
CARYOPHYLLACEAE (pink family)					
Cerastium glomeratum	sticky chickweed	introduced	annual	forb/herb	dicot
Silene gallica	catchfly	introduced	annual, biennial	forb/herb	dicot
Spergula arvensis ssp. *arvensis*	starwort	introduced	annual	forb/herb	dicot
Spergularia bocconii	sand-spurry	introduced	annual	forb/herb	dicot
Stellaria media	common chickweed	introduced	annual	forb/herb	dicot
CHENOPODIACEAE (goosefoot family)					
Chenopodium album	lamb's quarters	native, introduced	annual	forb/herb	dicot
Chenopodium ambrosioides	Mexican tea	introduced	annual, perennial	forb/herb, subshrub	dicot
Chenopodium multifidum	chenopodium	introduced	annual	forb/herb	dicot
Salsola tragus	russian tumbleweed	introduced	annual	forb/herb	dicot
CONVOVULACEAE (morning-glory family)					
Convolvulus arvensis	bindweed	introduced	perennial	vine, forb/herb	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
CRASSULACEAE (stonecrop family)					
Crassula aquatica	water pygmyweed	native	annual	forb/herb	dicot
CUCURBITACEAE (cucumber family)					
Marah fabaceus	manroot	native	perennial	vine, forb/herb	dicot
CUSCUTACEAE (dodder family)					
Cuscuta pentagona	dodder	native	annual, perennial	vine, forb/herb	dicot
CYPERACEAE (sedge family)					
Carex praegracilis	carex	native	perennial	graminoid	monocot
Cyperus eragrostis	sedge	native	perennial	graminoid	monocot
Cyperus erythrorhizos	redroot flatsedge	native	annual, perennial	graminoid	monocot
Cyperus esculentus	yellow nut sedge	native, introduced	perennial	graminoid	monocot
Eleocharis macrostachya	spike rush	native	perennial	graminoid	monocot
Schoenoplectus acutus (syn. *Scirpus acutus var. occidentalis*)	hardstem bulrush	native	perennial	graminoid	monocot
Schoenoplectus mucronatus (syn. *Scirpus mucronatus*)	bog bulrush	introduced	perennial	graminoid	monocot
Scirpus robustus	alkali bull rush	native	perennial	graminoid	monocot
Schoenoplectus glaucus (syn. *Scirpus tuberosus*)	scirpus	introduced	perennial	graminoid	monocot
EUPHORBIACEAE (spurge family)					
Chamaesyce maculata	spotted sandmat	native	annual	forb/herb	dicot
Eremocarpus setigerus	turkey mullin, doveweed	native	annual	forb/herb	dicot
FABACEAE (pea family)					
Glycyrrhiza lepidota	wild licorice	native	perennial	forb/herb	dicot
Lotus corniculatus	trefoil	introduced	perennial	forb/herb	dicot
Lotus unifoliolatus var. unifoliolatus (syn. *Lotus purshianus* var. *purshianus*)	lotus	native	annual	forb/herb	dicot
Lupinus albifrons var. *albifrons*	lupine	native	perennial	subshrub, shrub	dicot
Lupinus bicolor	annual lupine	native	annual	forb/herb	dicot
Medicago polymorpha	California burclover	introduced	annual, perennial	forb/herb	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
Medicago sativa	alfalfa	introduced	annual, perennial	forb/herb	dicot
Melilotus alba	white sweetclover	introduced	annual, biennnial, perennial	forb/herb	dicot
Melilotus indica	yellow sweetclover	introduced	annual	forb/herb	dicot
Trifolium depauperatum var. *depauperatum*	balloon clover	native	annual	forb/herb	dicot
Trifolium dubium	hopclover, shamrock	introduced	annual	forb/herb	dicot
Trifolium fucatum	bull clover	native	annual	forb/herb	dicot
Trifolium hirtum	rose clover	introduced	annual	forb/herb	dicot
Trifolium microdon	thimble clover	native	annual	forb/herb	dicot
Trifolium variegatum	whitetip clover	native	annual	forb/herb	dicot
Trifolium willdenovii	tomcat clover	native	annual	forb/herb	dicot
Vicia sativa ssp. *nigra*	common vetch	introduced	annual	vine, forb/herb	dicot
Vicia villosa	hairy vetch	introduced	annual, biennnial, perennial	vine, forb/herb	dicot
FAGACEAE (beech family)					
Quercus douglasii	blue oak	native	perennial	tree	dicot
Quercus lobata	valley oak	native	perennial	tree	dicot
Quercus wislizenii	live oak	native	perennial	tree	dicot
Centaurium muehlenbergii	centaury	native	annual, biennial	forb/herb	dicot
Erodium botrys	broad leaf cranes bill	introduced	annual, biennial	forb/herb	dicot
Erodium cicutarium	red stemmed filaree	introduced	annual, biennial	forb/herb	dicot
Erodium moschatum	white-stemmed filaree	introduced	annual, biennial	forb/herb	dicot
GERANIACEAE (geranium family)					
Geranium carolinianum	Carolina geranium	native	annual, biennial	forb/herb	dicot
Geranium dissectum	geranium	introduced	annual, biennial	forb/herb	dicot
HYDROPHYLLACEAE (waterleaf family)					
Nemophila menziesii	baby blue-eyes	native	annual	forb/herb	dicot
Nemophila pedunculata	nemophila	native	annual	forb/herb	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
IRIDACEAE (iris family)					
Sisyrinchium bellum	blue-eyed grass	native	perennial	forb/herb	monocot
JUGLANDACEAE (walnut family)					
Juglans californica var. *hindsii*	black walnut	native	perennial	tree	dicot
JUNCACEAE (rush family)					
Juncus arcticus ssp. *littoralis* (syn. *Juncus balticus*)	baltic rush	native	perennial	graminoid	monocot
Juncus bufonius	toad rush	native	annual	graminoid	monocot
Juncus patens	rush	native	perennial	forb/herb	monocot
Juncus phaeocephalus	rush	native	perennial	graminoid	monocot
Juncus xiphioides	irisleaf rush	native	perennial	graminoid	monocot
LAMIACEAE (mint family)					
Lamium amplexicaule	henbit	introduced	annual, biennial	forb/herb	dicot
Lycopus americanus	bugleweed	native	perennial	forb/herb	dicot
Marrubium vulgare	white horehound	introduced	perennial	subshrub, forb/herb	dicot
Mentha pulegium	pennyroyal	introduced	perennial	forb/herb	dicot
Pogogyne douglasii	Douglas' mesamint	native	annual	forb/herb	dicot
Pogogyne ziziphoroides	Sacramento mesamint	native	annual	forb/herb	dicot
Stachys ajugoides	hedge nettle	native	perennial	forb/herb	dicot
Trichostema lanceolatum	vinegar weed	native	annual	forb/herb	dicot
LAURACEAE (laurel family)					
Umbellularia californica	California bay tree	native	perennial	tree, shrub	dicot
LILIACEAE (lily family)					
Asparagus officinalis ssp. *officinalis*	asparagus	introduced	perennial	forb/herb	monocot
Brodiaea elegans ssp. elegans	harvest brodiaea	native	perennial	forb/herb	monocot
Chlorogalum pomeridianum	soap root	native	perennial	forb/herb	monocot
Dichelostemma capitatum ssp. *capitatum*	blue dicks	native	perennial	forb/herb	monocot
Triteleia hyacinthina	white brodiaea	native	perennial	forb/herb	monocot
Triteleia laxa	Ithuriel's spear	native	perennial	forb/herb	monocot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
LYTHRACEAE (loosestrife family)					
Ammannia coccinea	ammannia	native	annual	forb/herb, subshrub	dicot
Lythrum hyssopifolia	hyssop loosestrife	introduced	annual, biennial	forb/herb	dicot
Lythrum tribracteatum	threebract loosestrife	introduced	perennial	forb/herb	dicot
MALVACEAE (mallow family)					
Abutilon theophrasti	velvetleaf	introduced	annual	forb/herb	dicot
Malva neglecta	cheeses	introduced	annual, biennnial, perennial	forb/herb	dicot
Malvella leprosa	alkali mallow	native	perennial	forb/herb	dicot
OLEACEAE (olive family)					
Fraxinus latifolia	Oregon ash	native	perennial	tree	dicot
ONAGRACEAE (evening primrose family)					
Epilobium brachycarpum	willowweed	native	annual	forb/herb	dicot
Epilobium canum	zauschneria	native	perennial	subshrub, forb/herb	dicot
Epilobium ciliatum	willow weed	native	perennial	forb/herb	dicot
Epilobium pygmaeum	epilobium	native	annual	forb/herb	dicot
Ludwigia peploides ssp. *peploides*	water primrose	native	perennial	forb/herb	dicot
PAPAVERACEAE (poppy family)					
Eschscholzia californica	California poppy	native	annual, perennial	forb/herb	dicot
PLANTAGINACEAE (plantain family)					
Plantago coronopus	buckhorn plantain	introduced	annual, biennial	forb/herb	dicot
Plantago elongata	little plantain	native	annual	forb/herb	dicot
Plantago lanceolata	English plantain	introduced	annual, biennnial, perennial	forb/herb	dicot
PLATANACEAE (plane-tree family)					
Platanus racemosa	California sycamore	native	perennial	tree	dicot
POACEAE (grass family)					
Alopecurus saccatus	foxtail	native	annual	graminoid	monocot
Avena fatua	wild oats	introduced	annual	graminoid	monocot
Briza minor	quaking grass	introduced	annual	graminoid	monocot
Bromus carinatus	California brome	native	annual, perennial	graminoid	monocot
Bromus diandrus	ripgut brome	introduced	annual, perennial	graminoid	monocot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
Bromus hordeaceus	soft chess	introduced	annual	graminoid	monocot
Bromus madritensis ssp. *rubens*	foxtail chess	introduced	annual	graminoid	monocot
Crypsis schoenoides	swamp grass	introduced	annual	graminoid	monocot
Crypsis vaginiflora	swamp timothy	introduced	annual	graminoid	monocot
Cynodon dactylon	bermuda grass	introduced	perennial	graminoid	monocot
Deschampsia cespitosa	tufted hairgrass	native	perennial	graminoid	monocot
Distichlis spicata	salt grass	native	perennial	graminoid	monocot
Echinochloa crus-galli	water grass	introduced	annual	graminoid	monocot
Elymus glaucus	blue wild rye	native	perennial	graminoid	monocot
Elymus trachycaulus	wheat grass	native	perennial	graminoid	monocot
Eragrostis mexicana	Mexican lovegrass	native	annual	graminoid	monocot
Schedonorus phoenix (syn. *Festuca arundinacea*)	tall fescue	introduced	perennial	graminoid	monocot
Festuca brevipila (syn. *Festuca trachyphylla*)	hard fescue	introduced	perennial	graminoid	monocot
Hordeum brachyantherum	meadow barley	native	perennial	graminoid	monocot
Hordeum jubatum	foxtail barley	native	perennial	graminoid	monocot
Hordeum marinum ssp. *gussonianum*	mediterranean barley	introduced	annual	graminoid	monocot
Hordeum murinum ssp. *leporinum*	foxtail barley	introduced	annual	graminoid	monocot
Koeleria macrantha	junegrass	native	perennial	graminoid	monocot
Leymus triticoides	creeping wild rye	native	perennial	graminoid	monocot
Leptochloa uninervia	Mexican sprangletop	native	annual, perennial	graminoid	monocot
Lolium perenne ssp. *multiflorum* (syn. *Lolium multiflorum*)	annual rye grass	introduced	annual, perennial	graminoid	monocot
Melica californica	California melic	native	perennial	graminoid	monocot
Muhlenbergia rigens	deer grass	native	perennial	graminoid	monocot
Nassella cernua	nodding needlegrass	native	perennial	graminoid	monocot
Nassella pulchra	purple needle grass	native	perennial	graminoid	monocot
Paspalum dilatatum	dallis grass	introduced	perennial	graminoid	monocot
Phalaris californica	California canarygrass	native	perennial	graminoid	monocot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
Phalaris minor	canary grass	introduced	annual	graminoid	monocot
Phalaris paradoxa	hood canarygrass	introduced	annual	graminoid	monocot
Phleum pratense	cultivated timothy	introduced	perennial	graminoid	monocot
Poa annua	annual bluegrass	introduced	annual	graminoid	monocot
Poa bulbosa	bulbous bluegrass	introduced	perennial	graminoid	monocot
Polypogon monspeliensis	rabbit foot grass	introduced	annual	graminoid	monocot
Setaria pumila	bristly foxtail	introduced	annual	graminoid	monocot
Sorghum halepense	johnsongrass	introduced	perennial	graminoid	monocot
Taeniatherum caput-medusae	medusahead	introduced	annual	graminoid	monocot
Vulpia myuros	rat tail fescue	introduced	annual	graminoid	monocot
POLYGONACEAE (buckwheat family)					
Polygonum amphibium var. *emersum*	water smartweed	native	perennial	forb/herb	dicot
Polygonum arenastrum	common knotweed	introduced	annual, perennial	forb/herb	dicot
Polygonum lapathifolium	willow smartweed	native	annual	forb/herb	dicot
Polygonum persicaria	thumbprint smartweed	probably introduced	annual, perennial	forb/herb	dicot
Polygonum punctatum	annual smartweed	native	annual, perennial	forb/herb	dicot
Rumex conglomeratus	clustered dock	introduced	perennial	forb/herb	dicot
Rumex crispus	curly dock	introduced	perennial	forb/herb	dicot
Rumex maritimus	golden dock	native	annual, biennial	forb/herb	dicot
Rumex pulcher	fiddle dock	introduced	perennial	forb/herb	dicot
POLEMONIACEAE (phlox family)					
Linanthus montanus	mustang clover	native	annual	forb/herb	dicot
Navarretia leucocephala	whitehead navarretia	native	annual	forb/herb	dicot
PONTEDERIACEAE (water-hyacinth family)					
Eichhornia crassipes	water hyacinth	introduced	perennial	forb/herb	dicot
PORTULACEAE (purslane family)					
Calandrinia ciliata	red maids	native	annual	forb/herb	dicot
Claytonia parviflora	miners lettuce	native	annual	forb/herb	dicot
Claytonia perfoliata ssp. *mexicana*	miners' lettuce	native	annual	forb/herb	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
Montia fontana	water chickweed	native	annual	forb/herb	dicot
PRIMULACEAE (primrose family)					
Anagallis arvensis	scarlet pimpernel	introduced	annual, biennial	forb/herb	dicot
RANUNCULACEAE (buttercup family)					
Clematis ligusticifolia	virgin's bower	native	perennial	vine	dicot
Ranunculus bonariensis var. *trisepalus*	buttercup	native	annual	forb/herb	dicot
Ranunculus muricatus	spiny-fruited buttercup	introduced	annual, biennnial, perennial	forb/herb	dicot
Rosa californica	California rose	native	perennial	subshrub	dicot
Rubus armeniacus (syn. *Rubus discolor)*	himalayan blackberry	introduced	perennial	subshrub	dicot
Rubus ursinus	California blackberry	native	perennial	subshrub	dicot
RUBIACEAE (madder family)					
Cephalanthus occidentalis var. *californicus*	California button willow	native	perennial	tree, shrub	dicot
Galium tricornutum	rough corn bedstraw	introduced	annual	forb/herb	dicot
SALICACEAE (willow family)					
Populus fremontii	Fremont's cottonwood	native	perennial	tree	dicot
Salix exigua	sandbar willow	native	perennial	tree, shrub	dicot
Salix gooddingii	Goodding's willow	native	perennial	tree	dicot
Salix laevigata	red willow	native	perennial	shrub	dicot
Salix lasiolepis	arroyo willow	native	perennial	tree, shrub	dicot
Salix lucida ssp. *lasiandra*	yellow willow	native	perennial	tree, shrub	dicot
SCROPHULARIACEAE (figwort family)					
Castilleja attenuata	valley tassels	native	annual	forb/herb	dicot
Castilleja campestris ssp. *campestris*	owl's clover	native	annual	forb/herb	dicot
Castilleja campestris ssp. *succulenta*	succulent owl's clover	native	annual	forb/herb	dicot
Castilleja exserta	purple owl's clover	native	annual	forb/herb	dicot
Kickxia spuria	sharppoint fluellin	introduced	annual	forb/herb	dicot
Diplacus aurantiacus ssp. aurantiacus (syn. *Mimulus aurantiacus*)	orange bush monkeyflower	native	perennial	subshrub, shrub	dicot

Scientific name	Common name	U.S. Nativity	Duration	Growth habit	Group
Mimulus glaucescens (syn. *Mimulus guttatus*)	shieldbract monkeyflower	native	annual	forb/herb	dicot
Mimulus latidens	broadtooth monkeyflower	native	annual	forb/herb	dicot
Mimulus tricolor	tricolor monkeyflower	native	annual	forb/herb	dicot
Triphysaria eriantha ssp. *eriantha*	ohnny jump-up	native	annual	forb/herb	dicot
Triphysaria pusilla	dwarf owl's-clover	native	annual	forb/herb	dicot
Veronica peregrina ssp. *xalapensis*	purslane speedwell	native	annual	forb/herb	dicot
Veronica persica	persian speedwell	introduced	annual	forb/herb	dicot
SOLANACEAE (potato family)					
Nicotiana quadrivalvis	coyote tobacco	native	annual	forb/herb	dicot
Physalis lanceolata	ground cherry	native	perennial	forb/herb	dicot
TYPHACEAE (cat-tail family)					
Typha angustifolia	cattail	introduced	perennial	forb/herb	monocot
Typha latifolia	narrow leaf cattail	native	perennial	forb/herb	monocot
URTICACEAE (nettle family)					
Urtica dioica	stinging nettles	native and introduced	perennial	forb/herb	dicot
Urtica urens	dwarf nettle	introduced	annual	forb/herb	dicot
Phyla nodiflora	phyla	native	perennial	forb/herb	dicot
VERBENACEAE (Verbena family)					
Verbena bonariensis	verbena	introduced	annual, biennnial, perennial	subshrub, forb/herb	dicot
VISCACEAE (Christmas mistletoe family)					
Phoradendron macrophyllum ssp. *macrophyllum* (syn. *Phoradendron tomentosum* ssp. *macrophyllum*)	mistletoe	native	perennial	subshrub, shrub	dicot
VITACEAE (grape family)					
Vitis californica	wild grape	native	perennial	vine	dicot
ZYGOPHYLLACEAE (Creosote-bush family)					
Tribulus terrestris	punctureVine	introduced	annual	forb/herb	dicot

All plant scientific names confirmed by: USDA, NRCS. 2006. The PLANTS Database (http://plants.usda.gov, August 2006). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Appendix K. Glossary

Adaptive Management. The rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from refuge research and monitoring and evaluation of management actions to support or modify objectives and strategies at all planning levels.

Alkalinity. Refers to the extent to which water or soils contain soluble mineral salts. Waters with a pH greater than 7.4 are considered alkaline.

Alluvium. Clay, sand, or other sediment that is gradually deposited by moving water (see also alluvial-fan).

Alternatives. Different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues. (1) A reasonable way to fix the identified problem or satisfy the stated need. (40 CFR 150.2) (2) Alternatives are different means of accomplishing refuge purposes and goals and contributing to the System mission (Draft Service Manual 602 FW 1.5).

Animal Unit Month (AUM). The amount of forage necessary to maintain one 1,000-pound animal for one month.

Aquatic. Pertaining to water, in contrast to land. Living in or upon water.

Aquatic Habitat. The physical, chemical, and vegetative features that occur within the water of lakes, ponds, reservoirs, rivers, irrigation canals, and other bodies of water.

Aquifer. An underground layer of porous rock, sand, or gravel containing large amounts of water.

Artifact. An object made by humans; usually in reference to primitive tools, vessels, weapons, etc.

Basin. A depressed area with little or no surface water; an area where water flows in, but where surface water does not flow out.

Biodiversity (biological diversity). Refers to the full range of variability within and among biological communities, including genetic diversity, and the variety of living organisms, assemblages of living organisms, and biological processes. Diversity can be measured in terms of the number of different items (species, communities) and their relative abundance, and it can include horizontal and vertical variability. The variety of life, including the variety of living organisms, the genetic differences among them, and the communities in which they occur.

Biological Control. The use of organisms or viruses to control weeds or other pests.

Biological Integrity. Biotic composition, structure, and functioning at the genetic, organism, and community levels consistent with natural conditions, including the natural biological processes that shape genomes, organisms, and communities.

Carnivore. An animal that kills and eats other animals.

Categorical Exclusion (CE, CX, CATEX, CATX). A category of actions that do not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a Federal agency pursuant to the National Environmental Policy Act (40 CFR 1508.4).

CFR. Code of Federal Regulations.

Community. The combined populations of all organisms in a given area, and their interactions. For example, the frogs, fish, algae, cattails, and lily pads in a backyard pond make up a community.

Compatible Use. A wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the Director, will not materially interfere with or detract from the fulfillment of the Mission of the System or the purposes of the refuge (Draft Service Manual 603 FW 3.6).

Comprehensive Conservation Plan (CCP). A document that describes the desired future conditions of the refuge or planning unit; and provides long-range guidance and management direction to accomplish the purposes of the refuge, helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; helps achieve the goals of the National Wilderness Preservation System; and meets other mandates.

Concern. See Issue.

Cultural Resource. The physical remains of human activity (artifacts, ruins, burial mounds, petroglyphs, etc.) and conceptual content or context (as a setting for legendary, historic, or prehistoric events, such as a sacred area of native peoples) of an area. It includes historical, archaeological and architectural significant resources.

Cultural Resource Inventory. A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4 (Service Manual 614 FW 1.7).

Cultural Resource Overview. A comprehensive document prepared for a field office that discusses, among other things, its prehistory and cultural history, the nature and extent of known cultural resources, previous research, management objectives, resource management conflicts or issues, and a general statement on how program objectives should be met and conflicts resolved. An overview should reference or incorporate information from a field offices background or literature search described in Section VIII of the Cultural Resource Management Handbook (Service Manual 614 FW 1.7).

Easement. A privilege or right that is held by one person or other entity in land owned by another.

Ecosystem. The sum of all interacting parts of the environment and associated ecological communities within a particular area; an ecological system. Many levels of ecosystems have been recognized. Very few, if any ecosystems are self-contained; most influence, or are influenced by, components or forces outside the system. For administrative purposes,

we have designated 53 ecosystems covering the United States and its possessions. These ecosystems generally correspond with watershed boundaries, and their sizes and ecological complexity vary.

Effect. A change in a resource, caused by a variety of events including project attributes acting on a resource attribute (direct), not directly acting on a resource attribute (indirect), another project attributes acting on a resource attribute (cumulative), and those caused by natural events (e.g., seasonal change).

Emergent Vegetation. Rooted, aquatic plants that have most of their vegetative (nonroot) parts above water.

Endemic Species. Plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality.

Endangered Species. Any species that is in danger of extinction throughout all or a significant portion of its range and listed as such by the Secretary of the Interior in accordance with the Endangered Species Act of 1973. Endangered species are afforded protection under the Act as amended and under various State laws for State-listed species.

Environmental Assessment (EA). A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

Environmental Health. Abiotic composition, structure, and functioning of the environment consistent with natural conditions, including the natural abiotic processes that shape the environment

Ethnography. The branch of anthropology that deals descriptively with specific cultures, especially those of non-literate peoples.

Evapotranspiration. The collective processes by which water is transferred from the surface of the earth, including from the soil and the surface of water-bodies (through evaporation) and from plants (through transpiration).

Exotic and Invading Species (Noxious Weeds). Plant species designated by Federal or State law as generally possessing one or more of the following characteristics: aggressive or difficult to manage; parasitic; a carrier or host of serious insects or disease; or nonnative, new, or not common to the United States, according to the Federal Noxious Weed Act (PL 93-639), a noxious weed is one that causes disease or has adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the Unite States and to the public health.

Fallow. Allowing land that normally is used for crop production to lie idle.

Finding of No Significant Impact (FONSI). A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a Federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).

Flyway. A route taken by migratory birds between their breeding grounds and their wintering grounds. Four primary migration routes have been identified for birds breeding in North America: the Pacific, Central, Mississippi, and Atlantic Flyways.

Foraging. The act of feeding; another word for feeding.

Forbs. Herbaceous dicotyledonous plants.

Fragmentation. The process of reducing the size and connectivity of habitat patches.

GIS. Geographic Information System. Refers to such computer mapping programs as ArcView, ArcInfo, ERDAS, etc.

Goal. Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units (Draft Service Manual 620 FW 1.5).

Grain. A single, hard seed of a cereal grass.

Habitat. Suite of existing environmental conditions required by an organism for survival and reproduction. The place where an organism typically lives.

Integrated Pest Management (IPM). Methods of managing undesirable species, such as weeds, including education; prevention, physical or mechanical methods or control; biological control; responsible chemical use; and cultural methods.

Invertebrate. Animals that do not have backbones. Included are insects, spiders, mollusks (clams, snails, etc.), and crustaceans (shrimp, crayfish, etc.).

Irrigation Drainwater. Ideally, subsurface water which flows from irrigated land and generally transports higher concentrations of dissolved salts than the water applied to the land.

Irrigation Return Flow. Water which reaches surface drainage by overland flow or through groundwater discharge as a result of applied or natural irrigation.

Issue. Any unsettled matter that requires a management decision, e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition.

Lethal Dose 50 (LD50). The LD50 or colloquially, semi-lethal dose of a particular substance is a measure of how much constitutes a lethal dose. The related units of an LD50/30 or an LD50/60 are used to refer to a dose that without treatment will be lethal to 50% of the population within (respectively) 30 or 60 days.

Mitigation. To avoid or minimize impacts of an action by limiting the degree or magnitude of the action; to rectify the impact by repairing, rehabilitating, or restoring the affected environment; to reduce or eliminate the impact by preservation and maintenance operations during the life of the action.

Moist-Soil. A process where water is drawn down intentionally or naturally to produce mudflats (i.e., moist soil) that are required for germination of many desirable plants.

National Environmental Policy Act (NEPA). An act which encourages productive and enjoyable harmony between humans and their environment, to promote efforts that will prevent or eliminate damage to the environment and atmosphere, to stimulate the health and welfare of humans. The act also established the Council on Environmental Quality (CEQ). Requires all agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision making (from 40 CFR 1500).

National Wildlife Refuge (Refuge or NWR). A designated area of land or water or an interest in land or water within the system, including national wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas (except coordination areas) under the Service jurisdiction for the protection and conservation of fish and wildlife. A complete listing of all units of the Refuge System may be found in the current "Report of Lands Under Control of the U.S. Fish and Wildlife Service."

National Wildlife Refuge System, Refuge System, or System. Various categories of areas that are administered by the Secretary for the conservation of fish and wildlife, including species that are threatened with extinction; all lands, waters, and interest therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges; game ranges; wildlife management or waterfowl production areas.

Native Species. Species that normally live and thrive in a particular ecosystem.

NEPA. National Environmental Policy Act of 1969.

No Action Alternative. An alternative under which existing management would be continued.

Objective. A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Make objectives attainable, time-specific, and measurable.

Plant Community. An assemblage of plant species of a particular composition. The term can also be used in reference to a group of one or more populations of plants in a particular area at a particular point in time; the plant community of an area can change over time due to disturbance (e.g., fire) and succession.

Playa. A shallow basin where water collects and is evaporated.

Population. All the members of a single species coexisting in one ecosystem at a given time.

Preferred Alternative. This is the alternative determined (by the decision maker) to best achieve the Refuge purpose, vision, and goals; contributes to the Refuge System mission, addresses the significant issues; and is consistent with principles of sound fish and wildlife management. The Service's selected alternative at the Draft CCP stage.

Prescribed Fire. The skillful application of fire to natural fuels under conditions of weather, fuel moisture, soil moisture, , etc., that allows confinement of the fire to a predetermined area and produces the intensity of heat and rate of spread to accomplish planned benefits to one or more objectives of habitat management, wildlife management, or hazard reduction.

Priority Public Uses. Compatible wildlife-dependent recreation uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation).

Proposed Action. The Service's proposed action for Comprehensive Conservation Plans is to prepare and implement the CCP.

Public Involvement. A process that offers impacted and interested individuals and organizations an opportunity to become informed about, and to express their opinions on Service actions and policies. In the process, these views are studied thoroughly and thoughtful consideration of public views is given in shaping decisions for refuge management.

Public Scoping. See public involvement.

Purposes of the Refuge. "The purposes 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, refuge unit, or refuge subunit." For refuges that encompass congressionally designated wilderness, the purposes of the Wilderness Act are additional purposes of the refuge.

Raptor. A bird of prey, such as a hawk, eagle, or owl.

Refuge. Short of National Wildlife Refuge.

Refuge Operating Needs System (RONS). The Refuge Operating Needs System is a national database that contains the unfunded operational needs of each refuge. We include projects required to implement approved plans and meet goals, objectives, and legal mandates.

Refuge Purposes. The purposes 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, a refuge unit, or refuge subunit (Draft Service Manual 602 FW 1.5).

Salinity. An expression of the amount of dissolved solids in water.

Shorebirds. Long-legged birds, also known as waders, belonging to the Order Charadriiformes that use shallow wetlands and mud flats for foraging and nesting.

Sound Professional Judgment. A finding, determination, or decision that is consistent with principles of sound fish and wildlife management and administration, available science and resources, and adherence to the requirements of the Refuge Administration Act and other applicable laws.

Species. A distinctive kind of plant or animal having distinguishable characteristics, and that can interbreed and produce young. A category of biological classification.

Step-Down Management Plan. A plan that provides specific guidance on management subjects (e.g., habitat, public use, fire, safety) or groups of related subjects. It describes strategies and implementation schedules for meeting CCP goals and objectives.

Strategy. A specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives (Draft Service Manual 602 FW 1.5).

Threatened Species. Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, and one that has been designated as a threatened species in the Federal Register by the Secretary of the Interior. Threatened species are afforded protection under the Endangered Species Act of 1973.

Upland. An area where water normally does not collect and where water does not flow on an extended basis. Uplands are non-wetland areas.

Vernal Pool. Seasonally flooded depressions found on ancient soils with an impermeable layer such as a hardpan, claypan, or volcanic basalt. The impermeable layer allows the pools to retain water much longer then the surrounding uplands; nonetheless, the pools are shallow enough to dry up each season. Vernal pools often fill and empty several times during the rainy season. Only plants and animals that are adapted to this cycle of wetting and drying can survive in vernal pools over time.

Vision Statement. A concise statement of what the planning unit should be, or what we hope to do, based primarily upon the Refuge System mission and specific refuge purposes, and other mandates. We will tie the vision statement for the refuge to the mission of the Refuge System; the purpose(s) of the refuge; the maintenance or restoration of the ecological integrity of each refuge and the Refuge System; and other mandates.

Waterfowl. A group of birds that include ducks, geese, and swans (belonging to the order Anseriformes).

Watershed. The entire land area that collects and drains water into a river or river system.

Wilderness Review. The process we use to determine if we should recommend Refuge System lands and waters to Congress for wilderness designation. The wilderness review process consists of three phases: inventory, study, and recommendation. The inventory is a broad look at the refuge to identify lands and waters that meet the minimum criteria for wilderness. The study evaluates all values (ecological, recreational, cultural), resources (e.g., wildlife, water, vegetation, minerals, soils), and uses (management and public) within the Wilderness Study Area. The findings of the study determine whether or not we will recommend the area for designation as wilderness.

Wildfire. A free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands (Service Manual 621 FW 1.7).

Wildlife. All nondomesticated animal life; included are vertebrates and invertebrates.

Wildlife-Dependent Recreational Use. "A use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation." These are the six priority public uses of the Refuge System as established in the National Wildlife Refuge System Administration Act, as amended. Wildlife-dependent recreational uses, other than the six priority public uses, are those that depend on the presence of wildlife. We also will consider these other uses in the preparation of refuge CCPs; however, the six priority public uses always will take precedence.

Appendix L. Summary of Public Involvement/ Comments and Consultation/ Coordination

This page is intentionally left blank, for the 2006 public Draft of the Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan (CCP). This appendix will be provided in the Final CCP.

Appendix M. Mailing List

This page is intentionally left blank, for the 2006 public Draft of the Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan (CCP). This appendix will be provided in the Final CCP.

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Appendix O. Integrated Pest Management Plan for Mosquito-Associated Threats

DRAFT
Integrated Pest Management Plan for Mosquito-Associated Threats
Stone Lakes National Wildlife Refuge
August, 2006

I. Introduction

Stone Lakes National Wildlife Refuge (Refuge) collaborates with the Sacramento-Yolo Mosquito Vector Control District (District) in monitoring and controlling mosquitos to ensure the human health concerns of neighboring communities are addressed. The Refuge is located within Sacramento County, 10 miles south of downtown Sacramento and bordered by the city of Elk Grove on the east. The potential for mosquitos to be produced or harbored on the Refuge is a concern to nearby residents and urbanized areas immediately adjacent to the Refuge are well within the flying range of many species of mosquitos. Because of this and commitments made by the U.S. Fish and Wildlife Service (Service) in the Final Environmental Impact Statement (1992) establishing the Refuge approved boundary, the Service entered into a Memorandum of Understanding (MOU) in 1993, to ensure the public health and well-being of residents would not be adversely affected by mosquitos from the Refuge. This Integrated Pest Management (IPM) Plan for Mosquito and Associated Threats will facilitate implementation of the MOU and ensure mosquito management practices are consistent with Service IPM policies and regulations regarding management of the national wildlife refuge (NWR) system.

Refuge Description

Stone Lakes National Wildlife Refuge was established in 1994 becoming the 505th NWR. The approved Refuge boundary encompasses 17,640 acres, of which approximately 6,200 acres are currently managed by the Service. Stone Lakes NWR lies between the Coast and Diablo Ranges to the west and the Sierra Nevada to the east. Most of the Refuge lies within the 100-year floodplain of the Mokelumne and Cosumnes rivers. Interstate highway 5 roughly bisects the Refuge north to south. Annual temperature in the area averages approximately 61.0 F degrees and annual precipitation averages approximately 17.93 inches; virtually all of the precipitation occurs during the winter months. Summer is typically hot (>100 °F) and dry; winter temperatures are generally moderate (50-60 °F). Habitats on the Refuge consist of upland grasslands (55 percent), riparian forest and associated shrublands (7 percent), open water (7%), seasonal and permanent wetlands including vernal pools and irrigated pastures (26 percent), and croplands (5 percent). Land uses adjacent to the Refuge include farming (vineyards, orchards and row crops), grazing, and suburban housing developments.

Memorandum of Understanding (MOU)

The 1993 MOU between the District and the Refuge outlines a mosquito management program that includes consultation on wetland design and water management, use of physical, biological and chemical control agents to control mosquito larvae and adults, and

cooperative research on landbird populations. Both the Refuge and the District agree that biological, cultural and physical control methods are preferred over chemical measures and that wetlands can be designed and managed to minimize mosquito production. In summary, the MOU provides for: 1) allowing the District to review planned Refuge wetland construction projects; 2) providing the District an annual summary of the upcoming Refuge water management program and notification of flood ups and irrigations; 3) the District providing a proposed annual mosquito abatement operating plan to the Refuge, 4) the Refuge submitting pesticide use proposals (PUP's), as needed, for any chemical mosquito control agents requested by the District; 5) providing access to the District for mosquito monitoring and control as defined in an annual Special Use Permit (SUP); and 6) with notification and coordination, application of larvicides or adulticides by the District, when treatment thresholds are exceeded.

II. Mosquito Borne Disease

Disease History

Due partly to its climate, California has a history of serious arboviral disease problems that are not expected to diminish. Western equine (WEE) and St. Louis encephalitis (SLE) viruses are endemic and intermittently represent significant public health threats throughout the state. St. Louis encephalitis, historically a rural disease in the western USA, has now moved into the expanding metropolitan areas of southern California. Several international arboviral diseases have recently been introduced to the United States, such as dengue, Venezuelan equine encephalitis, and West Nile virus (WNV). WEE tends to be most serious in very young children, whereas elderly people are most at risk to SLE and WNV (CA Dept. of Heath Services 2003). WEE and WNV can also cause diseases in horses and emus, and WNV kills a wide variety of endemic and imported birds. Mosquito control is practically the only known method of protecting people and animals from WEE, SLE, and WNV. With the exception of available vaccines to protect horses against WEE and WNV, there are no known specific treatments or cures for the diseases caused by these viruses (CA Dept. of Health Services 2004).

West Nile virus was introduced into New York City during 1999 and has subsequently expanded its occurrence dramatically throughout North America. It was first documented as becoming established in California in 2004 when a total of 822 human cases were verified, primarily in southern California (Table 1). Of the 58 counties in the state, 23 reported virus activity during 2004, based on a range of monitoring methods, including: mosquito pools, sentinel chicken flocks, wild birds, or equine and human cases (CA Dept. of Heath Services 2004, CA West Nile Virus website 2006). During 2005, 54 counties were documented as supporting virus activity as it moved northward into the Central Valley and the northern state. In 2005, Sacramento County was recognized as a focus of WNV activity in the state.

Table 1. West Nile virus human cases in California (2004-2006). Numbers in parentheses are totals for Sacramento and Yolo counties.

Year	Human Cases	Human Fatalities
2004	822	25
	(4)	(0)
2005	935	19
	(189)	(1)
2006	50	1
(as of 08/18/06)	(16)	(0)

A number of characteristics of the Sacramento region may have contributed to this, including: (1) number of days per year temperatures exceed 95 degrees Fahrenheit., (2) abundance of mosquito production habitat particularly rice fields, irrigated pasture, dairies, and wetlands, (3) abundance of local migratory bird populations, (4) burgeoning human population interfacing with nearby agricultural lands, (5) heavy spring rains, and (6) the relative abundance of the primary WNV vector, *Culex tarsalis* (P. Sanders, SYMVCD, pers. comm.). During 2004-2005, human cases were documented in the state from approximately the first week of July through the first week of November. To date, there have been 16 human WNV cases in Sacramento and Yolo counties and one mortality in Butte County. WNV activity has been detected in a total of 43 counties. The five major species of birds most commonly found dead and testing positive for WNV in the state have been American crow, Western scrub-jay, yellow-billed magpie, American robin, and house finch.

A statewide encephalitis virus surveillance program has been in place since the 1960s that tracks mosquito abundance and enzootic transmission (transmission within the same geographic area) to provide an early warning of the potential for human infection. WEE and SLE have been recorded in the Central Valley since the 1940s reappearing intermittently after periods of apparent extinction. Though SLE has been rare since 1972, WEE enzootic transmission in the Sacramento Valley appears to be cyclic, recurring at 10 year intervals (Reisen et al. 1995). WEE is transmitted enzootically during the summer between wild birds and *Culex tarsalis*, while *Ocheloratus melanimon* is involved in a secondary cycle with rabbits in the Central Valley during the late summer (Reeves 1990). The mechanisms by which the viruses overwinter and are able to persist despite periods of apparent extinction are still unclear though they have been the subject of intense study for over 50 years (Kramer 1999). There are currently two main hypotheses, one, that WEE overwinters by chronic infection of one or more species of birds, and two, that the virus persists between seasons in adult mosquitos. Humans and horses are infected tangentially by mosquitos but are dead-end hosts for the virus. Data collected from county health clinics by the Encephalitis Virus Surveillance indicating a low rate of infection in humans even during periods of elevated enzootic transmission may reflect a lowered rate of mosquito-human contact. This reduction in the exposure of humans to mosquito bites is likely due to cultural factors like the prevalence of televisions and air conditioners that encourage the population to spend more time indoors during dusk, the main period of mosquito activity. Expanded mosquito control and water management programs have also reduced *Culex tarsalis* populations.

Mosquitos

The mosquito species identified by the District for monitoring and control at the Refuge are *Culex tarsalis*, *Anopheles freeborni, Ochlerotatus vexans, Ochlerotatus melanimon, Ochlerotatus nigromaculis,* and *Aedes increpitus*. *Culex tarsalis* is the primary vector of WEE and SLE in California and is also considered to be a significant vector of WNV (CA Dept. of Health Services 2003). *Anopheles freeborni* can transmit the malaria parasite to humans and is common in the rice growing regions of California. *Ochlerotatus melanimon* is involved in the encephalitis virus (sleeping sickness) cycle, and is considered a secondary vector for WNV (SYMVCD 2004).

Mosquito Biology

Mosquitos are dipterans with aquatic immature stages and an aerial adult stage. Eggs must come in contact with water in order to hatch. Mosquitos have four aquatic larval stages (instars) plus an aquatic pupal stage. The aerial adult emerges from the pupal stage onto the surface of the water, expands its wings, hardens its exoskeleton, and flies off. It takes from three to 12 days for a mosquito to complete its life cycle in northern California, depending on seasonal and environmental factors and the particular mosquito species involved. In general, the warmer the ambient temperature, the fewer days are required from hatching to emergence.

Ochlerotatus (floodwater) mosquitos (*O. melanimon, O. nigromaculis, O. vexans*)
The *Ochlerotatus* life cycle is initiated with the flooding of ground that has undergone a dry period. In the Sacramento Valley, the dry period may occur at any time from May through September. Once flooded, eggs that had been laid during the previous wet cycle hatch, pupate, and emerge as adults. Gravid females lay their eggs singly on damp soil, in leaf litter, in cracks in the soil, at the edges of drying ponds, or at the bases of grasses and other plants. Each female lays approximately 150 eggs per ovarian cycle. These eggs are very drought resistant, which allows them to survive during the summer. These mosquito species overwinter in the egg stage and to a much lesser extent in the larval stage. *Ochlerotatus* mosquitos (primarily *O. melanimon*) are the most abundant produced on Refuge habitats, primarily during late summer and fall flooding. Numerous *O. melanimon* can also be produced as a result of wetland irrigations in late spring through early summer. During these times, mosquito eggs hatch, pupate, and reach the adult stage rapidly. *Ochlerotatus* are most numerous on Refuges during the fall when the majority of wetlands are flooded. Multiple hatchings of eggs commonly occur due to the timing of the different broods of eggs and differences in flooding schedules for individual areas. During the warmer months, it generally takes 3-10 days for these mosquitos to develop from egg to adult (i.e., after initial flooding). Adult females of the three species of *Ochlerotatus* mentioned above are all aggressive, relative to other species, and are biters of primarily mammals. During the day, females will bite if disturbed or if a host presents itself, but generally are more active at dusk. Biting and swarming (mating) activities are typically crepuscular (occurring at twilight). When newly emerged, these mosquitos do not readily move away from their emergence sites. As they age, however, they will move about much more freely. Although all three species of *Ochlerotatus* are produced in this area, *O. melanimon* has consistently been the most numerous and the cause of most concern as both as a nuisance and a public health risk. *Ochlerotatus* mosquitos have been documented as secondary vectors for California Encephalitis and WNV.

Culex tarsalis (Encepalitis Mosquito)
Culex tarsalis occur in northern California in very large numbers during the summer. Females lay their eggs on the water surface in bunches called rafts. Each raft contains around 100-150 eggs, hatching about 24 hours after being laid. The immature stages can be found in almost any source of water except treeholes. During the summer, development from egg to adult takes about 9 days in the Sacramento Valley. This species is dramatically multivoltine (producing several broods), with adults emerging continuously throughout the summer. Abundant larva are commonly found in rice fields, poorly drained pastures, wetlands, sewer treatment plants, log decks, dairy farms, and seepages. Within Refuge habitats, *C. tarsalis* can be abundant in seasonal marsh and watergrass production units that have been flooded for more than two weeks during the fall. Adults spend daylight hours resting in secluded places such as cellars or animal burrows. Biting and swarming activities are crepuscular. Peak populations occur in late June or early July. *C. tarsalis* are primarily biters of birds, but will bite humans, livestock, and other mammals if the opportunity presents itself. *C. tarsalis* are strong fliers. Mark-release-recapture studies conducted in Sutter County in 1989 and 1990 showed that adult *C. tarsalis* could move up to 3 miles in just one night. *C. tarsalis* are the primary vector for Western Equine Encephalitis, St. Louis encephalitis, and WNV in humans.

Anopheles freeborni
A. freeborni also occur in northern California and are numerous during the summer. Rice fields are the primary production areas for this species although the immature stages are also found in ditches, seepages, sloughs, and wetlands. Females lay their eggs singly on the surface of the water where they hatch approximately 24 hours later. On the average, it takes 12 days for *A. freeborni* to develop from egg to adult in the Sacramento Valley. *A. freeborni*

are most abundant in persistent wetlands, thus Refuge perennial marsh can produce *A. freeborni* during the summer months. However, relatively stable water levels and a relative abundance of mosquito predators (fish, dragonflies, and aquatic beetles) tend to minimize adult mosquito emergence from these habitats.

This species is also multivoltine, with the ability to produce a continuous supply of newly emerged adults under the right habitat conditions. Adults rest during the day and engage in biting and swarming activities during crepuscular periods. In the fall, females go into diapause (overwintering stage) until January, February, or March when they come out of diapause and seek blood meals on warm days. After obtaining a blood meal, many females resume their overwintering stage until April or May. *A. freeborni* populations peak in late July or August. The females will readily bite humans and livestock. Area-wide, they are the most common nuisance mosquito for humans. Studies on *A. freeborni* in California have indicated long flight ranges from source areas. Work done in Sutter County found that this species could fly 2-3 miles in one night. This species is considered to be the most important vector of malaria in the Western United States.

III. Monitoring Mosquito Populations

District monitoring activities are designed to assess the abundance of immature (larvae and pupae) and adult mosquito populations. Monitoring activities conducted on the Refuge may include: larval sampling, adult light and host-seeking traps and adult leg counts. Monitoring by District staff may occur as often as 3-4 times per week during the summer irrigation (May 1st-July 31st) and fall flood up (August 1st-October15th). If temperatures are above average beyond October 15, District staff may continue to require access to the Refuge for monitoring.

Light and carbon dioxide traps are used to capture adult mosquitos for monitoring purposes. Dip counts are used to estimate the numbers of immature mosquitos and to determine the need for larval mosquito control. The dipper method entails using a long-handled ladle (ca 500 ml) called a dipper to collect water samples from possible mosquito sources. Captured immature mosquitos are identified taxonomically as precisely as possible. All Refuge units supporting wetlands or irrigated land potentially may be monitored using the dipper method. However, units supporting managed wetlands would be targeted. Sampling locations for larvae may include wetland margins and shorelines and riparian habitats for adults.

As provided for in the MOU, the monitoring activities described above are conducted under a Special Use Permit (SUP) that the Refuge intends to continue issuing annually to the District.

1. Larval Mosquito Thresholds

Guidelines for control of immature or larval mosquitos follow integrated pest management principles and are defined in a District Mosquito and Mosquito-Borne Disease Management Plan (Appendix I), available on their website (http://www.fightthebite.net) (Boyce 2005). In keeping with the MOU, the District requests annual approval from the Refuge to control mosquitos by treating areas where larval stages of *Culex tarsalis*, *Ochlerotatus melanimon, Oc. nigromaculis, Anopheles freeborni* or *Aedes* spp. may exceed thresholds. According to the District Management Plan, the threshold for initiating a larval control response will be a density of 0.1 mosquito larvae per 350-ml dipper of water for all species.

2. Adult Mosquito Thresholds

The District Management Plan defines criteria for five possible levels of adult mosquito activity and control responses (Appendix II). The thresholds for Level 1 (Standard or Routine) adult mosquito control are 10 *Culex tarsalis* female mosquitos per light trap night or 100 per CO_2 baited trap per night. For *Aedes* spp. the thresholds for Level 1 control are 50 female mosquitos per light trap night or 150 per CO_2 baited trap per night. Under Level I, the thresholds for landing (leg) count collections are exceeded when two or more *Aedes* or *Ocheloratus* spp. land on an individual during a one-minute interval. Level 1 control in the District Management Plan is consistent with Level 1 (Normal Season) in the California Department of Health Services Mosquito-Borne Virus Surveillance and Response Plan (CA Dept. of Heath Services 2004).

The District Management Plan calls for a Level 2 control response when a mosquito-borne virus is confirmed from a dead bird or mosquito pool within District boundaries. The threshold for levels 2-5 adult control is 10 *Culex tarsalis* or *Cx. Pipiens* female mosquitos per light trap night or 25 per CO_2 baited trap per night. For *Aedes* spp. the thresholds for Level 2-5 control responses are 25 female mosquitos per light trap night or 50 per CO_2 baited trap per night. Level 2 control in the District Management Plan is equivalent to Level 2 (Epidemic Conditions) in California Department of Health Services Mosquito-Borne Virus Surveillance and Response Plan (CA Dept. of Heath Services 2004). According to the District Management Plan, levels 2-5 adult treatment thresholds remain at the reduced level until control activities are terminated for the mosquito season. The thresholds used by the District are based on historical monitoring that indicate all mosquitos have the potential to transmit a wide range of diseases. Thresholds also minimizes annoyance levels to nearby communities from adult mosquitos.

IV. Surveillance of Mosquito-Borne Disease

Vectorborne disease surveillance and associated health threat determinations are made by the California Vectorborne Disease Surveillance System (CVDS), a cooperative project of the Mosquito and Vector Control Association of California, the California Department of Health Services (CDHS), and the University of California at Davis. The UC Davis Center for Vectorborne Diseases (CVEC) analyzes samples collected from mosquito pools, sentinel chickens and dead birds and publishes results in the California Arbovirus Surveillance Bulletins. The samples are collected by the District.

The District arbovirus surveillance program includes testing of mosquito populations, sentinel chickens and wild birds for WEE, SLE and WNV. The information generated by the encephalitis program provides an early indication of local arboviral activity. Small populations of mosquitos from sites that have a history of disease activity are sampled and tested by the mosquito abatement district. Carbon dioxide traps attract and capture mosquitos which are subsequently identified, sorted and grouped into pools. The pools are sent to the CVEC where they are tested for encephalitis viruses. Mosquitos are collected annually from March to November.

As part of monitoring conducted by the District for the presence of mosquito borne public health diseases, a sentinel chicken flock is maintained on private property adjacent to the Refuge Headquarters Unit. Service Region 1 policies prevent placement of sentinel chicken flocks on wildlife refuges because of the risk of avian diseases passing from chickens to migratory birds. Sentinel chickens are exposed to the environment and to mosquitos moving through the area that may choose to feed on them. Regular blood samples are periodically taken from the chickens to detect any mosquito-vector pathogen activity. Once

the flock exhibits positive viral titers and sero-conversion occurs, the California Department of Health Services is alerted to the potential threat to public health due to mosquito borne diseases.

For approximately the last ten years, Refuge staff and the District have conducted a collaborative research effort to collect blood samples from resident and migratory birds captured on the Refuge. The wild bird sera samples are processed and tested for the presence of WEE, SLE and WNV virus antibodies at the District laboratory. These cooperative efforts also provide the Service with important data regarding the status of migratory bird populations occurring on the Refuge.

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Reporting

1. The District will notify the Refuge Manager in the event of detection of virus activity within or near the Refuge and the method of disease surveillance yielding positive results.

2. Refuge staff will participate in collections of wild bird sera for testing and will monitor any unusual bird die-offs that may be caused by WNV or other diseases. Wild bird mortality due to WNV can provide an early warning of the risk of transmission to the public via mosquitos.

V. Treatment Options

Mosquito control at the Refuge follows an ordered succession, using nonchemical treatments first (i.e., wetland and water delivery system design, water control strategies, vegetation management, mosquitofish, guppies, and other biological agents, etc.), resorting to chemical treatment only when necessary, as determined through standard mosquito monitoring procedures. Among chemical treatments, adulticides will be used as a last resort. Refuge staff work with the District to minimize production of mosquitos on the Refuge by means of habitat management and biological controls and are mindful of abiotic sources of mosquito production (e.g., tanks, buckets, equipment holding water) and promptly eliminate them if discovered.

Habitat Management

Refuge habitat management techniques that support mosquito abatement consist of: (1) design of managed wetlands, (2) efficient water management, and (3) physical manipulation of vegetation. These are mostly preventative measures to eliminate or reduce mosquito breeding habitat or conditions before it develops. If habitats were managed entirely for mosquito abatement, wildlife habitat values would be compromised. Therefore, Refuge staff strive to incorporate management techniques for mosquito abatement into ongoing wildlife habitat efforts. In an officially determined health emergency, mosquito abatement would become a higher priority than habitat management.

Wetland Design and Water Management

Water management techniques for minimizing mosquito production include timing and duration of flooding, the speed at which individual units are flooded up, irrigated, or drawn down and the stability of water levels. The Refuge is only able to conduct efficient water management on managed wetlands impoundments with pumps and water control structures where they can be manipulated to reduce mosquito production. These occur on the Beach Lake, Headquarters, and South Stone Lake units. Elements incorporated into the design of these wetlands that promote minimizing mosquito breeding include contouring of wetland margins, construction of drainage swales, and sizing of water control structures for relatively rapid flood up and de-watering. Steeper sloped wetlands support narrower perimeter margins where warm, shallow, vegetated conditions provide optimal breeding habitat for many species of mosquitos.

Managed permanent and summer water wetlands produce the fewest numbers of mosquitos and pose the least concern for the District. Permanent wetlands are flooded to a depth of approximately three feet which minimizes their use by floodwater mosquitos and encourages abundant populations of mosquito predators (e.g., fish, dragonflies). Deep, open water provides water circulation and generates wave action that reduces micro-habitats suitable for mosquito breeding.

Seasonal wetland impoundments with water control structures are managed to provide wildlife habitat while minimizing the potential for mosquito production. Water delivery infrastructure is sized for rapid flood up, irrigations, and draw down, providing at least two means by which mosquito production is reduced. Slow irrigations, especially over large units, usually result in multiple hatches of adult mosquitos. For example, if it takes five days to inundate a unit, a new hatch of eggs (i.e., typically *Ochlerotatus melanimon*) could be produced every day resulting in five separate cohorts of larvae/pupae and subsequent adult mosquitos emerging over a five day period. The alternative is to flood up rapidly, covering the entire unit within one day if possible. This will not reduce the overall amount of mosquitos produced but it will result in a more synchronous egg hatch and adult emergence. This will facilitate a more efficient control effort, requiring fewer applications for the same objective.

The timing of the fall flood up can substantially affect both mosquito production and wildlife habitat values. Delaying the initial fall flood up also delays associated initial mosquito production and may reduce the need for mosquito abatement if temperatures have already dropped sufficiently to discourage mosquitos. Historically, Sacramento Valley wetlands flooded naturally and much later, in the fall or early winter, based largely on the Sacramento River overflowing its banks. However, current managed wetland flooding regimes are dictated largely by water availability through irrigation districts and the need to provide wetlands for early migrating waterbirds during August-September. For example, providing roosting habitat for sandhill cranes is a priority at the Refuge which requires flooding up by mid-September, when they first arrive in the valley. Though this practice conflicts with District abatement recommendations, sandhill crane habitat considerations are given precedence over mosquito control. In the event of a threat to public health and/or unusually warm fall temperatures that would encourage mosquito production, delaying fall flood up remains an option.

Effective communication between Refuge staff and the District remains a critical requirement for coordinated mosquito management. In addition to submitting an annual summary of planned water management to the District, Refuge staff provide advance notifications of flood ups and irrigations so mosquito monitoring and possible treatments can be scheduled at an optimal time. Such notifications can result in applications of adulticides not being required since the District then has an opportunity to control larval populations, thus controlling adult emergence rates. For example, the Refuge attempts to flood wetlands early in the week so that mosquito hatches do not occur over the weekend when District staff are not in the field.

Physical Manipulation of Vegetation

Vegetative structure in wetlands provides habitat features that generally favor mosquito production. The benefits of vegetation include egg-laying sites, protection from the elements, and escape cover. The literature suggests that reduction of vegetation by burning or mowing (Batzer and Resh 1992) can reduce mosquito production significantly.

Mowing, herbicide applications, disking, or burning are the most common methods of reducing accumulations of vegetation in wetlands on the Refuge. Depending on the extent of vegetation they support, managed wetlands may be manipulated during the dry season to support a target mix of open water to emergent vegetation: approximately 50% vegetation to 50% open water. These manipulations improve wildlife habitat by promoting wetland plants of more food value for migratory waterfowl, increasing edge habitat, and the overall openness of wetland units, making them more attractive to shorebirds and species such northern pintail, green-winged teal, and sandhill crane. These treatments also reduce the extent of mosquito breeding habitat and improve accessibility to mosquito larvae by mosquito fish and other natural predators. Seasonal wetlands lacking in water control structures cannot be as easily managed but wetland perimeters may be mowed or disced both to improve conditions for mosquito fish and as well as to increase their value for waterbirds.

Major portions of Refuge waterways (e.g., South Stone Lake, SP Cut) have been invaded by the invasive aquatic plants, water hyacinth and Brazilian elodea (Egeria densa). Left unchecked, these continuous floating or submerged mats of vegetation can encourage mosquito production by providing harborage from predation, concentration of organic foods, and interference with wave action and water circulation. The Refuge was a founding member and has the lead role in the Stone Lakes Basin Water Hyacinth Control Program, along with the District and the Sacramento Regional County Sanitation District. This program contributes to both mosquito abatement and wildlife habitat improvement goals.

In summary, habitat management techniques promoting mosquito abatement include:
- Construct wetland impoundments with appropriate slopes and adequate water management capacities
- Flood up/irrigate quickly to discourage multiple hatches
- Maintain a depth of 2-3 feet of water in permanent wetlands
- Control emergent vegetation to maintain 50 percent open water in managed wetlands
- Disc/mow pond perimeters in seasonal wetlands to maintain open water and access by fish
- Control invasive aquatic weeds
- Notify the District of planned flood up/irrigation events

Biological Controls

Reducing production of mosquitos in a wetland ecosystem is partially dependant upon maintaining a diversity of habitats that support various predators and parasitic species that can then control mosquito populations. Predators and parasites can take sizable numbers of mosquitos but if conditions support the rapid development of mosquitos, then natural predation can be augmented by the addition of insectivorous (insect eating) fishes. The District has introduced three species of insectivorous fish to the Refuge, mosquito fish (*Gambusia affinis*), guppies (*Poecilia reticulata*) and the native threespine stickleback (*Gasterosteus aculeatus*).

Mosquitofish

Mosquitofish have played an active role in mosquito larvae control at refuges within California's Sacramento Valley over the last twenty years. Mosquitofish exhibit a tremendous tolerance for a wide range of water temperatures. Previously acclimated fish may tolerate minimum and maximum temperatures of 33° and 104°F (0.6° and 40°C), although sudden drastic changes of temperature are often lethal. Preferred temperatures appear to lie between 77° and 86°F (25° and 30°C). When surface water temperatures approach higher lethal limits, mosquitofish usually swim down to cooler water strata. Conversely, in the cooler seasons mosquitofish will move into shoal areas to reach the sun-warmed shallow waters. Other environmental factors that influence mosquito fish survival include densities of mosquito larvae, aquatic vegetation, availability of alternative forage organisms, presence of predaceous bird and fish populations, water depth and flow patterns, and several water quality criteria. For the fish to be effective, there must be no limitations to their normal distribution, rapid reproduction, and population recruitment. In general, mosquitofish are stocked in very small numbers because they quickly reproduce to the maximum population levels that a particular habitat may sustain.

Mosquitofish are transported by tanker truck directly to mosquito sources. Primary stockings of fish in semi-permanent wetlands are usually conducted at a minimal initial rate of 0.1 lb per acre. When necessary, these applications are augmented up to 1.0 lb per acre, based on larval dipping data. The District has stocked Refuge waters with mosquitofish every year since 1996. Most of the mosquitofish have been planted in the Lewis unit, but some have also been placed in small ponds on the Sun River and Beach Lake properties.

Guppies and Threespine Sticklebacks

The District is evaluating the use of guppies and threespine sticklebacks for mosquito larvae control. Literature suggests that guppies will do an excellent job of controlling mosquitos during the summer months but will not survive the cold winter months. Using this species in areas that are prone to winter flooding will ensure that these fish will not impact threatened or endangered species occurring within the floodplain. Threespine sticklebacks prefer to feed on benthic organisms rather than on the surface where mosquito larvae are found, but where the benthic community is insufficient, the Sticklebacks will expand their feeding range to the surface. Sticklebacks were only planted at the Refuge in 2001, while guppies were used in 2002 and 2003.

Chemical Controls

Larvicides/Pupacides

The District proposes to control mosquitos by treating areas infested with larval stages of *Culex tarsalis*; *Ochlerotatus melanimon, Oc. nigromaculis, Anopheles freeborni* and *Aedes* spp. The District would use the biological larvicides *Bacillus thuringiensis isrealensis* (Bti) and *Bacillus sphaericus* (Bsp) and the insect growth inhibitor methoprene. Use of the petroleum distillate Golden Bear (GB1111) as a pupacide was discontinued after 2000 and has been replaced with the monomolecular film Agnique. These treatments would be applied via ground methods. Based on December 2005 Service Delegation of Approval Authority for the California Nevada Operations (CNO) area, refuge managers now have authority to approve use of Bti, Bsp, methoprene, and Agnique.

Bti is a microbial insect pathogen used to control larval stages of mosquitos and black flies. It is a naturally occurring anaerobic spore forming bacteria that is mass produced using modern fermentation technology. Bti produces protein endotoxins that are activated in the alkaline mid-gut of insect species and subsequently bind to protein specific receptors of susceptible insect species resulting in the lethal response (Lacey and Mulla 1990). Bti must therefore be ingested by the target insect to be effective. It is most effective on younger mosquito larval instars but does not affect pupae or adult mosquitos. The District prefers to use Bti because of the low impacts to the environment and non-target organisms and its effectiveness in reducing the numbers of mosquito larvae. The Bti formulations Vectobac 12AS or Vectobac G would be employed at the Refuge by the District. Bti may be applied at the Refuge between March and October.

Like Bti, Bsp is a microbial insect pathogen with a similar mode of action (Walton 1998). Formulated Bsp products used as mosquito larvicides consist of bacterial spores and protein endotoxins. The granular formulation of Bsp, Vectolex CG, would be applied by the District. Both Bti and Bsp may be applied as a spot treatment to small areas or broadcast over larger areas. Use of Bsp is permitted between June 1 and September 30 and applications would likely be made within 7-10 days of initial flooding to control third and fourth instar larva.

Methoprene is a synthetic insect growth regulator (IGR) that mimics juvenile hormones (Tomlin 1994). It interferes with the insect's maturation stages preventing the insect from transforming into the adult stage, thereby precluding reproduction. Methoprene is a contact insecticide that does not need to be ingested. It is most effective on early larval instars but does not affect pupae or adult mosquitos (ETN 1996a). Treated larvae will pupate, but will not emerge as adults. The District proposes to use the formulated methoprene product Altosid in pellets or A.L.L. Growth Regulator. Use of methoprene is permitted between June 1 and September 30.

The monomolecular film, Agnique, reduces water surface tension. This interferes with larval orientation at the air-water interface and/or increases wetting tracheal surfaces, thus suffocating the organism. As the film spreads over the water surface, it tends to concentrate mosquito pupae, which may increase mortality from crowding stress (Dale and Hulsman 1990). Use of Agnique is permitted between June 1 and September 30.

Area Subject to Larvicides

Applications of larvicides may occur in managed permanent wetlands (106 acres), irrigated pastures (490 acres) and occasionally perennial wetlands (193 acres), totaling approximately 790 acres. The shorelines of open water areas may be treated. In addition, the District will treat ditches, culverts and low areas not classified as wetlands.

As a result of IPM practices and cooperation between the Refuge and the District, larval control applications on the Refuge have been limited to small acreages during any single treatment (less than five acres). The total Refuge acreage that may be treated varies with rainfall conditions each year. During drought years mosquito populations tend to be low, and during wet years mosquito populations tend to be high. From 2000-2004, the range in total acreage treated varied from a low of 104 acres in 2000 to a high of 477 acres in 2004. The majority of the treatments occur from August to October, but in some years applications of Bti have begun as early as March and have extended into November.

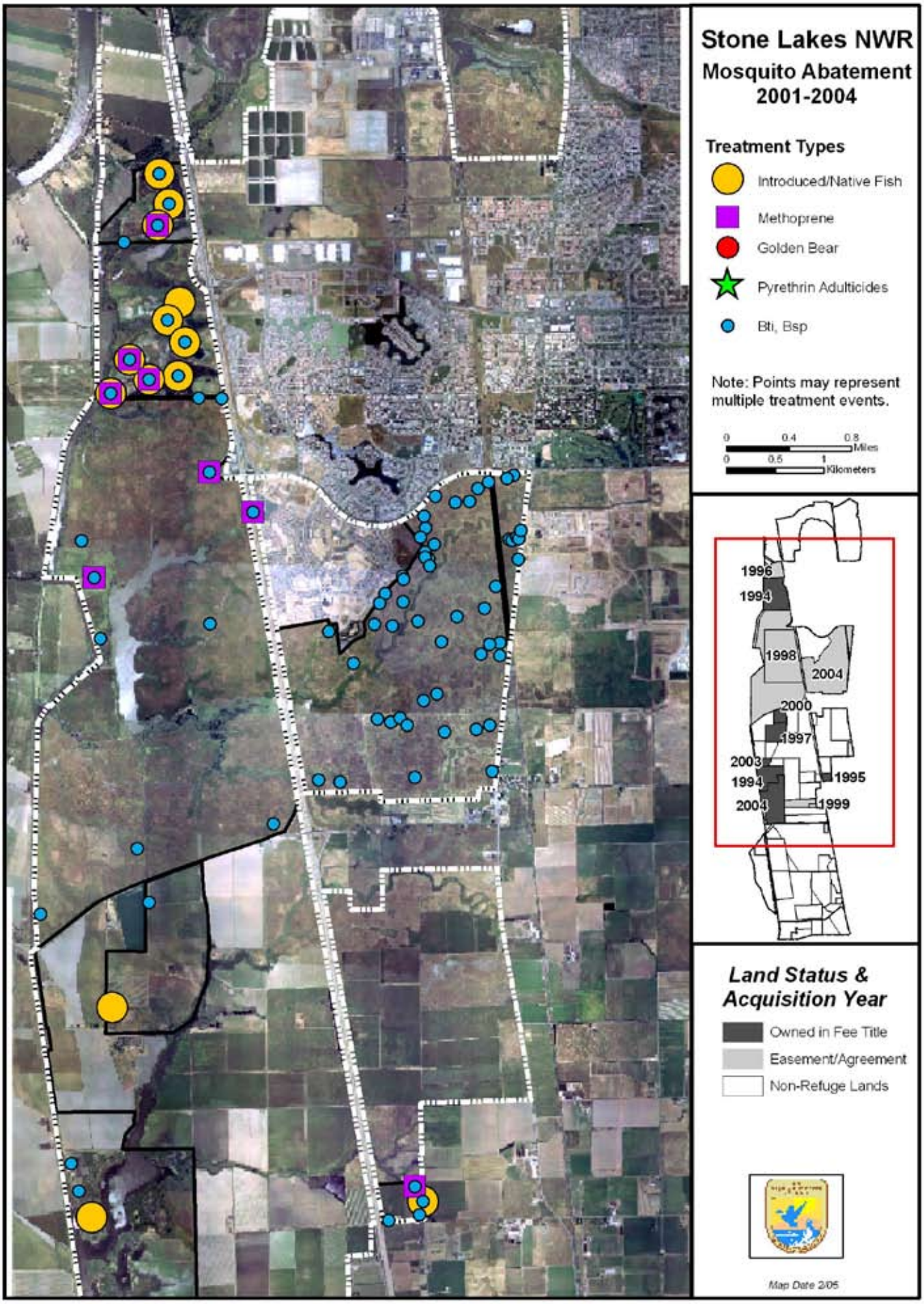
Adulticides

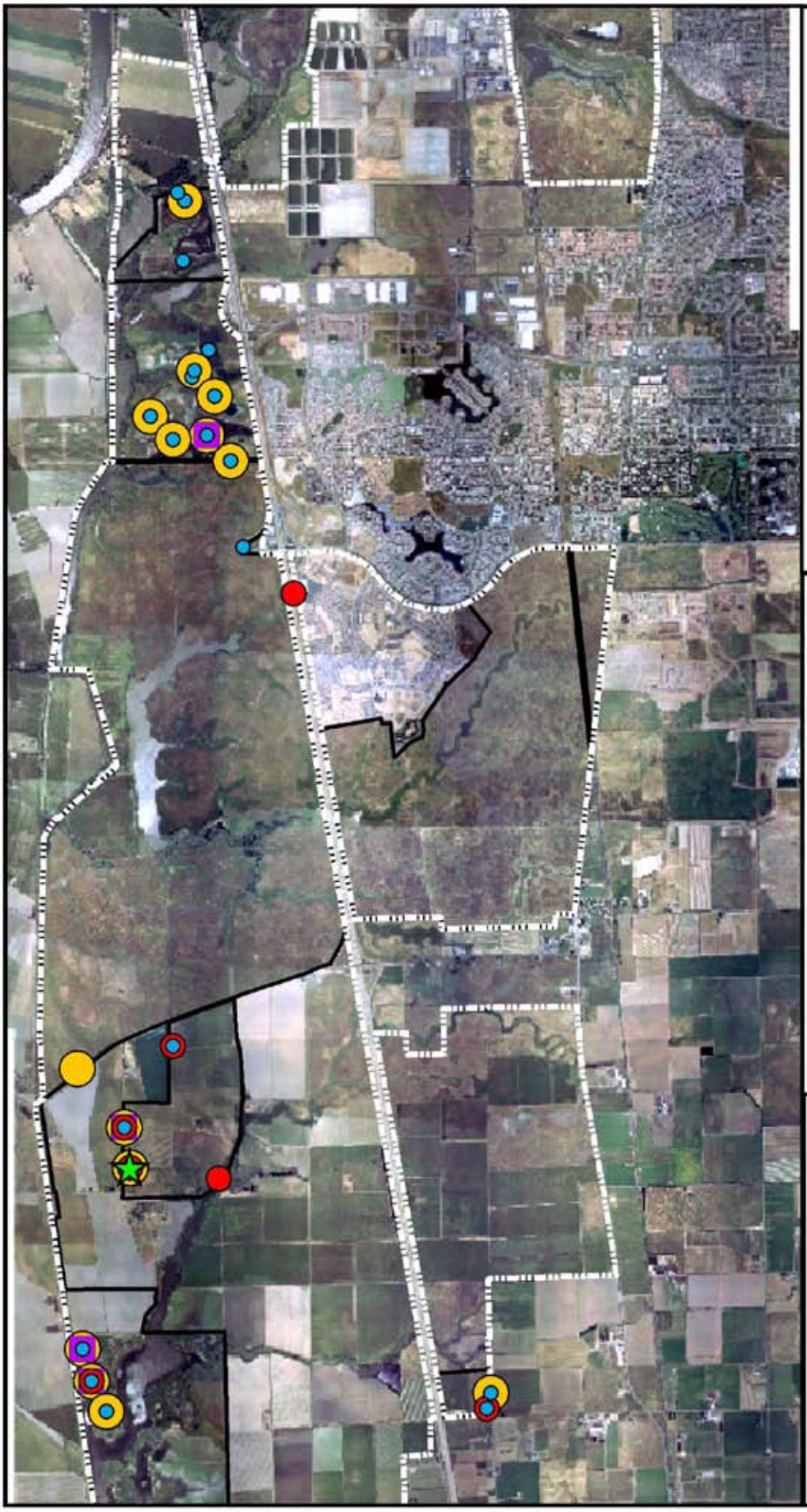
If efforts to control immature mosquitos fail to prevent the adult mosquito population from exceeding thresholds, and a documented historical or current health threat exists, the District proposes to treat infested areas with a mosquito adulticide. The District has requested annual approval for use of liquid formulations of synthetic pyrethrins, such as Pyrenone 25-5 or Pyrocide 7338. The District also requests and has received approval for use of the adulticide Trumpet (Naled) but it has not been used on the Refuge to date. Use of all adulticides is limited to June 1 through September 30, with a possible extension if unusually hot weather occurs together with a documented public health threat. Based on the December 2005 Service Delegation of Approval Authority for the CNO area, refuge managers have authority to approve use of pyrethrins for controlling mosquitos near facilities used by staff and visitors and in terrestrial sites (not aquatic sites or wetlands). Approval of use of pyrethrins in aquatic or wetland settings or Trumpet necessitates submittal of Pesticide Use Proposals to the CNO and Washington offices.

Pyrethrins are non-systemic contact poisons which quickly penetrate the nerve system of the insect and cause paralysis and subsequent death (ETN 1994, Tomlin 1994). A few minutes after application, the insect cannot move or fly away. But, a "knockdown dose" does not mean a killing dose. Pyrethrins are swiftly detoxified by enzymes in the insect. Thus, some pests will recover. To delay the enzyme action so a lethal dose is assured, commercial products are formulated with synergists such as piperonyl butoxide, which inhibit detoxification (Tomlin, 1994). Trumpet (Naled) is a non-systemic, broad-spectrum organophosphate insecticide which affects the nervous system of adult mosquitos and other insects by cholinesterase inhibition. When treatments occur, Pyrethrins and Trumpet, would be applied as an ultra-low volume (ULV) mist by ground. To minimize pesticide drift, dispersing vehicles follow routes on existing roads set up to fog downwind or outside buffers of 300 feet from areas supporting listed or proposed special status species. All chemical applications occur when wind speeds are between 2 and 8 mph.

Between 1994 when then Refuge was established and 2004, adult mosquito applications only occurred once in 1998 to five acres (0.09 gallons of Scourge) and once in 1999 to four acres (0.05 gallons of Pyrocide 7338). Both treatments were ULV ground applications at the same location, a drainage channel on the Headquarters Unit. That adulticides were utilized so infrequently, attests to the level of cooperation between District and Refuge who initiated water management and larval control measures to discourage mosquito production and adult emergence.

In 2005, West Nile Virus (WNV) became established in Sacramento and Yolo counties, triggering more aggressive and widespread mosquito control efforts. In August of 2005 the number of human WNV cases and rate of infected adult mosquitos were so high that SYMVCD initiated aerial applications of pyrethrin over significant portions of Sacramento County. The Refuge received ultra-low volume (ULV) ground applications of pyrethrin on 16 occasions between July 28 and October 12, 2005. As of August 18, 2006, 16 human cases of WNV have been documented in Sacramento and Yolo counties (Table 1) and the Refuge has been adulticided 12 times beginning on June 27.


Stone Lakes NWR
Mosquito Abatement
2001-2004
Treatment Types
Introduced/Native Fish
Methoprene
Golden Bear
Pyrethrin Adulticides
Bti, Bsp
Note: Points may represent multiple treatment events.
0 0.4 0.8 Miles
0 0.5 1 Kilometers
1996
1994
1998
2004
2000
1997
2003
1994
2004
1995
1999
Land Status & Acquisition Year
Owned in Fee Title
Easement/Agreement
Non-Refuge Lands
Map Date 2/05



Stone Lakes NWR

Mosquito Abatement 1996-2000

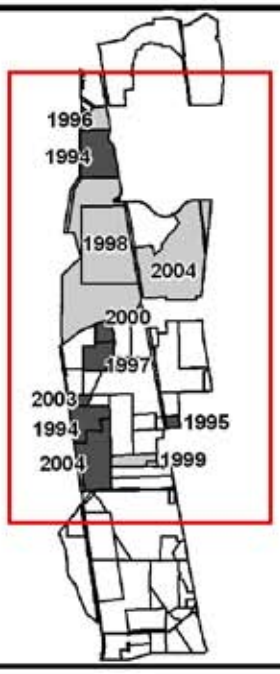
Treatment Types

- Introduced/Native Fish
- Methoprene
- Golden Bear
- Pyrethrin Adulticides
- Bti, Bsp

Note: Points may represent multiple treatment events.

0 0.4 0.8 Miles

0 0.5 1 Kilometers



Land Status & Acquisition Year

- Owned in Fee Title
- Easement/Agreement
- Non-Refuge Lands

Map Date 2/05

VI. Toxicity and Effects to Non-Target Organisms

The dominant impact of mosquito control will relate to the toxicity and effects of the treatments on non-target organisms. The possible effects of the larvicides *Bacillus* spp. and methoprene, the pupacide Agnique, and the adulticides will be discussed separately.

Larvicides

Bacillus thuringiensis israelensis (Bti)

Bti has practically no acute or chronic toxicity to mammals, birds, fish, or vascular plants (U.S. EPA 1998). Extensive acute toxicity studies indicated that Bti is virtually innocuous to mammals (Siegel and Shadduck 1992). These studies exposed a variety of mammalian species to Bti at moderate to high doses and no pathological symptoms, disease, or mortality were observed. Laboratory acute toxicity studies indicated that the active ingredient of Bti formulated products is not acutely toxic to fish, amphibians or crustacaceans (Brown et al. 2002, Brown et al. 2000, Garcia et al. 1980, Lee and Scott 1989, and Wipfli et al. 1994). However, other ingredients in formulated Bti products are potentially toxic. The acute toxicity response of fish exposed to the formulated Bti product Teknar® HPD was attributed to xylene (Fortin et al. 1986, Wipfli et al. 1994). Field studies indicated no acute toxicity to several fish species exposed to Bti (Merritt et al. 1989, Jackson et al. 2002); no detectable adverse effects to breeding red-winged blackbirds using and nesting in Bti treated areas (Niemi et al. 1999, Hanowski 1997); and no detectable adverse effects to tadpole shrimp 48 hours post Bti treatment (Dritz et al. 2001).

In addition to mosquitos (Family Culicidae), Bti affects some other members of the suborder Nematocera within the order Diptera. Also affected are members of the Family Simuliidae (black flies) and some chironomids midge larvae (Boisvert and Boisvert 2000, Garcia et al. 1980). The most commonly observed Bti effects to non-target organisms were to larvae of some chironomids in laboratory settings when exposed to relatively high doses (Boisvert and Boisvert 2000, Lacey and Mulla 1990, Miura et al. 1980). In field studies, effects to target and susceptible nontarget invertebrates have been variable and difficult to interpret. Field study results are apparently dependent on the number, frequency, rate and aerial extent of Bti applications; the Bti formulation used; the sample type (e.g., benthic, water column or drift); the sampling interval (e.g., from 48 hrs to one or more years after treatment); the habitat type (e.g., lentic or lotic); the biotic (e.g., aquatic communities), and abiotic factors (e.g., suspended organic matter or other suspended substrates, temperature, water depth); the mode of feeding (e.g., filter feeder, predator, scraper or gatherer); the larval development stage and larval density (Ali 1981, Boisvert and Boisvert 2000, Lacey and Mulla, 1990). Bti activity against target and susceptible nontarget invertebrates is also related to Bti persistence and environmental fate which are in turn affected by the factors associated with field study results (Dupont and Boisvert 1986, Mulla 1992). Simulated field studies resulted in the suppression of two unicellular algae species, *Closterium* sp. and *Chlorella* sp. resulting in secondary effects to turbidity and dissolved oxygen of aquatic habitats, with potential trophic effects (Su and Mulla 1999). For these reasons, Bti effects to target and susceptible nontarget organisms, and potential indirect trophic impacts in the field are difficult to predict.

Bacillus sphaericus (Bsp)

Bsp has slight to practically no acute mammalian toxicity, practically no acute avian toxicity, slight to practically no acute fish toxicity, and slight aquatic invertebrate toxicity (USFWS 1984, and FCCMC 1998). Insecticidal activity may persist longer than 20 days because Bsp can reproduce and sporulate in larval cadavers (Becker et al, 1995) and can retain its larvicidal properties after passing through the gut of a mosquito. Bsp is insoluble in water. Spores and toxin become suspended in the water column and retain insecticidal

activity in water with high organic matter content and suspended solids. Because Bsp is a more recently developed larvicide than Bti, there are fewer studies that have examined the non-target effects of this pesticide. The data available, however, indicate a high degree of specificity of Bsp for mosquitos, with no demonstrated toxicity to chironomid larvae at any mosquito control application rate (Mulla, 1984, Ali, 1986, Lacey, 1990, and Rodcharoen, 1991). Therefore risks to sensitive wildlife resources resulting from direct exposure to a single Bsp application and indirect food chain effects are expected to be negligible. However, the ability for a population to re-colonize a wetland following multiple larvicide treatments would depend on the intensity and frequency of applications at different spatial scales.

Agnique (Monomolecular film)

Monomolecular film has practically no acute mammalian or avian toxicity, and slight acute fish toxicity (USEPA 2000, USFWS 1984). The risk quotient for mammals is well below the EPA endangered species level of concern (LOC) indicating negligible risk resulting from direct exposure, Table 2 (Urban and Cook 1986). Risk quotients for birds and fish exceed EPA endangered species LOCs indicating a hazard to those taxa resulting from direct exposure. Risk to fish is limited by the insolubility of monomolecular film in water. Monomolecular film is insoluble in water, average persistence in the environment is 5 to 14 days. Indirect effects to animals dependent on invertebrate food resources are possible resulting from a reduction of those resources caused by monomolecular film. The magnitude of the impact would depend on the aerial extent of the treatment, the number of treatments, treatment frequency, and the location of the treatment relative to the areas used by invertebrate feeding animals.

Table 2. Monomolecular film risk quotients.

Animal	Acute toxicity (ppm)	EEC (ppm)	RQ	LOC (ES)
bird	> 5000 (8 D LC 50)	850 (short grass)	0.2	0.1
fish	98 (96 hr LC 50)	2600 (6" water)	26.5	0.05
mammal	>20,000 (LD 50)	850 (short grass)	0.004	0.1

EEC calculated using a rate of 0.5 gal/ac (3.6 lbs ai/ac)
LD 50 for mammals converted to 1 Day LC50 using a conversion factor of 0.1 for RQ calculation

Methoprene

Methoprene has moderate acute fish toxicity, slight acute avian toxicity, and practically no acute mammalian toxicity (USEPA 2000, and USFWS 1984). In mallard ducks, dietary concentrations of 30 parts per million (ppm) caused some reproductive impairment (USEPA 1991). This figure exceeds the estimated environmental concentration by a factor 10 (Table 1). Methoprene residues have been observed to bioconcentrate in fish and crayfish by factors of 457 and 75, respectively (USEPA 1991). Up to 95 percent of the residue in fish was excreted within 14 days (USEPA 1991). Risk quotients for birds, fish and mammals are below EPA levels of concern for endangered species indicating negligible risk to those taxa resulting from direct exposure using maximum labeled rates for mosquito control (Table 3) (Urban et al. 1986). In field studies no detectable adverse effects to breeding red-winged blackbirds using and nesting in areas treated with methoprene were observed (Niemi et al. 1999).

Methoprene affects terrestrial and aquatic invertebrates and is used to control fleas, sciarid flies in mushroom houses; cigarette beetles and tobacco moths in stored tobacco; Pharaoh's ants; leaf miners in glasshouses; and midges (Tomlin 1994). Methoprene may also be fed to livestock in a premix food supplement for control of hornfly (WHO undated). Methoprene is

Table 3. Risk assessment for Methoprene.

Animal	Acute Tox (ppm)	EEC (ppm)	RQ	LOC (ES)
Bird	> 4640 (8 D LC 50)	3.0 (short grass)	0.0006	0.1
Fish	0.4 (96 hr LC 50)	0.01 (6 inches)	0.025	0.05
Mammal	> 34,000 (LD 50)	3.0 (short grass)	0.00001	0.1

EEC calculated using a rate of 0.013 lbs ai/ac (1.0 fluid oz/ac Altosid 20 % methoprene)
LD 50 for mammals converted to 1 Day LC50 using a conversion factor of 0.1 for RQ calculation

highly toxic to aquatic invertebrates with a 48 hour EC50 (the concentration of a compound where 50 percent of its effect is observed) of 0.89 ppm for *Daphnia magna* (USEPA 1991). Laboratory studies show that methoprene is acutely toxic to chironomids, cladocerans, and some decapods (Horst and Walker 1999, Celestial and McKenney 1994, McKenney and Celestial 1996, Chu et al. 1997). In field studies, significant declines of aquatic invertebrate, mollusk and crustacean populations have been directly correlated to methoprene treatments for mosquito control (Breaud et al. 1977, Miura and Takahashi 1973, Niemi et al. 1999, and Hershey et al. 1998).

Methoprene has a ten day half life in soil, a photolysis half life of ten hours, and solubility in water is 2 ppm (Zoecon 2000). Degradation in aqueous systems is caused by microbial activity and photolysis (USEPA 1991). Degradation rates are roughly equal in freshwater and saltwater systems and are positively correlated to temperature (USEPA 1991).

Adulticides

There are only two general classes of mosquito adulticides, organophosphates and pyrethroids. The pyrethroids include both natural products called pyrethrins and synthetic molecules that mimic the natural pyrethrins, such as permethrin, resmethrin, and sumithrin. One organophosphate, Trumpet (Naled), is approved for use at the Refuge in the past but not applied to date. The two pyrethroid products approved for use at the Refuge, Pyrenone 25-5 and Pyrocide 7336 are both synthetic pyrethrins.

In general, pyrethroids have lower toxicity to terrestrial vertebrates than organophosphates. Although not toxic to birds and mammals, pyrethroids are very toxic to fish and aquatic invertebrates (Anderson 1989, Siegfried 1993, Milam et al. 2000). The actual toxicity of pyrethroids in aquatic habitats, however, is less than may be anticipated because of the propensity of these pesticides to adsorb organic particles in water (Hill et al. 1994). Pyrethrins are toxic to all invertebrates, but the method of application via ultra-low volume atomizer limits toxicity and contact with non-targets. To minimize pesticide drift, applications would take place during the evening hours, when wind speeds are reduced and temperatures decreased; this is also the period when mosquito activity is the greatest. Naled is a fast acting, nonsystemic contact and stomach organophosphate insecticide used to control aphids, mites, flies, and mosquitos. Naled is highly to moderately toxic via the oral route. It is moderately toxic through skin exposure, may cause skin rashes and skin sensitization and may be corrosive to the skin and eyes. Naled is highly to moderately toxic to birds. The reported acute oral LD50 (lethal dose 50, the dose of a substance which is fatal to 50% of the test animals) for naled is 52 mg/kg in mallard ducks, 65 mg/kg in sharp-tailed grouse, 36-50 mg/kg in Canadian geese, 120 mg/kg in ring-neck pheasants. Naled is highly to moderately toxic to fish and may be very highly toxic to aquatic invertebrate species (ETN 1996). However, Trumpet (Naled) is practically nonpersistent in the environment, with reported field half-lives of less than 1 day. It is not strongly bound to soils and is rapidly broken down if wet. Soil microorganisms break down most of the naled in the soil. It therefore should not present a hazard to groundwater (ETN 1996).

Threatened and Endangered Species

The Refuge provides potential habitat for the following federally-listed species: giant garter snake, valley elderberry longhorn beetle, vernal pool tadpole, and vernal pool fairy shrimp. Potential impacts to these species from mosquito control activities were addressed in a number of previous Intra-Service Section 7 Consultations conducted with the Sacramento Fish and Wildlife Office (SFWO):

March 27, 1995: The SFWO concurred with the determination that use of the bacterium *Bacillus thuringiensis israelensis* (Bti) and Altocid® (methoprene) for mosquito control at Stone Lakes NWR is not likely to adversely affect the vernal pool fairy shrimp, vernal pool tadpole shrimp, giant garter snake, valley elderberry longhorn beetle, Sacramento splittail, and delta smelt (SFWO file: 1-1-95-I-0680).

January 9, 1997: The SFWO concurred with the determination that the use of the bacterium *Bacillus sphaericus* for mosquito control, is not likely to adversely affect the vernal pool fairy shrimp, vernal pool tadpole shrimp, giant garter snake, valley elderberry longhorn beetle, delta smelt, or Sacramento splittail at the Stone Lakes NWR (SFWO file: 1-1-96-I-0639).

January 31, 2001: The SFWO concurred that pest management activities at the Refuge are not likely to jeopardize the giant garter snake, valley elderberry longhorn beetle, vernal pool tadpole shrimp, or vernal pool fairy shrimp. (SFWO file:1-1-00-F-0162).

Giant Garter Snake (Thamnophis gigas)

Mosquito control activities in giant garter snake habitat may affect giant garter snakes by harassment or injury from vehicle use. The District will only operate vehicles in existing roads; therefore, harassment or injury from vehicle use would occur only if snakes are in the roadway. Regarding the effects of the proposed pesticides, a Fish and Wildlife Service-sponsored study indicated that the short-term effects of adulticides approved for mosquito control on the Sacramento NWRC did not significantly reduce abundance or biomass of the snake's prey items, macro-invertebrates and fish, in treated wetlands (Lawler et al. 1997). However, no information is available on the toxicity of the proposed pesticides directly to the giant garter snake. Without further information, it must be assumed that exposure of giant garter snakes to these chemicals could result in direct impacts, such as loss or sublethal effects to individual animals. Adverse effects to the giant garter snake from mosquito control activities will therefore be minimized by avoiding any wetland habitat suitable for giant garter while applying chemical treatments for control of mosquitos. The application of adulticides by dispersal vehicles will be planned to fog downwind of and outside a buffer of 300 feet away from permanent emergent wetlands.

Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus)

Adverse effects on the valley elderberry longhorn beetle are not likely since the main mosquito abatement period (June-September) does not coincide with the period of adult beetle emergence (late April through mid-May or early June). Also, the riparian corridors that house the valley elderberry longhorn beetle, generally do not require treatment with chemical control agents. If control measures are needed in these areas, some granular applications of Bti or Altocid (Methoprene) may be used during February or March when adult beetles are not present.

Vernal Pools

The growth regulator Methoprene (Altosid or A.L.L) can have deleterious effects on vernal pool shrimp by delaying the development of adult shrimp and thus the number of eggs laid before the pools dry up. Because of the effects of Methoprene on fairy shrimp and a lack of information on how long the agent remains in the soil, use of the larvicide methoprene within

vernal pools or swales at any time, in either wet or dry conditions, is prohibited (USFWS 2001).

The majority of vernal pools and seasonal swales will be dry during the main pesticide application period (June-October). In general, naturally functioning vernal pool habitats are not significant mosquito-producing habitat and should not require chemical treatments for control of mosquito larvae. A study of vernal pools in Sacramento County suggested that when mosquito larvae were present in the pools, productivity was limited to a narrow time period just prior to drying in late spring. Therefore, vernal pools do not contribute at all to mosquito productivity in winter and early spring. In the event that the use of a larvicide does become necessary in the vicinity of vernal pools, Bti, which is relatively specific to mosquitos and flies, will be the agent of choice.

The majority of the vernal pools at the Refuge occur on the Wetland Preserve property which became part of the Refuge under a conservation easement in 2004. During the spring of 2004, before the conservation easement went into effect, numerous vernal pools were treated with Bti. Relatively warm spring temperatures in 2004 likely contributed to elevated larval populations, but other factors may also be involved. The mosquito abatement district had increased larval monitoring in the area because the Wetland Preserve property is adjacent to a new housing development and WNV had recently arrived in Sacramento County. Many of the vernal pools in the Wetland Preserve property are man-made mitigation pools that may not be functioning as naturally occurring vernal pools would. A study of naturally occurring and constructed vernal pools conducted by the District showed that while natural vernal pools produced very few mosquitos throughout most of the wet season and then produced a spike in numbers in late April, the constructed vernal pools produced significantly more mosquitos throughout the wet season as well as a spike in numbers in April (Wright 1997). In addition, the data suggested that natural vernal pools may pose a greater threat of mosquito productivity when associated with constructed pools. For these reasons, the mosquito abatement district policy is to dip-sample constructed vernal pools and adjacent natural vernal pools. Mosquito abatement treatments near vernal pools will be limited to Bti to reduce effects on endangered vernal pool species. Future mosquito abatement activities in the Wetland Preserve property will be closely monitored by Refuge staff to avoid conflicts between wildlife habitat improvement goals and mosquito control goals.

Wetlands and Waterfowl

The Refuge was established to provide habitat for migratory birds, in particular waterfowl. The District will continue to minimize disturbance and non-target effects to wildlife by limiting mosquito abatement activities between October 15 and February 15 when the majority of migratory bird species arrive on the Refuge. However, since the District continues to treat in fall until temperatures have dropped sufficiently to reduce the abundance of mosquitos, in warmer years there may well be a longer period of overlap between the arrival of migratory birds and continued mosquito abatement activities. In addition, if mosquito thresholds are exceeded, or the presence of WNV or other arboviruses are detected in or around the Refuge, then the District may need to extend mosquito surveillance and control into late fall.

In some years, most notably 2004, the District has applied Bti or planted mosquito fish as early as March when some migratory waterfowl may still be lingering before departing on their spring migration. However, Bti has not been found to be toxic to birds (USFWS 2001). In addition, it has been found that birds are not negatively affected by utilizing foods exposed to Bti or methoprene (Niemi et al. 1999). Although physico-chemico data and environmental fate data are limiting, *Bacillus* spp. are virtually non-toxic to mammals, birds and fish. Though methoprene has not been shown to pose a threat to birds from direct

exposure, it may affect insectivorous species by decreasing the invertebrate food source. However, during the last 8 years methoprene has not been applied prior to June, and was applied as late as October in only one instance. Thus, applications of methoprene have not directly or indirectly affected migratory birds utilizing the Refuge because migratory birds have not been present during mosquito abatement activities.

There is not likely to be much impact on geese and swans from pesticides because they are year round herbivores. Geese feed mainly on grasses and agricultural lands, while swans feed mainly on roots, tubers, stems, and leaves of submerged and emergent aquatic vegetation. In contrast, ducks are known to be opportunistic feeders on both plants and invertebrates, utilizing the most readily available food sources. Invertebrates, plants, and seeds compose the majority of their diet, varying with the season and the geographic location. A study in California's Sacramento Valley has shown that plant foods are dominant in fall diets of northern pintails, while invertebrate use increases in February and March (Miller 1987). Seeds of swamp timothy comprise the most important duck food in the summer-dry habitats of the San Joaquin Valley (Miller 1987). Waterfowl in general tend to feed on seeds when they reach their wintering areas, perhaps to regain energy lost during long flights (Heitmeyer 1988, Miller 1987). Thus any food chain impacts resulting from larvicide and adulticide treatments will have limited impacts to the mainly seed diet of newly arriving ducks. Their diet shifts to invertebrates after mosquito treatments are expected to be reduced in frequency, thereby allowing the invertebrate populations to recover.

Birds utilizing the Refuge during the summer months and early fall, when most of the mosquito abatement occurs, could have a greater risk of being affected by pesticide applications. These species include herons, egrets, white pelicans, mallards and wood ducks. The pesticides being applied at the Refuge have not been shown to be toxic to birds, but could potentially affect resident waterfowl indirectly by reducing invertebrate food sources. Shorebirds could also be of concern, since they feed on a wide variety of invertebrates all year, feeding which intensifies at the onset of spring migration. However, documentation of indirect food-chain effects have not come to light. Hanowski et al. (1997) studied 19 different bird species after collecting data on wetlands 2 years before treatment and 3 years after treatment of both Bti and methoprene applications and found no negative effects. Jensen et al. (1999) found that no decreases were detected in the biomass or abundance of aquatic invertebrates in seasonal wetlands from ultra-low volume applications of pyrethrin, permethrin, or malathion.

VII. Health Threat Determination

For the purpose of allowing the use of certain pesticides or bio-rational pesticides to control mosquitos, a mosquito-borne public health emergency is defined as:

Actual or threatened, imminent outbreak of western equine encephalitis, St. Louis encephalitis, West Nile encephalitis, malaria, or other mosquito vector-borne public health disease. The presence of WEE, SLE, WNV or malaria viral titers or mosquito pool titers in the mosquito population or in sentinel chickens (in accordance with test protocols developed by the CDHS Environmental Management Branch, and the U.S. Department of Health and Human Services, Center for Disease Control) will confirm that a public health emergency exists or is imminent. This threshold will have been met when the mosquito abatement district notifies the Refuge manager of a laboratory test that is positive for any of the above viruses.

The recurring presence of arboviruses in the Central Valley since the 1940s has been well documented (Reeves 1987) such that the baseline health threat level at the Refuge is 2-3, depending on monitoring. Occurrences of WNV within Sacramento County in humans, domestic animals and wildlife are expected to increase in 2005 relative to 2004 (see Disease

History above) based on observed arboviral disease cycles. The health threat level for the Refuge is therefore 4-5 (see Table 4) for 2005 and may be elevated to 6-7 if an officially determined health emergency is declared due to WNV. Historically, the mosquito abatement response has been the same at threat levels 2-3 as in threat levels 4-5, that is, adulticides and pupacides have been approved for use by the Service based on the historical health threat rather than being reserved for use only when an existing health threat has been documented. As a result, mosquito larval control activities since 1994 have been largely limited to localized (less than five acres) applications of larvicides and until 2005, only three applications of adulticides.

Table 4. Example of Mosquito-Borne Disease Health Threat and Response Matrix

Current Conditions			Refuge Response
Health Threat Category[1]	**Refuge Mosquito Populations** [2]		
No documented existing or historical health threat/ emergency	No action threshold	1	Remove/manage artificial mosquito breeding sites such as tires, tanks, or similar debris/containers.
Documented historical health threat/emergency	Below action threshold	2	Response as in threat level 1, plus: allow compatible monitoring and disease surveillance. Consider compatible nonpesticide management options to reduce mosquito production.
	Above action threshold	3	Response as in threat level 2, plus: allow site-specific compatible larviciding of infested areas as determined by monitoring.
Documented existing health threat (specify multiple levels, if necessary; e.g., disease found in wildlife, disease found in mosquitos, etc.)	Below action threshold	4	Response as in threat level 2, plus: increase monitoring and disease surveillance.
	Above action threshold	5	Response as in threat levels 3 and 4, plus: allow compatible site-specific larviciding, pupaciding, or adulticiding of infested areas as determined by monitoring.
Officially determined existing health emergency	Below action threshold	6	Maximize monitoring and disease surveillance.
	Above action threshold	7	Response as in threat level 6, plus: allow site-specific larviciding, pupaciding, and adulticiding of infested areas as determined by monitoring.

1 Health threat/emergency as determined by Federal and/or State/local public health authorities with jurisdiction inclusive of Refuge boundaries and/or neighboring public health authorities.

2 Action thresholds represent mosquito population levels that may require intervention measures. Thresholds will be developed in collaboration with Federal and/or State/local public health authorities and vector control districts. They must be species and life stage specific.

VIII. Stipulations and Reporting

1. Every attempt will be made to minimize mosquito production through wetland design, habitat (water level and vegetation) management techniques, mosquito fish or other non-chemical treatments, before larvicides or adulticides are applied. Among chemical treatments, adulticides will be considered a last resort.

2. In keeping with the MOU, the Refuge will provide the District with an annual summary of planned Refuge water management and with notification of timings of flood ups and irrigations.

3. As required under the MOU, the District will provide the Refuge Manager with an annual operating plan for anticipated mosquito monitoring and control activities that may be needed on the Refuge during the upcoming year. The plan will provide for Refuge access requirements, control thresholds, and proposed larvicides and adulticides.

4. Mosquito control will be authorized on an annual basis by a Special Use Permit (SUP) issued by the Refuge. SUP conditions will reflect any applicable restrictions required under approved Pesticide Use Proposals or Section 7 Consultations.

5. The Refuge will submit to the CNO Office all required Pesticide Use Proposals to maximize likelihood of PUP approval prior to onset of upcoming mosquito season.

6. The District will notify the Refuge manager as soon as possible when mosquito larval thresholds are exceeded and ground treatments are warranted.

7. When adult thresholds are exceeded, and in the event of a planned adulticiding, the District will contact and personally coordinate with the Refuge Manager or Assistant Refuge Manager prior to conducting the treatments to ensure control efforts do not conflict with routine Refuge operations.

8. The District will continue to consider environmental conditions, including water temperature, density of mosquito larvae, and presence of mosquito predators, when determining mosquitos on the Refuge pose a threat to public safety and whether treatments are required.

9. To minimize pesticide drift, dispersing vehicles will follow routes on existing roads set up to fog downwind or outside buffers of 300 feet from areas supporting listed or proposed special status species, including vernal pools.

10. All chemical applications will occur when wind speeds are between 2 and 8 mph.

11. Any applications of mosquito adulticides will occur outside a buffer of 300 from any permanent emergent wetlands.

12. Application of mosquito control measures is to be conducted in accordance with approved Pesticide Use Proposals.

13. Mosquito control will be authorized on an annual basis by a Special Use Permit (SUP) issued by the Refuge. SUP conditions will reflect any applicable restrictions required under approved Pesticide Use Proposals or Section 7 Consultations.

14. At the end of the season and as required under the MOU, the District will provide the Refuge Manager with an annual report summarizing mosquito control activities during the previous year.

References

Ali, A. 1981. *Bacillus thuringiensis* serovar *israelensis* against chironomids and some non-target aquatic invertebrates. Journal of Invertebrate Pathology 38: 264-272.

Anderson, R.L. 1989. Toxicity of synthetic pyrethroids to freshwater invertebrates. Environmental Toxicology and Chemistry 8: 403-410.

Batzer D. P., V. H. Resh. 1992. Macroinvertebrates of a California seasonal wetland and responses to experimental habitat manipulation. Wetlands. 12:1–7.

Boisvert, M., and J. Boisvert. 2000. Effects of *Bacillus thuringiensis* var. *israelensis* on target and nontarget organisms: a review of laboratory and field experiments. Biocontrol Science and Technology 10: 517-561.

Boyce, K. W. 2005. Mosquito and Mosquito-Borne Disease Management Plan. Sacramento-Yolo Mosquito and Vector Control District. 17 pp.

Breaud, T.P., J.E. Farlow, C.D. Steelman, and P.E. Schilling. 1977. Effects of the insect growth regulator methoprene on natural populations of aquatic organisms in Louisiana intermediate marsh habitats. Mosquito News. 37(4); 704-712.

Brown, M.D., T.M. Watson, S. Green, J.G. Greenwood, D. Purdie, and B.H. Kay. 2000. Toxicity of insecticides for control of freshwater *Culex annulirostris* (Diptera: Culicidae) to the nontarget shrimp, *Caradina indistincta* (Decapoda: Atyidae). Journal of Economic Entomology. 93(3): 667-672.

Brown, M.D., J. Carter, D. Purdie, D. Thomas, D.M. Purdie, and B.H. Kay. 2002. Pulse-exposure effects of selected insecticides to juvenile Australian Crimson-Spotted Rainbowfish (*Melanotaenia duboulayi*). Journal of Economic Entomology 95(2):294-298.

California West Nile Virus Website (www.westnile.ca.gov). 2006. California Department of Health Services, California Department of Food and Agriculture, Mosquito and Vector Control Association of California.

California Department of Health Services (CDHS). 2003. California mosquito-borne virus surveillance and response plan.

California Department of Health Services. 2004. California Mosquito-Borne Virus Surveillance and Response Plan. 51pp.

Celestial, D.M and C.L. McKenney, Jr. 1994. The influence of an insect growth regulator on the larval development of the mud crab *Rhithropanopeus harrisii*. Environmental Pollution. 85: 169-173.

Chu, K.H., Wong, C.K., and Chiu, K.C. 1997. Effects of the insect growth regulator (S)-methoprene on survival and reproduction of the freshwater cladoceran *Moina macrocopa*. Environmental Pollution. 96: 173-178.

Dale, P.E.R. and K. Hulsman. 1990. A critical review of salt marsh management methods for mosquito control, Crit. Rev. in Aquatic Science 3:281–311.

Dritz, D.A., S.P. Lawler, J. Albertson, W. Hamersky, and J.R. Rusmisel. 2001. The impact of Bti on survival of the endangered tadpole shrimp *Lepidurus packardi*. *In* Proceeding and Papers of the Sixty-ninth Annual Conference of the Mosquito and Vector Control Association of California. Jan. 21-24. pp. 88-91.

Dupont, C. and J. Boisvert. 1986. Persistence of *Bacillus thuringiensis* serovar. *israelensis* toxic activity in the environment and interaction with natural substrates. Water, Air, and Soil Pollution 29:425-438.

Extension Toxicology Network (ETN). 1994. Pyrethrin Pesticide information profile. http://ace.ace.orst.edu/info/extoxnet/pips/ghindex.html

Extension Toxicology Network (ETN). 1996a. Methoprene Pesticide information profile. http://ace.ace.orst.edu/info/extoxnet/pips/methopre.htm

Extension Toxicology Network (ETN). 1996b. Naled Pesticide information profile. http://ace.ace.orst.edu/info/extoxnet/pips/naled.htm

Florida Coordinating Council on Mosquito Control (FCCMC). 1998. Florida mosquito control: The state of the mission as defined by mosquito controllers, regulators, and environmental managers. University of Florida.

Fortin, C, D. Lapointe, and G. Charpentier. 1986. Susceptibility of brook trout (*Salvelinus fontinalis*) fry to a liquid formulation of *Bacillus thuringiensis* serovar. *israelensis* (Teknar®) used for blackfly control. Canadian Journal of Fisheries and Aquatic Science 43:1667-1670.

Garcia, R., B. Des Rochers, amd W. Tozer. 1980. Studies on the toxicity of *Bacillus thuringiensis* var. *israelensis* against organisms found in association with mosquito larvae. California Mosquito and Vector Control Association Proceedings and Papers 48:33-36.

Hanowski, J. M., G. J. Niemi, A. R. Lima, and R. R. Regal. 1997. Do mosquito control treatments of wetlands affect red-winged blackbird (*Agelaius phoeniceus*) growth, reproduction, or behavior? Environmental Toxicology and Chemistry 16(5):1014-1019.

Heitmeyer, M. E. 1988. Body composition of female mallards in winter in relation to annual cycle events. Condor 90:669-680.

Hershey, A. E., A. R. Lima, G. J. Niemi, and R R. Regal. 1998. Effects of *Bacillus thuringiensis israelensis* (Bti) and methoprene on non-target macroinvertebrates in Minnesota wetlands. Ecological Applications 8:41-60.

Hill, I. R., J. L. Shaw, and S. J. Maund.Hill, I. R., Heimbach, F., Leeuwangh, P., and Mattiessen, P. [eds.]. 1994. Review of Aquatic Field Tests With Pyrethroid Insecticides. Lewis Publishers. Boca Raton, FL (USA).

Horst, M.N., and A.N. Walker. 1999. Effects of the pesticide methoprene on morphogenesis and shell formation in the blue crap *Callinectues sapidus*. Journal of Crustacean Biology 19: 699-707.

Jackson, J. K., R.J. Horowitz, and B.W. Sweeny. 2002. Effects of *Bacillus thuringiensis israelensis* on black flies and nontarget macroinvertebratess and fish in a large river. Transactions of the American Fisheries Society 131:910-930.

Jensen, T., S. P. Lawler, and D. A. Dritz. 1999. Effects of ultra-low volume pyrethrin, malathion, and permethrin on nontarget invertebrates, sentinel mosquitos, and mosquitofish in seasonally impounded wetlands. Journal of the American Mosquito Control Association 15: 330-338.

Kramer, LD, and HM Fallah. 1999. Genetic variation among isolates of western equine encephalomyelitis virus from California. Am. J. Trop. Med. Hyg. 60: 708-713.

Lacey, L.A., and Mulla, M.S. 1990. Safety of *Bacillus thuringiensis* var. *israelensis* and *Bacillus sphaericus* to non-target organisms in the aquatic environment. *In* Laird, M., L.A. Lacey, E.W. Davidson, eds. Safety of microbial insecticides. CRC Press.

Lawler, S. P., T. Jensen, and D. A. Dritz. 1997. Mosquito management on National Wildlife Refuges: ecosystem effects study, phase II, part 1 - Effects of ultra low volume applications of pyrethrin, malathion, and permethrin on macro-invertebrates in the Sacramento National Wildlife Refuge, California. Final rep. to U.S. Fish Wildl. Serv., Coop. Agreem. No. 14-48-0001-94582. 102 pp.

Lee, B. M. And G. I. Scott. 1989. Acute toxicity of temephos, fenoxycarb, diflubenzuron, and methoprene and *Bacillus thuringiensis* var. *israelensis* to the mummichog (*Fundulus heteroclitus*). Bulletin of Environmental Contamination and Toxicology 43:827-832.

McKenney, C.L., Jr., and D.M. Celestial. 1996. Modified survival, growth, and reproduction in an estuarine mysid (*Mysidoposis bahia*) exposed to a juvenile hormone analogue through a complete life cycle. Aquatic Toxicology 35:11-20.

Merritt, R. W., E. D. Walker, M. A. Wilzbach, K. W. Cummings, and W. T. Morgan. 1989. A broad evaluation of Bti for black fly (Diptera: Simuliidae) control in a Michigan River: Efficacy, carry, and non-target effects on invertebrates and fish. Journal of the American Mosquito Control Association 5:397-415.

Millam, D.C., J.L. Farris, and J.D. Wilhide. 2000. Evaluating mosquito control pesticides for effect on target and nontarget organisms. Mosquito News 40:619-622.

Miller, M. R. 1987. Fall and winter foods of northern pintails in the Sacramento Valley, California. Journal of Wildlife Management. 51:405-414.

Miura, T., and R.M. Takahashi. 1973. Insect development inhibitors. 3. Effects on nontarget aquatic organisms. Journal of Economic Entomology. 66(4):917-922.

Miura, T.; Takahashi, R. M.; and Mulligan, F.S. 1980. Effects of the bacterial mosquito larvicide *Bacillus thuringiensis* stereotype H-14 on selected aquatic organisms. Mosquito News. 40:619-622.

Mulla, M.S. 1992. Activity, Field Efficacy, and Use of *Bacillus thuringiensis israelensis* against Mosquitos. Pp. 134-160 in de Barjac, Hugette and Donald J. Sutherland, eds. Bacterial Control of Mosquitos and Blackflies: Biochemistry, Genetics, and Applications of *Bacillus thuringiensis israelensis* and *Bacillus sphaericus*. Kluwer Academic.

Niemi, G. J., A. E. Hershey, L. Shannon, J. M. Hanowski, A. Lima, R. P. Axler, and R. R. Regal. 1999. Ecological Effects of Mosquito Control on Zooplankton, Insects, and Birds. Environmental Toxicology and Chemistry, 18(3):549-559.

Reeves, W.C. 1990. Overwintering of arboviruses. Reeves, W.C., ed. Epidemiology and Control of Mosquito-Borne Arboviruses in California, 1943-1987. Sacramento, CA: California Mosquito and Vector Control Association, 357-382.

Reisen WK, Boyce K, Yoshimura G, Lemenager D, Emmons R.W. 1995. Enzootic transmission of western equine encephalomyelitis virus in Sacramento Valley of California during 1993 and 1994. J Vector Ecol 20:153-163.

Sacramemento/Yolo Mosquito Vector Control District (SYMVCD). 2004. Vector Information.
http://www.sac-yolomvcd.com/vectorinfo.htm

Siegel, Joel, P. and J. A. Shadduck. 1992. Mammalian safety of *Bacillus thuringiensis israelensis* and *Bacillus sphaericus*. Pp. 202-217 in de Barjac, Huguette and Donald J. Sutherland, eds. Bacterial control of mosquitos and blackflies: biochemistry, genetics, and applications of *Bacillus thuringiensis israelensis* and *Bacillus sphaericus*. Kluwer Academic.

Siegfried, B. D. 1993. Comparative toxicity of pyrethroid insecticides to terrestrial and aquatic insects. Environmental Toxicology and Chemistry 12: 1683-1689.

Su. T., and M.S. Mulla. 1999. Microbial agents *Bacillus thuringiensis* ssp. *israelensis* and *Bacillus sphaericus* suppress eutrophication, enhance water quality, and control mosquitos in microcosms. Environmental Entomology 28:761-767.

Tomlin, C. 1994. The Pesticide Manual. Farnham: British Crop Protection Council/ Cambridge: Royal Society of Chemistry.

Urban, J. D. and N.J. Cook. 1986. Standard evaluation procedure: Ecological risk assessment. U. S. EPA. Office of Pesticide Programs. Hazard evaluation division

U.S. Environmental Protection Agency (USEPA). 1991. Re-registration eligibility document. Isopropyl (2E, 4E)-11-methoxy-3,7,11-trimethyl-2,4-dodecadienoate (Referred to as methoprene). List A. Case 0030. Office of pesticide Programs. Special Review and Registration Division.

U.S. Environmental Protection Agency (USEPA). 1998. Re-registration eligibility document. *Bacillus thuringiensis.* Office of Prevention, Pesticides and Toxic Substances. EPA738-R-98-004.

U.S. Environmental Protection Agency (USEPA). 2000. Ecotoxicity online database. Division of Environmental Fate and Effects. Office of Pesticide Programs.

U.S. Fish and Wildlife Service (USFWS). 1984. Acute toxicity rating scales. Research Information Bulletin No. 84-78.

U.S. Fish and Wildlife Service (USFWS). 2001. Intra-Agency Formal Section 7 Consultation on Pest Management Activities at the Stone Lakes National Wildlife Refuge, Sacramento, California.

U.S. Fish and Wildlife Service. 1992. Final Environmental Impact Statement - Stone Lakes National Wildlife Refuge. Prepared by Jones & Stokes, Associates, Inc. for U.S. Fish and Wildlife Refuge.

Walton, W.E., M.C. Wirth, and B.A. Federici. 1998. The effect of the CytA toxin ratio on the suppression of resistance and cross-resistance to mosquitocidal *Bacillus* toxins. Mosquito Control Research Annual Report. University of California. Division of Agriculture and Natural Resources.

WHO. Undated. Data sheet on pesticides no. 47. Methoprene. World Health Organization. Food and Agriculture Organization. http://www.inchem.org/documents/pds/pds/pest47_e.htm

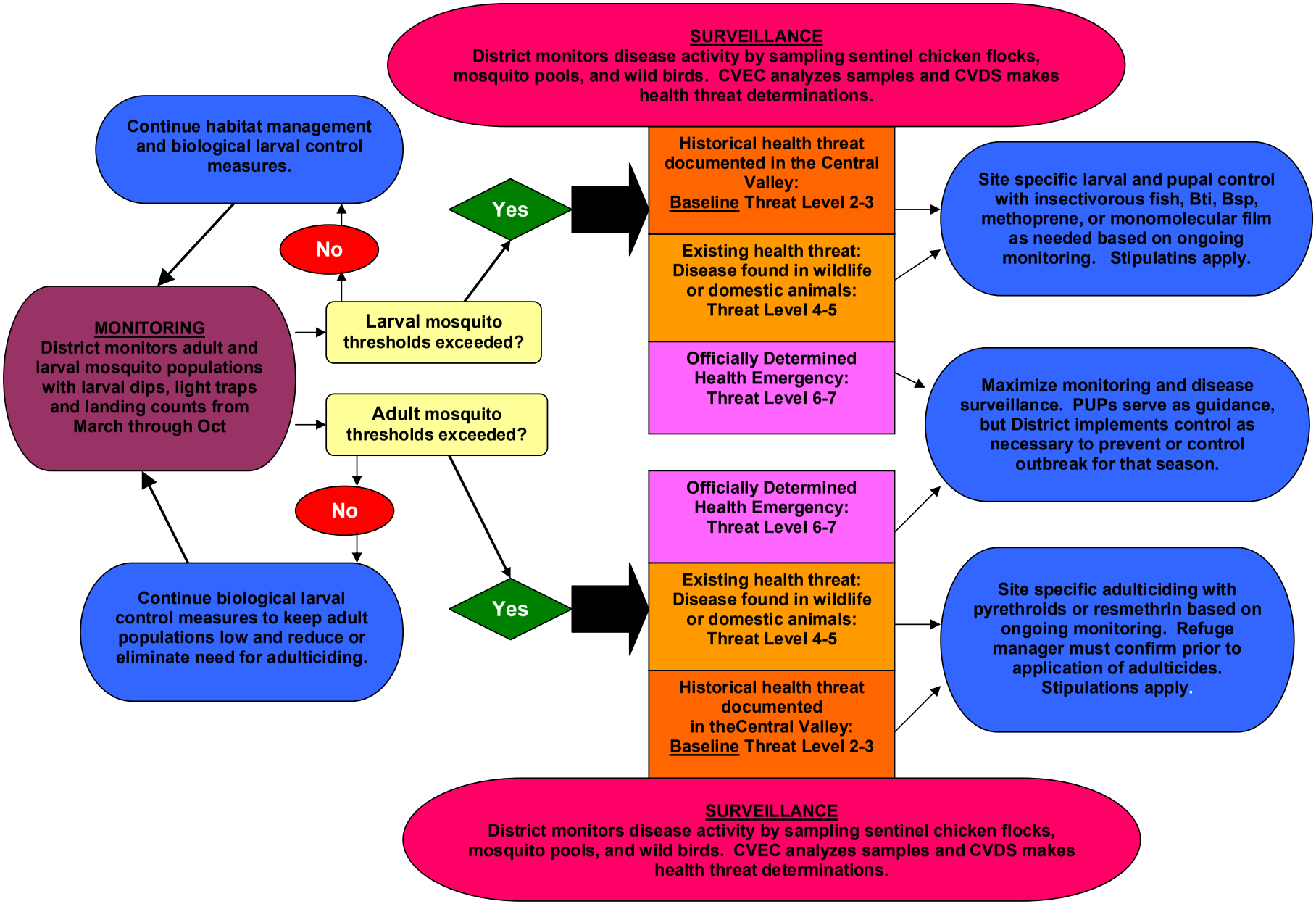
Wipfli, M.S., R.W. Merritt, and W.W. Taylor. 1994. Low toxicity of the blackfly larvicide *Bacillus thuringiensis* var. *israelensis* to early stages of brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), and steelhead trout (*Oncorhynchus mykiss*) following direct and indirect exposure. Canadian Journal of Fisheries and Aquatic Science 41:1451-1458.

Wright, S. and Yoshimura, G. 1997. Mosquito Productivity in Mitigated and Natural Vernal Pools in Sacramento County. Project Report: June 1997. Sacramemento-Yolo Mosquito Vector Control District.

Zoecon. 2000. Material Safety Data Sheet Altosid Liquid Larvicide Concentrate.

Personal Communications

Sanders, P. Sacramento-Yolo Mosquito Vector Control District (SYMVCD).


SURVEILLANCE
District monitors disease activity by sampling sentinel chicken flocks, mosquito pools, and wild birds. CVEC analyzes samples and CVDS makes health threat determinations.
Continue habitat management and biological larval control measures.
Yes
No
Historical health threat documented in the Central Valley: Baseline Threat Level 2-3
Existing health threat: Disease found in wildlife or domestic animals: Threat Level 4-5
Officially Determined Health Emergency: Threat Level 6-7
Site specific larval and pupal control with insectivorous fish, Bti, Bsp, methoprene, or monomolecular film as needed based on ongoing monitoring. Stipulatins apply.
MONITORING
District monitors adult and larval mosquito populations with larval dips, light traps and landing counts from March through Oct
Larval mosquito thresholds exceeded?
Adult mosquito thresholds exceeded?
Maximize monitoring and disease surveillance. PUPs serve as guidance, but District implements control as necessary to prevent or control outbreak for that season.
No
Yes
Officially Determined Health Emergency: Threat Level 6-7
Existing health threat: Disease found in wildlife or domestic animals: Threat Level 4-5
Historical health threat documented in theCentral Valley: Baseline Threat Level 2-3
Site specific adulticiding with pyrethroids or resmethrin based on ongoing monitoring. Refuge manager must confirm prior to application of adulticides. Stipulations apply.
Continue biological larval control measures to keep adult populations low and reduce or eliminate need for adulticiding.
SURVEILLANCE
District monitors disease activity by sampling sentinel chicken flocks, mosquito pools, and wild birds. CVEC analyzes samples and CVDS makes health threat determinations.

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