Appendix A. References

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Appendix B. Species Lists

- Vegetation
- Invertebrate
- Fish
- Bird
- Mammal

Vegetation List

Scientific Name	Family	Common Name	Non-native	Invasive	Status
Sesuvium verrucosum	Aizoaceae	Western sea purslane			
Tetragonia tetragonioides	Aizoaceae	New Zealand spinach	*Y*		
Conium maculatum	Apiaceae	Poison hemlock			
Foeniculum vulgare	Apiaceae	Common Fennel			
Achillea millefolium	Asteraceae	Common yarrow			
Baccharis pilularis	Asteraceae	Coyote brush			
Centaurea calcitrapa	Asteraceae	Purple star thistle	*Y*	*Y*	
Centaurea solstitialis	Asteraceae	Yellow star thistle	*Y*	*Y*	
Cirsium vulgare	Asteraceae	Bull thistle	*Y*	*Y*	
Cotula coronopifolia	Asteraceae	Brass buttons	*Y*	*Y*	
Gnaphalium stramineum	Asteraceae	Cudweed			
Grindelia stricta	Asteraceae	Gum plant			
Jaumea carnosa	Asteraceae	Salt marsh daisy			
Lactuca serriola	Asteraceae	Prickly lettuce	*Y*	*Y*	
Picris echioides	Asteraceae	Bristly ox tongue	*Y*	*Y*	
Silybum marianum	Asteraceae	Milk thistle	*Y*	*Y*	
Sonchus asper	Asteraceae	Prickly sow thistle	*Y*		
Sonchus oleraceus	Asteraceae	Common sow thistle	*Y*		
Amsinckia menziesii	Boraginaceae	Coast fiddlehead			
Lepidium latifolium	Brassicaceae	Perennial pepperweed	*Y*	*Y*	
Brassica rapa	Brassicaceae	Field Mustard	*Y*	*Y*	
Raphanus sativus	Brassicaceae	Common wild radish	*Y*	*Y*	
Spergula arvensis	Caryophyllaceae	Stickwort	*Y*		
Spergularia macrotheca	Caryophyllaceae	Sand spurrey			
Spergularia rubra	Caryophyllaceae	Sand spurrey			
Atriplex triangularis	Chenopodiaceae	Fat hen			
Salicornia europaea	Chenopodiaceae	European pickleweed			
Atriplex semibaccata	Chenopodiaceae	Australian saltbush	*Y*	*Y*	
Salicornia virginica	Chenopodiaceae	Common pickleweed			
Sarcocornia pacifica	Chenopodiaceae	Pickleweed			
Cuscuta salina	Cuscutaceae	Dodder			
Scirpus americanus	Cyperaceae	American bulrush			
Scirpus spp.	Cyperaceae	Bulrush			
Scirpus californicus	Cyperaceae	California bulrush			
Scirpus maritimus	Cyperaceae	Salt marsh bulrush			
Lathyrus jepsonii var. jepsonii	Fabaceae	Delta tule pea			SR
Lotus corniculatus	Fabaceae	Bird's foot trefoil	*Y*		
Vicia sativa	Fabaceae	Common vetch	*Y*		
Frankenia salina	Frankeniaceae	Alkali heath			
Juncus balticus	Juncaceae	Baltic rush			
Lythrum hyssopifolium	Lythraceae	Loosestrife			
Eucalyptus spp.	Myrtaceae	Eucalyptus			
Limonium californicum	Plumbaginaceae	Sea lavender			
Bromus hordeaceus	Poaceae	Soft chess	*Y*	*Y*	
Festuca myuros	Poaceae	Fox tail	*Y*	*Y*	
Lolium multiflorum	Poaceae	Italian rye grass	*Y*	*Y*	
Agrostis avenacea	Poaceae	Bent grass	*Y*	*Y*	
Avena fatua	Poaceae	Wild oats	*Y*	*Y*	
Bromus diandrus	Poaceae	Rip gut brome	*Y*	*Y*	
Distichlis spicata	Poaceae	Salt grass			
Hordeum marinum	Poaceae	Mediterranean barley	*Y*		
Lolium perenne	Poaceae	Perennial rye grass	*Y*		
Polypogon monspeliensis	Poaceae	Rabbitfoot beard grass	*Y*	*Y*	
Spartina foliosa	Poaceae	Cord grass			
Polygonum marinense	Polygonaceae	Marin knotweed			

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Vegetation List

Scientific Name	Family	Common Name	Non-native	Invasive	Status
Polygonum arenastrum	Polygonaceae	Prostrate knotweed	*Y*		
Rumex crispus	Polygonaceae	Curly dock	*Y*	*Y*	
Ruppia maritima	Potamogetonaceae	Ditch grass			
Anagallis arvensis	Primulaceae	Scarlet pimpernel	*Y*		
Glaux maritima	Primulaceae	Sea milkwort			
Cordylanthus mollis ssp. mollis	Scrophulariaceae	Soft bird's-beak			SR, FE
Scrophularia californica	Scrophulariaceae	Bee plant			
Typhus latifolia	Typhaceae	Broad-leaved cattail			

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Invertebrate List

Scientific Name	Common Name	Non-native	Status
Cancer antennarius	Brown rock crab		
Cancer gracilis	Slender crab		
Cancer productus	Red rock crab		
Carcinus maenas	Green crab		
Cnidarian	Jellyfish		
Crangon spp.	Crangon shrimp		
Crangon franciscorum	California bay shrimp		
Crangon nigricauda	Blacktail bay shrimp		
Crangon nigromaculata	Blackspotted bay shrimp		
Eriocheir sinensis	Chinese mitten crab	*Y*	
Exopalaemon modestus	Siberian prawn		
Hemigrapsus sp.	Hemigrapsus crab		
Heptacarpus stimpsoni	Stimpson coastal shrimp		
Metacarcinus magister	Dungeness crab		
Palaemon macrodactylus	Oriental shrimp	*Y*	
Palaemon sp.	Palaemon shrimp		

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Fish List

Scientific Name	Common Name	Non-native	Status
Acanthogobius flavimanus	Yellowfin goby	*Y*	
Alosa sapidissima	American shad	*Y*	
Atherinops affinis	Topsmelt		
Catostomus occidentalis	Sacramento sucker		
Citharichthys stigmaeus	Speckled sanddab		
Clevelandia ios	Arrow goby		
Clupea pallasii	Pacific herring		
Cottus asper	Prickly sculpin		
Cottus gulosus	Riffle sculpin		
Cymatogaster aggregata	Shinerperch		
Dorosoma petenense	Threadfin shad	*Y*	
Engraulis mordax	Northern anchovy		
Gambusia affinis	Western mosquitofish	*Y*	
Gasterosteus aculeatus	Three-spined stickleback		
Genyonemus lineatus	White croaker		
Gillichthys mirabilis	Longjaw mudsucker		
Hypomesus nipponensis	Wakasagi goby	*Y*	
Hypomesus pretiosus	Surf smelt		
Hypomesus transpacificus	Delta smelt		FT, ST
Hysterocarpus traskii	Tule perch		
Ilypnus gilberti	Cheekspot goby		
Lavinia symmetricus	California roach		
Lepidogobius lepidus	Bay goby		
Lepomis cyanellus	Green sunfish	*Y*	
Leptocottus armatus	Pacific staghorn sculpin		
Lucania parva	Rainwater killifish	*Y*	
Menidia beryllina	Inland silverside	*Y*	
Micrometrus minimus	Dwarf perch		
Morone saxatilis	Striped bass	*Y*	
Mustelus henlei	Brown smooth-hound		
Oncorhynchus mykiss irideus	Steelhead/Rainbow trout		
Oncorhynchus tshawytscha	Chinook salmon		
Orthodon microlepidotus	Sacramento blackfish		
Paralichthys californicus	California Halibut		
Parophrys vetulus	English sole		
Pimephales promelas	Fathead minnow	*Y*	
Platichthys stellatus	Starry flounder		
Pogonichthys macrolepidotus	Sacramento splittail		ST
Porichthys notatus	Plainfin midshipman		
Ptychocheilus grandis	Sacramento pikeminnow		
Spirinchus thaleichthys	Longfin smelt		
Stizostedion vitreum	Walleye surfperch		
Symphurus atricauda	California tonguefish		
Syngnathus leptorhynchus	Bay pipefish		
Triakis semifasciata	Leopard shark		
Tridentiger barbatus	Shokihaze goby	*Y*	

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Fish List

Scientific Name	Common Name	Non-native	Status
Tridentiger bifasciatus	Shimofuri goby	*Y*	

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Bird List

Common Name	Scientific Name	Status
Grebes		
Horned grebe	*Podiceps auritus*	
Eared grebe	*Podiceps nigricollis*	
Pied-billed grebe	*Podilymbus podiceps*	
Western grebe	*Aechmophorus occidentalis*	
Clark's grebe	*Aechmophorus clarkii*	
Pelecaniformes		
American white pelican	*Pelecanus erythrorhynchos*	CSC (breeding)
Brown pelican	*Pelacanus occidentalis*	CSC (breeding)
Double-crested cormorar	*Phalacrocorax auritus*	CSC (breeding)
Wading Birds		
American bittern	*Botaurus lentiginosus*	CSC (breeding)
Great blue heron	*Ardea herodias*	CSC (breeding)
Great egret	*Ardea alba*	CSC (breeding)
Snowy egret	*Egretta thula*	CSC (breeding)
Black-crowned night-herc	*Nycticorax nycticorax*	CSC (breeding)
Geese and ducks		
Greater white fronted goc	*Anser albifrons*	
Canada goose	*Branta canadensis*	
Mallard	*Anas platyrhynchos*	
Gadwall	*Anas strepera*	
Northern pintail	*Anas acuta*	
American wigeon	*Anas americana*	
Northern shoveler	*Anas clypeata*	
Cinnamon teal	*Anas cyanoptera*	
Green-winged teal	*Anas crecca*	
Canvasback	*Aythya valisineria*	CSC (breeding)
Redhead	*Aythya americana*	CSC (breeding)
Greater scaup	*Aythya marila*	
Lesser scaup	*Aythya affinis*	
Long-tailed duck	*Clangula hyemalis*	
Surf scoter	*Melanitta perspicillata*	
Common goldeneye	*Bucephala clangula*	
Bufflehead	*Bucephala albeola*	
Ruddy duck	*Oxyura jamaicensis*	
Raptors		
Northern harrier	*Circus cyaneus*	CSC (breeding)
White-tailed kite	*Elanus leucurus*	CSC (breeding)
Cooper’s hawk	*Accipiter cooperii*	CSC (breeding)
Sharp-shinned hawk	*Accipiter striatus*	CSC (breeding)
Red-shouldered hawk	*Buteo lineatus*	
Red-tailed hawk	*Buteo jamaicensis*	
Swainson's hawk	*Buteo swainsoni*	*ST, CC, CSC (breeding)*

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Bird List

Common Name	Scientific Name	Status
Ferruginous hawk	*Buteo regalis*	CSC (wintering)
Rough-legged hawk	*Buteo lagopus*	
Osprey	*Pandion haliaetus*	CSC (breeding)
Golden eagle	*Aquila chrysaetos*	
American kestrel	*Falco sparverius*	
Prairie falcon	*Falco mexicanus*	CSC (breeding)
Merlin	*Falco columbarius*	CSC (wintering)
Peregrine falcon	*Falco peregrinus*	CC, CSC (breeding)
Turkey vulture	*Cathartes aura*	
Upland Game Birds		
Ring-necked pheasant	*Phasianus colchicus*	
Gruiformes		
American coot	*Fulica americana*	
California clapper rail	*Rallus longirostris obsoletus*	FE, SE
Virginia rail	*Rallus limicola*	
Sora	*Porzana carolina*	
California black rail	*Laterallus jamaicensis coturniculus*	ST, CC
Shorebirds		
Black-bellied plover	*Pluvialis squatarola*	
American golden-plover	*Pluvialis dominica*	
Semipalmated plover	*Charadrius semipalmatus*	CC
Western snowy plover	*Charadrius alexandrinus nivosus*	*FT, CC*
Killdeer	*Charadrius vociferus*	
Black oystercatcher	*Haematopus bachmani*	CC
American Avocet	*Recurvirostra americana*	
Black-necked stilt	*Himantopus mexicanus*	
Greater yellowlegs	*Tringa melanoleuca*	
Lesser yellowlegs	*Tringa flavipes*	CC
Willet	*Catoptrophorus semipalmatus*	
Whimbrel	*Numenius phaeopus*	CC
Long-billed curlew	*Numenius americanus*	CC, CSC (breeding)
Marbled godwit	*Limosa fedoa*	CC
Black turnstone	*Arenaria melanocephala*	
Red knot	*Calidris canutus*	
Sanderling	*Calidris alba*	
Dunlin	*Calidris alpina*	
Western sandpiper	*Calidris mauri*	
Least sandpiper	*Calidris minutilla*	
Long-billed dowitcher	*Limnodromus scolopaceus*	
Short-billed dowitcher	*Limnodromus griseus*	CC
Common snipe	*Gallinago gallinago*	
Wilson's phalarope	*Phalaropus tricolor*	
Red-necked phalarope	*Phalaropus lobatus*	
Gulls/Terns		

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Bird List

Common Name	Scientific Name	Status
Bonaparte's gull	*Larus philadelphia*	
Franklin's gull	*Larus pipixcan*	
Ring-billed gull	*Larus delawarensis*	
California gull	*Larus californicus*	CSC (breeding)
Herring gull	*Larus argentatus*	
Glaucous-winged gull	*Larus glaucescens*	
Western gull	*Larus occidentalis*	
Heermann's gull	*Larus heermanni*	
Caspian tern	*Sterna caspia*	CSC (breeding)
Forster's tern	*Sterna forsteri*	CSC (breeding)
Least tern	*Sterna antillarum*	*SE, FE*
Black tern	*Chlidonias niger*	CSC (breeding)
Alcids		
Common murre	*Uria aalge*	
Pigeons/Doves		
Mourning dove	*Zenaida macroura*	
Rock dove	*Columba livia*	
Owls		
Barn Owl	*Tyto alba*	
Long-eared owl	*Asio otus*	CSC (breeding)
Short-eared owl	*Asio flammeus*	
Great-horned owl	*Bubo virginianus*	*CSC*
Western burrowing owl	*Athene cunicularia hypugea*	CSC (breeding/some wintering), CC
Swifts		
Vauxs swift	*Chaetura vauxi*	CSC (breeding)
Hummingbird		
Anna's hummingbird	*Calypte anna*	
Allen's hummingbird	*Selasphorus sasin*	CC, CSC (breeding)
Woodpeckers		
Northern flicker	*Colaptes auratus*	
Flycatchers		
Black phoebe	*Sayornis nigricans*	
Say's phoebe	*Sayornis saya*	
Shrikes		
Loggerhead shrike	*Lanius ludovicianus*	CC, CSC (breeding)
Jays, Crows, Ravens		
Scrub jay	*Aphelocoma californica*	
Common raven	*Corvus corax*	
American crow	*Corvus brachyrhynchos*	

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Bird List

Common Name	Scientific Name	Status
Horned lark	*Eremophila alpestris*	
Swallows		
Northern rough-winged s	*Stelgidopteryx serripennis*	
Tree swallow	*Tachycineta bicolor*	
Violet-green swallow	*Tachycineta thalassina*	
Cliff swallow	*Petrochelidon pyrrhonota*	
Barn swallow	*Hirundo rustica*	
Chickadees		
Bushtit	*Psaltriparus minimus*	
Wrens		
Marsh wren	*Cistothorus palustris*	
Thrushes		
American robin	*Turdus migratorius*	
Pipits		
American pipit	*Anthus rubescens*	
Waxwings		
European starling	*Sturnus vulgaris*	
Wood-warblers		
Salt marsh common yello	*Geothlypis trichas sinuosa*	CC
Sparrows		
Savannah sparrow	*Passerculus sandwichensis*	
Golden-crowned sparrow	*Zonotrichia atricapilla*	
White-crowned sparrow	*Zonotrichia leucophrys*	
Song sparrow	*Melospiza melodia*	
Alameda song sparrow	*Melospiza melodia pusillula*	
San Pablo song sparrow	*Melospiza melodia samuelis*	CC
Icterids		
Western meadowlark	*Sturnella neglecta*	
Brown-headed cowbird	*Molothrus ater*	
Red-winged blackbird	*Agelaius phoeniceus*	
Brewer's blackbird	*Euphagus cyanocephalus*	
Finches		
House finch	*Carpodacus mexicanus*	
American goldfinch	*Carduelis tristis*	

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Mammal List

Common Name	Scientific Name	Status
Opossum	*Didelphis marsupialis*	
Salt marsh wandering shrew	*Sorex vagrans haliocoetes*	CSC
Ornate shrew	*Sorex ornatus*	
Suisun shrew	*Sorex sinuosus*	CSC
Raccoon	*Procyon lotor*	
River otter	*Lontra canadensis*	
Skunk	*Mephitis mephitis*	
Coyote	*Canis latrans*	
Harbor seal	*Phoca vitulina*	
Beaver	*Castor canadensis*	
Western harvest mouse	*Reithrodontomys megalotis*	
Salt marsh harvest mouse	*Reithrodontomys raviventris*	FE, SE
Deer mouse	*Peromyscus maniculatus*	
California vole	*Microtus californicus*	CSC
Muskrat	*Ondatra zibethicus*	
Norway rat	*Rattus norvegicus*	
House mouse	*Mus musculus*	
California Ground Squirrel	*Citellus beecheyi*	
Blacktail jackrabbit	*Lepus californicus*	
Black-tailed deer	*Odocoileus hemionus*	

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Appendix C. Draft Environmental Assessment

TABLES

FIGURES

Glossary of Terms and Acronyms

CCP	Comprehensive Conservation Plan
CDFG	California Department of Fish and Game
EA	Environmental Assessment
EO	Executive Order
GIS	Geographic Information System
I&M	Inventory and Monitoring
NEPA	National Environmental Policy Act
NWR	National Wildlife Refuge
NWRS/Refuge System	National Wildlife Refuge System
Refuge	San Pablo Bay National Wildlife Refuge
RLGIS	Refuge Lands Geographic Information System
SLAMM	Sea-Level Affecting Marsh Model
Central California	
USDA	U.S. Department of Agriculture
USFWS/Service	U.S. Fish and Wildlife Service
1997 Improvement Act	The National Wildlife Refuge System Improvement Act of 1997

Chapter 1. Purpose and Need for Action

Introduction

This environmental assessment (EA), in accordance with the requirements of the National Environmental Policy Act (NEPA), evaluates the environmental effects of four alternatives for managing the San Pablo Bay National Wildlife Refuge (Refuge) as presented in the draft Comprehensive Conservation Plan (CCP). The purpose of the CCP (also referred to as the *plan*) is to provide a 15-year management plan for the Refuge and long-term guidance in relation to management decisions, as directed by the National Wildlife Refuge System Improvement Act of 1997 (1997 Improvement Act). Both direction and guidance are described in detail through a set of goals, objectives, and strategies in the CCP.

Plan Area

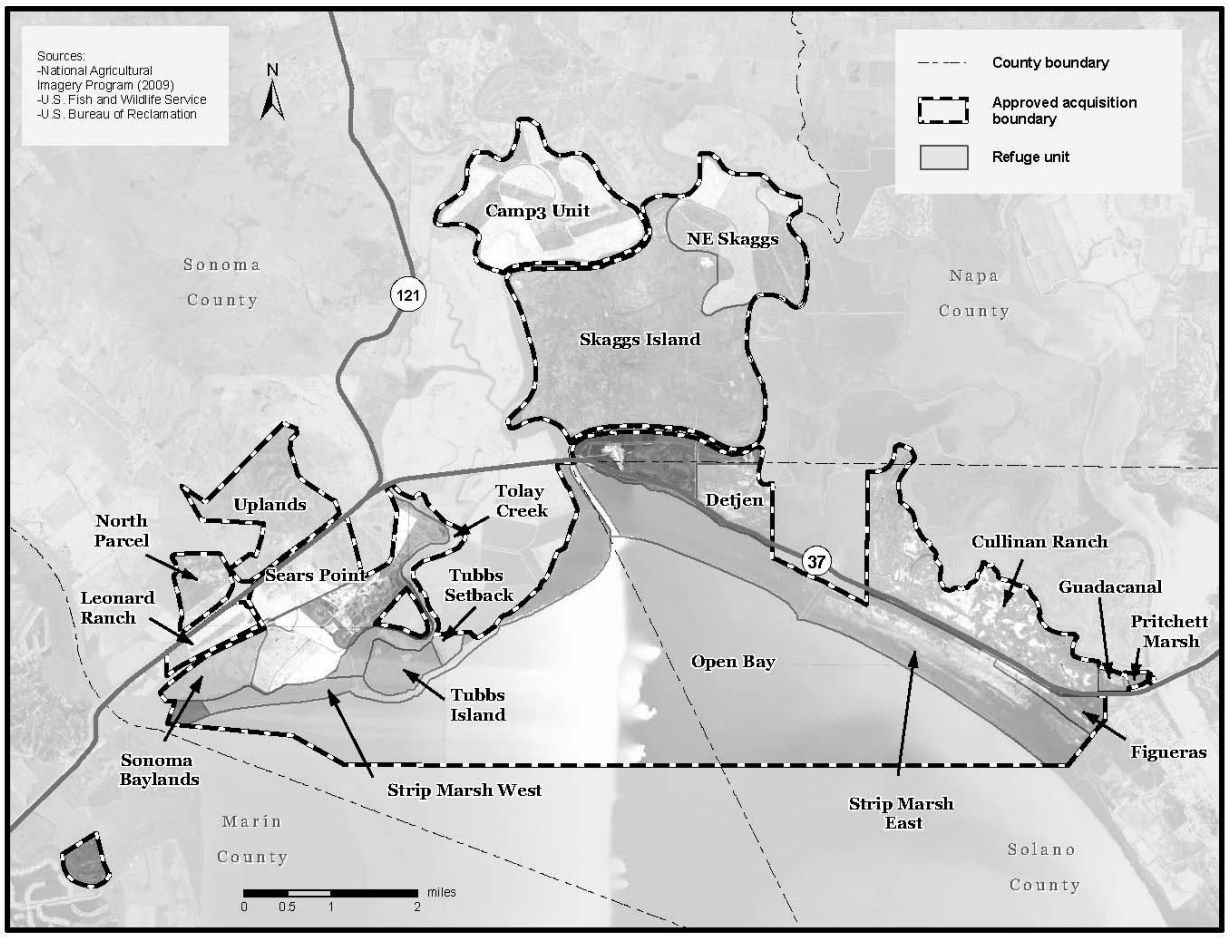
The Refuge abuts the northern edge of the San Francisco Bay Estuary. This sub region of the Estuary is also called San Pablo Bay. The Refuge extends into Sonoma, Napa and Solano Counties. According to Bay Area Air Quality Management District San Pablo Bay sits in the Cotati/Petaluma, Sonoma Valley, and Napa Valley regions. Eight non-contiguous units make up the Refuge: Figueras, Guadalcanal, Lower Tubbs Island, Tubbs Island Setback, Tolay Creek, Cullinan Ranch, Strip Marsh, and the open bay/mudflats. Some of these units owned by the California State Lands Commission (see Figure 1), but managed by the Service. The Refuge is an important stopping point for migratory waterfowl, shorebirds, and songbirds. Endangered species including California clapper rail and salt marsh harvest mouse rely on the Refuge habitat for breeding and resting habitat.

Proposed Action

The Service proposes to develop and implement a CCP for the San Pablo Bay Refuge that best achieves the purposes for which the Refuge was established, helps fulfill the mission of the National Wildlife Refuge System, is consistent with sound fish and wildlife management, and ensures that the biological integrity, diversity, and environmental health of the Refuge System are maintained.

The Service examined a range of management alternatives. A description of these alternatives is contained in Chapter 2. Alternative C represents the Service's proposed action for the Refuge; however, the final decision can be any of the alternatives, and may reflect a modification of certain elements of any alternative based on consideration of public comment. Of the alternatives evaluated, this alternative appears to best achieve the purpose, vision, and goals for the Refuge, while also appropriately addressing the major issues and relevant mandates identified for the Refuge during the development of the CCP.

Figure 1. San Pablo Bay NWR



Purpose and Need for the Proposed Action

The development of the CCP provides guidance for conduction general Refuge operations, wildlife and habitat management, habitat enhancement and restoration, and visitor services. The CCP is intended to ensure that management actions are consistent with the purposes for which the Refuge was established, the mandates of the Refuge System, and the Refuge's goals and objectives. The purpose of the CCP is to describe the desired future conditions of San Pablo Bay Refuge over the next 15 years and provide guidance for achieving those conditions. The CCP accomplishes the following:

- Sets a long term vision for the Refuge;
- Establishes management goals, objectives, and strategies for the Refuge;
- Provides the Refuge with a 15-year management plan for the conservation of fish, wildlife, and plant resources and their related habitats;
- Defines compatible public uses
- Develops a plan that, when fully implemented, will achieve Refuge purposes, help fulfill the mission of the System, and maintain and, where appropriate, restore ecological integrity;
- Communicates the Service's management priorities for the Refuge to the public; and

- Provides a basis for budget needs to support staffing, operations, maintenance, and capital improvements.

The development of this CCP is also required to fulfill legislative obligations of the Service. The National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), requires that every refuge or related complex of refuges have a CCP in place within 15 years of the Improvement Act's enactment. In order to comply with NEPA, an EA or Environmental Impact Statement (EIS) which evaluates the effects of different alternatives that meet the goals of the Refuge must be prepared to accompany the CCP. The Draft CCP and its appendices are herein incorporated by reference (U.S. Fish and Wildlife Service 2009).

NEPA and this Document

NEPA requires federal agencies to consider the environmental effects of all actions[1] they undertake. This EA evaluates the effects of various alternative management scenarios for the Refuge. Federal agencies must also consider the environmental effects of a reasonable range of alternatives and make public the environmental effects of the preferred alternative and other reasonable alternatives. If adverse environmental effects are identified, NEPA requires an agency to identify means to mitigate those adverse. An EA documents that an agency has considered and addressed all these issues. This EA has been prepared to assess the environmental effects of the action alternatives. The U.S. Fish and Wildlife Service (Service) will also use this EA process to solicit public involvement in the refuge planning process and determine whether the CCP will have a significant effect on the quality of the human environment, as well.

This EA discusses the purpose and need for the San Pablo Bay National Wildlife Refuge CCP; it also provides an analysis of the impacts that could be expected from each of the management proposals outlined in the plan. This analysis will help the Service determine if it will need to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI) regarding the preferred alternative for the Refuge.

The policies of the Service, the 1997 Improvement Act, and NEPA require the Service to actively seek public involvement in the preparation of environmental documents. NEPA also requires the Service to give serious consideration to all reasonable alternatives for managing refuges, including the no-action alternative representing continuation of current conditions and management practices. Alternative management scenarios were developed as part of the planning process described in this EA.

This EA describes the existing resources on the Refuge and the projected environmental effects of the three management alternatives on those resources. Two of the three alternatives presented in this EA are *action alternatives* that would involve a change in the current management of the Refuge. The remaining alternative is the *no-action alternative*, under which current management of the Refuge would continue, and which provides a basis of comparison to the action alternatives. A final CCP would be prepared regardless of which alternative is selected.

[1] Under NEPA and implementing regulations, *action* refers to a policy, plan, program, or project that is implemented, funded, permitted, or controlled by a federal agency or agencies.

Decisions to be Made

Based on the analysis documented in this Draft EA, the Regional Director must determine the type and extent of management and visitor service opportunities on the Refuge and if the selected management alternative would have a significant effect on the quality of the environment. If the selected alternative has no significant impacts, then the Service would prepare a Finding of No Significant Impact (FONSI). If the proposed management alternative is found to have significant impacts, then the Service would prepare an Environmental Impact Statement before making a decision.

The planning team has recommended Alternative C for implementation. The Service will make a final selection of an alternative to implement in the CCP, based on this document and the input received from the public during the comment process. The plan will be monitored annually and revised when necessary.

Comprehensive Conservation Planning Process

The Service developed the CCP using a systematic decision-making approach that encouraged public involvement in management decisions throughout the planning process. A planning team was assembled (see Chapter 5) of personnel from the Service's San Francisco Bay National Wildlife Refuge Complex. The Service contacted a wide array of people to participate, including representatives of federal agencies, Congress, state officials, state conservation agencies, conservation organizations, local interest groups, and other members of the public. These interested participants and local residents received announcements regarding the location, date, and time for the initial scoping meeting. At the scoping meeting the staff explained the Refuge's purpose, history, and laws and regulations governing management, as well as the purpose and need for the CCP and the relevant management activities and issues.

The planning team consists primarily of Refuge staff, Service technical experts, and other landowners of the Refuge (some Refuge lands are managed by the Service but owned by other public agencies). The team developed a list of issues and concerns that included comments generated from the scoping meeting, written comments, and verbal comments from discussions with various parties. The planning team reviewed the current Refuge management actions and ultimately presented four alternatives for future Refuge management during the planning process.

Key steps in the Service's comprehensive conservation planning are listed below:

1. Preplanning.
2. Identifying issues and developing a vision statement.
3. Gathering information.
4. Analyzing resource relationships.
5. Developing alternatives and assessing environmental effects.
6. Identifying a preferred alternative.
7. Publishing the draft plan and NEPA document.
8. Addressing public comments on the draft plan.
9. Preparing the final plan.
10. Securing approval of the Regional Director.
11. Implementing the plan.

Issues Identification

The Service followed NEPA guidelines and identified issues, concerns, and opportunities through early planning discussions and the public scoping process, which began with the first planning update in September 2006. The planning team identified a range of reasonable alternatives, evaluated the consequences of each alternative, and identified a preferred alternative for guiding the Refuge's future direction. This planning effort and the planning team's ongoing dialogue with various federal, state, and county agencies; interest groups; and individuals provided important direction in synthesizing the proposed goals, objectives, and strategies found in the draft CCP. It will be necessary to further coordinate and cooperate with these entities to implement the plan.

Public Involvement

Public involvement is an essential component of the comprehensive conservation planning and NEPA process. The Service announced the beginning of this planning effort for the San Pablo Bay National Wildlife Refuge through a Federal Register Notice of Intent on July 26, 2006. The Service sent individual letters announcing commencement of the planning process to several local organizations, the local city government, congressional members, state officials, state agencies, interested parties, and conservation organizations. Since July 2006, the Service has sent two planning updates to a mailing list of more than 100 individuals. The Refuge hosted a public scoping meeting on July 26, 2006 in Vallejo, California. Public comments were generated from the public scoping meeting and the Federal Register Notice published on July 26, 2006. Two people attended the meeting. The Service also held individual meetings with different stakeholders and stakeholder groups to orient them on the CCP process.

Written public input received during the process is incorporated into the CCP and EA when feasible, and a summary of the comments is presented in the CCP. The original comments are maintained in planning team files at the San Francisco Bay National Wildlife Refuge Complex headquarters in Fremont, California, and are available for review.

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

The mission of the Service is working with others 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. This responsibility to conserve the nation's fish and wildlife resources is shared with other federal agencies as well as with state and tribal governments.

As part of this responsibility, the Service manages the National Wildlife Refuge System (NWRS). The Refuge System is the only nationwide system of federal lands managed and protected 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 and other relevant legislation, executive orders, regulations, and policies.

Purposes of the San Pablo Bay National Wildlife Refuge

Refuges are not only guided by the Service and NWRS missions, but also individual purposes that form the authority for the establishment of a Refuge. These purposes are often drawn from

federal acts or executive orders. Further, these purposes provide the foundation for which the Refuge vision statement and the CCP goals have been developed. San Pablo Bay NWR was established under the authority of three federal acts:

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C.715d (Migratory Bird Conservation Act)

"... particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)

"... 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)

Vision Statement

San Pablo Bay National Wildlife Refuge lies within the larger San Francisco Estuary, one of the largest estuaries along the Pacific Coast. The location of San Pablo Bay relative to freshwater influences of the Sacramento and San Joaquin Rivers and saline waters of the Pacific Ocean result in a unique and rich array of physical and biological conditions. Large contiguous expanses of pickleweed-dominated tidal marsh support high densities of the endangered salt marsh harvest mouse, as well as provide habitat for the endangered California clapper rail and other sensitive estuarine-dependent species. This Estuary is of hemispheric importance to shorebirds. Hundreds of thousands of shorebirds and waterfowl use this area to overwinter or rest and feed as they migrate along the Pacific Flyway.

Through history, humans have altered San Pablo Bay, resulting in high levels of contaminants and conversion of tidal environments to agricultural lands, salt ponds, and other non-tidal conditions. Despite these changes and the proximity to a highly urbanized environment, lands immediately surrounding the Refuge are dominated by open space. These open spaces provide opportunities to restore historic tidal and upland environments, directly linking them to adjacent uplands and freshwater seasonal wetlands, a rare historic feature of the larger San Francisco Estuary and a condition that will enhance and sustain populations of native flora and fauna.

The Refuge, working with partners, will play an important role in protecting, enhancing, and restoring tidal and upland environments of San Pablo Bay, especially where opportunities exist to expand or link tidal wetlands to uplands and freshwater seasonal wetlands. Our efforts will focus on the use of natural processes, where possible, to achieve desired environmental structure and function. An adaptive management framework will be used to respond to changing environmental conditions, especially with respect to invasive species, enhancement and restoration projects, and projected climate-related events.

Although humans have had negative impacts on San Pablo Bay, a century of agricultural uses has resulted in the preservation of open spaces where tidal wetlands and native grasslands can be restored. This environment links people to open space and their agrarian past. The Refuge will be an open space resource where wildlife and people connect—where people belong with nature and are immersed in it. The Refuge will be inclusive of all age groups, backgrounds, and skill levels by providing a variety of opportunities, including fishing, hunting, trails, interpretive signs and guided tours, and off- refuge environmental education to facilitate that connection, that belonging, that immersion.

Goals of the Refuge

Refuge goals were developed on the basis of four themes: wildlife management, habitat management, compatible wildlife-oriented recreation, and environmental education and outreach.

GOAL 1: Support and contribute to the recovery and protection of threatened and endangered species and related ecosystems of the San Francisco Estuary.

GOAL 2: Protect, enhance and restore high quality roosting and foraging environments for over-wintering and migratory shorebirds and waterfowl.

GOAL 3: Acquire, protect, enhance, and restore functioning tidal marsh and associated upland systems to benefit all native wildlife and plants that use environments of the Refuge.

GOAL 4: Protect and enhance subtidal systems for the benefit of marine and tidal dependent species.

GOAL 5: Identify, assess and adapt to current and future climate change impacts to refuge resources.

GOAL 6: Develop a supportive relationship with the surrounding community to foster understanding and stewardship of the Refuge and the National Wildlife Refuge System Mission.

GOAL 7: Provide visitors and the local community with compatible wildlife-oriented outdoor recreation opportunities to enjoy, understand and appreciate the resources of the Refuge.

GOAL 8: Provide a quality environmental education and interpretation program that enriches the local community with the history and purpose of the natural habitats of North San Pablo Bay and the mission of the National Wildlife Refuge System.

Chapter 2. Alternatives, Including the Preferred Alternative

This chapter described three alternatives for managing the Refuge: Alternative A (No Action, current management); Alternative B, and Alternative C (*preferred alternative*). These alternatives are described below and summarized in Table 1 at the end of this chapter. The visitor service and environmental education alternatives are also depicted in Figure 2, Figure 3, and Figure 4 at the end of this chapter. All proposed alternatives considered in this EA were developed with the mission of the Refuge System and the purposes of the Refuge as guiding principles. Two of the three alternatives presented in this chapter are "action alternatives" that would result in a change to the current management of the Refuge. The Service's preferred alternative is Alternative C.

Current Management

The Refuge currently has no integrated plan to guide the management of all its resources and uses. Current management efforts on the Refuge focus on the monitoring endangered species, monitoring nonnative and invasive plants, habitat restoration, environmental education and public uses.

For a complete description of the current management practices, please see Chapter 4, *Current Refuge Management and Programs*, of the CCP.

Alternatives Development Process

Three alternatives were developed to manage San Pablo Bay NWR.

- Alternative A: current management (no action)
- Alternative B: standardize survey and monitoring protocols; expand tidal restoration activities; provide additional visitor access and environmental education
- Alternative C: same as B; additionally, develop wildlife population goals; provide additional visitor access locations; provide additional environmental education and interpretation opportunities.

The alternatives development process was an iterative process that began after the planning team developed the Refuge vision statement and revised the Refuge's goals. The first step in this process was to identify all the important issues related to Refuge management. The list of issues was generated collaboratively by the core planning team, Service staff, and Refuge stakeholders. The public also helped to identify important management issues through the scoping process.

Once the list of important management issues was generated, the planning team described Alternative A (no action). It was important to describe this alternative accurately because the no-action alternative serves as the baseline against which all other alternatives are compared.

Next, the planning team listed a wide range of management actions that would address the issues identified and would achieve one or more of the Refuge goals. These actions were refined during several meetings and planning team reviews. The planning team then clustered these actions into logical groupings to form the action alternatives. Many actions are common to more than one alternative, but the actions within each alternative reflect a common management approach, as described in detail below. The staff then analyzed the physical, biological, economic, and social impacts of each of the alternatives on the Refuge environment to select the preferred alternative.

Description of Management Alternatives

Alternative A: No Action

Under Alternative A, the Service would continue to manage the Refuge as it has done in the recent past. The focus of the Refuge would remain the same: to protect, conserve, and restore breeding and resting habitat for migratory waterfowl, shorebirds, songbirds, and endangered species. The Refuge would continue to be staffed with four full–time staff (who also manage Marin Islands and Antioch Dunes NWRs) to monitor wildlife, restore habitats, support public use activities, and promote environmental education. Additional support is often requested from the SF Bay Complex staff. Special Use Permits (SUPs) would be issued on a case-by-case basis to outside researchers meeting certain criteria.

Habitat Management. Under Alternative A, the Service would continue to conduct habitat restoration activities including tidal restoration, native plant restoration, and nonnative/invasive plant removal. Removal of perennial pepperweed (*lepidium latifolium*) through chemical and manual methods is the highest priority, with a goal of reducing its cover by 90 percent. Invasive *Spartina* is removed manually when detected. Staff have a current goal of increasing native plant cover along the marsh-upland transition zone to greater than 50 percent along 2-kilometers of levee bordering tidal marshes.

Hydrology would be improved for 80 acres of tidal marsh in the Tolay Creek and Lower Tubbs Island units through methods such as breaches to restore tidal flow. The 1,500-acre Cullinan Ranch upland will be restored to tidal marsh. The Refuge will continue to seek properties that benefit existing Refuge resources. Contaminants will be removed where known and where removal is feasible.

There is a long history of mosquito management throughout the San Francisco Bay region given the large human population in the area. Per public health protection, mosquito control on the Refuge is an existing activity conducted by the local Marin/Sonoma and Napa-Solano Mosquito Abatement Districts. Refuge staff is currently developing an integrative pest management plan for mosquitoes and NEPA documentation to comprehensively address these and other techniques for controlling mosquito populations.

Volunteers would continue to support habitat restoration through plant propagation at the refuge nursery, planting native vegetation on the Refuge, and conducting nonnative vegetation surveys. Priority nonnatives include pepperweed and *spartina.* The native marsh-upland transition zone would be targeted for increasing native plant cover.

Migratory Birds. Under Alternative A, biological monitoring would continue including waterfowl and shorebird surveys with partners on an annual basis by surveys on foot and by airplane.

Threatened and Endangered Species. Species listed under the Federal Endangered Species Act (ESA)—salt marsh harvest mouse and California clapper rail—breed or forage on the Refuge. Tidal marsh restoration activities will support recovery plan objectives for these species. Surveys for these species are conducted annually on a subset of the Refuge units. Data collection is standardized to allow for analysis of long-term datasets and distribution to other partners.

Public Access and Outreach. Access to all the Refuge units is limited because the only access

currently is via Highway 37, a two-lane highway with both directions of traffic separated by a concrete barrier. The Tolay Creek/Tubbs Island unit is currently the only public access site for wildlife observation, photography, and interpretation. Under Alternative A, this would continue to be the only public access point at the Refuge.

Fishing is allowed in the open bay (San Pablo Bay) and navigable slough sections of the Refuge. Waterfowl hunting is only permitted in the navigable sloughs and open waters of the Refuge, requiring waterfowl hunters to use boats (see CCP for hunting map). No waterfowl hunting from levees is permitted. There is limited upland game hunting by foot for the month of December at the Tolay Creek unit (domesticated pheasant escapees). All hunting on the Refuge must comply with State and Federal Regulations. Under Alternative A, these activities would be unchanged.

Environmental Education. Partners help to bring schoolchildren to the Refuge to learn about and participate in tidal marsh restoration. This restoration program has yielded approximately 980 and 650 participants (on and off the Refuge) in 2008 and 2009, respectively. Staff participates in environmental education festivals and fairs at least twice annually to disseminate information about the Refuge and on-site activities available to schools.

Cultural Resources. A comprehensive cultural resource assessment has never been conducted on the Refuge. The area where the Refuge is located was once open water and marsh, making it difficult to locate physical evidence of human activity. The possibility of prehistoric sites within the Refuge is minimal because of the drastically altered landscape due to gold washing activities (N. Valentine, pers. comm.).

The Refuge does not maintain any historic structures or archaeological sites. Under Alternative A, management of cultural resources would remain unchanged. If any unknown cultural resources are found during construction activities on the Refuge, these activities would be assessed by Service cultural resources staff to determine potential impacts.

Alternative B: Expand Wildlife Management and Habitat Management; Moderate Visitor Access

Under Alternative B, substantial wildlife monitoring and habitat restoration actions would be emphasized. Six additional visitor access points would be created at the different Refuge units and there would be further environmental education programs targeted at adults and families. Additional staff would be required for this alternative including: an outdoor recreation planner, a biological technician, an administrative officer, a maintenance worker, and a law enforcement officer. These positions would be shared with Marin Islands and Antioch Dunes NWRs.

Habitat Management. Under Alternative B, the Service would continue habitat management activities as described for Alternative A. In addition, the Service would begin to identify, analyze, prioritize, and propose new tidal marsh enhancement projects at a number of Refuge areas (e.g., Sonoma Creek, Tolay Creek, and Lower Tubbs Island) to reduce stagnant water and improve tidal hydrology. Annual projects will be prioritized based on this information and funding availability. As new land (e.g., Skaggs Island) is acquired, land protection, restoration, and more thorough habitat management plans will be developed.

Under this alternative, the current pepperweed control plan will be refined and adapted for

implementation. There will be an active search and eradication of invasive *Spartina* species within all units of the Refuge, and coordination with the Invasive Spartina Project to monitor pre- and post-treatment. Also, a marsh-upland ecotone restoration plan will be prepared and implemented. A summary of present and historical sub-tidal wildlife and plant resources on the Refuge will be conducted. There have been limited resources available for assessing contaminants. Under this alternative, the Service will assess the current state and source of contaminants on Refuge units.

Migratory Birds. Shorebird and waterfowl surveys would continue as in Alternative A. A summary will be prepared of existing survey data. Migratory bird data would be analyzed and summarized to identify high use areas and to develop management protections. Data surveying and monitoring would also be standardized based on time intervals and spatial reference. Invasive plant and predator population controls would be conducted to enhance migratory bird habitat.

Threatened and Endangered Species. Beyond the activities described in Alternative A, a comprehensive inventory and monitoring plan would be implemented for listed species as well as a survey of habitats, species, and processes that affect them. The monitoring plan would include a comprehensive survey of all Refuge resources rather than the current surveying of select species. Habitat management plans will be developed for the California clapper rail and the salt marsh harvest mouse. Native plant cover will be increased (through native plant propagation, planting of native plants, and control of invasive weeds) within the marsh-upland transition zone in order to provide high-tide refugia for tidal marsh species like salt marsh harvest mouse. Predator populations and impacts will also be assessed in this alternative to determine management needs for protecting listed species.

According to the California Natural Diversity Database, the endangered Soft bird's-beak plant is located on the Refuge. However, there is no available data on the presence of this species on the Refuge. Staff will work to determine presence, distribution, and abundance of this species at the Refuge units.

Other Species. An inventory and monitoring plan will also be developed for other wildlife, fish, invertebrate, and plant populations. Staff will also work with partners to assess fish, invertebrate, and plant species that are present in sub-tidal areas of the Refuge.

Climate Change. Under Alternative B, staff will work to refine and build upon the recent Sea Level Affecting Marshes Model (SLAMM) that was completed in 2009. SLAMM provided an estimate of the habitat changes expected on the Refuge as a result of sea-level rise. Staff will partner with others to analyze climate change projections for the Refuge to develop and prioritize future management actions. Additional local, regional, and national climate change modeling will be used to provide habitat change projections. An assessment of potential climate change impacts (flood risk, erosion analyses, and sediment dynamics) to refuge resources (e.g., wildlife habitat) will be conducted to address near-term and long-term impacts. High quality habitats, infrastructure (e.g., levees), and public access amenities (e.g., trails) will be evaluated to determine protection, mitigation, or removal needs. Also, an evaluation of the carbon footprint for refuge activities will be conducted to develop more efficient alternatives where feasible (e.g., transportation, energy use, recycling). Outreach activities will also include educating visitors about green activities to offset climate change.

Public Access and Outreach. Under this alternative, access to the Refuge would continue at the Tolay Creek/Tubbs Island units described in Alternative A. In addition, more outreach will be developed for hunting and fishing. Hunt brochures would be developed and disseminated to the hunting community. Similar information would be developed for fishing access on the Refuge. A shoreline fishing location would be developed, such as a boardwalk at Cullinan Ranch and a pier at Guadalcanal. Self-guided access (for hiking, biking, and boating) will be expanded at Guadalcanal, Cullinan Ranch, Sears Point, Figueras, Sonoma Baylands, and Skaggs Island as these properties become acquired. Recreational non-motorized boat (e.g., kayak) access (i.e., graded path) will be developed at Cullinan Ranch. Interpretive materials, panels, and kiosks will also be developed for these areas. Interpretation about the North Bay habitat, wildlife and cultural history will be expanded and shared.

Under this alternative, at least one additional outreach opportunity will be sought (e.g., attending a fair, festival). A volunteer program will be established to initiate Refuge to Backyard connections with the local communities. This program will outreach to the local community about how the Refuge benefits the local community.

Environmental Education. In addition to the activities described in Alternative A, the outdoor recreation planner, with the support from Complex staff, will develop an environmental education program geared towards the local community, adults, and families. A garden education program will also be developed for families to emphasize use of native plants, volunteer opportunities, and other learning workshops. Refuge staff will also expand use of partnerships and volunteerism to conduct environmental education at local elementary schools.

Cultural Resources. The office is located in an old ranch that is representative of the cultural aesthetic of the area. A cultural assessment of Sears Point will be conducted to identify cultural characteristics to be maintained. Based on this information, the farm and ranch aesthetic of the headquarter site will be maintained and enhanced when renovating the office and maintenance buildings.

Alternative C: Same as B; Wildlife Management Emphasis, Expand Environmental Education and Interpretation

Under Alternative C, population goals would be developed for the California clapper rail, salt marsh harvest mouse, and other priority species. High use migratory bird habitat would be mapped and protected. More extensive hydrological assessments would be conducted to reduce stagnant water in the tidal marsh habitats of the Refuge. Management plans for upland areas of the Refuge (e.g., Sears Point, when acquired) will be developed and implemented. Hunting and fishing would be supported by orientation workshops and fishing days to encourage these uses. The environmental education program would be expanded to the Sonoma Baylands and potentially the Guadalcanal site to accommodate more schools to the Refuge. Docent-led interpretation at the different publicly accessible sites would also be conducted. Additional staff would be required for this alternative including: a biologist/range conservationist, two biological technicians, an outdoor recreation planner, an administrative officer, a maintenance worker, and a law enforcement officer. These positions would be shared with Marin Islands and Antioch Dunes NWRs.

Habitat Management. Habitat management activities would be conducted as described in

Alternative B. In addition, the Service would design and implement methods for increasing hydrological connectivity on the Refuge. Such actions could include levee breaches, lowering of levees/berms, and removing culverts. Modeling will be conducted to analyze the effects of alternative restoration/enhancement methods. Staff will also consider creating and maintaining refuge islands or other high-tide refugia for tidal marsh species. Grazing, haying, and soil stabilization management plans will be developed for Sears Point (when acquired) to enhance or restore native plant species.

With regard to invasive species, a *Spartina* control plan will be developed to incorporate treatment methods, monitoring, and data collection and storage based on existing practices conducted by the Invasive Spartina Project. A prioritization scheme will be developed for invasive plant monitoring. An invasive plant early detection and rapid response program will be developed and implemented.

Under this alternative, efforts will be made to identify sub-tidal conservation priorities and to foster opportunities with existing agencies and groups to conduct sub-tidal restoration or enhancement on the Refuge.

Contaminants assessment results will be used to prioritize and identify methods to manage, remove, reduce, and prevent introduction of contaminants.

An inventory and monitoring plan will also be implemented to measure climate-related changes to resources over time. Acquisitions will also be assessed in light of climate change.

Migratory Birds. Under this alternative, the Refuge staff would conduct migratory bird activities as described in Alternative B. In addition, Refuge staff would conduct studies of high use marsh interior tidal ponds (e.g., formation, persistence, shorebird use) to determine their protection needs (e.g., closing areas to access, creating buffer zones). Additional studies would be conducted on the effects of enhancement and restoration projects to marsh interior tidal ponds.

Threatened and Endangered Species. Protection of listed species would the same as described for Alternative B. Based on survey information collected, staff will evaluate population health, assess population viability, develop population goals and identify and implement management actions for the California clapper rail, salt marsh harvest mouse, and other listed species in order to support recovery plan goals.

Staff will work with other Service experts and the USDA Wildlife Services to develop a predator management plan, including predator population thresholds.

Other Species. Actions under this alternative would be the same as Alternative B.

Public Access and Outreach. Under Alternative C, public access and education activities would be the same as those described for Alternative B. In addition, a hunt program would be developed and the existing hunt plan revised in cooperation with California Department of Fish and Game (CDFG), as well as a hunter orientation and cleanup program would be implemented. A pier fishing day at Cullinan (or Guadalcanal, when acquired) for children and a fishing regulation workshop would be held annually. A docent-led tour program will be provided at Guadalcanal, Sears Point, Sonoma Baylands, Skaggs Island, or Lower Tubbs units to promote interpretation,

wildlife observation, and photography. Wildlife photography and wildlife art workshops will be provided on the Refuge. A docent-led kayak tour would be conducted twice a year. Computer-based interpretive materials will be developed for online access.

To expand outreach, an interactive website and additional outreach materials will be developed. Staff will work to establish partnerships with local organizations. Staff will work with news media to highlight the Refuge and attend outreach events at the headquarter site. Staff will work with Refuge Friends group to conduct outreach projects.

Environmental Education. In addition to the activities described in Alternative B, staff would continue to direct in-class environmental education programs conducted by partners. Staff would conduct school programs on site at the Sonoma Baylands and potentially the Guadalcanal units (when acquired) three times per week that focuses on migratory birds, wetlands, and habitat restoration. A trail will be created to connect the Sonoma Baylands unit to the Sears Point/headquarter site to emphasize both the plant propagation and planting aspects involved with tidal marsh restoration. A volunteer program will be built to support Refuge to backyard connections by demonstrating the benefits of native plant use to the community.

Cultural Resources. Cultural resource activities would be conducted as described for Alternative B. In addition, research and interpretive materials would be developed about the Native American history of the area.

Features Common to All Alternatives

Endangered Species Survey and Monitoring. All proposed alternatives involve some level of monitoring for endangered species, particularly the California clapper rail and the salt marsh harvest mouse. Research studies relevant to management needs will be encouraged and supported.

Shorebird and Waterfowl Monitoring. Annual monitoring of shorebirds and waterfowl are conducted with partners throughout the San Francisco Bay Estuary.

Mosquito Control. Mosquito control activities are coordinated and conducted with the Marin-Sonoma and Solano County Mosquito Abatement Districts. An integrative pest management plan and NEPA documentation is being developed to address significant mosquito populations in order to protect refuge resources and human health.

Vegetation Management. All the alternatives prescribe some level of monitoring, response, and prevention of the spread of nonnative and invasive vegetation. The Refuge actively monitors and controls (through manual and chemical methods) invasive pepperweed. Invasive *Spartina* will be controlled when detected. The Refuge conducts native plant propagation and restoration of habitat through partners, volunteers, and school groups. Native plantings in marsh-upland transition zones are prescribed for all proposed alternatives. Monitoring of these plantings would be conducted to determine efficacy.

Tidal Marsh Restoration. Some tidal marsh restoration activities were planned prior to the CCP process (Cullinan Ranch and Tolay Creek/Lower Tubbs Island restoration plans) and the restoration of diked wetland or upland areas to tidal influence will continue.

Climate Change Considerations. Increased guidance at the regional level climate change will influence much of the decision, planning and restoration processes on the Refuge.

Public Access and Wildlife-oriented Recreation. The Refuge provides opportunities for wildlife observation, photography, hunting and fishing. These activities are prescribed for all the alternatives. At least one trail is provided for public access.

Environmental Education and Outreach. Through partners, the Refuge conducts a small field-based environmental education program. School groups and volunteers come to the Refuge to assist in the propagation and planting of native plants. Outreach activities for all proposed alternatives will involve attending off-site events such as fairs, festivals, and presentations with local organizations.

Facilities Maintenance. General maintenance of existing facilities including mechanical control of vegetation; inspection, repair, rehabilitation, or replacement of infrastructure and equipment (e.g., fencing and signage); and oversight of safety of operations, is required on the Refuge to provide safe access for staff, researchers, law enforcement activities, educational field trips, and the public. Upland areas require mowing to reduce fire hazards, provide non-native weed control, and provide access for maintenance, monitoring, and restoration/enhancement projects. The Refuge's headquarter site, levees, and trails require frequent maintenance and repair.

Alternatives Considered but Eliminated from Detailed Analysis

The alternatives development process under NEPA and the Improvement Act are designed to allow the planning team to consider the widest possible range of issues and develop feasible management solutions that respond to these issues. These management solutions are then incorporated into one or more alternatives evaluated in the EA process and considered for inclusion in the CCP.

Actions and alternatives that are not feasible or may cause substantial harm to the environment are usually not considered in an EA. Similarly, an action (and therefore, an alternative containing that action) should generally not receive further consideration if:

- It is illegal (unless it is the No Action Alternative, which must be considered to provide a baseline for evaluation of other alternatives, even though it may not be capable of legal implementation).
- It does not fulfill the mission of the National Wildlife Refuge System.
- It does not relate to or help achieve one of the goals of the Refuge.
- Its environmental impacts have already been evaluated in a previously approved NEPA document.

However, if such actions or alternatives address a controversial issue or an issue on which many public comments were received, they may be considered in detail in a NEPA document to demonstrate clearly why they are not feasible or would cause substantial harm to the environment.

During the alternatives development process, the planning team considered a wide variety of potential actions on the Refuge. The following actions were ultimately rejected and excluded from the alternatives proposed here because they did not achieve Refuge purposes or were incompatible with one or more goals.

Visitor Center. The idea of a visitor center on the Refuge to provide interpretive and environmental education programs was eliminated from detailed analysis. Staff felt that it was better to provide a contact station where visitors can receive information but emphasize resources and funding outdoor opportunities instead.

Close Tolay Creek/Tubbs Island public access trail. This alternative would close public access to the Tolay Creek and Tubbs Island unit in order to provide greater protection to sensitive wildlife habitats located near the trail areas and to reduce maintenance costs to the site. The trail to this site is not owned by the Service, but access is permitted to allow visitors to get to the Refuge. The site requires significant maintenance (i.e. mowing, potholes, weed control and levee erosion) to continue providing access. This alternative was not analyzed in detail because we do not have authority to close the trail and there was stakeholder interest in maintaining one of the few direct public access points to the San Francisco Bay.

Preferred Alternative

The planning policy that implements the Improvement Act requires the Service to select a preferred alternative, which is also the preferred alternative under NEPA. The complete written description of this preferred alternative is Chapter 5: Refuge Management Direction of the Draft CCP. Alternative C is the preferred alternative for the Refuge because it 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 habitats and populations on the Refuge
- addresses the important issues identified in the scoping process
- addresses the legal mandates of the Service and the Refuge
- is consistent with the scientific principles of sound fish and wildlife management and endangered species recovery

The preferred alternative described in the EA is preliminary. The action ultimately selected and described in the Final CCP will be determined, in part, by the comments received on the Draft EA. The preferred alternative presented in the Final CCP may suggest a modification of one of the alternatives presented here. The three alternatives considered for managing the Refuge are summarized in Table 1 and are described below.

Table 1. Summary of Alternatives

	Alternative A: No Action (Status Quo)	Alternative B: Develop an inventory and monitoring program; expand tidal restoration and enhancement activities; provide additional visitor access and limited environmental education	Alternative C: Same as B; additionally, develop wildlife population goals; expand environmental education and interpretation opportunities (*preferred alternative*)
WILDLIFE/PLANT POPULATION AND HABITAT MANAGEMENT			
Endangered Species			
California clapper rail and salt marsh harvest mouse	• Implement tidal marsh recovery plan objectives in core recovery areas of the Refuge. • Conduct annual surveys within a subset of Refuge units. • Standardize data collection, maintenance, and distribution.	• Same as Alternative A. • Develop and begin to implement an inventory and monitoring (I&M) program that prioritizes species, habitats, ecosystems, and processes. • Develop monitoring database (non-spatial and spatial) and use the Refuge Lands Geographic Information System (RLGIS) where appropriate. • Expand enhancement and restoration of the marsh-upland ecotone. • Prepare habitat management plans this species. • Support management-oriented research for this species. • Assess native and non-native predators of San Pablo Bay, including thresholds for management action.	• Same as Alternative A. • Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Evaluate population health, assess population viability, develop population goals and identify and implement management actions that will preserve or enhance existing populations.
Other listed species	• I&M for restoration projects.	• Develop and begin to implement an I&M program to determine presence, distribution, and abundance.	• Same as Alternative B. • Evaluate population health, assess

	Alternative A: No Action (Status Quo)	Alternative B: Develop an inventory and monitoring program; expand tidal restoration and enhancement activities; provide additional visitor access and limited environmental education	Alternative C: Same as B; additionally, develop wildlife population goals; expand environmental education and interpretation opportunities (*preferred alternative*)
			population viability, develop population goals and identify and implement management actions that will preserve or enhance existing populations.
Non-T&E Species Management			
Other Wildlife, Fisheries, and Plant Populations	• No activities currently conducted.	• Develop and begin to implement an inventory and monitoring (I&M) program.	• Same as Alternative B.
Migratory Birds	• Participate in regional waterfowl and shorebird surveys. • Conduct annual migration and winter surveys for shorebirds and waterfowl.	• Same as Alternative A. • Same as Alternative A. • Prepare a summary of migratory bird survey data pertinent to the Refuge (local, regional, Pacific Flyway). • Identify distribution and high use areas of the Refuge. • Implement recommendations from the Pacific Shorebird Plan and other appropriate conservation plans. • Control or eliminate invasive species populations. • Support shorebird and waterfowl research that informs refuge management.	• Same as Alternative A. • Same as Alternative A. • Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Identify and protect existing high tide roost environments as priority conservation areas (e.g., develop map). • Limit disturbance to priority conservation areas. • Conduct studies on interior tidal ponds (formation, persistence, shorebird use). • Evaluate effects of wetland restoration

	Alternative A: No Action (Status Quo)	Alternative B: Develop an inventory and monitoring program; expand tidal restoration and enhancement activities; provide additional visitor access and limited environmental education	Alternative C: Same as B; additionally, develop wildlife population goals; expand environmental education and interpretation opportunities (*preferred alternative*)
			or enhancement projects on shorebird and waterfowl habitat. Reduce or mitigate negative effects of management actions and improve habitat.
Native Plant Restoration	• Increase native plant cover within marsh-upland transition zone to greater than 50% along 2-km of levee bordering tidal marshes. • Propagate native plants using the Refuge nursery.	• Same as Alternative A. • Same as Alternative A. • Use partnerships and volunteers to support the propagation program. • Prepare and implement a marsh-upland ecotone restoration plan.	• Same as Alternative A. • Same as Alternative A. • Same as Alternative B. • Same as Alternative B. • Develop grazing, haying, and soil stabilization management plans for Sears Point (when acquired) to enhance or restore native plant species to the site. • Conduct a herpetological inventory of grazed and hayed sites. • Establish an expert panel of grassland and range scientists to develop a restoration plan(s). • Establish a seasonal wetland expert panel of scientists for the hayed wetland portion of the land.
Non-native and Invasive Plants	• Develop and implement a control program for pepperweed (*Lepidium latifolium*) with a goal of reducing cover by 90 percent.	• Same as Alternative A. • Refine and adapt the Refuge	• Same as Alternative A. • Same as Alternative B.

	Alternative A: No Action (Status Quo)	Alternative B: Develop an inventory and monitoring program; expand tidal restoration and enhancement activities; provide additional visitor access and limited environmental education	Alternative C: Same as B; additionally, develop wildlife population goals; expand environmental education and interpretation opportunities (*preferred alternative*)
	• Control invasive Spartina plants as they are detected.	pepperweed control plan. • Use RLGIS or other database to inventory and monitor pepperweed and treatments. • Fund and conduct treatments. • Search for and eradicate invasive Spartina species within all areas of the Refuge that have the potential to harbor this species. • Coordinate with the Invasive Spartina Project to monitor pre- and post-Spartina cover and treatments, incorporate RLGIS if possible. • Evaluate impacts of control efforts on target invasive species and non-target native species. • Control native and non-native vegetation in publicly accessible areas.	• Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Develop a Spartina control plan for the Refuge that incorporates treatment methods, monitoring, and data collection and storage. • Implement an invasive plant early detection and rapid response program. • Develop prioritization scheme for invasive plant monitoring: area, environment, and species foci. • Conduct or support research on high priority invasive species. • Same as Alternative B.
Sub-tidal Resource Management	• No activities currently conducted.	• Develop a summary of present and historical subtidal wildlife and plant resources of the Refuge.	• Same as Alternative B. • Identify subtidal conservation priorities

	Alternative A: No Action (Status Quo)	Alternative B: Develop an inventory and monitoring program; expand tidal restoration and enhancement activities; provide additional visitor access and limited environmental education	Alternative C: Same as B; additionally, develop wildlife population goals; expand environmental education and interpretation opportunities (*preferred alternative*)
			(e.g., Sub-Tidal Goals Project) and work with existing agencies and groups to conduct subtidal restoration or enhancement on the Refuge.
Predator Management	• No activities currently conducted.	• Assess native and non-native predators of San Pablo Bay, conduct baseline assessments of predators of concern.	• Same as Alternative B. • Develop predator population thresholds that will trigger control actions. • Consult with USFWS and USDA Wildlife Services to develop a predator management plan. • Assess implications of restoration projects and public access to predator movement.
Mosquito Population Management	• Develop and implement an integrative pest management approach to control significant mosquito populations while protecting refuge resources and human health.	• Same as Alternative A. • Identify, prioritize and begin to implement tidal marsh enhancement projects that would reduce human-induced water impoundments and improve tidal hydrology.	• Same as Alternative A. • Same as Alternative B.
WETLANDS MANAGEMENT			
Tidal Marsh Enhancement and Restoration	• Improve hydrology within 80 acres of tidal marsh in the Tolay Creek and Lower Tubbs Island units.	• Identify, prioritize and begin to implement tidal marsh enhancement projects (e.g., at Sonoma Creek, Tolay Creek, and Lower Tubbs Island) that would reduce human-induced water impoundments and improve tidal	• Same as Alternative B.

	Alternative A: No Action (Status Quo)	Alternative B: Develop an inventory and monitoring program; expand tidal restoration and enhancement activities; provide additional visitor access and limited environmental education	Alternative C: Same as B; additionally, develop wildlife population goals; expand environmental education and interpretation opportunities (*preferred alternative*)
	• Restore the 1,500 acre Cullinan Ranch unit to tidal marsh. • Identify, acquire, protect and enhance lands within the vicinity of the Refuge, particularly Guadalcanal, Sears Point, and Sonoma Baylands.	hydrology. • Same as Alternative A. • Same as Alternative A. • Acquire and develop restoration plan for Skaggs Island. • Develop and begin to implement a planning tool (e.g., database, work lists) the Refuge will use to annually prioritize and guide restoration and enhancement projects on the Refuge. • Identify parameters that may assist with project prioritization such as habitat quality, presence of sensitive species, climate change, adjacent landowner actions, mosquito reduction, invasive species, wildlife disease, and levee and erosion risks. • Evaluate and incorporate when feasible, USFWS national and regional restoration and conservation goals. • Delineate and describe tidal impoundments or hydrological issues.	• Same as Alternative A. • Same as Alternative A. • Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Design and implement methods for increasing hydrological connectivity including levee breaches, lowering levees/berms and removing culverts. • Analyze effects of alternative restoration/enhancement methods on tidal environments through modeling.

	Alternative A: No Action (Status Quo)	Alternative B: Develop an inventory and monitoring program; expand tidal restoration and enhancement activities; provide additional visitor access and limited environmental education	Alternative C: Same as B; additionally, develop wildlife population goals; expand environmental education and interpretation opportunities (*preferred alternative*)
			• Promote conservation or creation of refuge islands or other high-tide refuge.
Contaminants	• Remove contaminants or inputs when located and where possible.	• Same as Alternative A. • Conduct an assessment of contaminant sources that may affect the environmental health of refuge resources.	• Same as Alternative A. • Same as Alternative B. • Use assessment results to prioritize actions for reducing contaminant inputs or prevention where possible. • Prioritize actions for removal and prevention.
DATA MANAGEMENT			
GIS/RLGIS	• Use GIS/RLGIS to store invasive plant data.	• Same as Alternative A. • Identify and adopt standards for the collection and maintenance of spatially referenced biological and physical data collected on the Refuge. • Spatially document existing Refuge resources within the Refuge Lands Geodatabases.	• Same as Alternative A. • Same as Alternative B. • Same as Alternative B.
Data Sharing	• Share Refuge environmental data and findings whenever possible and appropriate including conferences, web data portals, scientific publications, etc.	• Same as Alternative A.	• Same as Alternative A. • Integrate Data sharing (metadata) standards.
CLIMATE CHANGE			
Modeling and monitoring	• Support and encourage climate-change related research on the Refuge.	• Same as Alternative A.	• Same as Alternative A

	Alternative A: No Action (Status Quo)	Alternative B: Develop an inventory and monitoring program; expand tidal restoration and enhancement activities; provide additional visitor access and limited environmental education	Alternative C: Same as B; additionally, develop wildlife population goals; expand environmental education and interpretation opportunities (*preferred alternative*)
		• Assess potential impacts to refuge resources, develop adaptive strategies and prioritize management to address near-term and long-term climate change impacts (e.g., erosion, flooding).	• Same as Alternative B.
		• Work with Service experts and others to conduct climate change analyses (or other appropriate modeling tools).	• Same as Alternative B.
		• Conduct flood risk and erosion analysis of lands on and adjacent to the Refuge.	• Same as Alternative B.
		• Incorporate research on current and expected sediment dynamics in San Pablo Bay.	• Same as Alternative B.
		• Identify areas that contain high quality habitats or features that will require a high level of protection relative to other refuge resources.	• Same as Alternative B.
		• Evaluate existing and future public access amenities relative to expected climate change impacts.	• Same as Alternative B.
		• Prioritize wetland restoration, enhancement projects, and acquisition based on climate change data.	• Same as Alternative B. • Develop and implement a climate change inventory and monitoring plan. • Develop and implement a plan that identifies lands that will be important to acquire in light of climate change. • Work with adjacent land owners in the San Pablo Bay region to plan and prioritize wetland and upland enhancement and conservation projects with respect to predicted environmental

	Alternative A: No Action (Status Quo)	Alternative B: Develop an inventory and monitoring program; expand tidal restoration and enhancement activities; provide additional visitor access and limited environmental education	Alternative C: Same as B; additionally, develop wildlife population goals; expand environmental education and interpretation opportunities (*preferred alternative*)
			changes. • Promote and support research that evaluates climate change related effects to endangered species populations.
Reduce carbon footprint		• Evaluate carbon footprint of refuge activities and improve efficiency where feasible (e.g., transportation, energy efficiency, recycling). • Increase carbon sequestration through tidal restoration projects and use solar and wind energy to power refuge operations. • Seek additional partnerships and funding sources to promote the use of solar and wind energy outside the Refuge and to fund projects within Refuge. • Educate and empower visitors to the Refuge about green activities that offset climate change.	• Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Develop and implement climate mitigation measures to offset refuge impacts on the environment.
VISITOR SERVICES AND ENVIRONMENTAL EDUCATION			
Hunting	• Waterfowl hunting in the open bay and navigable sloughs.	• Same as Alternative A. • Develop and disseminate a hunting brochure.	• Same as Alternative A. • Same as Alternative B. • Develop hunt program specifically for Refuge in cooperation with CDFG. • Organize a hunter cleanup day; provide an orientation day with refuge law enforcement to provide hunting regulations and service opportunities.
Fishing	• Fishing in the open bay and	• Same as Alternative A.	• Same as Alternative A.

	Alternative A: No Action (Status Quo)	Alternative B: Develop an inventory and monitoring program; expand tidal restoration and enhancement activities; provide additional visitor access and limited environmental education	Alternative C: Same as B; additionally, develop wildlife population goals; expand environmental education and interpretation opportunities (*preferred alternative*)
	navigable sloughs.	• Create and distribute to the public a fact sheet on fishing on the Refuge, include education on preventing introduction of nuisance species. • Expand fishing areas to others units of the Refuge such as a boardwalk at Cullinan and pier at Guadalcanal.	• Same as Alternative B. • Same as Alternative B. • Assess opportunities to conduct a fishing day at Cullinan and at Guadalcanal once this unit is acquired. • Formally permit fishing through a fishing plan.
Wildlife observation and photography	• Public Access, including bike, at Lower Tubbs Island, self-guided.	• Develop a visitor services plan to expand public uses including wildlife observation and photography. • Develop other self-guided public access (for hiking, biking, boating) in addition to Tubbs Island, such as Figueras, Guadalcanal, Sears Point, Skaggs Island and Sonoma Baylands. • Develop safe access and related infrastructure for recreational boaters and other visitors at Cullinan Ranch. • Expand opportunities, using partners when feasible, for wildlife observation and photography.	• Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Same as Alternative B. • Conduct docent/staff-led kayak tours of units of the Refuge twice a year. • Develop computer-based interpretive materials that can be downloaded to electronic devices.
Interpretation	• Self-guided tours at Lower	• Develop self-guided access with	• Same as Alternative B.

	Alternative A: No Action (Status Quo)	Alternative B: Develop an inventory and monitoring program; expand tidal restoration and enhancement activities; provide additional visitor access and limited environmental education	Alternative C: Same as B; additionally, develop wildlife population goals; expand environmental education and interpretation opportunities (*preferred alternative*)
	Tubbs Island.	interpretive signage, kiosks, and other related materials at sites such as Figueras, Guadalcanal, Sears Point, Skaggs Island, and Sonoma Baylands. • Expand opportunities for interpretation of the North Bay habitat, wildlife and cultural history.	• Same as Alternative B. • Develop docent-led tour program at Guadalcanal, Sears Point, Sonoma Baylands, Skaggs Island and Lower Tubbs units.
Outreach	• Participate in off-site established outreach events (e.g., fairs, festivals); develop and disseminate brochures. • Conduct outreach to the public through participation in at least two off-site events per year.	• Same as Alternative A. • Seek out new local outreach opportunities. • Build a volunteer program to initiate Refuge to Backyard connections that outreaches local communities.	• Same as Alternative A. • Same as Alternative B. • Same as Alternative B. • Conduct outreach events with the media at Sears Point (when acquired). • Develop additional outreach materials and update website information. • Work with the news media to highlight activities and programs at the Refuge. • Promote and support Refuge Friends group to conduct outreach projects.
Environmental Education	• Use partnerships to conduct on-site restoration projects with schoolchildren. • Provide support of	• Same as Alternative A. • Same as Alternative A.	• Same as Alternative A. • Same as Alternative A.

	Alternative A: No Action (Status Quo)	Alternative B: Develop an inventory and monitoring program; expand tidal restoration and enhancement activities; provide additional visitor access and limited environmental education	Alternative C: Same as B; additionally, develop wildlife population goals; expand environmental education and interpretation opportunities (*preferred alternative*)
	environmental and/or environmental education festivals and fairs in the North Bay (BAEER Fair and Flyway Festival) by staffing informational booth and providing handouts and on-site activities.	• Offer the Garden Education Program for families with emphasis on native plants and service opportunities, events, or workshops at least twice a year. • Expand partnering opportunities and volunteerism to further the environmental education program with local elementary schools.	• Same as Alternative B. • Offer an environmental education field trip program for elementary schools to the Baylands or Guadalcanal units (when acquired), focusing on migratory birds, wetlands, and habitat restoration three times per week. • Construct entry road, outdoor education facilities, tables, restrooms and parking at the Baylands and Sears Point sites (when acquired). • Develop a Refuge HQ/greenhouse program and infrastructure to physically link to Sonoma Baylands unit (when acquired). • Work with non-profit partners to implement in-class programs to support experiences on the Refuge.
Cultural Resource Management	• Assess any cultural resources found during construction or other activities.	• Conduct cultural assessment of Sears Point to identify cultural characteristics to be maintained. • Upon acquisition of Sears Point, continue the aesthetic environment of the haying/ranching region by	• Same as Alternative B. • Same as Alternative B.

	Alternative A: No Action (Status Quo)	Alternative B: Develop an inventory and monitoring program; expand tidal restoration and enhancement activities; provide additional visitor access and limited environmental education	Alternative C: Same as B; additionally, develop wildlife population goals; expand environmental education and interpretation opportunities (*preferred alternative*)
		maintaining and repairing existing structures in the same style. • When building new infrastructure, construct facilities that mimic the haying/ranching culture of the site and the region.	• Same as Alternative B. • Research and develop interpretive materials, presentations about the Native American presence on the Refuge.

Figure 2. Visitor Service and Environmental Education Activities for Alternative A

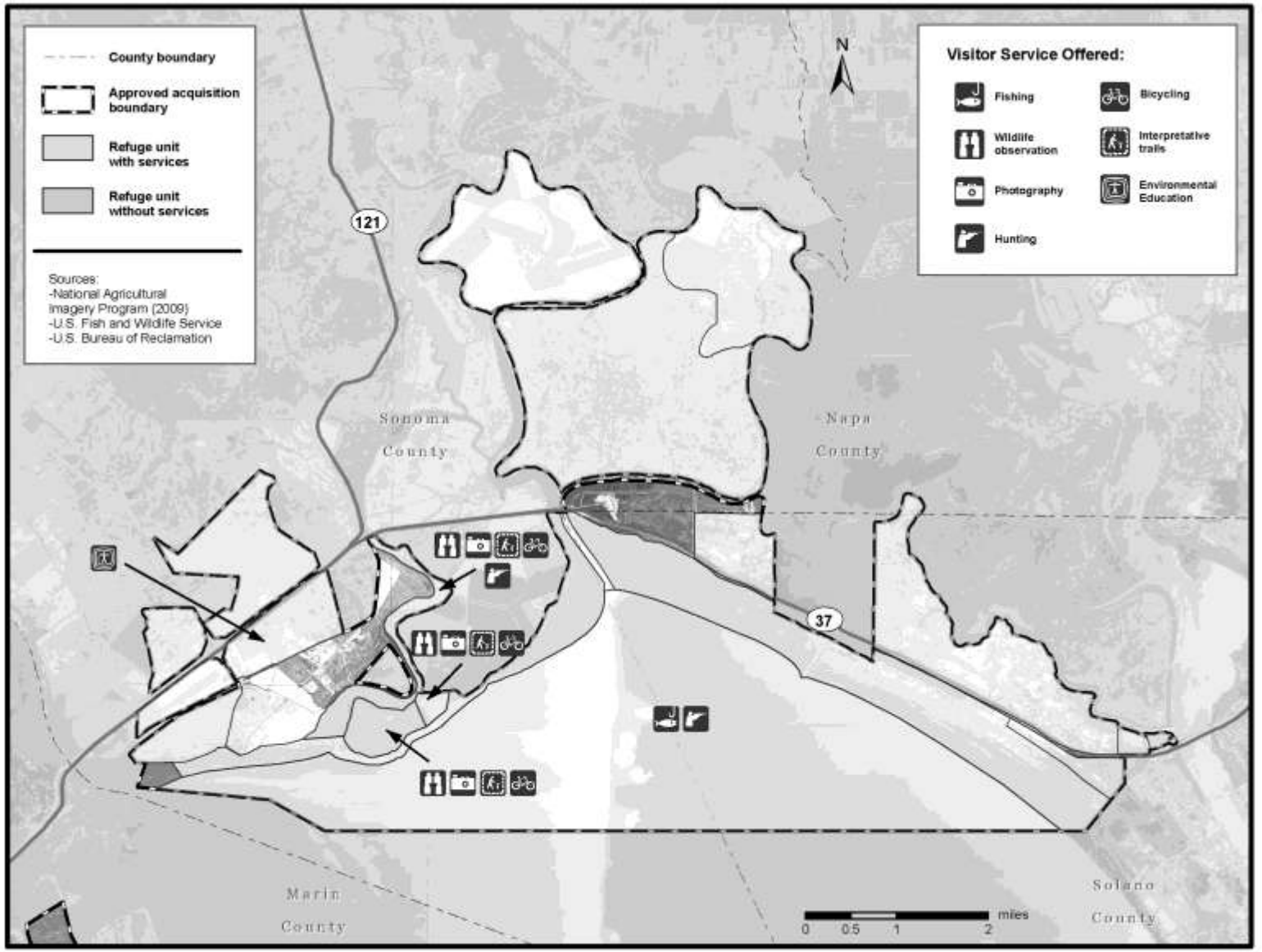


Figure 3. Visitor Service and Environmental Education Activities for Alternative B

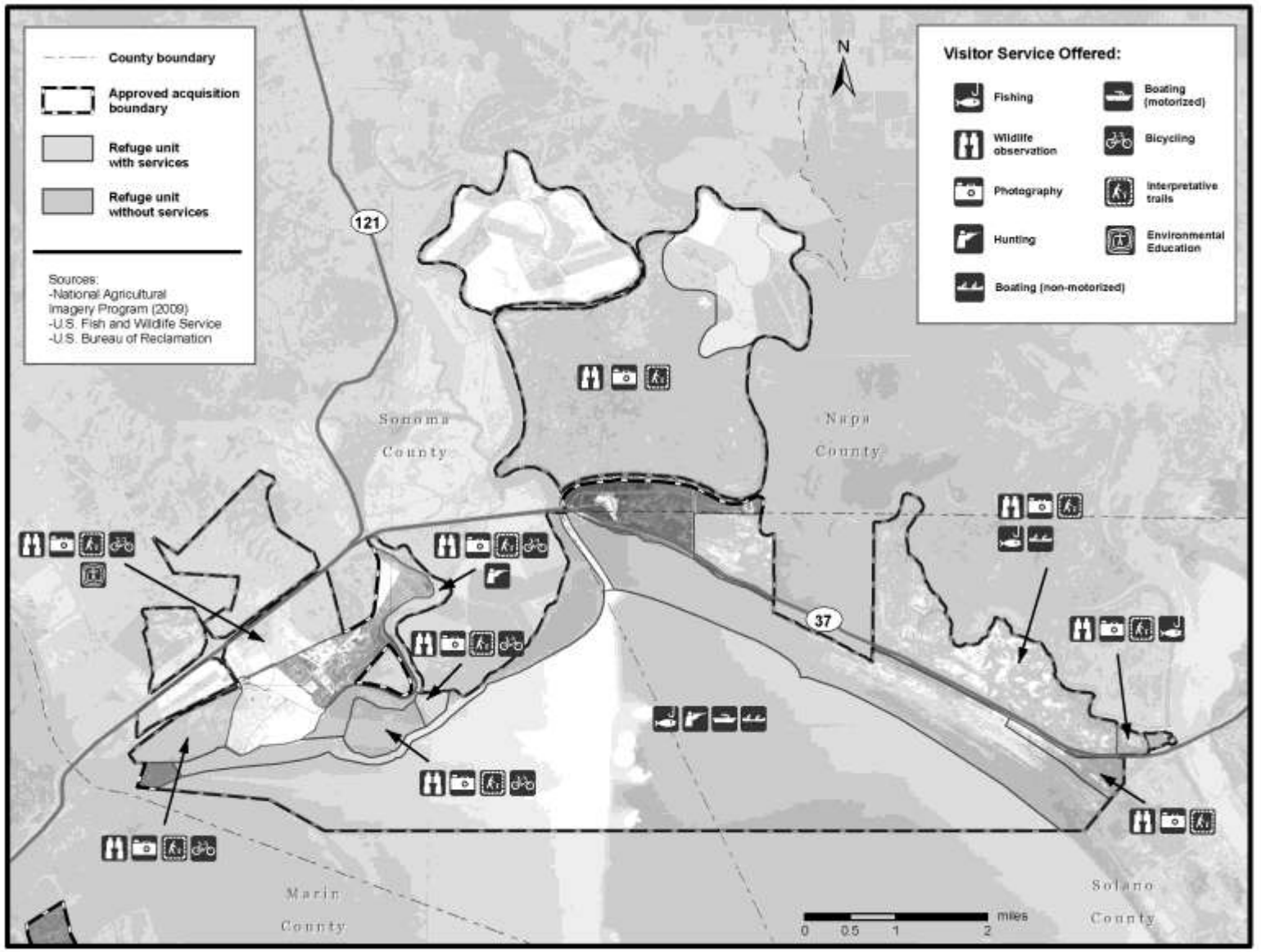
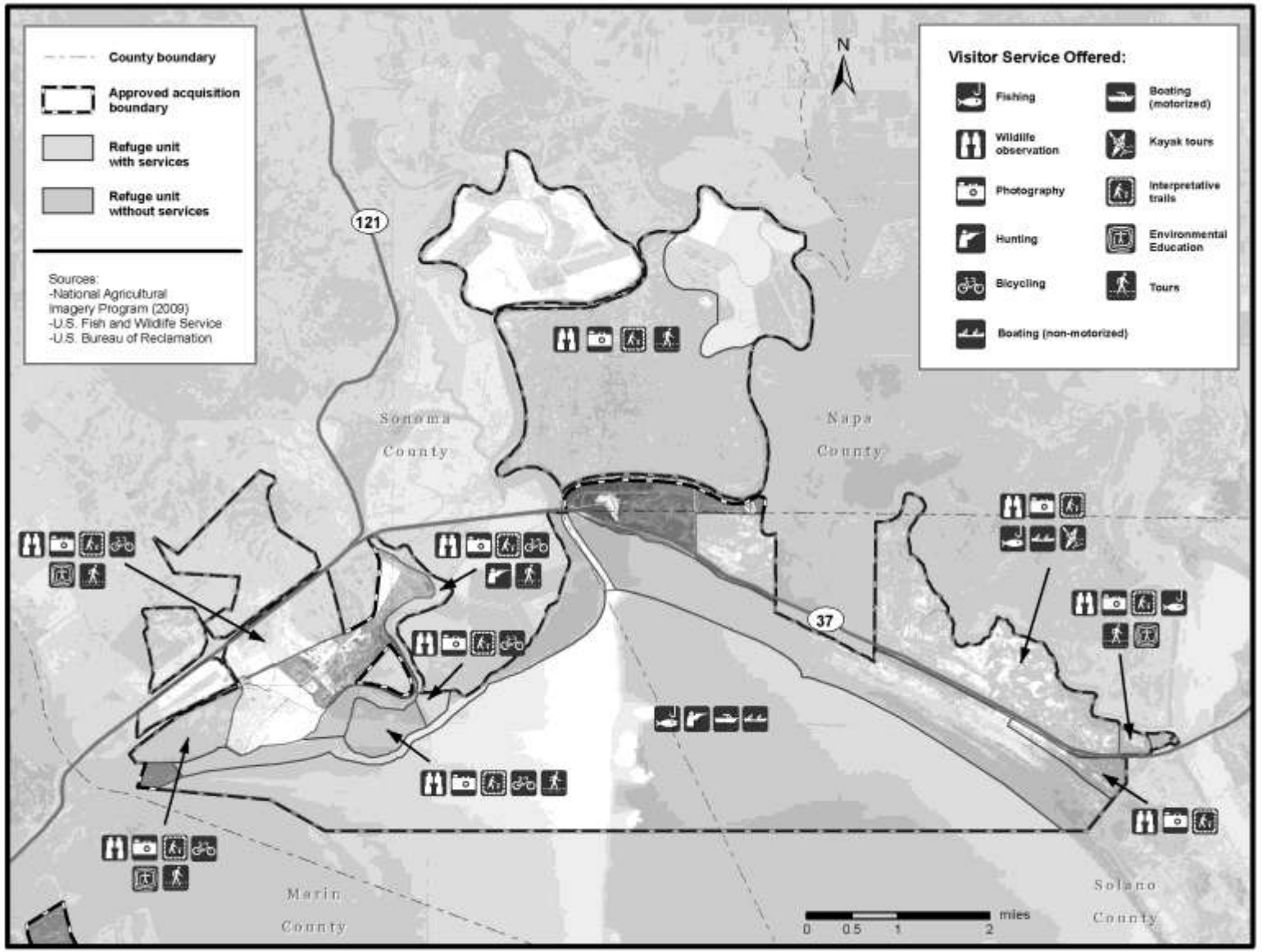


Figure 4. Visitor Service and Environmental Education Activities for Alternative C



Chapter 3. Affected Environment

This chapter is intended to describe the physical, biological, and cultural resources as well as the social and economic environment that would most likely be affected by the alternatives. Chapter 3, *Affected Environment*, of the CCP provides a detailed description of each of these components.

Chapter 4. Environmental Consequences

Chapter 4 analyzes the environmental impacts expected to result from implementation of the alternatives. Potential impacts to these resources are characterized by evaluating direct, indirect, and cumulative impacts where applicable for each alternative. Direct impacts are generally caused by the proposed actions and occur at the same time and place as the action, such as flushing of wildlife from wildlife observation activities. Indirect impacts are defined as reasonably foreseeable effects caused by the proposed action, but occurring later in time or farther away from the source of impact than direct effects. An example of an indirect impact is habitat modification that results in a change in abundance, breeding success, or prey availability. Cumulative effects would occur when incremental direct or indirect impacts are added to the impacts of other past, present and reasonably foreseeable future actions, regardless of the agency or person who undertakes them. The analysis is organized by each aspect of the environments described in Chapter 3 of the CCP, including physical, biological, cultural, social, and economic resources. The purpose of the analysis is to provide the context and intensity of the impacts of the action such that a determination of significance can be made by the decision-makers.

The analysis of environmental consequences focuses generally on all units of the Refuge. Separate, detailed analysis is completed for individual restoration projects, such as the Cullinan Ranch Project. For the Cullinan Ranch Wetland Restoration Project the Service completed an EIS/EIR in 2009. The discussion and analysis in that document is incorporated by reference and is discussed generally below.

NEPA requires the development of mitigation measures when federal activities are likely to result in adverse impacts on the human environment. The EA and CCP identify measures that would avoid and minimize any environmental impacts that could occur during implementation of the CCP. Alternative A (no action) is a continuation of management practices that are currently in place and serves as a baseline against which Alternatives B, and C are compared.

Physical Resources

Hydrology

All Alternatives

Because much of the Refuge is located at or below sea level, several units of the Refuge are affected by tide changes in the Estuary. Levees and water control features have altered the hydrological patterns (i.e., natural slough channels) in the area resulting in poor water circulation such as trapping of stagnant water in some areas. Poor circulation has in turn resulted in poor quality tidal vegetation. From a public health perspective, stagnant waters breed mosquito populations that may carry diseases that are a threat to human health. Activities prescribed in the alternatives are expected to have long-term benefits to the hydrology of the Refuge and surrounding area. Tidal restoration activity will reduce stagnant waters and improve vegetation over the long-term, but may result in short-term erosion due restoration activities.

The Service recognizes the need to protect levees and other structures for the purpose of public safety and private property. Refuge staff plans to consider hydrological impacts to neighboring public and private property when pursuing restoration activity. The proposed alternatives would

not likely result in any adverse impact to private properties.

Alternative A
Activities associated with all of the alternatives are expected to improve or restore hydrological patterns and wetland function at Tolay Creek and Lower Tubbs Island (80 acres) and Cullinan Ranch (1,500 acres). However, such restorations and enhancements will cause high velocity water flows thereby inundating sites. Sediment (e.g., silt, clay, sand, and gravel) carried into low elevation areas will settle and discourage stagnating water. Over time, sedimentation will reduce these flows and encourage plant communities to form and stabilize the area.

Alternative B
Under Alternative B, additional hydrological improvements would be identified, prioritized and implemented at Refuge locations including Sonoma Creek, Tolay Creek, and Lower Tubbs Island. Tidal function would be improved to create high quality tidal marsh plant communities. Additional assessments for tidal impoundments and other hydrological issues would be assessed. Increased effort to remove pepperweed and invasive *Spartina* by chemical and manual means may result in temporary soil erosion to those treated sites. However, those sites will be replaced by native plants in the long-term to prevent long-term soil loss.

Alternative C
In addition to those elements in Alternative B, hydrological patterns would clarify the possibilities for additional improvements to connectivity among the different tidal marsh units on the Refuge including breaches, lowering levees/berms, and removing culverts.

Water Quality and Contaminants

All Alternatives
Common water quality measures include salinity, pH, temperature, dissolved oxygen, and turbidity. Actions prescribed in the alternatives may cause short term impacts to water quality, but will result in the long term benefits to water quality. Tidal restoration and removal of invasive and non-native vegetation may result in short-term soil erosion and increase in turbidity in waterways. In the long-term restoration activities are expected improve water quality by allowing tidal exchange of water. Restoration actions will also draw sediment from waterways and the Bay into the refuge units to create land and eventually tidal marsh communities.

Tidal restoration activities in all the alternatives may introduce contaminants into or out of the Refuge.

Herbicide applications and manual removal of non-native vegetation may cause soil disturbance and the introduction of chemicals into the environment. Only approved herbicides appropriate for tidal marsh environments will be used according to label directions. Herbicide application will not be permitted near waterbodies or during inclement weather to reduce impacts to water quality.

Alternative A
Restoration activities could result in temporary, short-term water quality impacts such as increased turbidity from soil erosion, sedimentation, and the introduction of contaminants carried by tidal waters entering refuge units. As a mitigation measure, best management practices would be implemented including use of barriers to prevent sediment from flowing off the Refuge. Salinity and dissolved oxygen levels of waterbodies on the Refuge would be improved through

regular tidal exchange as a result of restoration.

The use of herbicides to remove non-native vegetation is anticipated under this alternative. Herbicides could be potentially applied near or in waterbodies which could impair water quality. As a mitigation measure, best management practices would be conducted such as using herbicides approved for aquatic use and avoiding use during inclement weather (e.g., rain, wind). All herbicides approved by the Service through the PUP process would be applied at label rates and all label recommendations would be followed (e.g., measures to preclude herbicide application on windy days).

Alternatives B and C

Alternatives B and C would result in similar effects described in Alternative A. Major restoration projects that will be assessed for Sonoma Creek, Tolay Creek, and Lower Tubbs Island may result in increased water turbidity from soil erosion in the short-term. In the long term, water quality such as salinity and dissolved oxygen will benefit through improved tidal exchange and reduction of water impoundments. Increased manual and chemical control of non-native and invasive vegetation may result in greater temporary water quality impacts such as introduction of herbicides and soil erosion into waterways and the Bay. Best management practices will be implemented to reduce water quality impacts such as avoiding restoration activities during inclement weathers and constructing barriers near waterbodies.

Under Alternatives B and C contaminants will likely be reduced through contaminants assessments to determine sinks and sources for removal on the Refuge.

Geology and Soils

All Alternatives

Tidal restoration activities proposed in all the alternatives will result in changes or disturbance to soil. Some areas may encounter increased sedimentation while sediment loss may occur in other areas depending on tidal flows. Grazing, mowing, nonnative plant removal, and native planting could disturb soils. These activities are expected to result in temporary impacts to soil while providing long-term stability to soil regimes on the Refuge.

Alternative A

Under Alternative A, current tidal restoration activities will increase sedimentation in some areas of the Refuge and reduce sedimentation in other areas, changing the topography of sites. Current invasive plant removal may also result in temporary soil erosion, but these areas are replaced by native plants which should reduce long-term erosion potential. Immediate best management practices to mitigate for soil erosion include constructing fencing to prevent soil from escaping the area.

Alternative B

Alternative B would also have would be similar to Alternative A in that tidal restoration would continue to take place but at a more accelerated pace. This could result in greater short-term loss of sediment, but overall long-term creation of stable native plant communities that will stabilize soils and reduce long-term sediment loss. Expanded invasive removal by means such as mowing, disking, and grazing may result in additional temporary disturbance and erosion, but would be offset by replacement with native plants. Increased soil disturbance and erosion my also occur from development of fishing infrastructure (i.e., boardwalk, pier), walking trails, interpretive

infrastructure, and a boat launch area. Signage will be placed in public areas to encourage the public to stay within trails to reduce erosion. As a mitigation measure, this infrastructure will be placed in less sensitive areas.

Alternative C
Activities conducted in Alternative C would result in the same effects as Alternative B. Developing an expanded on-site environmental education location at Sonoma Baylands has the potential to also increase soil erosion and disturbance potential. Sensitive habitat and erosion potential will be aspects considered when placing associated environmental education infrastructure (e.g., seating, signage, interpretive panels).

Air Quality and Climate

All Alternatives
The use of motorized construction equipment for restoration, construction, and maintenance activities in all alternatives would result in increase vehicle emissions (e.g., nitrous oxides, sulfur oxides, carbon dioxide) to the local area. Also, most visitors to the Refuge arrive by motorized vehicles which would result in particulates emissions as well. However, these activities are not expected to significantly affect air quality.

Alternative A
Under Alternative A (no action), no significant air quality or climate disturbances are expected. Existing impacts on air quality are localized and incidental to transportation; staff and visitor transport currently cause short-term increases in air emissions. Earth-moving equipment needed for maintenance (e.g., mowing) and restoration activities would also emit particulates into the local environment. However, these activities are expected to be infrequent and not to occur on a daily basis. The Service has not engaged in any other activities that would permanently affect the surrounding air quality or climate.

Alternatives B and C
Planning, prioritization, and implementation of tidal restoration activities (at sites such as Sonoma Creek, Tolay Creek, and Lower Tubbs Island) under Alternatives B and C will increase localized and temporary dust from heavy equipment operation. Construction of additional public use infrastructure such as trails and fishing piers will also increase localized dust particles vehicle emissions. Again, these activities are expected to be infrequent, one-time projects with short-term increases to air emissions. Measures to mitigate for dust include avoiding activities during extreme dry seasons or wetting down soil during construction activities to reduce dust.

Herbicide application in all the alternatives is not likely to affect air quality. Application of chemicals to control non-native vegetation would not occur during inclement weather or high winds to avoid the possibility of chemical drift. Prescribed burns for reducing non-native vegetation could increase particulate matter. The San Francisco Bay Area Quality District will be consulted regarding any prescribed burn activities to comply with permit requirements and determine best management practices.

Alternatives B and C are designed to increase visitation (an estimate of an additional 5,000 visitors) to the Refuge and thus may create overall long-term increases in tailpipe emissions to the area. However, these increases are not expected to significantly affect the overall air quality of the area. Overall, increased management and visitor activities prescribed in Alternatives B and C

are not expected to adversely affect Refuge resources or ambient air quality.

Hazardous Materials and Safety Issues

All Alternatives

Under all the alternatives, herbicides are the only known hazardous materials that will be used on the Refuge. These herbicides are not expected to result in any significant impacts to the Refuge or local environment. Herbicide will be stored in an approved spill-proof locker, according to label directions, California regulations, and Service policy. Crews applying the herbicide will be trained in storage and application to these same standards. In the long-term, the use of herbicides is expected to decrease with the reduction of nonnative vegetation.

Tidal restoration activities in all the alternatives may mobilize the contaminants found in the soils on the Refuge. Removal of levees to increase tidal circulation may facilitate the movement of contaminants to different areas of the Refuge or possibly off the Refuge into navigable waters.

Alternative A

The effects of Alternative A are expected to be those described above.

Alternatives B and C

The location of Refuge access points poses safety concerns to visitors. The two-lane Highway 37 cuts through the Refuge, but there are no deceleration/acceleration lanes to safely turn into the Refuge offices or public access locations. Alternatives B and C would improve safe access to the Refuge by including a deceleration/acceleration lane to the Cullinan Ranch unit and a safer entry road for the Sears Point unit (when acquired) when public access is developed at that site. A new entry road will also be developed at the Sears Point unit to provide safe access to the office headquarters.

Wilderness

Because there is no designated wilderness at the Refuge, none of the alternatives will impact wilderness.

Biological Resources

Vegetation and Habitat

All Alternatives

All proposed alternatives would have a beneficial impact to native plants. Herbicides, haying, grazing, and manual (e.g., mowing, pulling) methods would be used for removal of non-native and invasive vegetation, allowing for native plants to replace them. The application of herbicides will be properly calibrated to needs. Use of herbicides would result in reduced nonnative vegetation and allow for expansion of native plant communities. Herbicides will be used when native plants are not in their growing season. Refuge staff would use different planting pallets and compare results to determine how best to encourage the growth of native plant communities.

All the alternatives prescribe restoration of the marsh-upland transition zone with targeted removal of pepperweed and monitoring (and removal when detected) of invasive *Spartina* species. These removal activities will allow native vegetation to thrive, improving the marsh-upland ecotone. In the short-term, tidal restoration activities prescribed for the Cullinan Ranch unit in all

the alternatives will result in a significant impact with the conversion of seasonal freshwater wetland to tidal marsh. Over time, sediment will begin to accrete in these areas to facilitate formation of tidal marsh vegetation. Tidal restoration activities will eventually result in improved habitat for tidal marsh species, including the listed salt marsh harvest mouse and California clapper rail.

Alternative A

Under Alternative A, 80 acres of tidal salt marsh habitat at Tolay Creek and Lower Tubbs Island would be enhanced through hydrological modification. These improvements would result in higher quality pickleweed and associated vegetation ideal for salt marsh harvest mouse and California clapper rail. As noted above, 1,500 acres of diked upland area at the Cullinan Ranch unit would be converted to from seasonal wetlands to tidal marsh. The conversion of freshwater wetlands and upland to tidal habitat will impact mammals and birds, including migratory waterfowl that use the Cullinan Ranch unit for breeding and foraging. Therefore, conversion of the seasonal and emergent marsh wetlands at the Cullinan Ranch unit would constitute an adverse, unavoidable effect with no mitigation available to wildlife habitat. The Cullinan Ranch restoration would also result in filling of wetlands and waters of the United States, both of which are considered subject to the jurisdiction of the Army Corps of Engineers. Filling of a portion of the jurisdictional wetlands and waters is needed to armor and buttress the Highway 37 levee to protect the highway from restoration activities. No mitigation is available.

Removal of invasive vegetation and monitoring for invasive Spartina will help maintain the salt marsh plant community and support native shorebird and mammal species that rely upon this habitat.

Current wildlife-oriented recreation opportunities (e.g., wildlife observation, photography, fishing, and hunting) would not adversely affect vegetation. Public access areas are located away from sensitive vegetation. Signage also indicates closed areas near publicly accessible areas.

Alternative B

In addition to the activities proposed in Alternative A, Alternative B would result in additional enhancements to existing tidal marsh to improve habitats and vegetation at units including Tolay Creek, Lower Tubbs, and Sonoma Creek. These areas currently have low quality marsh plants due to poor water circulation. Specific enhancements have not been identified yet, but potential methods could include lowering of levees and breaches. These actions are not expected to replace one habitat type with another, but instead enhance tidal circulation in the tidal marsh habitat to improve vegetation for tidal marsh species. The pepperweed control plan and marsh-upland ecotone restoration plan developed under Alternative B would also improve native plant communities and control nonnative grasses and other vegetation.

According to the California Natural Diversity Database, a program that inventories the status and location of rare animal and plant species in California, soft bird's beak is present on the Refuge. However, this species has not been surveyed on the Refuge. Alternative B will result in improved understanding and protection of this species through surveying and monitoring.

Sub-tidal surveys will improve understanding and management needs of subtidal resources such as native eel grass. Climate change modeling will inform refuge management of habitats over the long-term. Models will provide information on anticipated habitat change scenarios for the

Refuge.

The environmental education and volunteer opportunities prescribed under Alternative B will also benefit Refuge habitat and vegetation. School groups and planting days will support habitats through native plant propagation, weeding of nonnative vegetation, and planting of native plants. Sensitive wildlife areas will be avoided.

Hunting activities are not expected to impact vegetation under Alternative B. There are limited hunting areas (Tolay Creek and Lower Tubbs Setback) and low participation is expected. The development of fishing areas, non-motorized boat launch (e.g., kayak), and infrastructure at Guadalcanal and Cullinan are expected to result in a loss of habitat and vegetation. It is anticipated that less than a 0.5 acre of habitat will be lost to the development of these fishing areas. Low quality habitat will be selected to reduce impacts on sensitive wildlife. Fishing participation is expected to increase. The Refuge does not currently have an accurate count of the number of people who fish on the Refuge as most of it occurs from boats in the open bay waters and sloughs which are accessed from boat launches outside of the Refuge. Therefore, it is estimated that by providing land based angling access points at Guadalcanal and Cullinan Ranch will increase fishing participation by as many as 5,000 people per year. Trail construction at Figueras, Guadalcanal, Sear Point, Skaggs Island and Sonoma Baylands would also result in loss of vegetation and habitat. However, loss of habitat for this use would be minimal in size (less than an acre) because trails will be improved along existing trail alignments and levees. Increased foot traffic under Alternative B could degrade vegetation near public areas. As a mitigation strategy, minimal fencing and signage would be placed to discourage visitors from wandering off designated trails. Closed areas would also be signed. The environmental education program focused on native plant propagation and planting will be beneficial to the native plant communities on the Refuge.

Alternative C

In addition to improvements in tidal influence noted in Alternative A and B, Alternative C will further improve tidal marsh habitats on the Refuge with the development of an action plan to identify hydrological connectivity among Refuge units. Alternative C will also support sub-tidal habitats by assessing historical information and identifying conservation priorities for these habitats.

The *Spartina* control plan and habitat management plan developed under Alternative C would improve native plant communities and control nonnative grasses and other vegetation. Grazing and haying activities prescribed for Sears Point would be used to control non-native grasses consistent with the farm landscape of the area. The early detection and rapid response program and invasive plant monitoring in Alternative C is one of the most effective means of avoiding costly long-term control measures. Identifying threats at an early stage and at an ecosystem level would maintain native plant communities, improves control effectiveness, and reduces costs.

Habitat restoration fulfills the Service's congressional mandate to preserve, restore, and enhance habitat for threatened and endangered species, songbirds, waterfowl, other migratory birds, interjurisdictional fish, marine mammals, resident wildlife, and plants. The plant and habitat restoration activities prescribed under all the alternatives will result in loss of seasonal freshwater wetland and upland habitat, but will result in an increase in tidal marsh habitat and enhancement of existing tidal marsh habitat.

The increase in public access opportunities under Alternative C may result in loss or damage of vegetation. Expanding outreach and education about hunting and fishing on the Refuge may result in increased number of hunters and minor impacts such as trampling of vegetation. Hunters will be informed of sensitive areas on the Refuge to avoid. Docent-led kayak and walking tours may result in trampling of vegetation, but groups will be limited in size and in the areas to which they will access, to reduce effects to the habitat. Under Alternative C, the creation of infrastructure such as entry road, sitting area, parking area and interpretive panels for the environmental education program at Sonoma Baylands, Sears Point, and Guadalcanal would result in a loss of vegetation. Sensitive vegetation and habitat will be avoided. Closed areas near publicly accessible areas will be properly minimally fenced and/or signed to deter disturbance. All visitors would be required to stay in designated areas.

Wildlife

All Alternatives

All proposed alternatives would result in short-term and long-term benefits for wildlife species due to the implementation of tidal restoration projects, invasive vegetation control, and native plant restoration activities. These activities would result in short-term disturbance to wildlife, but is not expected to result in population-level effects and would be outweighed by the creation of additional native habitat for wildlife.

Public access opportunities in all proposed alternatives could result in some disturbance and mortality to wildlife. Wildlife observation (through biking, boating, and walking), photography, and environmental education could result in temporary disturbance to wildlife.

Hunting

Hunting would occur in all the alternatives resulting in disturbing, injuring and killing pheasant and waterfowl. Waterfowl hunting on the open bay and navigable sloughs will result in the direct loss of waterfowl, migratory species protected under the Migratory Bird Treaty Act. Pheasant hunting, only allowed at the Tolay Creek/Tubbs Island units, will result in the direct loss of pheasants, but this domesticated species is not managed by the Refuge or by the State and originate from a nearby hunt club. Waterfowl hunt statistics are unknown for the Refuge because hunters access Refuge hunt areas by boat and must launch from outside the Refuge (e.g., Vallejo) because the Refuge lacks a launch site. Pheasant hunting is accessed by the trail to the Tolay Creek/Tubbs Island units. It is surmised that only a small number of pheasant hunters (less than 15 hunters annually) use the Refuge due to the difficulty of accessing hunt areas, shallow waters within the Refuge making boating difficult, and quality of hunt available. Also, species that are present are not considered high quality such as scaup. Hunting on the Refuge requires the purchase of a Duck Stamp, and is regulated by the State and is not expected to result in population level effects to waterfowl species. Law enforcement monitoring is also used to control over harvest. Promoting the hunt program may increase the number of birds taken, but is not expected to exceed population levels due to regulatory requirements.

Direct effects of hunting include mortality, wounding, and disturbance (DeLong 2002). Hunting can alter behavior (i.e., foraging time), population structure, and distribution patterns of wildlife (Owens 1977; Raveling 1979; White-Robinson 1982; Thomas 1983; Madsen 1985; Bartelt 1987; Cole and Knight 1990). There also appears to be an inverse relationship between the numbers of birds using an area and hunting intensity (DeLong 2002). In Connecticut, lesser scaup were observed to

forage less in areas that were heavily hunted (Cronan 1957). In California, the numbers of northern pintails on Sacramento Refuge non-hunt areas increased after the first week of hunting and remained high until the season was over in early January (Heitmeyer and Raveling 1988). Following the close of hunting season, ducks generally increased their use of the hunt area; however, use was lower than before the hunting season began. Human disturbance associated with hunting includes loud noises and rapid movements, such as those produced by shotguns and boats powered by outboard motors. This disturbance, especially when repeated over a period of time, compels waterfowl to change food habits, feed only at night, lose weight, or desert feeding areas (Wolder 1993; Madsen 1995).

These impacts can be reduced by the presence of adjacent sanctuary areas where hunting does not occur and birds can feed and rest relatively undisturbed. Sanctuaries or non-hunt areas have been identified as the most common solution to disturbance problems caused from hunting (Havera et al. 1992). Prolonged and extensive disturbances may cause large numbers of waterfowl to leave disturbed areas and migrate (Paulus 1984; Madsen 1995) elsewhere. In Denmark, hunting disturbance effects were experimentally tested by establishing two sanctuaries (Madsen 1995). Over a five-year period, these sanctuaries became two of the most important staging areas for coastal waterfowl. Numbers of dabbling ducks and geese increased 4 to 20 fold within the sanctuary (Madsen 1995). Thus, sanctuary and non-hunt areas are very important to minimize disturbance to waterfowl populations to ensure their continued use of the Refuge.

Intermittent hunting can be a means of minimizing disturbance, especially if rest periods in between hunting events are weeks rather than days (Fox and Madsen 1997). It is common for refuges to manage hunt programs with non-hunt days. At Sacramento Refuge, 3 to 16 percent of pintails were located on hunted units during non-hunt days, but were almost entirely absent in those same units on hunt days (Wolder 1993). In addition, northern pintails, American wigeon, and northern shovelers decreased time spent feeding on days when hunting occurred on public shooting areas, as compared to non-hunt days (Heitmeyer and Raveling 1988). The intermittent hunting program of three hunt days per week at Sacramento Refuge results in lower pintail densities on hunt areas during non-hunt days than non-hunt areas (Wolder 1993). However, intermittent hunting may not always greatly reduce hunting impacts.

The CDFG is California's lead agency for management of fish, wildlife, and native plants - collectively called "wildlife." CDFG has trustee responsibility for the conservation and management of wildlife for the benefit and enjoyment of the public.

Resident game species are protected on refuges by both Federal and State laws and regulations to ensure that harvest rates do not negatively affect populations. The potential impacts of hunting on migratory bird and resident upland game birds are discussed and evaluated in the California Environmental Quality Act process (California Department of Fish and Game 2001, 2004a). This process results in periodically updated and publicly reviewed documents. Based on the findings of these documents, the State ensures that game animal hunting in California does not adversely impact its wildlife populations at an unacceptable level (California Department of Fish and Game 2004b).

Wildlife populations on the Refuge are able to sustain hunting and to support other wildlife-dependent priority uses. To manage the populations to support hunting, the Refuge adopts harvest regulations set by the State within Federal framework guidelines. The regulatory

procedures that govern harvest are described in the section below.

By its very nature, hunting has very few positive effects on the target species while the activity is occurring. However, in the Service's experience, hunting has given many people a deeper appreciation of wildlife and a better understanding of the importance of conserving their habitat, which has ultimately contributed to the Refuge System's mission. Furthermore, despite the potential impacts of hunting, a goal of the Refuge is to provide visitors of all ages an opportunity to enjoy wildlife-dependent recreation. Of key concern is to offer a safe and quality program and ensure adverse impacts remain at an acceptable level.

Recreational hunting will remove individual animals, but does not negatively affect wildlife populations. To assure that populations are sustainable, the California Fish and Game Commission, in consultation with the CDFG, annually review the population censuses to establish season lengths and harvest levels.

Harvest Management – Regulatory Procedures
Waterfowl populations throughout the United States are managed through an administrative process known as flyways, of which there are four (Pacific, Central, Mississippi, and Atlantic). The review of the policies, processes, and procedures for waterfowl hunting are covered in the following documents.

NEPA considerations by the Service for hunted migratory game bird species are addressed by the programmatic document, ''Final Supplemental Environmental Impact Statement: Issuance of Annual Regulations Permitting the Sport Hunting of Migratory Birds (FSES 88–14),'' filed with the Environmental Protection Agency on June 9, 1988. The Service published a Notice of Availability in the Federal Register on June 16, 1988 (53 FR 22582) and the Record of Decision on August 18, 1988 (53 FR 31341). Annual NEPA considerations for waterfowl hunting frameworks are covered under a separate EA and FONSI. Further, in a notice published in the September 8, 2005, Federal Register (70 FR 53776); the Service announced its intent to develop a new Supplemental EIS for the migratory bird hunting program. Public scoping meetings were held in the spring of 2006, as announced in a March 9, 2006, Federal Register notice (71 FR 12216).

Because the Migratory Bird Treaty Act stipulates that all hunting seasons for migratory game birds are closed unless specifically opened by the Secretary of the Interior, the Service annually promulgates regulations (50 CFR Part 20) establishing the Migratory Bird Hunting Frameworks. The frameworks are essentially permissive in that hunting of migratory birds would not be permitted without them. Thus, in effect, Federal annual regulations both allow and limit the hunting of migratory birds.

The Migratory Bird Hunting Frameworks provide season dates, bag limits, and other options for the States to select that should result in the level of harvest determined to be appropriate based upon Service-prepared annual biological assessments detailing the status of migratory game bird populations. In North America, the process for establishing waterfowl hunting regulations is conducted annually. In the United States, the process involves a number of scheduled meetings (Flyway Study Committees, Flyway Councils, Service Regulations Committee, etc,) in which information regarding the status of waterfowl populations and their habitats is presented to individuals within the agencies responsible for setting hunting regulations. In addition, public hearings are held and the proposed regulations are published in the Federal Register to allow

public comment.

For waterfowl, these annual assessments include the Breeding Population and Habitat Survey, which is conducted throughout portions of the United States and Canada, and is used to establish a Waterfowl Population Status Report annually. In addition, the number of waterfowl hunters and resulting harvest are closely monitored through both the Harvest Information Program (HIP) and Parts Survey (Wing Bee). Since 1995, such information has been used to support the adaptive harvest management (AHM) process for setting duck-hunting regulations. Under AHM, a number of decision-making protocols render the choice (package) of pre-determined regulations (appropriate levels of harvest) which comprise the framework offered to the States that year. California's Fish and Game Commission then selects season dates, bag limits, shooting hours, and other options from the Pacific Flyway package. Their selections can be more restrictive, but cannot be more liberal than AHM allows. Thus, the level of hunting opportunity afforded each State increases or decreases each year in accordance with the annual status of waterfowl populations.

Waterfowl – Flyway Analysis
The 2008 annual waterfowl harvest estimate for the Pacific Flyway is 3.3 million ducks, similar to 2007. This estimate represents almost 25 percent of the estimated total harvest for the U.S. of 13.7 million ducks (Raftovich et al. 2009).

Waterfowl harvested in California are made up of wintering waterfowl (coming from breeding grounds to the north) and the resident breeding population. For comparison, the Mid-Winter Survey Index for 2008 estimated 5.3 million total ducks for the Flyway (Trost and Sanders 2008). Waterfowl breeding 2008 breeding estimates for California were 554,000 ducks down from 627,600 in 2007 (USFWS 2008). These numbers serve to demonstrate the relative importance of these areas (especially California) in the Pacific Flyway for wintering waterfowl, rather than for waterfowl production.

Waterfowl - Regional Analysis
Most recent available annual harvest estimates for California indicate that approximately 1.6 million ducks have been harvested by 53,200 and 58,100 waterfowl hunters in 2007 and 2008, respectively (Raftovich et al. 2009) in recent years. However, this may not be reflective of the exact hunter participation as estimates are based off voluntarily survey participation.

Most recent available estimates for the breeding duck population in California in 2009 was 510,800 birds, which was an 8.0 percent decrease from the 2008 estimate (CDFG 2009b). Mallards generally comprise more than half of each year's breeding population estimate. In contrast, the 2009 Midwinter Waterfowl Survey index for California totals 3.6 million ducks, further illustrating the relative importance of California's overall wintering waterfowl capacity within the Pacific Flyway (CDFG 2009a).

Waterfowl - Local Analysis
Waterfowl harvest numbers are unknown on the Refuge because hunters must access Refuge hunt areas by boat at boat launches off the Refuge (the Refuge does not have any launch points). The Refuge consists of 8,000 acres of open bay and navigable sloughs for waterfowl hunting. However, Refuge staff surmises that very few hunters (less than a dozen) hunt on the Refuge given this difficulty and the challenging tide conditions of two low tides per day.

Midwinter Waterfowl Surveys for 2009 estimated 551,035 ducks for the San Francisco Bay (CDFG 2009a). 2009 California Waterfowl Breeding Populations Surveys estimated about 19,000 ducks in Suisun Marsh and about 26,000 ducks in the Napa area (CDFG 2009b)

Significance Conclusion for Waterfowl
The hunting of waterfowl in the United States is based upon a thorough regulatory process that involves numerous sources of waterfowl population and harvest monitoring data. As a result of the regulatory options produced (AHM) in recent years, California hunter's estimated harvest of nearly 1.6 million ducks is approximately 12 percent of the total U.S. harvest of 13.7 million and nearly 50 percent of the Pacific Flyway's 3.3 million harvest estimate (Raftovich et al. 2009). Refuge staff estimates that hunting on the Refuge likely represents a negligible amount of all the waterfowl harvests conducted in California. Based on this analysis, the Service has concluded that hunting associated with each of the alternatives will not have a significant impact on local, regional, or Pacific Flyway waterfowl populations.

Alternative A
Under Alternative A (no action), tidal marsh restoration plans will revert the Cullinan Ranch unit from seasonal freshwater wetland and upland to tidal marsh, resulting in a conversion to sub-tidal habitat in the medium term until sedimentation increases and eventually tidal marsh. Upland habitat will no longer be available to the above species and individuals may be harmed or disturbed during the construction activities. This loss of upland would constitute an adverse, unavoidable effect. Upland species that use Cullinan such as mammals, raptors and, songbirds will be permanently displaced as it evolves into a tidal marsh that will support California clapper rail, salt marsh harvest mouse, and other marsh species. However, upland habitat will be available nearby. Refugia will also still be available for tidal marsh mammal species such as salt marsh wandering shrew and California vole.

In the long-term, tidal marsh species would benefit from higher quality vegetation that is exposed to tidal influence. Mudflats and shallow water intertidal habitats are important foraging and resting habitat for shorebirds. Conservation measures will be employed such as avoiding sensitive breeding seasons; surveying areas before activities take place; and trapping, relocating, and fencing before activities begin. Other measures that may be employed to reduce individual mortality include use of water control structures to slowly flood areas to allow egress of individuals and installation of barrier fencing to prevent re-entry.

Enhancements under this alternative to Tolay Creek and Lower Tubbs Island units would also significantly improve the quality of habitat for tidal marsh species. These areas currently have poor tidal circulation which results in poor quality salt marsh vegetation and poor quality habitat for wildlife species. Species may be temporarily disturbed by restoration activities that may involve earth-moving equipment, foot traffic, heavy equipment, and vehicles. The hydrological improvements being conducted on Tolay Creek and Lower Tubbs Island will have less of an effect on tidal marsh species because they are existing marshes.

Native plant restoration will directly cause disturbance in wildlife habitat and may temporarily flush wildlife. Manual and chemical removal of nonnative species such as pepperweed may adversely affect individuals, but not negatively affect wildlife populations because pepperweed is not considered habitat for native wildlife species. The use of herbicides for controlling invasive

vegetation is not expected to affect wildlife species. Herbicides will be applied by hand directly to plants to avoid non-target species. Sensitive breeding seasons and locations will be avoided. The use of herbicides and pesticides is highly regulated through the Service's Pesticide Use Proposal (PUP) process. This approach notes environmental hazards, efficacy, costs, and vulnerability of the pest. All herbicides approved by the Service through the PUP process would be applied at label rates and all label recommendations would be followed. Mitigation measures that may be employed include conducting surveys to prior to removal activities to determine presence of nests or young. In the long-term, plant community restoration activities will benefit species by providing additional habitat.

Existing wildlife-dependent recreation opportunities such as wildlife observation and photography may result in temporary disturbance to wildlife. However, this activity is limited to the Tolay Creek/Lower Tubbs Island unit during daylight hours only. Signage is used to deter the public from entering closed areas to protect sensitive habitat.

Alternative B

Acquisition objectives of nearby sites such as Guadalcanal, Sears Point, Sonoma Baylands, and Skaggs Island are expected to add additional habitat for tidal marsh and upland species native to the area. These sites may require restoration or enhancement to benefit native wildlife species. Existing wildlife in these areas may be displaced by such restoration or enhancement activities. Further site-specific planning will include mitigation measures such as consideration for existing wildlife habitat needs and slow flooding of areas to be restored to tidal influence to prevent mortality.

Additional inventory and monitoring through additional staff will benefit wildlife through additional data on species that will inform management decisions. The marsh-upland ecotone plan, pepperweed control, and invasive *Spartina* control will benefit wildlife species by enhancing native plant communities.

Under this alternative, developing and implementing a program for invasive vegetation control, early detection, and rapid response would help to maintain high quality habitat and vegetation for wildlife species. Short-term effects of control would include disturbance to birds through the use of chemical and manual removal of nonnative vegetation. Individuals may be temporarily flushed from the area, but these actions are not expected to result in negative impacts to the overall population levels of wildlife species.

A predator management program may also benefit wildlife species by first identifying whether or not major predator threats exist to individual species populations on San Pablo Bay, where they exist and then developing a phased control program to reduce predation if needed. Predator control will only be initiated when and if a protected or sensitive species will benefit and where a direct cause and effect can be measured in the field.

The addition of trails, fishing pier/boardwalk, boat launch, entry points and other associated infrastructure will increase number of visitors to the Refuge. Increased visitor use in the form of wildlife observation, photography, recreation, and environmental education will result in more traffic in habitat areas and may cause wildlife to temporarily flush from the area. Conducting a fishing day (catch and release only) at the Cullinan and/or Guadalcanal units may cause temporary disturbance to wildlife. This event will be directed by staff that would oversee the activity and

limit potential impacts to wildlife. Additional trails and access points for wildlife observation and photography may result in temporary disturbance to birds. However, visitation will also promote stewardship of habitat and wildlife. Additional signage and minimal fencing may be used to deter the public from entering sensitive wildlife habitat. This activity is not expected to result in a population-level effect on wildlife. To mitigate disturbance, public access areas will be designated where the least disturbance to wildlife would occur. Increased public education through signage and interpretive panels/material will be available to deter disturbance to wildlife. Expanded environmental education opportunities such as the Garden Education Program will improve wildlife habitat with nursery propagation and planting opportunities.

Alternative C

Alternative C would include those activities and effects in Alternative B. In addition, there would be increased benefits and disturbances from activities prescribed in this alternative. The evaluation of population health and viability for the listed species and other native wildlife will be beneficial to wildlife in the long-term. Additional studies on use of interior tidal ponds and mapping of high tide roost environments for protection will benefit birds and improve their habitat. Developing a predator management plan will provide benefit wildlife populations.

Additional hydrological enhancements in this alternative would benefit wildlife by providing higher quality habitat. The development of grazing, haying and soil stabilization plans for the Sears Point unit will control non-native vegetation and enhance native species appropriate for grassland-dependent species. Developing a Spartina control plan and an early detection and rapid response program for invasive species would have a positive benefit to habitat for wildlife. Sub-tidal wildlife resources will benefit from the implementation of sub-tidal restoration or enhancement activities that will be conducted by staff and partners. Climate change assessments and monitoring will also benefit long-term needs (such as identifying additional habitat) for wildlife.

Guided walking and kayaking tours will be conducted in a manner that reduces disturbance and will also encourage visitors to avoid disturbing wildlife. Environmental education programs at Sonoma Baylands and Guadalcanal could increase disturbance to wildlife. In order to reduce impacts to wildlife, staff will educate students on precautions to reduce disturbance to wildlife during these programs. Programs will also take place away from sensitive habitat and special-status species.

Fish and Marine Invertebrates

All Alternatives

Tidal restoration activities in all of the alternatives could result in entrapment of fish and marine invertebrates during low tide conditions. Potential mitigation elements that may be employed include avoiding construction activities during migration periods and use of water control structures such as culverts to prevent entrapment. Tidal restoration activities will result in open water habitat appropriate for fish and invertebrate habitat, until sedimentation begins to take place. In the long-term, sub-tidal habitat is expected to increase and expected to result in a benefit to fish and marine invertebrate populations.

Fish mortality occurs from fishing activities that are permitted in the open bay of the Refuge. However, fishing is enforced by the CDFG regulations and is not expected to result in a population-level affect on fish species.

Alternative A
The effects of Alternative A are expected to be those described above.

Alternatives B and C
Monitoring efforts will also be established for subtidal habitats. Sub-tidal habitats are not understood or actively managed, despite encompassing well over 8,000 acres of the Refuge. Under Alternatives B and C, staff will work with partners such as National Oceanic and Atmospheric Administration (NOAA) and specialists in sub-tidal habitats to conduct monitoring to better understand the fish and invertebrate species present in this habitat in order to develop management needs. Alternative C will include identifying conservation priorities for restoration or enhancement which will support fish and invertebrate needs.

Under Alternatives B and C, additional fishing will be prescribed including shoreline fishing locations such as a pier. Direct impacts include a probable higher fish loss than Alternative A. However, fishing will continue to be enforced by the CDFG regulations and is not expected to adversely affect fish populations.

Endangered species

All Alternatives
Individual wildlife may be affected, but restoration activities in all the alternatives are expected to benefit the long-term population of tidal marsh species including listed species such as the California clapper rail and the salt marsh harvest mouse. There would be a temporary loss of tidal marsh habitat from inundated areas where breaching occurs. Restoration activities could disturb and flush California clapper rail from the area. Activities could result in direct mortality of salt marsh harvest mice if they were present in areas where proposed breaches were implemented. In the long-term additional tidal marsh habitat would off-set the temporary loss of habitat. Potential mitigation measures to reduce impact to individuals may include surveying for presence or absence of individuals; providing a buffer near nest locations; avoiding activities during the nesting season; trapping and transplanting mice to other sites; installing barrier fence to prevent re-entry; and slow flooding to allow mammals to seek refugia in higher elevation pickleweed.

Use of herbicides, mechanical removal, and hand-pulling of nonnative plants under all the alternatives has the potential to impact wildlife. Short-term impacts of plant removal are likely to include disturbance of roosting (non-breeding) clapper rails or mice within close proximity to the field crews conducting the removal. Such disturbance may force wildlife to relocate to other parts of the Refuge temporarily. Herbicide spraying would not be conducted during the breeding or nesting season to reduce exposure to wildlife.

All the alternatives include native plant restoration and invasive plant management activities. Increasing native plant cover will provide additional habitat and refugia for listed tidal marsh species in high tide events.

Alternative A
The impacts in Alternative A are the same as those described above.

Alternatives B and C
Under Alternative B, Refuge staff will standardize and analyze monitoring protocol for listed

species. These changes in methodology will improve understanding of listed species and their recovery needs. Alternative B also prescribes the development of a monitoring and control program to respond specifically to nonnative cordgrass if and when it is found on the Refuge. This response plan will benefit wildlife, including endangered species, by protecting food and cover habitat from invasive plants. Similar to pepperweed, cordgrass infiltrates tidal marshes and drives out native plant communities. While dense patches have formed in the South Bay, it has yet to invade the North Bay. Only individual plants have been found and quickly removed. A rapid response plan will also be developed for dealing with other invasive plants as well.

Predator management activities as described earlier may be used to control predators of native wildlife if necessary and in specific cases where it will help protect population levels and direct cause and effect can be measured in the field.

Climate change actions under Alternative B will have added benefit to wildlife. Through climate change modeling and monitoring, staff will identify habitat changes and identify adaptive changes or acquisition needs that may be required to support wildlife. Modeling will help staff identify which species are most at risk of climate change effects and prioritize management actions to protect them. Staff will conduct monitoring activities that measures indicator resources (e.g., water gauges, temperature, arrival and departure dates of species) that are a result of climate change.

In addition to activities in Alternative B, improved hydrological connectivity between tidal marsh units as prescribed in Alternative C will improve connectivity between the different refuge units. These access points would be beneficial to listed species in high tide events or over time as climate change alters habitats. Alternative C would support recovery needs for the California clapper rail and salt marsh harvest mouse by evaluating population health, viability and goals to preserve and enhance existing populations.

Social and Economic Environment

None of the alternatives are expected to adversely affect the social and economic environment of Solano, Sonoma, and Napa Counties. Tourism revenue is potentially generated through activities and events held at the Refuge such as guided walks and plant restoration activities. If an increase in visits to the Refuge occurs or there is a net increase in visitors to the area, this could benefit the local economy and employment if visitors utilize local businesses such as gas stations, markets, and restaurants. Increased visitation provides an opportunity for public education, which can foster value for these native habitats.

Recreation

All Alternatives

All alternatives offer some level of wildlife-dependent recreational opportunities which include wildlife observation, photography, hunting, and fishing. All the alternatives provide some social benefit to nearby communities by providing access to open space.

Alternative A

Alternative A (no action) provides limited recreational opportunities on the Refuge. Currently, there is only one self-guided trail (for walking and biking) available for wildlife observation and photography which is located at the Tolay Creek/Tubbs Island Unit. Hunting and fishing are

allowed in the open bay waters and navigable sloughs. Hunting is not expected to conflict with wildlife observation or photography. Hunting is allowed on a small segment (less than one acre) of the Refuge (Tolay Creek) for pheasant only. Hunters walk through Refuge property to hunt in California Department of Fish and Game property.

Alternative B
Alternative B would encourage increased visitor use by offering more access sites and a larger variety of recreational activities. In addition to those elements described in Alternative A, Alternative B would provide more Refuge involvement in hunting activities on the Refuge by offering hunting brochures. Staff would also develop a hunt brochure, add a shoreline fishing pier location, and develop fishing information materials. Additional self-guided access (for walking and biking) would be developed at Guadalcanal, Cullinan Ranch, Sears Point, Figueras, and Sonoma Baylands. Alternative B also prescribes a non-motorized boat (i.e., kayak) launch at the Cullinan Ranch for recreational, non-motorized boaters and other visitors at Cullinan Ranch.

Alternative B would also expand environmental education opportunities directed towards the local community. A Garden Education Program for families would encourage the local community on the use of native plants and offer service opportunities, events, or workshops on the Refuge.

Alternative C
Alternative C would include those activities described in Alternative A and B, but also include more outreach on hunting and fishing activities. Outreach to the local community and other visitors would be improved through hunting and fishing program events such as the hunter cleanup day, hunter orientation workshop, and fishing day event. Additionally, kayak tours would be offered twice a year, while a docent-led tour program would be developed for Guadalcanal, Sears Point, Sonoma Baylands, Skaggs Island and Lower Tubbs units.

Also under Alternative C, the environmental education would provide more field-based opportunities for local schools and the community. The environmental education field trip program would bring local elementary schools to the Sonoma Baylands, Sears Point, and Guadalcanal units, to learn about migratory birds, wetlands, and habitat restoration. Staff would also collaborate with non-profit partners to implement in-class programs to support experiences on the Refuge.

Economy

All Alternatives
None of the alternatives are expected to negatively impact the economic environment of the area.

Alternatives B and C
Under all the alternatives, some employment opportunities will be created for the surrounding community. Alternatives B and C would add staff positions including a law enforcement officer, outdoor recreation planner, administrative officer, maintenance worker, range conservationist, and two biological technician positions. Construction projects, restoration projects, and management activities could benefit local companies, though projects would have to be sent out for competitive bid. Grazing and haying activities to manage nonnative vegetation would also be conducted by a local farmer and rancher.

Both Alternatives B and C could result in an increase in recreational spending related to

additional visitor recreational opportunities offered on the Refuge. Tourism dollars to local businesses (e.g., gas stations, restaurants, markets) may be generated from visitation to the Refuge.

Cultural Resources

All Alternatives

Under Federal ownership, archaeological and historical resources within the Refuge receive protection under Federal laws mandating the management of cultural resources, including, but not limited to, the Archaeological Resources Protection Act; the Archaeological and Historic Preservation Act; the Native American Graves Protection and Repatriation Act; and the National Historic Preservation Act. There are no identified historic and cultural elements on the Refuge. However, the office headquarters are located on an old farm property. While not identified as historically significant, any renovations, repairs, or modifications to the farm structure will strive to maintain their character. In addition, new structures will mimic the farm aesthetic of the site.

Site specific refuge management activities, such as construction or tidal restoration, have the potential to disturb cultural resources. To preserve Refuge historic resources, all undertakings, including but not limited to construction activities, will comply with Section 106 of the National Historic Preservation Act of 1966, as amended, as outlined in the existing Programmatic Agreement between the Service and the California State Historic Preservation Officer. Staff will also coordinate with the Service's Regional Archaeologist to comply with Federal laws relating to cultural resources.

The area where the Refuge is located was once open water and marsh making it difficult to locate physical evidence of human activity. Moreover, archaeological sites also tend to be situated on higher land than the Refuge (N. Valentine, pers. comm.). There are no known accounts or evidence of Native American use on the Refuge, though several Native American tribes are known to have inhabited the area including Pomo (central and western Sonoma County), Miwok (southern Sonoma County), Yukia (northern Sonoma County), Sotoyome (northern Sonoma County) and Suysune (eastern Sonoma County), Wappo (Solano County), and Suisun (Solano County) (Drake 1978, Hunt 1926). Therefore, it is unlikely that actions under any of the alternatives would affect cultural resources.

Alternatives B and C

Alternatives B and C include an outreach and education component that will include a history of the cultural resources on the Refuge. Environmental education brochures for visitors and local residents will include a discussion of the farming and ranching history of the area.

Climate Change

All Alternatives

Climate change could also have a profound effect on the Refuge because most of the area is below sea-level. Sea-level rise as a consequence of climate change could reduce the total land area of the Refuge. Based on a continuous record of mean sea level for the San Francisco Bay Estuary, the rate of relative sea level rise at the Presidio from 1855 to the present is estimated to be 0.0039 feet per year (Moffatt and Nichol et al. 1988). Neglecting the unusual values associated with all El Niño events during the recent 19-year period from 1967 to 1985, sea-level rose at a rate of 0.0059 feet per year, which still indicates that the rate of rise is increasing (Moffatt and Nichol et al. 1988). Climate change in conjunction with tidal wetland restoration and nonnative vegetation

removal activities will result in an increase in wetland or open water habitat, and a decrease in upland habitat. However, much of the diked upland on the Refuge was historically tidal wetland.

A SLAMM model was conducted in 2010 to assess habitat changes as a result of climate change on the Refuge (Clough and Larson 2010). The SLAMM identified habitat changes on the Refuge units that may be expected under five sea-level rise scenarios. The middle scenario of a 1-meter rise in sea level predicts losses of 13 percent dry land, 64 percent irregularly flooded marsh, 58 percent tidal flat, and 23 percent developed dry land. Increases would be in estuarine open water and salt marsh habitats (Clough and Larson 2010). However, there were a number of assumptions that were made, suggesting the need to consider other modeling efforts to confirm these findings.

Climate change could also result in changing habitat which would affect wildlife and plant communities. Not only could habitats shift, but also when birds migrate and leaves begin to bud (IPCC 2007). Climate change could magnify impacts on wildlife habitat, reduce native vegetation, and increase occurrence of nonnative (plant and animal) species on the Refuge. Climate change can result in physiological changes, phenological (lifecycle) changes, range shifts, community changes, ecosystem process shifts, and multiple stressor conditions (Parmesan and Galbraith 2004). Global warming may require organisms to migrate at much higher rates than they have done in the recorded past (Malcolm and Pitelka 2000). Native plants may not thrive in the Refuge boundaries due to changing temperatures. Moreover, climate change could result in changes to local food web dynamics, altering prey resources in the bay waters adjacent to the Refuge. The potential changes to food availability near the Refuge could deter or attract wildlife affecting productivity.

Over time, climate change could result in significant ramifications for wildlife and vegetation. Tidally-influenced habitat for wildlife at the shoreline could disappear, forcing wildlife to move onto higher ground, possibly competing with other wildlife for habitat. Plant communities at the shore could be inundated or be forced to migrate to higher ground, competing with other vegetation (Smerling et al. 2005).

The U.S. Department of Interior issued an order in January 2001 requiring its land management agencies to consider potential climate change impacts as part of long-range planning endeavors. The increase of carbon within the earth's atmosphere has been linked to the gradual rise in surface temperature commonly referred to as global warming. In relation to comprehensive conservation planning for national wildlife refuges, carbon sequestration constitutes the primary climate related impact to be considered in planning. The U.S. Department of Energy's report Carbon Sequestration Research and Development (1999) defines carbon sequestration as "...the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere."

Terrestrial biomes of all sorts – grasslands, forests, wetlands, tundra, perpetual ice, and desert – are effective in preventing carbon emissions and in acting as a biological "sinks" for atmospheric carbon monoxide. The Department of Energy's report conclusions note that ecosystem protection is important to carbon sequestration and may reduce or prevent loss of carbon currently stored in the terrestrial biosphere. Preserving natural habitat for wildlife is the heart of any long-range plan for national wildlife refuges. The actions proposed under any of the alternatives would conserve or restore land and water, and would thus enhance carbon sequestration. This in turn contributes positively to efforts to mitigate human-induced global climate changes. Several

impacts of climate change have been identified (Hassol 2004) that may need to be considered and addressed in the future:

- Habitat available for cold water fish such as trout and salmon in lakes and streams could be reduced.
- Forests may change, with some species shifting their range northward or dying out, and other trees moving in to take their place.
- Ducks and other waterfowl could lose breeding habitat due to stronger and more frequent droughts.
- Changes in the timing of migration and nesting could put some birds out of sync with the life cycles of their prey species.

Alternative A
Alternative A would have benefits against climate change because restoration and enhancement of tidal marsh would increase carbon sequestration.

Alternative B
Under Alternative B, increased habitat restoration, reduced carbon footprint (e.g., hybrid transportation, solar, wind technology), increased visitation would result in a positive impact on reducing climate change.

Alternative C
Under Alternative C, we would anticipate that further increases in habitat restoration, further reduced climate change impacts, and increased visitation would result in a moderate positive impact on climate change. Alternative C would have a slightly greater positive impact than Alternative B due to the implementation of the methods to reduce carbon footprint by developing further climate mitigation measures.

Environmental Justice

Executive Order 12898 ("Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations") requires all Federal agencies achieve environmental justice by "identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." Environmental justice is defined as the "fair treatment for peoples of all races, cultures, and incomes, regarding the development of environmental laws, regulations, and policies.

The mission of the Service is working with others to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people. The developing environmental justice strategy of the Service extends this mission by seeking to ensure that all segments of the human population have equal access to America's fish and wildlife resources, as well as equal access to information that will enable them to participate meaningfully in activities and policy shaping.

No minority and low-income populations or communities would be disproportionately affected by any of the alternatives. Outreach opportunities will be directed towards local minority and low-income populations. The Service has concluded that no disproportionately high and no adverse human health or environmental effects would result from any of the alternatives.

Cumulative Effects

Cumulative effects are those effects on the environment resulting from incremental consequences of the Service's proposed actions when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes those actions. Cumulative effects can be the result of individually minor impacts that can become significant when added over a period of time. It is difficult to accurately analyze cumulative effects because one action may increase or improve a resource in one area, while other unrelated actions may decrease or degrade that resource in another area. Moreover, CCP actions may be inhibited or accelerated by other activities or management plans occurring in the same area. This section assesses how these other activities and activities, in addition to the CCP actions, would affect the physical, biological, cultural, and social and economic environment.

Cumulative effects will take into account several ongoing projects where the Refuge is located. These projects are described in the CCP and include:

The San Pablo Bay Watershed Restoration Program. The U.S. Army Corps of Engineers, California Coastal Conservancy and the Bay Institute are working to restore 50,000 acres of wetlands to provide habitat for endangered species such as the California clapper rail (*Rallus longirostris obsoletus*) and the salt marsh harvest mouse (*Reithrodontomys raviventris halicoetes*). Also, tributary streams will provide valuable habitat for fish such as Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*), as well as other aquatic animals.

Sears Point Restoration Project. Sonoma Land Trust will restore the 2,300-acre site to tidal marsh, diked marsh, riparian, vernal pool, seasonal marsh, and grasslands. This project began in 2004 and is not slated for completion until 2012.

Napa-Sonoma Marsh Restoration Project. In 1994, the CDFG purchased about 9,000 acres of salt-making ponds from Cargill Salt Company. The State is planning to restore the historic wetlands upon which the salt ponds were originally built. In order to accomplish that goal, the salinity of several ponds needs to be reduced to levels that are harmless to fish and wildlife. The Bay Institute is working with the CDFG and the Sonoma County Water Agency to import reclaimed water from surrounding communities and use the water to dilute the salty ponds. This innovative approach not only will enable faster restoration of the marshes, but will also reduce the amount of discharge to the Bay from North Bay water treatment plants.

Petaluma Marsh Expansion. Sponsored by Marin Audubon Society, California State Coastal Conservancy, and Calfed. This project will restore approximately 100 acres of diked tidal marsh as part of 2,000 acres of Petaluma tidal marsh, the largest undiked tidal marsh remaining in the Bay. The project will benefit special status bird and fish species.

Sonoma Baylands Restoration. This 348-acre former diked farmland was returned to full tidal action in 1996 through a partnership with Sonoma Land Trust, the California State Coastal Conservancy, and the U.S. Army Corp of Engineers. The San Francisco Bay Trail runs along the levee top.

Cumulative Effects on the Physical Environment

All the alternatives are anticipated to enhance or restore the natural physical environment of the

Refuge to provide long-term benefit native wildlife and vegetation. The projects mentioned above, such as the Napa-Sonoma Marsh Restoration Project, will have added benefit of providing additional habitat for native wildlife and vegetation. However, the Refuge is surrounded by an increasingly urbanized area with impacts from not only agricultural activities, but also development pressure which could result in profound cumulative effects to the physical environment of the area. Any nearby developments, such as agriculture or other commercial activities, could have negative implications on the Refuge environment such as the introduction of invasive vegetation and contaminants. The Refuge has little control over these external impacts, but has and will continue to work with partners during their development planning process to protect important native habitat.

Cumulative Effects on Biological Resources

All proposed alternatives would have long-term benefits for native wildlife species and habitats within the area. The alternatives integrate wildlife conservation activities with compatible wildlife-dependent opportunities that would represent a cumulative benefit for local wildlife, native plant communities, and human communities.

The conversion of neighboring agricultural lands to tidal marsh, as mentioned in the projects above, could also result a positive cumulative effect to biological resources. The Napa-Sonoma Marsh Restoration Project occurring northeast of the Refuge has the potential to restore nearly 10,000 acres of tidal marsh and wetlands to the area. These former Cargill salt ponds will provide extensive habitat for endangered species, special status species, migratory waterfowl and shorebirds, and fish and other aquatic species. The project will most likely incorporate a broad, upland transition zone and may make use of the expansive, compacted former salt ponds for use as seasonal wetlands habitat. This project, along with the objectives described in the CCP will result in a positive net benefit to the ecosystem by restoring natural habitat for endangered species and migratory birds. Increased tidal wetlands restoration prescribed for both the CCP and Napa-Sonoma Marsh Restoration Project will also provide additional fish and invertebrate habitat for nursery and foraging. The activities will cumulatively support the goals of the Refuge and the region in restoring and conserving wildlife resources.

Visitor activities prescribed in the alternatives and other public access opportunities such as The Bay Trail (administered by the Association of Bay Area Governments) would result in increased visitation to the area. Refuge trails that permit bicycles will be included in the Bay Trail system. The Refuge will work with The Bay Trail staff to mitigate any potential disturbance and avoid sensitive habitat areas on the Refuge. Hunting on Refuge lands as well as hunting on neighboring California Department of Fish and Game lands is an existing activity that took place prior to the Refuge's establishment. The hunt season, type of waterfowl hunted, and hunt limits are regulated under State regulations. These regulations are designed to ensure that harvest does not reduce populations to unsustainable levels. Although hunting will result in direct loss of individuals, this activity is not expected to cause population-level changes in any of the hunted species. Moreover, the amount of hunting on the Refuge under any of the alternatives is not expected to substantially increase.

Cumulatively, these activities could potentially increase disturbance to wildlife and damage habitat. Some activities will be led by docents who will supervise visitors. Minimal fencing and signage will be placed near sensitive sites to deter visitors from disturbing wildlife.

Cumulative Effects on Cultural Resources

In general, the Service adheres to the policies and regulations pertaining to the protection of cultural resources in order to avoid or mitigate for any significant adverse effects resulting from management activities. No adverse effects on cultural resources are anticipated from any of the alternatives or other local activities. Increased funding will be needed for addressing increasing maintenance needs of the office structures that represent the farm aesthetic of the area.

Cumulative Effects on the Social and Economic Environment

The action alternatives, particularly those involving expansion of wildlife-dependent recreation and environmental education, would provide benefits to the residents of San Francisco. In addition, the environmental education and outreach programs would attempt to reach a diverse audience. Additional recreational opportunities in the form of hiking trails, fishing locations, and hunting outreach will act in concert with the Bay Trail and Water Trail systems.

Tourism dollars could be generated from the increased recreation opportunities. Local restaurants, stores, lodging and gas stations could benefit under any of the alternatives. Contract work may benefit the local economy, particularly grazing and haying activities contracted to a local farmer or rancher.

Table 2. Summary Impacts of Alternatives

	No Action	Alternative B **Develop an inventory and monitoring program; expand tidal restoration and enhancement activities; provide additional visitor access and limited environmental education**	Alternative C **Same as B; additionally, develop wildlife populations goals; expand environmental education and interpretation opportunities**
Physical Environment			
Hydrology	Minor impacts from higher velocity water flows, but long-term improved hydrological benefit	Additional hydrological benefits	Same as Alternative B
Water Quality/Contaminants	Minor impacts with increases in turbidity, but long-term positive benefit	Same as Alternative A	Same as Alternative A
Geology	Erosion from tidal restoration activities, but with long-term sedimentation benefits	Increased erosion due to additional restoration and construction activities, but with long-term sedimentation benefits	Same as Alternative B
Air Quality/Climate	Minor impacts from restoration activities	Increased minor impacts from additional restoration activities,	Same as Alternative B

		increased tailpipe emissions from increased visitors	
Hazardous Materials/Safety	No significant impact	No significant impact	Beneficial impact to public safety
Biological Environment			
Vegetation	Conversion of seasonal and emergent marsh wetlands to tidal habitat; beneficial impact to native plant communities	Additional beneficial improvements to native plant communities; minor impact due to wildlife-oriented activities	Same as Alternative B; minor impact due to public use and environmental education activities
Wildlife	Loss of habitat for upland species; beneficial impacts to tidal marsh species; minor disturbance and waterfowl mortality from hunting	Same as Alternative A; improved inventory and monitoring of species; minor impact due to wildlife-oriented activities	Same as Alternative B; minor impact due to public use and environmental education activities
Fish and Marine Invertebrates	Minor impact due to tidal restoration and fishing; beneficial impact due to increased habitat	Same as Alternative A; beneficial impact due to surveying and monitoring	Same as Alternative B ; beneficial impact due to developing conservation and restoration priorities
Endangered species	Beneficial impacts due to habitat restoration; minor disturbance due to habitat and tidal restoration	Same as Alternative A; improved inventory and monitoring of species	Same as Alternative B
Social and Economic Environment			
Recreation	Beneficial impact due to recreational opportunities	Beneficial impact due to additional recreational opportunities	Same as Alternative B
Economy	No significant impact	Minor beneficial impact due to increased staffing and contract needs, and increased visitation to area due to recreational activities	Same as Alternative B
Climate Change	Minor beneficial impact	Moderate beneficial impact	Same as Alternative B
Cultural Resources	No significant impact	No significant impact	No significant impact
Environmental Justice	No significant impact	No significant impact	No significant impact

Chapter 5. List of Planning Team Members and Persons Responsible for Preparing this Document

Giselle Block	U.S. Fish and Wildlife Service
Winnie Chan	U.S. Fish and Wildlife Service
Christy Smith	U.S. Fish and Wildlife Service

Chapter 6. Coordination, Consultation, and Compliance

Agency Coordination and Public Involvement

The draft CCP and EA were prepared with the involvement of technical experts, community groups, and private citizens. The Service has invited and continues to encourage public participation through planning updates and public comment periods.

Notice of Intent

A Notice of Intent to prepare a CCP for San Pablo Bay NWR was published in the Federal Register on July 26, 2006.

Environmental Review and Consultation

As a federal agency, the Service must comply with provisions of NEPA. An EA was developed to evaluate reasonable alternatives that would meet stated goals and assess the possible environmental, social, and economic impacts on the human environment. This EA serves as the basis for determining whether implementation of the preferred alternative would result in a federal action significantly affecting the quality of the environment. The EA also acts as a vehicle for consultation with other government agencies and interface with the public in the decision-making process.

Other Federal Laws, Regulations, and Executive Orders

In undertaking the preferred alternative, the Service would comply with the following federal laws, Executive Orders (EOs), and legislative acts: Intergovernmental Review of Federal Programs (EO 12372); Archaeological Resources Protection Act of 1979, as amended; Fish and Wildlife Act of 1956; Fish and Wildlife Conservation Act of 1980 (16 USC 661-667e); Fish and Wildlife Improvement Act of 1978; Endangered Species Act of 1973 (16 USC 1531 et seq.); National Environmental Policy Act of 1969; Federal Noxious Weed Act of 1990; National Historic Preservation Act of 1966, as amended; National Wildlife Refuge System Improvement Act of 1997; Antiquities Act of 1906; Protection and Enhancement of the Cultural Environment (EO 11593); Archaeological and Historic Preservation Act of 1974 (PL 93-291; 88 STAT 174; 16 USC 469); Environmental Justice (EO 12898); Management and General Public Use of the National Wildlife Refuge System (EO 12996); Refuge Recreation Act of 1962, as amended; Invasive Species (EO 13112); Migratory Bird Treaty Act of 1918, as amended (MBTA); and Responsibilities of Federal Agencies to Protect Migratory Birds (EO 13186).

Distribution and Availability

The draft CCP and EA has been sent to various agencies, organizations, community groups, and individuals for review and comment. Copies of this EA are available from the San Pablo Bay NWR, 7715 Lakeville Highway, Petaluma, CA, 94954 (phone 707/769 4200, and San Francisco Bay National Wildlife Refuge Complex, 1 Marshlands Road, Newark, CA, 94536 (phone 510/792 0222).

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Appendix D. Compatibility Determinations

Compatibility determinations are available for:

- Research
- Haying
- Livestock Grazing
- Wildlife Observation and Photography
- Environmental Education and Interpretation
- Hunting
- Fishing
- Recreational Boating
- Bicycling

Compatibility Determination for Research and Monitoring on San Pablo Bay National Wildlife Refuge

Uses: Research and Monitoring

Refuge Name: San Pablo Bay National Wildlife Refuge, Solano and Sonoma Counties, California

Establishing and Acquisition Authorities:
Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d)
Act Authorizing the Transfer of Certain Real Property for Wildlife (16 U.S. C. 667b)
Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, Stat 884)

Refuge Purpose(s):
San Pablo Bay NWR purposes include:

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. 715d (Migratory Bird Conservation Act),

"... particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes), and

"... 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 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):
Research and monitoring are integral parts of National Wildlife Refuge management. Two provisions of the 1997 Refuge Improvement Act are to "maintain biological integrity, diversity and environmental health" and to conduct "inventory and monitoring." Plans and actions based on research and monitoring provide an informed approach, which analyzes the management effects on refuge wildlife.

Research and Monitoring
Research and monitoring by individuals and organizations other than Service staff is currently conducted on the Refuge. For example, a current study is evaluating the impacts to endangered species on the Refuge in relation to climate change and sea level rise with management implications. Priority would be given to research that contributes to the enhancement, protection, preservation and management of migratory birds, habitat and wildlife on the Refuge. Research proposals would be reviewed by Refuge staff and conservation partners, as appropriate. If the proposal is approved, a special use permit (SUP) would be issued by the refuge manager.

Research proposals would be assessed based on criteria including, but not limited to:

- Research that will contribute to specific Refuge management challenges, CCP goals, or purposed for which the Refuge was established;
- Research designed to minimize disturbance to the wildlife and habitat on the Refuge as well as the surrounding human environment;
- Research that will conflict with other ongoing research, monitoring, or management programs will not be granted;
- Research that can be accomplished off-Refuge are less likely to be approved;
- Research which causes exceptional disturbance to wildlife or undue habitat degradation will not be granted;
- If staffing or logistics make it impossible for the Refuge to monitor research activity in a sensitive areas, proposal will not be granted; and
- Length of proposed research; research would not be allowed to be conducted open-ended and will be reviewed annually.

Availability of Resources:
Some staff time would be required to review research requests and manage research activities. However, refuge staff would not be expected to commit weekly staff time to managing this use. Oversight and review of proposals, study plans, and reports require an estimated $5,000 in staff time. Approving proposals will also be based upon available staff to monitor the research. Currently, limited staffing exists to monitor projects and compliance of research projects. Other than staff time, no special equipment, facilities, or improvements are necessary to support this proposed use.

Anticipated Impacts of the Use(s):
Expected short-term benefits to conducting research activities at the Refuge could include long-term benefits to management of habitat and wildlife populations. Monitoring of wildlife and habitat on the Refuge would provide feedback on the effectiveness of activities taking place. Some level of disturbance is also expected from this use because they could occur in sensitive areas and may involve collecting samples or handling wildlife. Sensitive periods, such as nesting season, will be avoided. Individual animals may be temporarily flushed from their habitat. In addition, native vegetation, rare plants and newly planted native seedlings may be trampled. Non-native plants may also be introduced through researchers' clothing, footwear, and equipment.

Overall, proper review and approval of appropriate research proposals should result in limited disturbance to wildlife and habitat, while resulting in maximum benefit to refuge management and scientific data on the San Francisco Bay Area ecosystem.

Public Review and Comment:
Public review and comments will be solicited in conjunction with distribution of the Draft CCP for San Pablo Bay NWR. The public will be provided at least 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 Stipulations

Stipulations Necessary to Ensure Compatibility:
Wildlife and habitat monitoring and studies will follow accepted protocols and regulations. Highly intrusive or manipulative research is generally not permitted, in order to protect wildlife and habitat. All researchers will be required to engage in procedures that will limit transport of non-native species onto the Refuge.

Justification:
Wildlife habitat research and monitoring are needed to understand impacts of all management activities on the Refuge. After assessing the potential impacts from the uses proposed for the Refuge, we have found that allowing these uses would not materially interfere with or detract from the purposes for which the refuge was created or the mission of the National Wildlife Refuge System.

Mandatory Reevaluation Date (provide year):

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

___X___ Mandatory 10-year Reevaluation Date (for all uses other than priority public uses)

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

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

Refuge Determination

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager: _____ _____
(Signature) (Date)

Project Leader Approval: _____ _____
(Signature) (Date)

Concurrence
Refuge Supervisor _____ _____
(Signature) (Date)

Assistant Regional
Director, Refuges _____ _____
(Signature) (Date)

Compatibility Determination for Research and Monitoring

Compatibility Determination for Haying on San Pablo Bay National Wildlife Refuge

Uses: Haying

Refuge Name: San Pablo Bay National Wildlife Refuge, Solano and Sonoma Counties, California

Establishing and Acquisition Authorities:
Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d)
Act Authorizing the Transfer of Certain Real Property for Wildlife (16 U.S. C. 667b)
Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, Stat 884)

Refuge Purpose(s):
San Pablo Bay NWR purposes include:

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. 715d (Migratory Bird Conservation Act),

"... particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes), and

"... 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 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):
Agriculture is a large part of the history of the northern San Francisco Bay region. Haying is currently conducted on the Sears Point unit and administered through a lease by Sonoma Land Trust and a local cooperator. Although haying is not identified as a wildlife-dependent public use by the National Wildlife Refuge System Improvement Act of 1997, haying will allow the Refuge to manage seasonal wetland habitats on the Refuge for the benefit of wildlife and native plants. Wildlife habitat values for amphibians (such as the red-legged frog (*Rana aurora draytonii*)), reptiles, birds, mammals and insects (native pollinators) will be improved through wetland enhancements and haying, a few of the tools used to manage the developing landscape. The program is needed to discourage the growth of non-native vegetation and provide seasonal winter habitat. Haying practices currently in place on the Sears Point property produce oat hay. The Sears Point property is currently being proposed for acquisition to the Refuge. Upon acquisition of this property, haying may be continued upon transfer through partnering with a contractor under a cooperative agreement, memorandum of understanding, or special use permit (SUP).

Due to the seasonal timing of planting and harvesting, the current haying program provides an open area free of non-native, invasive weed species throughout the winter months. Haying is

conducted through the summer growing season and is left fallow during the winter. Winter rainfall accumulates within the farmed area providing open, shallow wetland habitat for a variety of shorebirds, waterbirds and native seasonal wetland plants. Continuing haying practices would control non-native species. Haying practices would involve mechanical and limited pesticide chemical use to control non-native weeds. A habitat management plan would be developed to guide haying frequency, wetland enhancements, soil stabilization, and other elements. The plan will be adaptive due to the uncertainties of annual and seasonal precipitation and temperatures, and their consequent affect on vegetation growth. This is to insure that expected conditions are met and that refuge vegetation is neither over- or under-farmed—as both conditions result in degraded habitat.

Availability of Resources:
Actual haying activities would be conducted by contractors/permittees. Existing staffing could provide interim supervision to continue haying activites when management of Sears Point in transferred. However, a biologist/range conservationist and biological technician (positions shared with Antioch Dunes NWR) will be needed to provide long-term management including developing the habitat management plan, implementing plan actions, and monitoring. Other than staff time, no special equipment, facilities, or improvements are necessary to support this proposed use.

Item	One-Time Cost	Annual Costs
Biologist/Range Conservationist (0.25 FTE)	$21,000	$21,000
Biological technician (0.25 FTE)	$14,000	$14,000
TOTAL	$35,000	$35,000

Anticipated Impacts of the Use(s):
Haying will result in short-term disturbances and long-term benefits to both resident and migratory wildlife using the Refuge. Short-term impacts will include disturbance and displacement by haying operations. Haying activities will also result in short-term loss of habitat for species using those areas for nesting, feeding, or resting. Long-term benefits are positive with the ultimate goal of limiting non-native vegetation and encouraging the establishment native grassland and seasonal wetland communities communities. The resulting habitat will improve conditions for most of the species adversely affected by the short-term negative impacts. Control of the timing of haying will limit anticipated impacts.

Haying may result in several positive and negative effects such as removal of native plants and temporary disturbance to wildlife. Expected short-term benefits to continuing the haying program at Sears Point include maintenance of existing habitat and wildlife populations, especially control of non-native vegetation. Haying will provide habitat for migratory bird species, as the Refuge is located on the Pacific Flyway. Haying operations can reduce vegetation cover and bury plant matter, which benefits shorebirds, while controlling non-native invasive weeds (Rivers et al. 2001). Sensitive native plants will be avoided when possible.

Additional long-term effects could include expanding the knowledge base of habitat and wildlife of the larger San Francisco Bay Area through partnering, monitoring, experimentation and modification of haying practices. Biological monitoring of haying practices would provide feedback on the effectiveness of activities and benefits for native wildlife and plants, particularly rare plants. This information may in turn be used to encourage neighboring local farmers to use

methods to provide habitat for native wildlife and plants. Modifications made through adaptive management and best management practices on the Refuge may produce greater habitat benefits over time. Overall, maintenance and enhancement of habitat through haying practices coupled with other vegetation restoration/enhancement programs should result in maximum benefits to humans, wildlife and habitat producing a more diverse landscape on the tidal marsh rim.

Potential impacts of haying activities on the Refuge's resources will be minimized with guidance from a habitat management plan and monitoring by refuge staff. The refuge staff will ensure that haying contributes to the enhancement, protection, conservation, and management of native Refuge wildlife populations and their habitats, thereby helping the Refuge fulfill the purposes for which it was established, the mission of the National Wildlife Refuge System, and the need to maintain biological integrity, diversity, and environmental health of the ecosystem.

Public Review and Comment:
Public review and comments will be solicited in conjunction with distribution of the Draft CCP for San Pablo Bay NWR. The public will be provided at least 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 Stipulations

Stipulations Necessary to Ensure Compatibility:
Haying will be guided by a habitat management plan developed by refuge staff, and will be permitted in accordance with a cooperative agreement, memorandum of understanding, or SUP. Terms for conducting the activity shall be identified such as timing, location, access, personnel, and equipment allowed. Haying will be conducted during daylight hours only. Any property damage to the Refuge as a result of the contractor's activities will be mitigated or compensated by the contractor. Haying will not be allowed in sensitive natural areas or known cultural resource sites. Haying will follow accepted protocols and regulations of the Refuge system including current Service policy regarding chemical pesticide use (Integrated Pest Management) as well as additional requirements, such as timing restrictions for haying, and consideration of no-till haying, put forth through cooperative agreements, memorandum of understanding and special use permits. Other best management practices such as cleaning the machinery prior to activities to prevent the spread of invasive will also be considered.

Justification:
After assessing the potential impacts from the use proposed on Sears Point we have found that allowing this use would not materially interfere with or detract from the purposes for which the refuge was created or the mission of the National Wildlife Refuge System. The program is necessary as a refuge management activity to discourage the growth of non-native habitat and provide seasonal winter habitat.
Haying will directly benefit and support Refuge goals, objectives, and management plans and activities. Populations of fish, wildlife, plants, and their habitat will improve through vegetation management which will result in short-term and long-term reductions of non-native invasive plant

species, increases in native plants, increases in biomass, improved foraging conditions for migratory birds and local deer herds, and long-term improved nesting conditions for some species. Consequently, the haying program would increase or maintain the biological integrity, diversity, and environmental health of the Refuge. The wildlife-dependent, priority public uses (i.e., wildlife observation, photography, environmental education, and interpretation) would also benefit as a result of the increased biodiversity, wildlife, and native plant populations from improved habitat conditions associated with the haying program.

Mandatory Re-Evaluation Date:

_____ Mandatory 15-year Re-Evaluation (for priority public uses)

___X___ Mandatory 10-year Re-Evaluation, (for all uses other than priority public uses)

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

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

References Cited:

Rivers, J.W., T.T. Cable AND C. Lee. 2001. Seasonal avian use of farmed Kansas wetlands. Kansas State Univ. Experiment Sta. and Coop. Extension Service, Manhattan. SRP 863.

Refuge Determination

Prepared by:	_____ (Signature)	_____ (Date)
Refuge Manager:	_____ (Signature)	_____ (Date)
Project Leader Approval:	_____ (Signature)	_____ (Date)
Concurrence Refuge Supervisor	_____ (Signature)	_____ (Date)
Assistant Regional Director, Refuges	_____ (Signature)	_____ (Date)

Compatibility Determination for Livestock Grazing on San Pablo Bay National Wildlife Refuge

Uses: Livestock Grazing

Refuge Name: San Pablo Bay National Wildlife Refuge, Solano and Sonoma Counties, California

Establishing and Acquisition Authorities:
Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d)
Act Authorizing the Transfer of Certain Real Property for Wildlife (16 U.S. C. 667b)
Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, Stat 884)

Refuge Purpose(s):
San Pablo Bay NWR purposes include:

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. 715d (Migratory Bird Conservation Act),

"... particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes), and

"... 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 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):
Grazing is currently conducted on Sears Point annual grasslands to provide some wildlife habitat values, maintain agriculture on the site, and reduce non-native, invasive vegetation as well as for beef production. This history of grazing on this property extends over 100 years. Contingent upon transfer of Sears Point into the Refuge System, grazing will likely be continued in order to accommodate native grassland enhancements as well as to discourage non-native invasive plants and improve hydrology of the site. Wildlife habitat values for amphibians (such as red-legged frogs (*Rana aurora draytonii*)), reptiles, birds, mammals and insects (native pollinators) will be improved through grassland enhancements and grazing will be one of several tools used to manage the newly developing landscape. Grazing is currently administered by Sonoma Land Trust with a livestock cooperator under a five-year lease agreement. After transfer, grazing would continue to the lease expiration under a refuge special use permit.

If a grazing program is retained, it would be continued by the Refuge under a habitat management plan, refuge special use permit and/or a cooperative land agreement or memorandum of understanding. The habitat management plan will address soil erosion.

Provisions for habitat objectives, expected wildlife benefits, facility maintenance, and pest control damages, remedies, operating rules and laws and reporting requirements would be addressed in the permit or agreement. An annual grazing plan would be developed to identify grazing objectives (primary target weed and/or primary native species or taxa), prescribe expected conditions (vegetation height and composition), date by which expected conditions are to be met, livestock turn-in/turn-out dates and Animal Unit Months (AUM). The specific dates are determined by the refuge manager through consultation with the refuge range conservationist, cooperative extension specialist and cooperator to develop a strategy that meets target objectives. Grazing will likely be conducted as a seasonal rotation operation with at least one pasture resting during part or all of a year.

The habitat management plan would be adaptive due to the uncertainties of annual and seasonal precipitation and temperatures, and their consequent affect on vegetation growth. This is to insure that expected conditions are met and that refuge vegetation is neither over-grazed nor under-grazed—both conditions result in degraded habitat.

Availability of Resources:
Existing staffing could provide interim supervision to continue grazing activites when management of Sears Point in transferred. Additional Service staff will be necessary to provide long term management of this use. A biologist/range conservationist and biological technician (positions shared with Antioch Dunes NWR) will be needed to develop and implement the habitat management and annual grazing plans for the Sears Point unit. Infrastructure (e.g., fence, loading dock) will be needed to contain livestock.

Item	One-Time Cost	Annual Costs
Biologist/Range Conservationist (0.25 FTE)	$21,000	$21,000
Biological technician (0.25 FTE)	$14,000	$14,000
Replace and maintain existing infrastructure (fence, waterline, loading dock)	$5,000	$2,000
TOTAL	$40,000	$37,000

Monitoring will be addressed in the annual grazing plan. During the interim period, grazing would be conducted under a refuge special use permit. Typically a user fee is charged through a special use permit to cover the direct and indirect costs to the refuge carrying out the grazing program. However, the Refuge may or may not charge a user fee, depending on the scope of in-kind services provided by the permittee. The scope of in-kind services would be determined during the annual grazing plan meeting.

Currently, refuge operational funds are sufficient to complete the construction of a safer handling/loading facility for the rancher to use and for the interim administration costs of the program. If grazing is continued past the interim period, funds will be needed to replace and maintain the current fencing and corral system. Alternatively, a user fee may be charged to assist in supporting these costs, or these features may be replaced through in-kind services.

Anticipated Impacts of Use:
California annual grasslands have one of the longest livestock grazing histories of the western range types beginning during the seventeenth century with Spanish settlements (Holechek et.al.

1989). Original vegetation on this range type was comprised primarily of cool-season bunchgrasses (Holechek et. al 1989). These grasslands thrived with native ungulates such as elk, bison, deer and pronghorn. However, intensive grazing management practices using domestic animals over the past century have eliminated most of the native perennial grasses and plants and replaced them with cool season non-native species. These non-native species are persistent and out-compete native plant species. Removal of domestic grazers often results in the release of undesirable weed species such as pepperweed, yellow star thistle, and artichoke thistle and does not eliminate the non-native species being grazed. Vernal pools and an associated high diversity of some native plants still occur on the Sears Point site (John Brosnan, pers. comm.) with a grazing regime in place. Therefore, it is compatible with the refuge purposes to continue a grazing regime (Marty 2006). The use of well-timed and managed grazing, along with other mechanical and chemical treatments, is an effective tool to control non-native weeds, reduce biomass build up and stimulate growth of native grasses and plants (Hayes And Holl 2003, Menke 1992). Grazing can reduce thatch build up and competition from non-native plants so that seeding with native grass and forb species will be more successful. One goal of managing the Sears Point property is to re-establish native grassland plants and animals to the site, possibly including the endangered red-legged frog (*Rana aurora draytonii*) and California tiger salamander (*Ambystoma californiense*). Short-term grazing strategies carefully manipulated to improve habitat for endangered species may be a useful tool for managing habitat where prescribed burning is difficult to apply (Matlaga 2000) such as Sears Point.

While grazing may provide a good tool to manipulate and manage vegetation without the use of fire, the impacts to soils through compaction and nutrient loading must also be considered. Some erosion is evident in the draws and waterways extending across the Sears Point property. It may be possible to reduce erosion and other soil impacts through grazing and other mechanical means. The Refuge will consult with soils and agriculture extension specialists to best determine soil impact remedies as part of the development of the habitat management plan. Certain remedies may include seasonal rotation of grazing, exclusion zones and distribution of watering units and mineral supplements.

Public Review and Comment:
Public review and comments will be solicited in conjunction with distribution of the Draft CCP for San Pablo Bay NWR. The public will be provided at least 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:

_____ Use is Not Compatible

___X___ Use is Compatible with Stipulations

Stipulations necessary to ensure compatibility:
The criteria for evaluating need for vegetation management, including grazing, will be determined during annual review of the grazing program. Special use permits or cooperative land management agreements would be written and administered as short-term agreements that can be easily amended. Grazing would be conducted in accordance with the habitat management plan, special use permits and/or any agreements developed. Grazing would not be allowed in sensitive

natural or cultural resource sites. Any potential impacts to refuge natural and cultural resources are identified during the annual review of the program. These impacts are also recorded in the annual grazing plan under associated projects. Measures to eliminate or reduce grazing impacts to refuge resources would be identified and monitored by the refuge manager and biologist. If grazing impacts could not be eliminated or reduced to sufficiently protect natural and cultural resources, then other techniques for vegetation management would be considered. In addition to stipulations outlined above, all refuge rules and regulations must be followed by the livestock grazing cooperator unless otherwise accepted in writing by the refuge manager.

Justification:
It is determined that grazing within the San Pablo Bay National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. Refuge livestock grazing coupled with a vegetation restoration/enhancement program will directly benefit and support refuge goals, objectives and management plans and activities. Fish, wildlife, plants and their habitat will improve through vegetation management which will result in short-term and long-term reductions of non-native invasive plant species, increases in native plants, increases in biomass, improved soil condition, improved foraging conditions for migratory birds and local deer herds, and long-term improved nesting conditions for some bird species.

Consequently, the livestock grazing program would complement other refuge efforts to increase or maintain biological integrity, diversity and environmental health. Other wildlife-dependent, priority public uses (wildlife viewing and photography, environmental education and interpretation) would also benefit as a result of increased biodiversity and wildlife and native plant populations from improved habitat conditions associated with the grazing program. In our opinion, grazing will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the Refuge.

Mandatory Re-Evaluation Date:

_____ Mandatory 15-year Re-Evaluation (for priority public uses)

__X__ Mandatory 10-year Re-Evaluation, (for all uses other than priority public uses)

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

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

References Cited:

Hayes, G.F. AND K.D. Holl. 2003. Cattle grazing impacts on annual forbs and vegetation composition of mesic grasslands in California. Conservation Biology 17:6 pp1694-1702.

Holechek, J.L., R.D. Pieper AND C.H. Herbel. 1989. Range Management: Principles and Practices. Prentice Hall, Englewood Cliffs, New Jersey. Pp 84-87.

Marty, J. 2006. Grazing effects on biodiversity and ecosystem function in California vernal pool grasslands. CAL-PAC Society for Range Management Symposium. 3 pages.

Matlaga, D. 2000. Three methods to measure the effects of cattle grazing on plant populations. Bulletin of the Native Plant Society of Oregon 33 (11):113-120.

Menke, J.W. 1992. Grazing and fire management for native perennial grass restoration in California grasslands. Fremontia 20(2):22-25.

Refuge Determination

Prepared by:	_____	_____
	(Signature)	(Date)
Refuge Manager:	_____	_____
	(Signature)	(Date)
Project Leader Approval:	_____	_____
	(Signature)	(Date)
Concurrence Refuge Supervisor	_____	_____
	(Signature)	(Date)
Assistant Regional Director, Refuges	_____	_____
	(Signature)	(Date)

Compatibility Determination for Livestock Grazing

Compatibility Determination for Wildlife Observation and Photography on San Pablo Bay National Wildlife Refuge

Uses: Wildlife Observation and Photography

Refuge Name: San Pablo Bay National Wildlife Refuge, Solano and Sonoma Counties, California

Establishing and Acquisition Authorities:
Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d)
Act Authorizing the Transfer of Certain Real Property for Wildlife (16 U.S. C. 667b)
Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, Stat 884)

Refuge Purpose(s):
San Pablo Bay National Wildlife Refuge (NWR) purposes include:

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. 715d (Migratory Bird Conservation Act),

"... particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes), and

"... 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 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 six priority public uses (the other uses are hunting, fishing, environmental education, and interpretation) promoted in the National Wildlife Refuge System Improvement Act of 1997.

Currently there is only one public access point for wildlife observation and photography on the San Pablo Bay NWR at the Tolay Creek/Lower Tubbs Island unit. A portion of the San Francisco Bay Trail is located on this unit and as such provides the visitor access to the San Pablo Bay via a 2.5-mile long dirt road that connects to levees that surround Tubbs Island. The trail has two kiosks and some interpretive material present but there is no staff to lead interpretive tours. Volunteers have occasionally lead tours on this trail, particularly during the annual three-day event known as the SF Bay Flyway Festival. The trail is on an easement from the neighboring land owner so the trail surface is not always maintained and is often impassable during high tide or rain events.

The Refuge proposes to provide additional access points throughout several Refuge units to observe and photograph wildlife and natural habitats as sites are acquired, restored or funding is made available. When a Visitor Services Plan is developed that defines activities at each site, a new compatibility determination will be completed. Once new sites are acquired and improvements implemented, anticipated public access (use) could increase as many as 5,000 additional visitors annually during the first few years with increasing visitor use expected annually thereafter.

A portion of the San Francisco Bay Trail currently exists on the Tolay Creek/Lower Tubbs Island portion of the Refuge. Compatible wildlife observation opportunities are allowed year-round along the trail if the trail is accessible. Additional wildlife viewing will be accommodated throughout the Refuge as access sites are developed. The first to be developed will be Cullinan Ranch and the Sears Point (office headquarters) location which are already within the refuge boundary. Future wildlife observation and photography opportunities are proposed at Guadalcanal, Sears Point, Skaggs Island, and Sonoma Baylands, once these sites are acquired. Year round accessible trails, non-motorized boat launch (at Cullinan Ranch unit), kiosks, interpretative panels, and entry/parking areas will be developed at all sites to provide safe access, describe land management issues/practices, describe restoration activities, and inform the public about any regulations appertaining to each site and of the wildlife or habitats that are present. No plans for photo blinds are being considered at this time, but will be considered as opportunity, funding and proposals are presented. Docent-led walking and non-motorized boat tours will be conducted to facilitate wildlife observation and photography in a compatible manner.

Availability of Resources:
Adequate funding and staffing exists to manage the existing wildlife observation and photography site at the Tolay Creek/Lower Tubbs Island unit. The existing program requires staff assistance from the San Francisco Bay NWR Complex headquarters in Fremont, California. Due to the distance and time that travel to and from the South Bay incurs there are few staff led tours or presentations conducted at San Pablo Bay NWR.

Additional staff and Service funding will be necessary to construct trails, entry/parking areas, interpretive panels, and kiosk materials at new locations on the Refuge to enhance observation and photography opportunities. Grants and other funding sources will be sought as well. Maintenance of the additional facilities will require a maintenance worker (position shared with Marin Islands NWR) for mowing, trail, kiosk and sign repair, and trash collection throughout the year, particularly during refuge events such as the Flyway Festival, Wildlife Refuge Week, and Migratory Bird Day. An outdoor recreation planner (position shared with Marin Islands and Antioch NWRs) would be needed to develop materials and infrastructure to facilitate safe and informative visitor experiences. Refuge law enforcement (position shared with Marin Islands and Antioch NWRs) would be needed to protect infrastructure and provide a safe visitor experience.

Item	One-Time Cost	Annual Costs
Interpretive Panels	$180,000 (6 sites)	$5,000
Kiosk Materials	$120,000 (6 sites)	$5,000
Trail construction	$350,000 (6 sites)	$1,000
Parking/entry area construction	$300,000 (6 sites)	$5,000
Maintenance Worker (0.1 FTE)	$7,500	$7,500

Outdoor Recreation Planner (0.2 FTE)	$13,500	$13,500
Refuge Law Enforcement (0.1 FTE)	$7,500	$7,500
TOTAL	$978,500	$44,500

Anticipated Impacts of the Use(s):
Impacts associated with wildlife observation and wildlife photography would be limited to areas on and adjacent to designated trails. Human activities along wildlife observation trails can reduce foraging or even cause waterbirds to avoid foraging habitats adjacent to the trails (Klein 1993), especially when it involves close proximity and/or fast-moving human activities (Burger 1981). However, more recently, Lafferty (2001) found that joggers caused fewer disturbances to wintering snowy plovers than walkers, whereas dogs and horses caused more disturbance than either human activity. Activities along trails tend to displace wildlife and can cause localized reduction in species richness and abundance (Riffell et al. 1996). In addition, nest predation tends to increase near more frequently utilized areas for songbirds (Miller et al. 1998), raptors (Glinski 1976), colonial nesting species (Buckley and Buckley 1978), and waterfowl (Boyle and Samson 1985).

Off-trail human activity in habitat restoration areas can slow restoration efforts through soil compaction, vegetation trampling, and introduction of invasive plants. Litter from visitors can harm wildlife or be ingested by wildlife. Federally-listed salt marsh harvest mice and California clapper rails occur on the Refuge and may occur in proposed visitor areas. Visitors will be discouraged from going off-trail into wetland areas where these species may be located.

Wildlife photography tends to have the greatest disturbance impacts of the two proposed uses (Klein 1993, Morton 1995, Dobb 1998). Even a slow approach by wildlife photographers tends to have behavioral consequences to wildlife species (Klein 1993). The explanation for these impacts includes the tendency for casual photographers, with low power lenses, to get much closer to their subject than other activities require (Morton 1995), and the potential of some photographers to remain close to wildlife for extended periods of time, in an attempt to habituate the wildlife subject to their presence (Dobb 1988). Regulatory signage will clearly mark sensitive areas closed to the public. Staff and informational signage will inform visitors of proper etiquette for taking wildlife photographs.

Public Review and Comment:
Public review and comments will be solicited in conjunction with distribution of the Draft CCP for San Pablo Bay NWR. The public will be provided at least 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 Stipulations

Stipulations Necessary to Ensure Compatibility:

Wildlife observation and photography would be allowed at all access sites, only between sunrise and sunset, unless they are part of a refuge-led activity. Public access would be restricted to trails and other developed facilities. Regulations would be enforced to ensure public safety and to prevent resource impacts. Regulatory signage will clearly mark sensitive areas closed to the public. Staff, brochures and signage will inform visitors of proper etiquette for taking wildlife photographs. Collection of plants, animals, and other specimens, debris, or artifacts would be strictly prohibited. Dogs will be permitted at the Cullinan Ranch/Pond 1 levee access site but must be kept on a leash. Information will be provided at Kiosks regarding any regulations or restrictions that pertain to the access site. Interpretive panels will describe the sensitivity of habitat or species found at each site.

Justification:
The National Wildlife Improvement Act of 1997 (Pub. L. 105-57) identifies six legitimate and appropriate uses of wildlife refuges: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. Where these uses have been determined compatible, they are to receive enhanced consideration over other uses in planning and management.

These uses have been determined compatible because wildlife observation and photography will not materially interfere with or detract from unit purposes. 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 highly urbanized San Francisco Bay area. The Refuge provides one of the few undisturbed, natural viewscapes of the Bay, and has the potential to attract a high number of visitors. With the stipulations considered in this compatibility determination, expanding wildlife observation and photography would be compatible with Refuge purposes and the System mission.

Mandatory Re-evaluation Dates (Provide Month and Year)

___X___ 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)

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

References Cited:

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Refuge Determination

Prepared by:	_____	_____
	(Signature)	(Date)
Refuge Manager:	_____	_____
	(Signature)	(Date)
Project Leader Approval:	_____	_____
	(Signature)	(Date)
Concurrence Refuge Supervisor	_____	_____
	(Signature)	(Date)
Assistant Regional Director, Refuges	_____	_____
	(Signature)	(Date)

Compatibility Determination for Environmental Education and Interpretation on San Pablo Bay National Wildlife Refuge

Uses: Environmental Education and Interpretation

Refuge Name: San Pablo Bay National Wildlife Refuge, Sonoma and Solano Counties, California

Establishing and Acquisition Authorities:
Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d)
Act Authorizing the Transfer of Certain Real Property for Wildlife (16 U.S. C. 667b)
Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, Stat 884)

Refuge Purpose(s):
San Pablo Bay NWR purposes include:

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. 715d (Migratory Bird Conservation Act),

"... particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes), and

"... 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 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 six priority public uses (the other uses are hunting, fishing, wildlife observation, and photography) promoted in the National Wildlife Refuge System Improvement Act of 1997.

The Refuge will conduct environmental education and interpretation opportunities for schools, families and the general public. Anticipated public use could include as many as 5,000 visitors annually during the first few years with increasing visitor use expected annually thereafter. Currently the refuge relies on environmental education-based activities through a partnership program with The Bay Institute. The Bay Institute brings children to the Refuge and other areas around the Refuge to learn about tidal marsh restoration and participate in stewardship activities. An estimated 980 and 650 participants took part in that program in 2008 and 2009, respectively.

Refuge staff would focus on on-site activities brings students out to the Refuge where they can connect with wildlife and habitat resources directly. Environmental education and interpretation activities will take place at the Sears Point, Sonoma Baylands, and Guadalcanal units. Programs

would include arranging activities at Refuge sites to develop an awareness and concern for Refuge's resource management issues including preservation of significant wildlife habitat, threatened and endangered species and migratory birds. Elements required for conducting the program include:

- Developing a refuge sites for staging field programs;
- Constructing a trail leading from the plant nursery at Sears Point to Sonoma Baylands; and
- Constructing entry/parking areas, interpretive panels, kiosks, and materials.

Some activities would be targeted towards adults such as docent-led interpretive walks once per month and docent-led kayak tours twice a year. Other programs would be targeted towards adults and families such as a garden education and volunteer program based from the greenhouse located at the headquarters on the Sears Point unit. These programs would promote direct habitat restoration on the Refuge and encourage use of native plants in the visitor's own backyards.

Availability of Resources:
Current infrastructure is not in place to provide an adequate environmental education program. The acquisition of new properties will be a critical component to developing this use. Also, Service funding will be necessary to construct program sites, trails, interpretive panels, kiosks, and other associated infrastructure. Although staff and volunteers provide intermittent interpretive walks on the Refuge, expanding these efforts to become regular events throughout the Refuge will require further staffing, funding, and volunteers.

Service funding will be necessary to construct program sites, trails, entry/parking areas, interpretive panels, and kiosk materials at the Sears Point, Sonoma Baylands, and Guadalcanal units to facilitate environmental education and interpretation activities. Grants and other funding sources will be sought as well. Maintenance of the additional facilities will require a maintenance worker (position shared with Marin Islands NWR) for mowing, trail, kiosk and sign repair, and trash collection throughout the year. An outdoor recreation planner (position shared with Marin Islands and Antioch NWRs) would be needed to develop the environmental education and interpretation program.

Item	**One-Time Cost**	**Annual Costs**
Program site	$60,000 (3 sites)	$2,500
Interpretive Panels and kiosk materials	$90,000 (3 sites)	$2,500
Trail construction	$350,000 (3 sites)	$1,000
Parking/entry area construction	$150,000 (3 sites)	$5,000
Maintenance Worker (0.1 FTE)	$7,500	$7,500
Outdoor Recreation Planner (0.2 FTE)	$13,500	$13,500
TOTAL	$671,000	$32,000

Anticipated Impacts of the Use(s):
Impacts associated with environmental education and interpretation would be limited to areas on and adjacent to designated trails. Most programs would also be supervised by Refuge staff or partners. Disturbance of wildlife is the primary concern regarding these uses. Disturbance to wildlife, such as the flushing of feeding, resting, or nesting birds, is inherent to these activities. There is some temporary disturbance to wildlife due to human activities on trails (hiking, bird watching) however, the disturbance is generally localized and will not adversely impact overall populations. Increased facilities and visitation would cause some displacement of habitat and increase some disturbance to wildlife, although this is expected to be minor given the size of the Refuges and by avoiding or minimizing intrusion into important wildlife habitat. Individual animals may be disturbed by human contact to varying degrees. Human activities on trails can result in direct effects on wildlife through harassment, a form of disturbance that can cause physiological effects, behavioral modifications, or death (Smith and Hunt 1995). Many studies have shown that birds can be impacted from human activities on trails when they are disturbed and flushed from feeding, resting, or nesting areas. Flushing, especially repetitive flushing, can strongly impact habitat use patterns of many bird species. Flushing from an area can cause birds to expend more energy, be deterred from using desirable habitat, affect resting or feeding patterns, and increase exposure to predation or cause birds to abandon sites with repeated disturbance (Smith and Hunt 1995). Migratory birds were observed to be more sensitive than resident species to disturbance (Klein 1989).

Herons and shorebirds were observed to be the most easily disturbed (when compared to gulls, terns and ducks) by human activity and flushed to distant areas away from people (Burger 1981). A reduced number of shorebirds were found near people who were walking or jogging, and about 50 percent of flushed birds flew elsewhere (Burger 1981). In addition, the foraging time of sanderlings decreased and avoidance (e.g., running, flushing) increased as the number of humans within 100 meters increased (Burger and Gochfeld 1991). Nest predation for songbirds (Miller et al. 1998), raptors (Glinski 1976), colonial nesting species (Buckley and Buckley 1976), and waterfowl (Boyle and Samson 1985) tends to increase in areas more frequently visited by people. In addition, for many passerine species, primary song occurrence and consistency can be impacted by a single visitor (Gutzwiller et al. 1994). In areas where primary song was affected by disturbance, birds appeared to be reluctant to establish nesting territories (Reijnen and Foppen 1994).

Depending on the species (especially migrants vs. residents), some birds may habituate to some types of recreation disturbance and either are not disturbed or will immediately return after the initial disturbance (Hockin et al. 1992; Burger et al. 1995; Knight and Temple 1995; Madsen 1995; Fox and Madsen 1997). Rodgers and Smith (1997) calculated buffer distances that minimize disturbance to foraging and loafing birds based on experimental flushing distances for 16 species of waders and shorebirds. They recommended 100 meters as an adequate buffer against pedestrian traffic, however, they suggest this distance may be reduced if physical barriers (e.g., vegetation screening) are provided, noise levels are reduced, and traffic is directed tangentially rather than directly toward birds. Screening may not effectively buffer noise impacts, thus visitors should be educated on the effects of noise and noise restrictions should be enforced (Burger 1981, 1986; Klein 1993; Bowles 1995; Burger and Gochfeld 1998). Seasonally restricting or prohibiting recreation activity may be necessary during spring and fall migration to alleviate disturbance to migratory birds (Burger 1981, 1986; Boyle and Samson 1985; Klein et al. 1995; Hill et al. 1997).

Education helps make visitors aware that their actions can have negative impacts on birds, and will increase the likelihood that visitors will abide by restrictions on their actions. For example, Klein (1993) demonstrated that visitors who had spoken with refuge staff or volunteers were less likely to disturb birds. Increased surveillance and imposed fines may also help reduce visitor caused disturbance (Knight and Gutzwiller 1995). Monitoring is recommended to adjust management techniques over time, particularly because it is often difficult to generalize about the impacts of specific types of recreation in different environments. Local and site-specific knowledge is necessary to determine effects on birds and to develop effective management strategies (Hockin et al. 1992; Klein et al. 1995; Hill et al. 1997). Informed management decisions coupled with sufficient public education could do much to mitigate disturbance effects of wildlife-dependent recreations (Purdy et al. 1987).

Environmental education and interpretation activities generally support the Refuges purposes and impacts can largely be minimized (Goff et al. 1988). The minor resource impacts attributed to these activities are generally outweighed by the benefits gained by educating present and future generations about refuge resources. Environmental education is a public use management tool used to develop a resource protection ethic within society. While it targets school age children, it is not limited to this group. This tool allows us to educate refuge visitors about endangered and threatened species management, wildlife management and ecological principles and communities. A secondary benefit of environmental education is that it instills an 'ownership' or 'stewardship' ethic in visitors and most likely reduces vandalism, littering and poaching. It also strengthens Service visibility in the local community.

The disturbance by environmental education activities is 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 instructed in etiquette while on the Refuge and the best ways to view wildlife with minimal disturbance; (3) education groups will be required to have a sufficient number of adults to supervise the group; and (4) activity areas will located away from sensitive wildlife habitat.

Education staff coordinates with biologists regarding activities associated with restoration or monitoring projects to ensure that impacts to both wildlife and habitat are minimal. As with any restoration and monitoring activities conducted by refuge personnel, these activities conducted by students would be at a time and place where the least amount of disturbance would occur. The environmental education and interpretation programs are designed to avoid or minimize impacts anticipated to the Refuges' resources and visitors.

Federally-listed species that may occur on the Refuge include California clapper rail, salt marsh harvest mouse, delta smelt, and soft bird's beak. No significant impacts are anticipated to these wetland and open bay species from environmental education and interpretation as visitors will be confined to established trails and monitored by staff.

Public Review and Comment:
Public review and comments will be solicited in conjunction with distribution of the Draft CCP for San Pablo Bay NWR. The public will be provided at least 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 Stipulations

Stipulations Necessary to Ensure Compatibility:
Environmental education and interpretation activities will be arranged in advance of visit and will have established limit on number of students, number of adult per students to supervise, and will include orientation on proper refuge etiquette. Activities would be allowed only between sunrise and sunset, unless they are part of a refuge-led activity. Activities would be restricted to established trails and designated sites. Regulations would be enforced to insure public safety and to prevent resource impacts. The Refuge and partners will work closely with visiting school groups either prior to or during visits to explain designated learning sites and offer guidance on appropriate lessons and group activities to ensure compatibility. Interpretation programs will be monitored to ensure compatibility.

Justification:
The National Wildlife Improvement Act of 1997 (Pub. L. 105-57) identifies six legitimate and appropriate uses of wildlife refuges: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. Where these uses have been determined compatible, they are to receive enhanced consideration over other uses in planning and management.

These uses have been determined compatible because environmental education and interpretation will not materially interfere with or detract from unit purposes. Environmental education and interpretation would allow school groups and the visiting public to enjoy, experience, and learn about native fish, wildlife, and plants in these unique and rare habitats of the northern San Francisco Bay area. Environmental education and interpretation promotes awareness and knowledge of fish and wildlife resources, and would be balanced to ensure that wildlife species receive priority consideration when evaluating public access opportunities.

Mandatory Reevaluation Date (provide year):

___X___ 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):

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

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Refuge Determination

Prepared by: _____ _____

(Signature) (Date)

Refuge Manager:	_____	_____
	(Signature)	(Date)
Project Leader Approval:	_____	_____
	(Signature)	(Date)
Concurrence Refuge Supervisor	_____	_____
	(Signature)	(Date)
Assistant Regional Director, Refuges	_____	_____
	(Signature)	(Date)

Compatibility Determination for Environmental Education and Interpretation

Compatibility Determination for Recreational Hunting on San Pablo Bay National Wildlife Refuge

Use: Recreational Hunting

Refuge Name: San Pablo Bay National Wildlife Refuge, Solano and Sonoma Counties, California.

Establishing and Acquisition Authorities:
Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d)
Act Authorizing the Transfer of Certain Real Property for Wildlife (16 U.S. C. 667b)
Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, Stat 884)

Refuge Purpose(s):
San Pablo Bay NWR purposes include:

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. 715d (Migratory Bird Conservation Act),

"... particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes), and

"... 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 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):
Recreational hunting for waterfowl and pheasant is an existing use that has occurred prior to the Refuge's establishment. Hunting was opened on the Refuge in the 1980s and is regulated under the Code of Federal Regulations and California Department of Fish and Game laws. A Recreational Hunt Plan was developed in 1986. The Refuge's hunt program complies with the Code of Federal Regulations Title 50, 32.24 and will continue to be managed in accordance with Service Manual 605 FW2. Hunting is one of six priority public uses (the other uses are fishing, wildlife observation, photography, environmental education, and interpretation) promoted in the National Wildlife Refuge System Improvement Act of 1997. The Draft Comprehensive Conservation Plan contains a map (Figure 8) indicating where hunting is allowed.

The principles of Service Manual 605 FW 2 (the Refuge System's hunting program) are to:

- manage wildlife populations consistent with Refuge System-specific management plans approved after 1997 and, to the extent practicable, State fish and wildlife conservation plans;

- promote visitor understanding of and increase visitor appreciation for America's natural resources;
- provide opportunities for quality recreational and educational experiences consistent with criteria describing quality found in 605 FW 1.6;
- encourage participation in this tradition deeply rooted in America's natural heritage and conservation history; and
- minimize conflicts with visitors participating in other compatible wildlife-dependent recreational activities.

Under the existing lease with California State Lands Commission (SLC), the Service is encouraged to allow "... waterfowl hunting and fishing … unless it is determined after consultation with the State of California Department of Fish and Game that the area be closed because of the public safety, for waterfowl resource protection, or for administrative purposes." The original lease language is based upon the historic "Public Trust" doctrine, which requires that State-owned tidelands remain open to "commerce, navigation and fisheries." Courts have ruled that the Public Trust also includes the right to hunt. The existing lease requirement with SLC (since 1980) is consistent with the National Wildlife Refuge System Administration Act of 1997, which recommends promoting hunting and fishing as "priority public uses", when found compatible with the purposes for which that refuge was established.

Waterfowl (primarily scaup, canvasback, and other diving ducks) hunting will continue to be allowed from boat access only within approximately 8,200 acres of the Refuge consisting of open waters and navigable sloughs of northern San Pablo Bay. The hunt season varies year to year. As an example, the 2009-2010 hunt season specifies the following:

- Duck and geese hunt: begins the fourth Saturday in October extending for 100 days with a daily bag limit of 7 (8 for geese).
- Scaup hunt: begins the first Saturday in November extending for 86 days with a daily bag limit of 7.
- Hunting is allowed within the open bay and navigable sloughs from a boat on a daily basis.

Hunters may access the open waters and navigable sloughs from boat ramp facilities located in Vallejo and on the Petaluma River. No Special Use Permit is required to hunt waterfowl on the Refuge. Temporary floating blinds may be placed in the open waters or navigable sloughs at the beginning of the hunting season but must be removed by February 1 each year. Blinds placed on the Refuge are a first come first serve basis regardless of ownership. See Code of Federal Regulations and California Department of Fish and Game regulations for additional hunting regulations.

Upland game hunting of domesticated pheasant escapees by foot for the month of December is permitted at a portion of the Tolay Creek unit (less than one acre area).

Field checks by refuge law enforcement officers will be planned, conducted, and coordinated with state game wardens to ensure compliance with state and federal regulations. Dogs will be required to be kept on leash, except when engaged in authorized hunting activities and under the direct control of a licensed hunter.

This use will be implemented in a manner to insure protection for endangered species and migratory birds. The Comprehensive Conservation Plan includes an objective to revise the existing 1986 Recreational Hunt Plan within five years of the Plan's completion.

Availability of Resources:
Additional staffing and funding is needed to improve outreach and management of the hunt activities proposed on the Refuge. An outdoor recreation planner (position shared with Marin Islands and Antioch NWRs) would be needed to develop the hunt outreach program. A Refuge law enforcement officer (position shared with Marin Islands and Antioch NWRs) would also be needed to improve outreach with hunters. Service funding will be necessary for developing brochures and signage to improve outreach.

Item	One-Time Cost	Annual Costs
Outdoor Recreation Planner (0.1 FTE)	$7,000	$7,000
Refuge Law Enforcement (0.1 FTE)	$7,500	$7,500
Brochures, signage	$5,000	$1,000
TOTAL	$19,500	$15,500

Anticipated Impacts of the Use(s):
Direct effects of hunting include mortality, wounding, and disturbance (De Long 2002). Hunting can alter behavior (e.g., foraging time), population structure, and distribution patterns of wildlife (Owens 1977, Raveling 1979, White-Robinson 1982, Thomas 1983, Bartelt 1987, Madsen 1985, and Cole and Knight 1990). There also appears to be an inverse relationship between the numbers of birds using an area and hunting intensity (DeLong 2002). In Connecticut, lesser scaup were observed to forage less in areas that were heavily hunted (Cronan 1957). In California, the numbers of northern pintails on Sacramento Refuge non-hunt areas increased after the first week of hunting and remained high until the season was over in early January (Heitmeyer and Raveling 1988). Following the close of hunting season, ducks generally increased their use of the hunt area; however, use was lower than before the hunting season began. Human disturbance associated with hunting includes loud noises and rapid movements, such as those produced by shotguns and boats powered by outboard motors. This disturbance, especially when repeated over a period of time, compels waterfowl to change food habits, feed only at night, lose weight, or desert feeding areas (Madsen 1995, Wolder 1993).

These impacts can be reduced by the presence of adjacent sanctuary areas where hunting does not occur and where birds can feed and rest relatively undisturbed. Sanctuaries or non-hunt areas have been identified as the most common solution to disturbance problems caused from hunting (Havera et al. 1992). Prolonged and extensive disturbances may cause large numbers of waterfowl to leave disturbed areas and migrate elsewhere (Madsen 1995, Paulus 1984). In Denmark, hunting disturbance effects were experimentally tested by establishing two sanctuaries (Madsen 1995). Over a 5-year period, these sanctuaries became two of the most important staging areas for coastal waterfowl. Numbers of dabbling ducks and geese increased 4 to 20 fold within the sanctuary (Madsen 1995). Thus, sanctuary and non-hunt areas are very important to minimize disturbance to waterfowl populations to ensure their continued use of the Refuge.

Intermittent hunting can be a means of minimizing disturbance, especially if rest periods in between hunting events are weeks rather than days (Fox and Madsen 1997). It is common for

refuges to manage hunt programs with non-hunt days. At Sacramento Refuge, 3-16 percent of pintails were located on hunted units during non-hunt days, but were almost entirely absent in those same units on hunt days (Wolder 1993). In addition, northern pintails, American wigeons, and northern shovelers decreased time spent feeding on days when hunting occurred on public shooting areas, as compared to non-hunt days (Heitmeyer and Raveling 1988). The intermittent hunting program of three hunt days per week at Sacramento Refuge results in lower pintail densities on hunt areas during non-hunt days than non-hunt areas (Wolder 1993). However, intermittent hunting may not always greatly reduce hunting impacts.

The impacts addressed here are discussed in detail in the EA (Appendix C) for the Draft CCP (USFWS 2010) which is incorporated by reference.

Hunting is a highly regulated activity, and generally takes place at specific times and seasons (fall and winter) when the game animals are less vulnerable, reducing the magnitude of disturbance to refuge wildlife. Managed and regulated hunting will not reduce species populations to levels where other wildlife-dependent uses will be affected.

The use of retrieving dogs would be permitted and encouraged in all areas open to waterfowl hunting. These dogs would be required to be under control at all times. Law enforcement officers will enforce regulations requiring owners to maintain control over their dogs while on the Refuge. Although the use of dogs is not a form of wildlife-dependent recreation; they do in this case support a wildlife-dependent use. Implementing the prescribed restrictions outlined in the Stipulations section should alleviate any substantial impacts.

Hunting is an appropriate wildlife management tool that can be used to manage wildlife populations. Some wildlife disturbance will occur during the hunting seasons. Proper zoning, regulations, and Refuge seasons will be designated to minimize any negative impacts to wildlife populations using the Refuge. Harvesting these species, or any other hunted species, would not result in a substantial decrease in biological diversity on the Refuge.

By its very nature, hunting has very few positive effects on the target species while the activity is occurring. However, in our opinion, hunting has given many people a deeper appreciation of wildlife and a better understanding of the importance of conserving their habitat, which has ultimately contributed to the Refuge System mission. Furthermore, despite the potential impacts of hunting, a goal of the Refuge is to provide visitors of all ages an opportunity to enjoy wildlife-dependent recreation. Of key concern is to offer a safe and quality program and to ensure adverse impacts remain at an acceptable level.

Recreational hunting will remove individual animals, but will not negatively affect waterfowl populations. Pheasant hunting will result in the direct loss of pheasants, but this domesticated species is not managed by the Refuge or by the State and originate from a nearby hunt club. To assure that waterfowl populations are sustainable, the California Fish and Game Commission, in consultation with the CDFG, annually review the population censuses to establish season lengths and harvest levels. The areas closed to various hunting activities do provide adequate sanctuaries for wildlife.

Hunters also may trespass into sensitive habitats. Hunting beyond the open bay waters or navigable sloughs in non-designated sites, into the interior of the marsh or other restricted areas

would result in disturbance to endangered species such as the salt marsh harvest mouse (*Reithrodontomys raviventris raviventris*) and California clapper rail (*Rallus longirostris*), as well as shorebirds, wading birds, and songbirds. The Service will protect these habitats and resources with signage and hunting brochures to increase hunter awareness. Restrictions will be enforced through law enforcement field checks. In addition, unauthorized human access in fragile tidal marsh habitat could cause trampling creating a lower quality marsh and creating trails for mammalian predators.

The Service believes that there will be minimal conflicts between hunters and the other wildlife-dependent recreational uses because of estimated low hunt participation numbers and limited interaction between the users. While the open bay is open to hunting, these areas are not frequented by visitors for wildlife observation and photography. Furthermore, those areas on land where hunters and other users may interact make up a small segment of the Refuge (less than one acre).

Public Review and Comment:
Public review and comments will be solicited in conjunction with distribution of the Draft CCP for San Pablo Bay NWR. The public will be provided at least 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 Stipulations

Stipulations Necessary to Ensure Compatibility:
The Service has an active law enforcement program to protect Refuge resources and the visiting public. Environmental education and outreach will remain a key component and priority for the refuge. Hunting materials will be updated and developed by the outdoor recreation planner. These brochures will be made available to the public at the Refuge office.

The use of retrieving dogs would be permitted and encouraged in all areas open to hunting. These dogs would be required to be under control at all times. Dogs will be required to be kept on leash, except when engaged in authorized hunting activities and under the direct control of a licensed hunter.

Justification:
Hunting is one of six priority public uses (the other uses are fishing, wildlife observation, photography, environmental education, and interpretation) promoted in the National Wildlife Refuge System Improvement Act of 1997 (Pub. L 105-57). Hunting would allow the visiting public to enjoy, experience, and learn about the unique and rare habitats of northern San Francisco Bay region. Concerns about protecting rare native plants and animals, and the overall integrity of the marsh ecosystem, require that hunting opportunities be limited to the open waters and navigable sloughs of the San Pablo Bay and a small segment of the Tolay Creek unit at this time.

Mandatory Reevaluation Date (provide year):

____X____ 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):

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

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Refuge Determination

Prepared by:	_____	_____
	(Signature)	(Date)
Refuge Manager:	_____	_____
	(Signature)	(Date)
Project Leader Approval:	_____	_____
	(Signature)	(Date)
<u>Concurrence</u> Refuge Supervisor	_____	_____
	(Signature)	(Date)
Assistant Regional Director, Refuges	_____	_____
	(Signature)	(Date)

Compatibility Determination for Recreational Hunting

Compatibility Determination for Fishing on San Pablo Bay National Wildlife Refuge

Use: Fishing

Refuge Name: San Pablo Bay National Wildlife Refuge, Solano and Sonoma Counties, California.

Establishing and Acquisition Authorities:
Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d)
Act Authorizing the Transfer of Certain Real Property for Wildlife (16 U.S. C. 667b)
Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, Stat 884)

Refuge Purpose(s):
San Pablo Bay NWR purposes include:

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. 715d (Migratory Bird Conservation Act),

"... particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes), and

"... 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 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):
Fishing is one of six priority public uses (the other uses are hunting, wildlife observation, photography, environmental education, and interpretation) promoted in the National Wildlife Refuge System Improvement Act of 1997.

San Pablo Bay's navigable sloughs and open waters is leased from the State of California Lands Commission (SLC) and managed by the Refuge. Under the existing lease with SLC, the Service is encouraged to allow "... waterfowl hunting and fishing … unless it is determined after consultation with the State of California Department of Fish and Game that the area be closed because of the public safety, for waterfowl resource protection, or for administrative purposes." The original lease language is based upon the historic "Public Trust" doctrine, which requires that State-owned tidelands remain open to "commerce, navigation and fisheries."

The Refuge's sloughs and open waters are extremely important angling waters due to significant fish populations and the proximity to safe road access and boat launches in Vallejo and Port Sonoma. These facilities enable the Refuge to promote additional fishing areas to the general public and neighboring communities in Solano, Napa, Sonoma, and Contra Costa counties.

Fishing is an existing use on the Refuge and will continue to be allowed from boat access in the open waters and navigable sloughs of northern San Pablo Bay. State of California fishing regulations provide further guidance for this public use opportunity.

Additional fishing opportunities will be provided in the form of a boardwalk at the Cullinan Ranch unit and a pier at the Guadalcanal unit. A fishing day will be held at these sites to encourage this use. The use will be implemented in a manner to insure protection for endangered species and migratory birds. This use will be permitted during daylight hours only. No commercial or shoreline fishing is permitted.

Availability of Resources:
Existing funds are adequate for the existing fishing activities. Costs for construction of the fishing pier and associated infrastructure at the Cullinan Ranch Unit will be provided by Wildlife Conservation Board (WCB). Additional staffing and funding is needed to expand the fishing program on the Refuge. Service funding will be necessary to construct the pier, boardwalk, and entry/parking areas. An outdoor recreation planner (position shared with Marin Islands and Antioch NWRs) would be needed to develop the fishing day program and informational materials. Fishing brochures will be produced to provide the public to facilitate a safe and informative fishing experience. Refuge law enforcement (position shared with Marin Islands and Antioch NWRs) would be needed to ensure that visitors adhere to fishing regulations. Grants and other funding sources will be sought as well. Maintenance of the additional facilities will require a maintenance worker (position shared with Marin Islands NWR) for maintenance and repair of fishing infrastructure.

Item	One-Time Cost	Annual Costs
Fishing facility at Guadalcanal	$100,000	$1,000
Parking/entry area construction	$100,000 (2 sites)	$1,000
Fishing brochure, signage	$15,000	$500
Maintenance Staff (0.1 FTE)	$7,500	$7,500
Outdoor Recreation Planner (0.1 FTE)	$7,000	$7,000
Refuge Law Enforcement (0.1 FTE)	$7,500	$7,500
TOTAL	$237,000	$24,500

Anticipated Impacts of the Use(s):
The proposed use would not adversely impact sensitive fish species in the San Pablo Bay. Two sensitive fish species occur within the San Pablo Bay including the Sacramento splittail minnow (*Pogonichthys macrolepidotus*) and the green sturgeon (*Acipenser medirostris*). The splittail has been de-listed (Pers. Commun., Mike Nepstad, USFWS). Delta smelt (*Hypomesus transpacificus*) may occur in the bay during large fresh water outflows from the Sacramento delta, but because they are a small (3-inch) fish, they are not likely to be caught. Fishermen will be required to adhere to all California Fish and Game regulations.

Fishing will be limited to sloughs, open water, and constructed facilities. The proposed use is not expected to impact the ability of the Refuge to protect diverse tidal marsh, seasonal wetland habitats and adjacent transitional uplands critical to the needs of migratory birds and endangered species. However, unauthorized human access in fragile tidal marsh habitat could cause trampling

creating a lower quality marsh and creating trails for mammalian predators. Signage will be used to identify closed areas and deter entry into sensitive wildlife habitat and restrictions will be enforced. The fishing facilities at Guadalcanal and Cullinan Ranch have the potential to create litter and disturb wildlife. These facilities would be installed in locations that avoid sensitive wildlife habitat. Additional signage would be installed to encourage visitors to limit their disturbance to wildlife and properly dispose of litter.

Public Review and Comment:
Public review and comments will be solicited in conjunction with distribution of the Draft CCP for San Pablo Bay NWR. The public will be provided at least 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 Stipulations

Stipulations Necessary to Ensure Compatibility:
Adequate law enforcement monitoring will be crucial to ensure that fishing regulations are adhered to protect wildlife resources. A "Fish on the Refuge" flyer and signage will be developed by the outdoor recreation planner for the Refuge to inform users of fishing regulations. This information will be available to the public at appropriate access points on the Refuge.

Monitoring of habitat in all areas where fishing occurs will take place during biological surveys for other species. If habitat or wildlife disturbance is determined to be detrimental, modifications to this use will be determined to make fishing on the Refuge compatible.

Justification:
The National Wildlife Improvement Act of 1997 (Pub. L. 105-57) identifies six legitimate and appropriate uses of wildlife refuges: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. Where these uses have been determined compatible, they are to receive enhanced consideration over other uses in planning and management.

These uses have been determined compatible because fishing will not materially interfere with or detract from unit purposes. Fishing would allow the visiting public to enjoy, experience, and learn about native fish and plants in these unique and rare habitats of northern San Francisco Bay region. Concerns about protecting rare native plants and animals, and the overall integrity of the marsh ecosystem, require that fishing opportunities be limited to the open waters, navigable sloughs, and fishing facilities of the San Pablo Bay NWR at this time.

Mandatory Reevaluation Date (provide year):

___X___ 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):

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

Refuge Determination

Prepared by:	_____ (Signature)	_____ (Date)
Refuge Manager:	_____ (Signature)	_____ (Date)
Project Leader Approval:	_____ (Signature)	_____ (Date)
Concurrence Refuge Supervisor	_____ (Signature)	_____ (Date)
Assistant Regional Director, Refuges	_____ (Signature)	_____ (Date)

Compatibility Determination for Fishing

Compatibility Determination for Recreational Boating on San Pablo Bay National Wildlife Refuge

Uses: Recreational Boating

Refuge Name: San Pablo Bay National Wildlife Refuge, Sonoma and Solano Counties, California

Establishing and Acquisition Authorities:
Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d)
Act Authorizing the Transfer of Certain Real Property for Wildlife (16 U.S. C. 667b)
Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, Stat 884)

Refuge Purpose(s):
San Pablo Bay NWR purposes include:

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. 715d (Migratory Bird Conservation Act),

"... particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes), and

"... 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 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 U.S. Fish and Wildlife Service has identified six priority public uses including fishing, hunting, wildlife observation, photography, environmental education, and interpretation. These activities are promoted in the National Wildlife Refuge System Improvement Act of 1997. Motorized and non-motorized boats for the purposes of research, hunting, environmental education, wildlife observation, wildlife photography and fishing may be accommodated.

San Pablo Bay's navigable sloughs and open waters, much of which is leased from the State of California Lands Commission (SLC) and managed by the Refuge, are extremely important waters due to fish and wildlife populations. Nearby safe road access and boat launches in Vallejo, Port Sonoma, and Hudeman Slough enable the Refuge to promote additional compatible wildlife-dependent recreation opportunity to the public and neighboring communities in Solano, Napa, Sonoma, Marin, and Contra Costa counties.

Motorized boats from San Pablo Bay and the Napa River will be permitted to enter the Refuge's navigable sloughs and open waters (See Figure 1) for wildlife observation, wildlife photography,

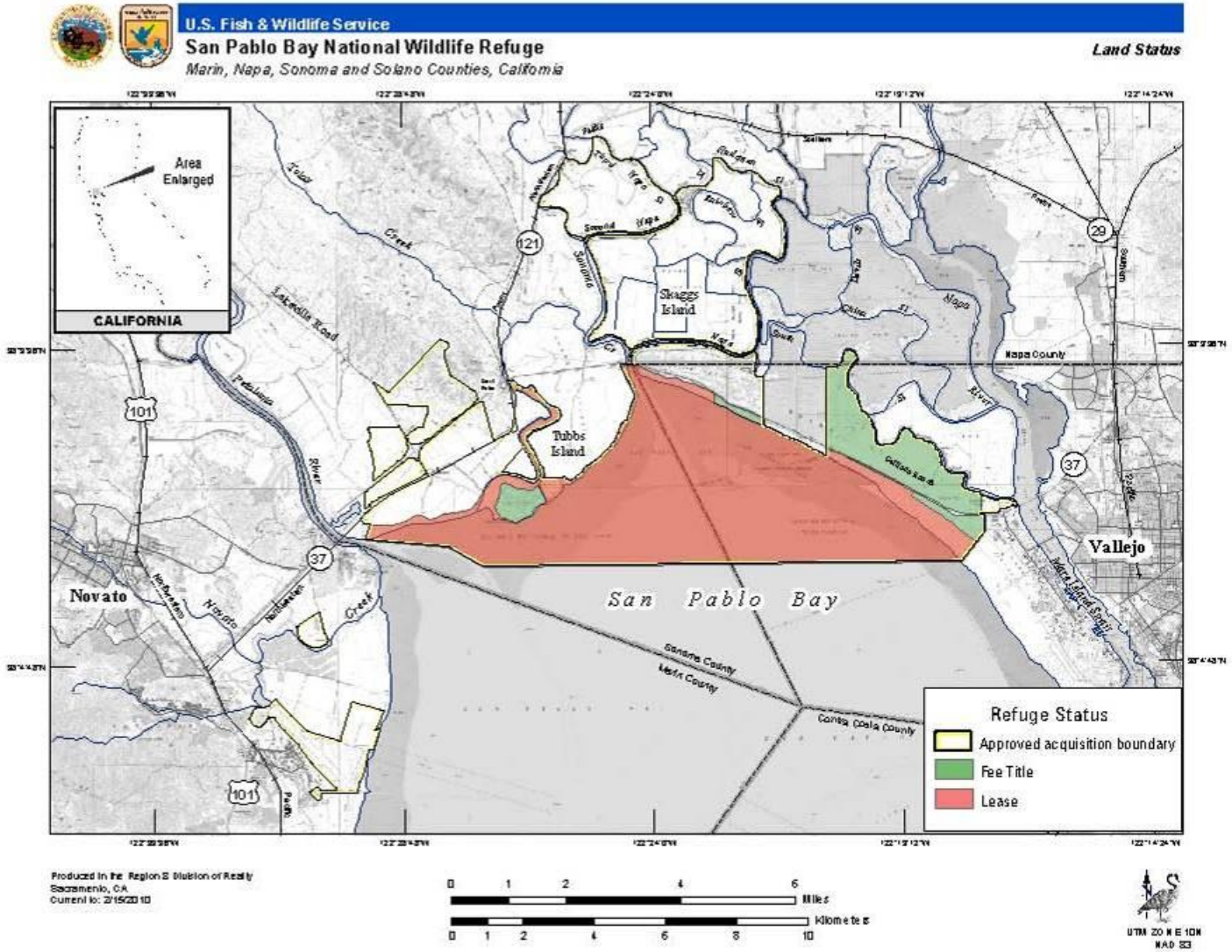
environmental education, and fishing. Hunting by boat only is allowed in the open bay waters and navigable sloughs of the Refuge but not in Cullinan Ranch, Guadalcanal, and Tubbs Setback. Only non-motorized boats will be permitted in the Cullinan Ranch unit and will be required to maintain a no-wake speed to reduce erosive effects of waves to the shorelines and levees as well as to minimize disturbance to wildlife in the area. Non-motorized boat access directly onto the Refuge will be accommodated through the construction of an access point at the Cullinan Ranch unit once it is restored to tidal influence. Motorized boat launching at this non-motorized boat access point will not be permitted. Regulations pertaining to boating in the Cullinan Unit and maps of the adjoining sloughs will be available at a kiosk located near the parking lot.

It is not expected that non-motorized boating will remain focused within the Cullinan Ranch Unit due to the open water conditions and wind fetch that will prevail for as long as 50 years after restoration is complete. Most non-motorized boaters will use Cullinan as an access site to other areas of the Refuge, adjacent sloughs and channels. Motorized boats entering into Cullinan from the adjacent sloughs may find Cullinan a challenge as eventual formation of tidal marsh and sedimentation throughout the unit develop. Eventual formation of tidal marsh and slough channels within Cullinan may provide better non-motorized boat suitability eventually, but development of these marshes and channels may also require future closures of some areas to all boating access as they become inhabited by sensitive wildlife species. A slough channel leading to the launch access site will be dredged prior to tidal restoration of the Cullinan Ranch Unit. This channel will not be dredged or maintained once tidal restoration is completed. If the access site becomes filled with sediments, a new access site will be located and designated elsewhere within the Refuge boundary.

Due to presence of sensitive wildlife species, no motorized or non-motorized boat access will be permitted within Lower Tubbs Island, Tubbs Setback or Guadalcanal. Eventual formation of tidal marsh and slough channels within other newly restored sites of the Refuge may require future closures of some areas that become inhabited by sensitive wildlife species.

All public use opportunities will be implemented in a manner to ensure protection for endangered species and migratory birds by providing law enforcement patrols, education and outreach conducted on site as well as through tours and other group programs to create an environmental awareness of stewardship for marshes of the area; particularly at the Cullinan Ranch Unit. Once tidal restoration is complete, boating to facilitate wildlife observation, wildlife photography, and fishing will be monitored and regulated. Public use activities will be permitted during daylight hours only.

Figure 1. San Pablo Bay NWR



Availability of Resources:
Adequate funding and staffing exists to manage the existing motorized boating activities on the Refuge. Costs for construction of the non-motorized boat access at the Cullinan Ranch Unit will be provided by Wildlife Conservation Board (WCB). Service funding will be necessary to maintain boat access and the associated area. Maintenance of the non-motorized boat access will not include dredging of the site, only maintenance of the area leading to the water from the parking area at Cullinan Ranch. An outdoor recreation planner (position shared with Marin Islands and Antioch NWRs) would be needed to offer design support of the launch area to facilitate a safe and informative visitor experience. Maintenance of this infrastructure will require a maintenance worker (position shared with Marin Islands NWR) for mowing, maintenance, repair, and trash collection. A Refuge law enforcement officer (position shared with Marin Islands and Antioch NWRs) would be needed to protect infrastructure and provide a safe visitor experience. Periodic replacement and repair of signage will be necessary. Signage and/or buoys will be placed on the perimeter of Cullinan and other areas where appropriate, to indicate refuge boundaries and no-wake speed for motorized boats. No jet skis or other personal motorized vehicles will be permitted within Cullinan, Lower Tubbs Island, Tubbs Setback or Guadalcanal.

Item	One-Time Cost	Annual Costs
Information signage	$30,000	$1,000
Maintenance Staff (0.1 FTE)	$7,500	$7,500
Outdoor Recreation Planner (0.1 FTE)	$7,000	$7,000
Refuge Law Enforcement (0.1 FTE)	$7,500	$7,500
TOTAL	$52,000	$23,000

Anticipated Impacts of the Use(s):
Large numbers of waterfowl, shorebirds, fish and other wildlife species use the Refuge for feeding, resting and in some cases, breeding. Two sensitive fish species occur within the San Pablo Bay including the Sacramento splittail minnow (*Pogonichthys macrolepidotus*) and the green sturgeon (*Acipenser medirostris*). Delta smelt (*Hypomesus transpacificus*) a small (3 inch) fish, may occur in the San Pablo Bay and may enter Cullinan during large fresh water outflows from the Sacramento delta. The presence of boats should not create any adversely affect fish species.

Open water and tidal areas of the Refuge provide habitat for other sensitive species including the California clapper rail, black rail, western snowy plover, and salt marsh harvest mouse. Potential impacts to wildlife may occur through the use of boating. Individual animals may be disturbed by human contact to varying degrees. Studies have shown that birds can be impacted from human activities when they are disturbed and flushed from feeding, resting, or nesting areas. Flushing, especially repetitive flushing, can strongly impact habitat use patterns of many bird species. Flushing from an area can cause birds to expend more energy, be deterred from using desirable habitat, affect resting or feeding patterns, and increase exposure to predation or cause birds to abandon sites with repeated disturbance (Smith and Hunt 1995). Migratory birds are observed to be more sensitive than resident species to disturbance (Klein 1989).

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). However, compared to motorboats, canoes and kayaks appear to have less disturbance effects on most wildlife species (DeLong 2002) and disturbance to birds in general is reduced when boats travel at or below the 5 mile per hour speed limit.

The proposed use would not significantly impact the ability of the Refuge to protect wildlife, diverse tidal marsh, seasonal wetland habitats and adjacent transitional uplands critical to the needs of migratory birds and endangered species. The Refuge is already open to public access including boating, and also provides habitat for waterfowl, waterbirds, shorebirds and terns. In addition, the Service's effort to protect these habitats and resources will be aided by placing speed restrictions on boats within some areas and increasing public awareness of the habitats within and around the Refuge through environmental education and outreach. Education is critical for making visitors aware that their actions can have negative impacts on wildlife, and will increase the likelihood that visitors will abide by restrictions on their actions. For example, Klein (1993) demonstrated that visitors who spoke with refuge staff or volunteers were less likely to disturb birds.

Public Review and Comment:
Public review and comments will be solicited in conjunction with distribution of the Draft CCP for San Pablo Bay NWR. The public will be provided at least 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 Stipulations

Stipulations Necessary to Ensure Compatibility:
The Service has an active law enforcement program to protect Refuge resources and the visiting public. Environmental education and outreach will remain a key component and priority for the Refuge. A "Boating on the Refuge" flyer will be developed by the outdoor recreation planner for San Pablo Bay NWR. These fliers will be available to the public at the Refuge Office on Highway 37. Information provided in this flyer will include no-wake speed limits, seasonal or specific area closures, and a map of trails in the adjacent sloughs.

Monitoring of habitat in all areas where boating occurs will take place during biological surveys for other species. If habitat or wildlife disturbance is determined to be detrimental, modifications to this use will be determined to make non-motorized and motorized boat use on the Refuge compatible.

Justification:
Although boating and kayaking are not considered wildlife-dependent recreation, many wildlife dependent recreational activities (fishing, wildlife observation and photography) are associated with this use. Boating and kayaking would allow the visiting public to enjoy, experience, and learn

about native fish and plants in these unique and rare habitats of northern San Francisco Bay region. Concerns about protecting rare native plants and animals, and the overall integrity of the marsh ecosystem, require that boating and kayaking be limited to the open waters of Cullinan Ranch and the west levee and the wildlife observation/fishing piers constructed on the west levee.

Mandatory Re-evaluation Dates (Provide Month and Year)

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

___X___ Mandatory 10-year Reevaluation Date (for all uses other than priority public uses)

NEPA Compliance (Check One Below)

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

References Cited:

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

Klein, M. 1989. Effects of high levels of human visitation on foraging waterbirds at J.N. "Ding" Darling National Wildlife Refuge, Sanibel Florida. Masters thesis. Gainsville, Florida: University of Florida.

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

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pages 71-79 in R.L. Knight and K.J. Gutzwiller, ed. Wildlife and Recreationists: coexistence through management and research. Island Press, Washington, D.C. 372 pp.

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.

Refuge Determination

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager: _____ _____
(Signature) (Date)

Project Leader Approval: _____ _____
(Signature) (Date)

Concurrence
Refuge Supervisor _____ _____
(Signature) (Date)

Assistant Regional Director, Refuges _____ _____
(Signature) (Date)

Compatibility Determination for Boating

Compatibility Determination for Bicycling on San Pablo Bay National Wildlife Refuge

Uses: Bicycling

Refuge Name: San Pablo Bay National Wildlife Refuge, Solano and Sonoma Counties, California

Establishing and Acquisition Authorities:
Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d)
Act Authorizing the Transfer of Certain Real Property for Wildlife (16 U.S. C. 667b)
Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, Stat 884)

Refuge Purpose(s):
San Pablo Bay NWR purposes include:

"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. 715d (Migratory Bird Conservation Act),

"... particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes), and

"... 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 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):
Bicycle access would be allowed at the Sears Point, Guadalcanal and Sonoma Baylands units, once they are acquired and trails are developed. This compatibility determination will be updated after planning begins to determine exact locations. Currently there is only one public access point for wildlife observation and photography on the San Pablo Bay NWR at the Tolay Creek/Lower Tubbs Island unit. This unit provides the visitor access to the San Pablo Bay via a 2.5-mile long dirt road that connects to levees that surround Tubbs Island. Bicycle access would facilitate wildlife observation and photography, which are two of six priority public uses (the other uses are hunting, fishing, environmental education, and interpretation) promoted in the National Wildlife Refuge System Improvement Act of 1997. Anticipated public access (use) could include as many as 5,000 additional visitors annually during the first few years with increasing visitor use expected annually thereafter.

Restoration of the Cullinan Ranch unit to tidal flows in 2010-2011 will include enhancement of an existing public use access levee owned by the California Department of Fish and Game (CDFG). Bicycle access is currently allowed at this site and will continue once the Refuge completes its enhancements.

The San Francisco Bay Trail (Bay Trail) at Sonoma Baylands is currently pedestrian and bicycle access only. The Bay Trail is located along the northern perimeter of Sonoma Baylands allowing travel from west to east. This form of access is proposed to continue after acquisition to encourage the public to access the Refuge and appreciate the wildlife values found there. Eventually, after the Sears Point Restoration (Sonoma Land Trust) is complete, the Bay Trail will extend from the eastern edge of Sonoma Baylands eastward on California Department of Fish and Game Lands, then north to Highway 37. This portion of the trail will link to the Tolay Creek/Lower Tubbs Island Bay Trail section via a short stretch of Highway 37. The trails are a total distance of 11 miles roundtrip. Due to their length, bicycle access is advisable. Guadalcanal is several miles from Vallejo, CA yet it is connected by various trails to the city. Bicycle access will increase the accessibility of this site to the citizens within that community.

Availability of Resources:
Service funding will be necessary to construct trails and interpretive panels. Maintenance of the additional facilities will require a maintenance worker (shared with Marin Islands NWR) for mowing, maintaining gravel surface of trail, infrastructure repair, and trash collection. An outdoor recreation planner (position shared with Marin Islands and Antioch NWRs) would be needed to develop materials and infrastructure to facilitate safe and informative visitor experiences. The Service intends to provide resources necessary to provide safe, high quality visitor services through partnering and volunteer activities.

Item	One-Time Cost	Annual Costs
Interpretive Panels	$40,000 (2 sites)	$1,000
Trail construction	$100,000 (2 sites)	$2,000
Maintenance Staff (0.1 FTE)	$7,500	$7,500
Outdoor Recreation Planner (0.1 FTE)	$7,000	$7,000
TOTAL	$154,500	$17,500

Anticipated Impacts of the Use(s):
Impacts associated with bicycling would occur in areas on levee top surfaces. Creation of additional trails at Sears Point and Guadalcanal would cause some displacement of habitat and increase some disturbance to wildlife, although this is expected to be minor given the size of the Refuges and by avoiding or minimizing intrusion into sensitive wildlife habitat.

Bicycle use will occur on designated levees and trails that have little to no vegetation since they are hard-packed dirt. Therefore, it is anticipated that bicycles will have very minor impacts on plant communities. However, bicycling could impact soil surfaces leading to erosion or compaction, especially on steep grades and during wet periods. Trails for bicycles will be designed will little elevation change to prevent erosion and compaction. Bicycling off-trail will not be permitted.

Human activities along wildlife observation trails can reduce foraging or even cause waterbirds to avoid foraging habitats adjacent to the trails (Klein 1993), especially when it involves close proximity and/or fast-moving human activities (Burger 1981). However, more recently, Lafferty (2001) found that joggers caused fewer disturbances to wintering snowy plovers than walkers, whereas dogs and horses caused more disturbance than either human activity. Activities along trails tend to displace wildlife and can cause localized reduction in species richness and abundance

(Riffell et al. 1996). In addition, nest predation tends to increase near more frequently utilized areas for songbirds (Miller et al. 1998), raptors (Glinski 1976), colonial nesting species (Buckley and Buckley 1978), and waterfowl (Boyle and Samson 1985).

Public Review and Comment:
Public review and comments will be solicited in conjunction with distribution of the Draft CCP for San Pablo Bay NWR. The public will be provided at least 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 Stipulations

Stipulations Necessary to Ensure Compatibility:
Bicycling activities would be allowed on designated levees and trails, only between sunrise and sunset, unless they are part of a refuge-led activity. Dogs and horses would not be allowed. Public access would be restricted to established trails and other developed facilities. Regulatory and directional signs will clearly mark designated routes of travel and areas closed to the public. Regulations would be enforced to insure public safety and to prevent resource impacts. Collection of plants, animals, and other specimens, debris, or artifacts would be strictlyprohibited. Information kiosk and interpretive panels would be used to provide wildlife viewing tips and inform users about ethics and responsibilities of wildlife viewing. Off-trail bicycling will be prohibited. Refuge staff will monitor levee and on the Refuge. Regular trail or levee top maintenance will prevent serious damage but if routine maintenance does not prevent trail damage, the information will be used to develop modifications necessary to ensure the compatibility of bicycling.

Justification:
After assessing the potential impacts from the use proposed for the Sears Point, Guadalcanal and Sonoma Baylands Units, the Refuge has found that allowing this use would not materially interfere with or detract from the purposes for which the refuge was created or the mission of the National Wildlife Refuge System. Bicycling would allow the visiting public to enjoy, experience, and learn about native fish, wildlife, and plants in these unique and rare habitats of the northern San Francisco Bay area. Bicycle access will allow the public to experience the entire length of the trail within a reasonable time frame.

Mandatory Re-evaluation Dates (Provide Month and Year)

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

___X___ Mandatory 10-year Reevaluation Date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (Check One Below)

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

References Cited:

Boyle, S. A. and F. B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: a review. Wildl. Soc. Bull. 13:110-116.

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

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Riffell, S. K., K. J. Gutzwiller, and S. H. Anderson. 1996. Does repeated human intrusion cause cumulative declines in avian richness and abundance? Ecol. Appli. 6(2): 492-505.

Refuge Determination

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager: _____ _____
(Signature) (Date)

Project Leader Approval: _____ _____
(Signature) (Date)

Concurrence
Refuge Supervisor _____ _____
(Signature) (Date)

Assistant Regional Director, Refuges

_____ _____

(Signature) (Date)

Compatibility Determination for Bicycling

Appendix E. Wilderness Inventory

Wilderness Inventory for San Pablo Bay National Wildlife Refuge

Introduction

A wilderness inventory is the process used to determine whether to recommend lands or waters in the National Wildlife Refuge System to Congress for designation as wilderness under the National Wilderness Preservation System (NWPS). The Service is required by policy to conduct a wilderness review for each refuge as part of the CCP process outlined in 602 FW 1 and 3, and according to the National Environmental Policy Act compliance. 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 NWPS.

There are three phases to the wilderness inventory process: (1) inventory, (2) study, and (3) recommendation. Land and waters that meet the minimum criteria for wilderness are identified in the inventory. These areas are called wilderness study areas (WSAs). In the study phase, a range of management alternatives are evaluated to determine if a WSA is suitable for wilderness designation or management under an alternate set of goals and objectives that do not involve wilderness designation.

The recommendation phase consists of forwarding or reporting the suitable recommendations from the Director through the Secretary and the President to Congress in a wilderness study report. The wilderness study report is prepared after the record of decision for the final CCP has been signed.

Areas recommended for designation are managed to maintain wilderness character in accordance with management goals.

Evaluation Criteria

According to Section 13 of the Service's Director's Order No. 125 (12 July 2000), in order for a refuge to be considered for wilderness designation, all or part of the refuge must:

- Be affected primarily by the forces of nature, with the human imprint substantially unnoticeable;
- Have outstanding opportunities for solitude or a primitive and unconfined type of recreation;
- Have at least 5,000 contiguous acres (2,000 ha) or be sufficient in size to make practicable its preservation and use in an unimpaired condition, or be capable of restoration to wilderness character through appropriate management, at the time of review; and
- Be a roadless island.

Evaluation of the Size Criteria

Roadless areas or roadless islands meet the size criteria if any one of the following standards applied:

- An area with over 5,000 contiguous acres. State and private lands are not included in making this acreage determination.
- A roadless island of any size. A roadless island is defined as an area surrounded by permanent waters or that is markedly distinguished from the surrounding lands by topographical or ecological features.
- An area of less that 5,000 contiguous Federal acres that is of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management.
- An area of less than 5,000 contiguous Federal acres that is contiguous with a designated wilderness, recommended wilderness, or area under wilderness review by another Federal wilderness managing agency such as the Forest Service, National Park Service, or Bureau of Land Management.

Evaluation of Naturalness Criteria

In addition to being roadless, a wilderness area must meet the naturalness criteria. The area must appear natural to the average visitor rather than "pristine"; it should "generally appear to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable." The presence of historic landscape conditions is not required. An area may include some human impacts provided they are substantially unnoticeable in the unit as a whole. Significant human-caused hazards, such as the presence of unexploded ordnance from military activity, and the physical impacts of refuge management facilities and activities are also considered in evaluation of the naturalness criteria. An area may not be considered unnatural in appearance solely on the basis of the "sights and sounds" of human impacts and activities outside the boundary of the unit.

Evaluation of Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation

In addition to meeting the size and naturalness criteria, a wilderness area must provide outstanding opportunities for solitude or primitive recreation. The area does not have to possess outstanding opportunities for both solitude and primitive and unconfined recreation, and does not need to have outstanding opportunities on every acre. Further, an area does not have to be open to public use and access to qualify under this criteria; Congress has designated a number of wilderness areas in the Refuge System that are closed to public access to protect resource values.

Opportunities for solitude refer to the ability of a visitor to be alone and secluded from other visitors in the area. Primitive and unconfined recreation means non-motorized, dispersed outdoor recreation activities that are compatible and do not require developed facilities or mechanical transport. These primitive recreation activities may provide opportunities to experience challenge and risk; self-reliance; and adventure.

These two "opportunity elements" are not well defined by the Wilderness Act, but in most cases, can be expected to occur together. However, an outstanding opportunity for solitude may be present in an area offering only limited primitive recreation potential.

Conversely, an area may be so attractive for recreation use that experiencing solitude is not an option.

Evaluation of Supplemental Values
Supplemental values are defined by the Wilderness Act as "…ecological, geological, or other features of scientific, education, scenic, or historical value." These values are not required for wilderness.

INVENTORY FINDINGS
As documented below, none of the units of San Pablo National Wildlife Refuge (NWR) meet the criteria to warrant wilderness consideration. Therefore, inclusion of San Pablo NWR in the NWPS will not be sought.

Roadless Areas and Roadless Islands
Highway 37 bisects the Refuge units, and therefore does not meet the roadless island criteria.

Size Criteria
The Service owns less than 5,000 acres of the Refuge in fee title. The majority of the lands are leased from the California Department of Fish and Game. Therefore, the Refuge does not meet the size criteria for wilderness designation.

Naturalness Criteria
The Refuge units have been substantially changed from their origins as tidal wetlands. The Gold Rush era in the 1800s heavily changed the region where the Refuge is located. Mining operations contributed to large amounts of sedimentation in the area. Later, most of the Refuge was diked and actively managed for farming and ranching. For these reasons, the Refuge does not meet the naturalness criteria for wilderness designation.

Opportunities for Solitude or Primitive and Unconfined Recreation
Highway 37 can be heard or seen from many of the Refuge's units. This highway is heavily traveled as it provides the only main thoroughfare between the North and East San Francisco Bay. Based on this assessment, the Refuge does not fully provide opportunities for solitude or primitive and unconfined types of recreation that are characteristic of a wilderness area.

Supplemental Values
The location of the Refuge relative to freshwater influences of the Sacramento and San Joaquin Rivers and the saline waters of the Pacific Ocean result in a unique and rich tidal environment that directly transitions to uplands. Large contiguous expanses of pickleweed-dominated tidal marsh support high densities of the endangered salt marsh harvest mouse as well as provide habitat for the endangered California clapper rail and other sensitive species. Hundreds of thousands of shorebirds and waterfowl use the Refuge as they migrate along the Pacific Flyway.

Appendix F: Persons Responsible for Preparing this Document, Core Team Members, and Expanded Team Members

Persons Responsible for Preparing this Document, Core Team Members, and Expanded Team Members

Persons Responsible for Preparing this Document

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Core Team Members

Expanded Team Members (invited)

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Mike Casazza	USGS
Len Lui	PRBO Conservation Science
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Howard Shellhamer	Salt marsh harvest mouse expert
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